

ISPEC 8TH INTERNATIONAL CONFERENCE ON AGRICULTURE, ANIMAL SCIENCES AND RURAL DEVELOPMENT

December 24-25, 2021

Bingöl / TURKEY

CONFERENCE PROCEEDINGS BOOK

Editors

Prof. Dr. Kagan KOKTEN

Assoc. Prof. Dr. Hakan INCI

Assoc. Prof. Dr. Seyithan SEYDOSOGU

ISPEC
8th INTERNATIONAL CONFERENCE ON AGRICULTURE,
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CONFERENCE ID

CONGRESS TITLE

**8th INTERNATIONAL CONFERENCE ON AGRICULTURE, ANIMAL
SCIENCES AND RURAL DEVELOPMENT**

DATE-PLACE

**December 24-25, 2021
Bingol, TURKEY**

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BINGOL UNIVERSITY, TURKEY

December 24-25, 2021

CONFERENCE PROGRAM

IMPORTANT, PLEASE READ CAREFULLY

- ❖ To be able to attend a meeting online, login via <https://zoom.us/join> site, enter ID “Meeting ID or Personal Link Name” and solidify the session.
- ❖ The Zoom application is free and no need to create an account.
- ❖ The Zoom application can be used without registration.
- ❖ The application works on tablets, phones and PCs.
- ❖ The participant must be connected to the session 5 minutes before the presentation time.
- ❖ All congress participants can connect live and listen to all sessions.
- ❖ Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

Points to Take into Consideration - TECHNICAL INFORMATION

- ◆ Make sure your computer has a microphone and is working.
- ◆ You should be able to use screen sharing feature in Zoom.
- ◆ Attendance certificates will be sent to you as pdf at the end of the congress.
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ÖNEMLİ, DİKKATLE OKUYUNUZ LÜTFEN

- ❖ Kongremizde Yazım Kurallarına uygun gönderilmiş ve bilim kurulundan geçen bildiriler için online (video konferans sistemi üzerinden) sunum imkanı sağlanmıştır.
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- ❖ Her oturumdaki sunucular, sunum saatinden 5 dk öncesinde oturuma bağlanmış olmaları gerekmektedir.
- ❖ Tüm kongre katılımcıları canlı bağlanarak tüm oturumları dinleyebilir.
- ❖ Moderatör – oturumdaki sunum ve bilimsel tartışma (soru-cevap) kısmından sorumludur.

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CONGRESS LANGUAGES: English and All Turkish Dialects

24.12.2021 | SESSION-1 | HALL-1



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Kağan KÖKTEN

Authors	Affiliation	Presentation title
Mehmet Reşit Tayşi Muammer Kirici Mahinur Kirici	Bingol University	Antioxidant Enzymes Of 2,4-D (Dichlorophenoxyacetic Acid) In Capoeta Umbla Brain Tissue And Determination Of Effect On Lipid Peroxidation Level
Cüneyt Temür Mehtap Güney Sibel Erdoğan Murat Demirel	Van Yüzüncü Yıl University	Fermentation And Digestibility Characteristics Of Soybean, Sunflower And Their Mixture Silages
Cafer Nisan Sıdıka Ekren	Ege University	The Effect Of Different Priming Times Applied To Oriental Tobacco Seeds On Seedling Development
Abdurrahim Yılmaz Hakkı Ekrem Soydemir Emrah Güler	Bolu Abant İzzet Baysal University	Importance Of Aronia Cultivation And Production Opportunities
Hakkı Ekrem Soydemir Abdurrahim Yılmaz Vahdettin Çiftçi	Bolu Abant İzzet Baysal University	Advantages Of Haploid Technique In Plant Breeding
Aysun Yener Ögür Gürhan Özaydin	Selcuk University	The Current Status And The Future Of The Livestock Sector In Turkey
Aysun Yener Ögür	Selcuk University	The Effect Of Alternative Poultry Sector On Rural Development In Konya
Zeynep Dumanoglu Çiğdem Sönmez	Bingol University	The Importance Of Lavender (<i>Lavandula officinalis</i> L.) And Some Morphological Features Of Its Seeds
Meltem Türkeri Dürdane Mart	Eastern Mediterranean Agricultural Research Institute	Pea Studies On Dry Grain In Cukurova Region

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-1 | HALL-2



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Yaşar KARADAĞ

Authors	Affiliation	Presentation title
Ali Dönmez Barış Atalay Uslu Ömer Uçar	Cumhuriyet University	Recent Overview Of Factors Affecting The Success Of Oestrus Synchronisation In Sheep
Murat Şevik	Necmettin Erbakan University	Seroprevalence And Risk Factors Of The Bluetongue Virus Infection In Cattle
Fahir Cankat Brav Serdal Dikmen	Bursa Uludag University	The Relationship Between Anti-Müllerian Hormone (Amh) And Fertility Performance In Dairy Cattle
Bilge Kaan Tekelioğlu Roaa Al-Saedi	Cukurova University	Avian Biosecurity Practices
Roaa Al-Saedi Bilge Kaan Tekelioğlu	Cukurova University	Diagnostic Methods Of Avian Infectious Bronchitis Virus Disease
Can Metin Yazici Yahya Öztürk	Burdur Mehmet Akif Ersoy University	Welfare In Poultry Breeding
Ömer Faruk Keleş Mahmut Yardimci Turan Yaman Zabit Yener	Van Yuzuncu Yıl University	A Case Of Diaphragmatic Hernia In A Pregnant Sheep
Hülya Girgin	Dokuz Eylül University	Effects Of Pineal Gland And Melatonin In Fish And Some Animal Groups
Özgür Cengiz Ali Nazli	Van Yüzüncü Yıl University	The Studies On Sarda sarda (Actinopteri: Scombriformes: Scombridae) In Turkish Seas From Past To Present
Muhammed Milani Bahar Milani	Bandırma Onyediy Eylül University	Predicting milk production using first lactation data and artificial neural network

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-1 | HALL-3



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assist. Prof. Dr. Ahmet AYDIN

Authors	Affiliation	Presentation title
Tahir Karaşahin	Aksaray University	Cattle Presence And The Amount Of Cattle Milk Produced In Turkey By Years
Nevzat Saat İhsan Kisadere Barış Güner	Balıkesir University	The Effect Of Estrous Presynchronization And Synchronization Applications On Some Blood Parameters In Kivircik Sheep
Erinç Gümüş Behlül Sevim Osman Olgun	Aksaray University	Effect Of Addition Of Lavender Essential Oil To The Diet On Performance, Meat Colour And Serum Parameters In Male Quails
Semine Dalga Kadir Aslan	Kafkas University	Anatomy Of Digestive System In Experimental Animals
Ebubekir İzol Zeynebe Bingöl Hakan İnci Mehmet İlkaya İlhami Gülçin	Bingol University	Abts Radical Scavenging Activity Of Drone Larvae (Apılarnıl)
Tuğçe Atçalı Fatih Mehmet Kandemir Seda Yakut Aykut Ulucan Cüneyt Çağlayan Adem Kara	Bingol University	Therapeutic Effects Of Silymarin On Paclitaxel-Induced Hepatotoxicity And Nephrotoxicity In Rats
Kurtuluş Merdan	Gumushane University	Recommendations About The Status And Development Of Organic Livestock In Turkey
Metehan Kutlu Dursun Ali Dinç	Selcuk University	Early Pregnancy Diagnosis In Awassi Ewes By Serum Progesterone Concentration
Aydan Atalar Nurcan Çetinkaya	Zonguldak Bülent Ecevit University	Investigation Of The Digestibility Of Corn Straw Treated With Biological Methods By In-Vitro Gas Production Technique

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-1 | HALL-4



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Atilla ÇAKIR

Authors	Affiliation	Presentation title
Erdoğan Altınçekiç Şeniz Öziş Altınçekiç	Bursa Uludağ University	The Relationship Of Good Animal Welfare On-Farm And Safe Food Production
Semine Dalga Kadir Aslan	Kafkas University	A Macroanatomic and Morphometric Study On The Appendicular Skeleton In An Jungle Cat (Felis chaus)
Şeniz Öziş Altınçekiç Funda Erdoğan Ataç	Bursa Uludağ University	The Importance Of The Vaginal Environment In Small Ruminants
Elif Merve Çınar Mehmet Ferit Özmen	Dicle University	Reproductive Parameters İn Brown Cows
Muhammed Baydemir	Malatya Turgut Ozal University	Effect Of Queen Breed On Acceptance Of Queens In Colonies With Similar Conditions
Muhammed Baydemir	Malatya Turgut Ozal University	The Relationship Of Apricot Production Amount With Exports And Prices
Mustafa Öz Suat Dikel	Aksaray University	The Importance Of Grass Carp (Ctenopharyngodon idella, Valenciennes 1844) in Management Of Wetlands
Mustafa Öz	Aksaray University	The Effect Of Fish Nutrition On Fat Amount And Fatty Acid Profile Of Fish Meat
Ömer Arslan Emine Budaklı Çarpıcı	Bursa Uludağ University	Determination Of The Effects Of Different Drought Levels On Germination Traits Of Some Buckwheat (Fagopyrum esculentum Moench) Varieties
Tuba Parlak Ak Engin Esen	Munzur University	Immunohistochemical Distribution Of Nucb2/Nesfatin-1 In Lung Tissues Of Female Rats

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-1 | HALL-5



Ankara Local Time: 09:00-11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assist Prof. Gülen ÖZYAZICI

Authors	Affiliation	Presentation title
Emre Demirci	Kastamonu Directorate Of Provincial Agriculture And Forestry	Statistics Of Artificial Insemination In Küre Breeding
Rahşan Koç Akpınar	Samsun Veterinary Control Institute	Çukurova Bölgesindeki Arı İşletmelerinde Bazı Viral Arı Hastalıklarının Epidemiyolojisi
Sena Yonga Sena Ardiçli	Bursa Uludag University	Frontiers In Genome-Enabled Selection And Advances In Sequencing Technology For Production And Quality Traits In Beef Cattle
Mehmet Arif Özyazici Semih Açıkbaz	Siirt University	The Effects Of Boric Acid Priming On Germination And Seedling Development In Foage Pea
Emre Demirci	Kastamonu Directorate Of Provincial Agriculture And Forestry	The Effect Of Artificial Insemination To Livestock In Kastamonu
Semih Açıkbaz Mehmet Arif Özyazici	Siirt University	The Effects Of Zinc Priming On The Growth And Seedling Development Of Narbon Vetch (Vicia narbonensis L.) Varieties
Gülen Özyazici	Siirt University	Determination Of Germination Traits Of Milk Thistle (Silybum marianum L.) Plant Under Salt Stress
Burhan Bahadır Ufuk Karadavut	Bingöl Directorate Of Provincial Agriculture And Forestry	Evaluation Of Agricultural Support In Rural Development Area In Bingol Province
Burhan Bahadır Ufuk Karadavut	Bingöl Directorate Of Provincial Agriculture And Forestry	Technical And Economic Problems And Solution Suggestions Of Livestock In The Eastern Anatolia Region
Halil Tunca	Pamukkale University	Measuring Of Agricultural Efficiency Of Nuts-2 Region In Turkey

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-2 | HALL-1



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Hakan İNCİ

Authors	Affiliation	Presentation title
Ahmet Aydın	Dicle University	Affection Of Additional Different Dose Enzyme (Grindazym Gp 5000) To Rations On Feeding And Carcass Characteristics Of Broiler
Ahmet Aydın	Dicle University	Effects Of The Supplementation Of Essential Oil Isolated From Orange Peel (Citrus Sinensis L.) To Broiler Diets On The Performance, Some Blood Parameters And Microfloras Of Small Intestine
Mehmet Yaman	Erciyes University	Determination Of Some Fruit Characteristics In Rosehip (Rosa canina) Genotypes
Yeşim Bulak Korkmaz	Atatürk University	The Lygaeidae (Hemiptera) Species Of Iğdır Province
Selin Altıntaş Birsen Çakır Aydemir	Ege University	Expression Analysis Of Pdr Subfamily Genes Of Abc Proteins In Grapevine (Vitis vinifera L.)
Ahmet Uzatici Önder Canbolat	Çanakkale Onsekiz Mart University	Effect Of Different Ginger Essential Oil Doses On In Vitro Gas Production, Rumen Fermentation And Methane Production Of Corn Grain Feed
Mehmet Demiray Cansu Altuntaş	Artvin Çoruh University	Effect Of Exogenous Proline Application On Photosynthetic Performance In Drought Stress Artvin-Şavşat (Local) Tomato Seedlings
Batuhan Tarcan Özlem Küplülü	Ankara University	Rapid Determination Of Chicken Meat Mixture Ratios In Beef Mixtures By Near Infrared (Nir) Spectroscopy
Fuat Yetişsin	Muş Alparslan University	Investigation Of The Interaction Of Aceton O-(4 Chlorophenylsulfonyl) Oxime With Antioxidant System Enzymes By Molecular Docking Method

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-2 | HALL-2



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Hakan İNCİ

Authors	Affiliation	Presentation title
Ali Karanfil	Çanakkale Onsekiz Mart University	Prevalence And Genetic Diversity Of Cucumis Melo Endornavirus Infecting Cucurbit Plants In South Marmara Region Of Turkey
Nurgül Ergin Muhammed Fatih Kaya Mehmet Demir Kaya	Bilecik Şeyh Edebali University	Stomatal Characteristics Of Some Safflower (Carthamus tinctorius L.) Cultivars
Aydın Şükrü Bengü Bülent Kaya	Bingöl University	Evaluation Of Chemical Content Of Honey Procured From Bingol Province
Hüccet Vural Hasan Er	Bingöl University	The Effect Of Different Salt Concentrations And Water Levels On The Development Of Marigold (Tagetes Erecta “Titania”)
Sinem Öztürk Erdem Çetin Çekiç	Bilecik Şeyh Edebali University	Effects Of Microbial Fertilizer And Different Iba Doses On Rooting Of Jujube (Zizyphus jujuba Mill.) Cuttings
Mürşide YAĞCI	Directorate Of Plant Protection Central Research Institute	Resistance Mechanisms of Plants Against to Plant Parasitic Nematodes
Fatma Dolunay Erdoğan	Directorate Of Plant Protection Central Research Institute	Quarantine plant parasitic nematodes and quarantine practices
Büşra Bildir Bülent Kaya	Bingöl University	Use Of Natural Antioxidant Source Plants As Functional Food Component
Sercan Bedir Tuba Elhazar Zeynep Demirkan Büşra Bildir Bülent Kaya	Bingöl University	Determination Of The Biosynthesis And Cytotoxicity Of Silver Nanoparticles Using Chitosan And Propolis
Bahar Milani Muhammed Milani	Bandırma Onyedü Eylül University	Prediction and optimization of biogas yield using artificial neural network
Bahar Milani Muhammed Milani	Bandırma Onyedü Eylül University	Mathematical Models To Interpret Ruminant Disappearance Curves

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24.12.2021 | SESSION-2 | HALL-3



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assist. Prof. Dr. Hava Şeyma İNCİ

Authors	Affiliation	Presentation title
Mehmet Sütyemez Şakir Burak Bükücü Akide Özcan İlker Büşah Ayaz Fahriye Bekşen Fatih Temizyürek	Kahramanmaraş Sütçü İmam University	Evaluation of Citrus Sapling Production in Turkey
Zehra Gül Oğuz Hatice Bozoğlu	Ondokuz Mayıs University	Seed Vigour And Viability İn Pulses
Ezgi Canbaz Ahmet Eryaşar	Ege University	The Effects Of Biogas Systems On Rural Development In Turkey And Worldwide
Gamze Kaya	The Ministry of Agriculture and Forestry	Physiological Response Of Pepper Cultivars To Cold Stress At Seedling Transplantation Stage
Sema Gün	Ankara University	Experiences Of The Institutional And Legal And Structuring In Turkey's Land Consolidation Process And Its Inferences
Orhan Karakaya	Sakarya Uygulamalı Bilimler University	Nut Traits And Bioactive Contents Of Kalinkara Hazelnut Cultivar Grown In Different Region
Büşra Beltekin Ramazan Meral Nurullah Demir Cemil Aydoğan	Bingöl University	Nano-Lc Chromatography: A New Perspective Of Foodomics And Food Analysis
Seda Bice Ataklı Sabriye Belgüzar	Tokat Gaziosmanpaşa University	The Effects Of Vermicompost Ratios And Bacteria Applications On The Development And Production Elements Of Basic Plant
Tuğçe Avcı Gülen Yıldız Turp	Ege University	The Effects Of Usage Of Perga And Propolis Which Are Bee Products With Beetroot Powder In The Production Of Nitrite-Free Or Nitrite Ratio Reduced Chicken Sausage
Elif Kartal Aycan Mutlu Yağanoğlu	Atatürk University	Modeling Of The Factors Affecting Milk Production In Livestock (Milling Time, Live Weight, External Temperature, Internal Temperature) With Artificial Neural Networks

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-2 | HALL-4



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr.Selvinaz YAKAN

Authors	Affiliation	Presentation title
Derya Güler Orhan Özbey	Atatürk University	The Current Situation Of Dairy Cattle Operations In Elazığ, And The Statistical Analysis Of Their Yield
Ömer Kaymaz Fikret Yaşar Özlem Üzal	Van Yüzüncü Yıl University	The Improving Role Of Gibberelic Acid On Drought Stress In Plants
Hülya Saygi	Çukurova University	The Current Status Of Greenhouse Culture In Turkey
Selvinaz Yakan	Ağrı İbrahim Çeçen University	Beekeeping Potential And General Evaluation Status Of Ağrı Province
Selvinaz Yakan	Ağrı İbrahim Çeçen University	Method Of Measuring Intraocular Pressure
Adem Ergün	Balıkesir University	Interaction Of Alachlor Herbicide With Banana Polyphenol Oxidase Enzyme
Mahir Özkurt Orhan Mete Kiliç Mesut Budak	Muş Alparslan University	Spatial And Temporal Investigation Of Land Use And Land Cover In Muş Province
Orhan Mete Kiliç	Tokat Gaziosmanpaşa University	Modeling And Mapping Of Sediment Distribution Areas Using Invest Model: Case Study Of Tokat Plain
Münire turhan	Bingöl University	Antimicrobial Properties Of Honey
Gülistan Genli İlhan Kaya Tekbudak Mustafa Usta Muzaffer Mükemre	Van Yuzuncu Yil University	Determining Phonetic Relations Of Endemic Species Of Astragalus L. In The Van Lake Basin

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-2 | HALL-5



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Faruk TOKLU

Authors	Affiliation	Presentation title
Çiğdem Gözel Özlem Moumin Chasan	Çanakkale Onsekiz Mart University	Investigation Of Nematode Fauna In Agricultural Areas In Gumulcine (Greece)
Pınar Ambarcioğlu	Hatay Mustafa Kemal University	Estimation Of The Effects Of Fetal Gender And Foetus Number On Maternal Body Condition Using Generalised Estimating Equations (Gee)
Melek Akgül Faruk Toklu	Çukurova University	Determination Of The Effects Of Different Nitrogen Dose Applications On Grain Yield, Some Agromorphological Characters And Popping Properties Of Popcorn
Engin Irmak Faruk Toklu	Çukurova University	Determination Of The Effect Of Different Sowing Times On Grain Yield And Some Plant Characteristics Of Dent Corn (Zea mays L.) In Çukurova Region Conditions
Gül Gür Faruk Toklu	Çukurova University	Determination Of The Effect Of Different Sowing Rates On Grain Yield And Some Agromorphological Characteristics Of Popcorn (Zea mays everta) In The Çukurova Region Conditions
Hakkı Ekrem Soydemir Abdurrahim Yılmaz	Bolu Abant İzzet Baysal University	Virus-Free Potato Seed Production By Tissue Culture
Abdurrahim Yılmaz Hakkı Ekrem Soydemir Emrah Güler Vahdettin Çiftçi	Bolu Abant İzzet Baysal University	The Place And Importance Of Artificial Intelligence In Agriculture
Seda Bice Atakli Yağmur Kaya	Tokat Gaziosmanpaşa University	Changes In Some Soil Properties After Incubation When Differently Thermal Treated Vermicompost Is Added To The Soil
Seda Bice Atakli	Tokat Gaziosmanpaşa University	The Effects Of Humic Acid Applications On The Development And Production Elements Of Bordan Plant

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

24.12.2021 | SESSION-3 | HALL-1



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Tolga KARAKÖY

Authors	Affiliation	Presentation title
Muammer Ekmekçi Kağan Kökten	Bingöl University	Cultivation Of Energy Crops On Contaminated Soils
Onur Kirmizigül Muammer Ekmekçi Kağan Kökten	Bingöl University	New Methods Used In Agricultural Appraisal And Expertise
İlker Yüce Yeter Çilesiz Tolga Karaköy	Sivas Bilim ve Teknoloji University	Determination Of Yield And Yield Components Of Some Bread Wheat (Triticum aestivum L.) Varieties In Sivas Ecological Conditions
Yeter Çilesiz İlker Yüce Tolga Karaköy Nejdet Kandemir	Sivas Bilim ve Teknoloji University	Determination Of The Adaptation Performance Of Some Winter Barley (Hordeum vulgare L.) Varieties In Sivas Ecological Conditions
Elif Günal Mesut Budak	Siirt University	Spatial Distribution Of Available Phosphorus And Potassium Contents In Soils Under Different Land Uses
Gözdenur Çakar Abdullah Güller Gökhan Erarslan Ersin Karakaya	Bingöl University	Mycelial Growth Inhibition Activity Of Basil Essential Oil At Different Concentrations Against Phytophthora Sp. And Alternaria Solani
Gözdenur Çakar Abdullah Güller Esra Mesci Ersin Karakaya	Bingöl University	Evaluation Of Antifungal Activities Of Royal Jelly, Bee Bread (Perga) And Bee Venom On Sclerotinia Sclerotiorum And Phytophthora Sp. Phytopathogens In Vitro Conditions
Alpaslan Koçak Murat Kürşat Gülten Koçak	Bingöl University	Molecular Phylogeny And Systematic Status Of Some Ranunculus L. (Ranunculaceae) Taxa From Turkey
Gülten Koçak Murat Kürşat Alpaslan Koçak	Bingöl University	Molecular Phylogeny Of The Some Ranunculus L. Taxa From Turkey

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-3 | HALL-2



Ankara Local Time: 15:00-17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Nurhan KESKIN

Authors	Affiliation	Presentation title
Siddık Keskin Nurhan Keskin	Van Yüzüncü Yıl University	Categorical Principal Component Analysis: General Properties And Application
Siddık Keskin Nurhan Keskin	Van Yüzüncü Yıl University	Analysis Of Means (Anom) With General Characteristics And Its Application
M. İlhan Odabaşioğlu	Adıyaman University	The Effect Of Different Pruning Applications On Grape Yield And Some Pomological Characteristics In Shiraz (Vitis vinifera L.) Grape Variety
Cenap Yılmaz	Eskişehir Osmangazi University	Effect Of Gibberelic Acid Applications On Fruit Juice Ratio And Other Quality Criteria In Interdonato Lemon Variety
Betül Gidik Zehra Can	Bayburt University	Antioxidant Activity Of Lavandin (Lavandula x intermedia Emeric ex Loisel.) Plant Growing In Erzurum
Erhan Göçmen Gökmen Azder Ahmet İstanbulluoğlu	Tekirdağ Namık Kemal University	The Seasonal Water-Yield Relationship Of Paste Pepper
Handan Karaoğlu	Recep Tayyip Erdoğan University	An Investigation For Benefits Of The Amphibians On Agriculture
Cenap Yılmaz	Eskişehir Osmangazi University	The Effects Of Self And Open Pollination Treatments On Fruit Quality In Wonderful Pomegranate Variety
Haydar Kurt Onur Tekin	Yüzüncü Yıl University	An Overview On The Policy Hazelnut Of Turkey

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-3 | HALL-3



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Atilla ÇAKIR

Authors	Affiliation	Presentation title
Zeliha Ustun-Argon	Necmettin Erbakan University	Chemical Composition Of Equisetum Arvense And Cymbopogon Martini Oil
Yusuf Çakir Engin Paksoy Sertan Sesveren	Kahramanmaraş Sütçü İmam University	Yield-Water Relationships Of Mungbean (Phaseolus mungo L.) Under Various Irrigation Regimes
Mustafa Yaşar Nazlı Aybar Yalinkiliç	Muş Alparslan University	Main Problems And Solutions Of Cotton Agriculture In Turkey
Emine Yurteri Fatih Seyis Haydar Küplemez	Recep Tayyip Erdoğan University	Determination Of Volatile Oil Components Of Calamintha nepeta (L.) savi. subsp. glandulosa Collected From Çat/Rize
Emine Yurteri Fatih Seyis Haydar Küplemez	Recep Tayyip Erdoğan University	Volatile Oil Composition Of Salvia glutinosa
Gürkan Aykutoğlu Yusuf Çakir	Bingöl University	Current Status In The Production Of Organic Agricultural And Animal Products In Turkey
Yusuf Çakir Songül Çakmakçı	Bingöl University	The Future Potential And Current Status Of Dairying In Bingöl Province
Melis Inalpulat Levent Genc	Canakkale Onsekiz Mart University	Detection Of Agricultural Land Changes Through Machine Learning And High Resolution Satellite Imageries
Ayşe Nida Kurt Yasir Tufan Mahir Özkurt Yaşar Karadağ	Muş Alparslan University	An Alternative Silage Plant: Sunflower (Heliantus annus L.)

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-3 | HALL-4



Ankara Local Time: 15:00-17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Kağan KÖKTEN

Authors	Affiliation	Presentation title
Bahadır Atmaca	Giresun University	Determination Of Some Land Properties With Geographical Information Systems And Evaluation In Terms Of Agriculture: The Case Of Şebinkarahisar District Of Giresun Province
Merve Macit Mihriban Ahiskali Büşra Kayantaş	Bingöl University	Some Widely Distributed Crataegus sp. An Evaluation On The Systematic Properties And Phenolic Components Of The Species
Çağrı Owayurt Nesrin Karaca Sanyürek Atilla Çakır	Bingöl University	Opportunities Of Using Renewable Energy In Agricultural Production
Şeyda Çavuşoğlu Fırat İşlek Nurettin Yılmaz	Van Yüzüncü Yıl University	Strawberry Growing And Post-Harvest Conservation Methods
Şeyda Çavuşoğlu Fırat İşlek	Van Yüzüncü Yıl University	Techniques To Be Considered In Melon Growing And Post-Harvest Storage Methods
Halit Tutar Kağan Kökten Ömer Eren	Bingöl University	Alternative Plants Grown As An Energy Plant In Marginal Soils
Rıdvan Uçar Selim Özdemir Kağan Kökten Mahmut Kaplan Erdal Çaçan	Bingöl University	Evaluation Of Some Hairy Vetch (<i>Vicia villosa</i> Roth.) Varieties In Terms Of Herbage Yield And Quality In Bingöl Ecological Conditions
Selim Özdemir Rıdvan Uçar Kağan Kökten Mahmut Kaplan Erdal Çaçan	Bingöl University	Evaluation Of Hairy Vetch (<i>Vicia villosa</i> Roth) In Terms Of Seed Yield, Straw Yield And Straw Quality
Şule Erkovan	Eskisehir Osmangazi University	The Effects Of Sowing Time On Quality In Some Annual Legumes - Cereals Mixtures

(All speakers required to be connected to the session 10 min before the session starts)

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24.12.2021 | SESSION-3 | HALL-5



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Nesrin ÖRÇEN

Authors	Affiliation	Presentat ion title
Aynur Bilmez Özçınar	Siirt University	Sunflower (<i>Helianthus annuus</i> L.): Genetics, Environment, Physiology And Utilisation
Nesrin ÖRÇEN	Ege University	Chromium Accumulation Capacities Of Some Tobacco Varieties (<i>Nicotiana tabaccum</i> L.)
Nesrin ÖRÇEN	Ege University	Cadmium Accumulation In Some Tobacco Varieties (<i>Nicotiana tabaccum</i> L.) Plants Parts
Nesrin ÖRÇEN	Ege University	Concentrations Of Chromium In Some Oriental Tobacco Varieties (<i>Nicotiana tabaccum</i> L.)
Nesrin ÖRÇEN	Ege University	Phytoremediation Capacities Of Some Tobacco Varieties (<i>Nicotiana tabaccum</i> L.) Of Cadmium In Soil
Arzu Koçak	Siirt University	The Importance Of Colors In Biological Systems
Sipan SOYSAL Murat ERMAN Necat TOĞAY	Siirt University	Renewable Energy And Technology In Sustainable Agriculture
Nizamettin TURAN Seyithan SEYDOŞOĞLU	Siirt University	A Minor Feed Legume Crop: Yellow Lupine (<i>Lupinus luteus</i> L.)

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-1 | HALL-1**Ankara Local Time: 09:00–11:30****Meeting ID: 899 0040 8534 | Passcode: 001001****HEAD OF SESSION: Assist. Prof. Dr. Ayman El Sabagh**

Authors	Affiliation	Presentat ion title
Lawal Lateef Adefalu Oluwafemi Peter Olabanji Habeb Ifedolapo Bhadmus Sikiru Ibrahim-Olesin Oyedola Waheed Kareem	University of Ilorin	Information Needs Of Wildlife Hunters In Kwara State: Implication For Extension Service Delivery In Nigeria
A. Hameed T. Farooq A. Hameed M. A. Sheik	Government College University Faisalabad	Chitosan Seed Priming Improves The Tolerance To Water-Deficit Stress Induced By Polyethylene Glycol In Wheat (<i>Triticum aestivum</i> L.) Seedlings
Mujahid Ali Chaudhary Muhammad Ayyub Emily Silverman Malik Abdul Rehman Shahid Iqbal Zahoor Hussain Muhammad Azher Nawaz	University of Agriculture	Sustaining Water Balance And Various Physiological Traits In <i>Cucumis Sativus</i> L. By Foliar Application Of Chitosan In Three Sowing Dates Grown Under Hot Environment
Stela Gyudorova Plamen Glogov	Bulgarian Academy of Sciences	An Attempt To A Classification Of Plant Communities With The Participation Of <i>Fraxinus Ornus</i> L. In Bulgaria
Oyewole, A. L. Oyewole, S. O. Ayanrinde F. A. Anifowose T. O.	Federal College of Forestry	Promotion Of Farm Estate Agricultural Scheme For Employment Creation And Poverty Alleviation Among Youths In Nigeria
Alihanova Halya Bakhadirovna Serimbetova Kuralay Mukhtarovna Dildabekova Lazzat Anarkulovna	Acting Associate professor of UKMA	Research of phytochemical and biological properties of toothed clover
Dildabekova Lazzat Anarkulovna Serimbetova Kuralay Mukhtarovna Alihanova Halya Bakhadirovna Bazarbayeva Gulayim Mutalibkyzy	Acting Associate professor of UKMA	Phytochemical and pharmacognostic study of the Loach of the snake plant of the flora of South Kazakhstan
Ataur Rahman Afia Sultana Yeamin Hossain	University of Rajshahi	Management of Barred spiny eel <i>Macroglyptodon</i> <i>pancalus</i> (Hamilton, 1822) in the Gajner Beel, wetland ecosystem using length-based indicators and fisheries references point
Hary Priyanto, S.T, M.Si Nana Noviana, S.ST, M.Kes	17 August 1945 University	Prostitution Handling Strategies In Hiv/Aids Prevention Based On Local Wisdom: Banyuwangi Regent Regulation No. 45 Year 2015

(All speakers required to be connected to the session 10 min before the session starts)

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25.12.2021 | SESSION-1 | HALL-2



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Nusret ÖZBAY

Authors	Affiliation	Presentation title
Hadjira Naoui Mohamed Yousfi Mohamed Benalia	Université Amar Telidji Laghouat	Fatty acid composition , quantification of total tocopherols and antioxidant activity of lipid extrats from Algerian Ficus Carica fruit
Dijana Blazhekovikj - Dimovska Stojmir Stojanovski	University “St. Kliment Ohridski	Bighead Carp (Hypophthalmichthys Nobilis, Richardson, 1845) (Pisces: Cyprinidae) As Host Of New Parasite Species Dactylogyrus Aristichthys (Long & Yu, 1958) In Macedonian Waters
A. U. Arun Usha K. Aravind Aneesh V. Pillai	Cochin University of Science and Technology	Climate Change And Indian Legal Framework: An Anlytical View
Batoul Essalimi Siham Esserti Lalla Aicha Rifai Tayeb Koussa Nimine Ezzouine Kacem Makroum Malika Belfaiza Lydia Faize Mohamed Faize	University Chouaib Doukkali	Enhancement Of Plant Growth, Using Plant Growth-Promoting Rhizobacteria (Pgpr) Associated With Plum Trees (Prunus domestica)
Nasiru Adamu Aminu Adamu Ahmed	Abubakar Tafawa Balewa University Bauchi	Influence Of Feed Type And Period On Egg Quality Traits
Ogunlesi Oluwagbenga Olaoluwa Tiyati Humwapwa Mujong Aderemi Timothy Adeleye Ogunlesi Opeyemi Elizabeth Oyeleke Peter Olaoye Akinfoyeku Aanuoluwapo Feyisayo Igwe Chigbo Okereke	Landmark University Omu Aran Kwara State	Efficient Utilization Of Eco-Friendly Biochar-Derived Materials For Sustainable Environmental Remediation
Hamdaoui Nora Mouncif Mohamed Mennane Zakariae Omari Abdeloudoude Meziane Mustapha	University Mohammed I	Biochemical and technological characteristics of lactic acid bacteria genus Lactococcus lactis isolated from raw cow's milk
Youssef Khachtib Lalla Hasna Zinelabidine Said Bouda Abdelmajid Haddioui	Sultan Moulay Slimane University	Genetic Diversity In Moroccan Apple Cultivars Revealed With Ssr Markers
Nasiru Adamu Aminu Adamu Ahmed	Abubakar Tafawa Balewa University	Influence Of Feed Type And Period On Egg Quality Traits
Bhupendra Singh Manoj Kumar Riyal	Uttarakhnad University of Horticulture and Forestry	Traditional agroforestry system of Grahwal Himalaya and their management through the study of intercropping

(All speakers required to be connected to the session 10 min before the session starts)

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25.12.2021 | SESSION-1 | HALL-3



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Muharrem ERGUN

Authors	Affiliation	Presentat ion title
Ivan Pavlovic Milan Stevanovic Nemanja Zdravkovic	Scientific Veterinary Institute of Serbia	Most Important Parasitic Insects Of Bees In Serbia
SZJ Zaidi M.S Shahbaz S.Hassan	University of the Punjab	Biosensors for the detection of viruses and pathogens- An emerging technology for point of care diagnostics
Elena Sergeevna Tkacheva Ilya Nikolaevich Medvedev	Russian State Social University	Physiological Activity Of Platelets In Piglets During The Milk Food Phase
Svetlana Yurievna Zavalishina	Russian State Social University	Functional Activity Of The Hemostasis System In Newborn Calves With Signs Of Iron Deficiency, Received Ferroglukin
Bardha Korça Bahrije Dobra Kaltrina Jusufi Skender Demaku	University of Pristine	Evaluation of heavy metals levels in water, sludge, and soil samples from Kosovo's Drini Bardh river
Slavka Kalapchieva Valentin Kosev Viliana Vasileva	Maritsa Vegetable Crops Research Institute	Genotype X Environment Interaction And Yield Stability In Garden Peas Genotypes
Khedim Radjaa	Abu-Bekr Belkaid University	Typology And Characterization Of Isolated Colonies Of Honey Bees (Apis Mellifera Intermissa), In North Of Algeria By Morphometric, Geometric, And Phylogenetic Approaches
Khlila Ilham Baidani Aziz Amamou Ali Sibaourih Mounia El Kodrim Mohamed	Hassan 1er University	Effect Of Irrigation And Nitrogen Rates On Yield And Quality Of Soft Wheat
Blerina Pupuleku Lulëzim Shuka Donald Shuka Gëzim Kapidani Ermelinda Gjeta Klea Trokoliçi	University of Tirana	Comparative Data On The Palynomorphological Features Of Pollen Grains Of Two Albania's Plants Of Austroadriatic Specie Of Campanula Genus

(All speakers required to be connected to the session 10 min before the session starts)

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25.12.2021 | SESSION-1 | HALL-4



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Hakan İNCİ

Authors	Affiliation	Presentat ion title
Widya Pintaka Bayu Putra	Research Center for Biotechnology	The Haplotype Diversity Of Mitochondrial 16s-Rna Region In Black-Spotted Rock Frog (<i>Staurois guttatus</i>) At Borneo Island: A Meta-Analysis Study
Nadezhda Viktorovna Vorobyeva	South-West state University	Features Of Platelet Activity In Black-And-White Calves During The Phase Of Dairy-Plant Nutrition
Afsaneh Mohajer Parisa sadighara Nader Akbari	Tehran University of Medical Science	Effect Of Aloe Vera Extract On Reducing Aflatoxin B1 In Eggs Of Laying Hen And Egg Yolk
Elżbieta Patkowska	University of Life Sciences in Lublin	Effect Of Biostimulators And Living Mulch On The Healthiness Of Carrot (<i>Daucus carota</i> L.)
Dino DAVOSIR Ivana ŠOLA	University of Zagreb	Antioxidative And Antiobesity Potential Of Biofortified Broccoli (<i>Brassica oleracea</i> var. <i>italica</i>) Seedlings Enriched With Phenolics And Vitamin C
Benghalem B Kidoud B Gaouar S.B.S	Abou-Bekr Belkaid University	Genetic Characterization Of Local Bee Populations <i>Apis Mellifera Intermissa</i> In North-West Algeria
Gheorghe Giurgiu Manole Cojocaru	Titu Maiorescu University	The Role Of The Gut-Brain Axis In Neuromuscular Diseases In Paralyzed Dogs
Rahele Tahmasebi Amirhossein Abedini Parisa Sadighara Naiema Vakili Saatloo	Urmia University	Determination of Patulin residues in the raw milk collected from milk collection centers in Urmia in 2021
Ahmad Farhad Talebi Mahdie Khani Sara Kabirnataj	Semnan University	Bioremediation Of Laboratory Wastewater Pollutants Using <i>Sarocladium</i> Sp.
Djemai Mounira Hadjadj Aoul Elias Saad Salah Khalfa Dalila	Badji Mokhtar University	Control Study Of The Asynchronous Cage Motor Within The Unit (Lac) Sider -Annaba

(All speakers required to be connected to the session 10 min before the session starts)

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25.12.2021 | SESSION-1 | HALL-5



Ankara Local Time: 09:00–11:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Kağan KÖKTEN

Authors	Affiliation	Presentation title
Ahmad Farhad Talebi Hanie Alipour Sara Kabirnataj	Semnan University	Fungal Bioremediation Of Heavy Metal Contaminated Media
Kapka Mancheva Svetla Danova Neli Vilhelmova-Ilieva Lora Simeonova Lili Dobрева Georgi Atanasov	The Stephan Angeloff Institute of Microbiology	Some Treatment Methods For Koi Herpesvirus Infection
Kidoud B M. Chahbar N. Adidou-Chahbar H. Tefiel S.B.S. Gaouar	University of Tlemcen	Health performance of local domestic bee Apis mellifera intermissa; case study: susceptibility to nosemosis.
Tien Dzung Nguyen Stephen Zahra	Tien Dzung Nguyen Western Australian School System	How Has The Construction, Operation And Politics Of Mainstream Dams On The Mekong River Affected The Lower Mekong Basin Region?
Fatemeh Shoa'a Amin Janghorbani Ahmad Farhad Talebi	Seman University	Prediction of Aptamer Binding Affinity to Influenza Viruses Using Radial Basis Function Neural Network
Ashwini A. Wao Charu Vyas	AKS University	Microbial Consortium Mediated Approach For Restoration Of Heavy Metal Contaminated Soil
Ashwini A. Wao Shivangi Agnihotri	AKS University	Bioinoculants For Alleviating Salinity Stress In Plants
Sulekha Tripathi Praveen Garg Jyoti Pandey	Department of Science VITS College	Applications Of Integrated Farming System On Farmer's Agriculture Income
Nadezhda Viktorovna Vorobyeva	South-West state University	Plate Activity In Golshin's Calves During The Milk Feeding Phase
Folake Oluwatoyin Adegoke Deborah Uzoamaka Ebem Kile Awuna Samuel	University of Nigeria	Development of Computer
Alesyah Binti Asa Nur Syahirah Binti Ariffin Gabriella George	Keningau Vocational College, Construction Technology Department	A Specifically Designed Tool To Spread Mortar On Floor For Tile Installation

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-2 | HALL-1



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assist. Prof. Dr. Ayman El Sabagh

Authors	Affiliation	Presentat ion title
Elena Sergeevna Tkacheva	Vologda State Dairy Farming Academy named after N.V. Vereshchagin	Physiological Parameters Of The Organism Of Piglets At The End Of Early Ontogenesis
Svetlana Yurievna Zavalishina	Russian State Social University	Physiological Changes In The Organism Of Dairy Calves Under The Influence Of A Biostimulator
Ekaterina Vladimirovna Makhova	Russian State Social University	Functional Features Of Platelets In Physically Untrained First Mature Men
Mohamed El housse Abdallah Hadfi Ilham Karmala Said Ben-aazaa Mohamed Errami M'barek Belattar Said Mohareb Ali Driouiche	Ibn Zohr University	Title: Determination of the causes of the scaling phenomenon and investigation of the effect of phosphate fertilizers as inhibitors on the formation of scale in modern irrigation systems
Fisy Amalia Firmansyah Muhammad Tafsirudin	College of Economics	Integrated Marketing Communication Strategy On The Purchase Of Medicinal Plants Products: Qualitative Study On Farming Women's Group In The City Of Tangerang Selatan, Banten Province, Indonesia
Rahmoun Hadj Boumedien	Université de Tlemcen Faculté de Technologie	The bio-adsorption process for the treatment of textile wastewater using agricultural waste
Dilfuza Jabborova Dilbar Kadirova	Institute of Genetics and Plant Experimental Biology	Responses Of Ginger Plant Growth, Physiological Properties And Yield By Mineral Fertilizers
Kingsley Uchenna Ozioko	University of Nigeria	Protective role of Phyllanthus amarus leaf extract against malaria induced packed cell volume, body weight and rectal temperature reduction in mice model
Le Tran Thanh Liem Pham Van Trong Tinh Nguyen Thi Bach Kim	Can Tho University	Analysis Of The Current Farming Situation And Financial Efficiency Of The Cultivated Maize On Paddy Rice Land Farming Model In Soc Trang Province, Vietnam
Natela Borisovna Popkhadze	Head of Scholarly Information at Phassis Academy in Tbilisi	The Drawback Of Calling My/Our Republic Sakartvelo As 'Georgia' Instead Of Aiakolkheti And/Or Aiakolkhetikardugeorgia At The Permanent Viticulture Excibition In France In The City Bordeaux

(All speakers required to be connected to the session 10 min before the session starts)

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25.12.2021 | SESSION-2 | HALL-2



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Tolga KARAKÖY

Authors	Affiliation	Presentat ion title
Truong Thi Bich Hong Nguyen Dinh Mao Dinh The Nhan	Nha Trang University	Selection Of Substrate Thickness And Initial Biomass For Culturing Limnodrilus hoffmeisteri Claparede, 1862 (Oligochaeta, Annelida)
Wassan Nori Rihab Abbas Ali Wisam Akram Ismael	Mustansiriyah University	Can Platelet To Lymphocyte Ratio Predict Early-Onset Fetal Growth Restriction In Preeclamptic Women?
Bouriga Nawzet Bejaoui Safa Rejiba Wafa Mili Sami	University of Carthage	Extraction, Characterization Of Chitosan From Blue Crabs And Their Use As A Food Preservative In Strawberries
Bouriga Nawzet Mili Sami Bejaoui Safa Jammali Bayrem Jean-Pierre Quignard Trabelsi Monia	University of Carthage	Genetic Variation And Population Structure Of The Herring Fish From The Tunisian Markets
Bouriga Nawzet Rejiba Wafa Bejaoui Safa Mili Sami	University of Carthage	Canning Blue Crabs Meat: Transformation Processes And Sensory Characterizations
Bouriga Nawzet Bejaoui Safa Mili Sami Jean-Pierre Quignard Trabelsi Monia	University of Carthage	Comparative Study Of The Biochemical Composition In Lira Ramada Muscles
Bejaoui Safa Chetoui Imene Ghribi Ferial Trabelsi Wafa Fouzai Chaima Soudani Nejla	University of Carthage	Fatty Acid Disruption In Venus Verrucosa Gills As Responses To Lead Chloride Toxicity
Juan Rizo David Diaz	Universidad Nacional Autónoma de México	Degradation Of Methyl-Parathion With Copper(I) Oxide Nanoparticles
Bahareh Rafiei Mahboobeh Sharifi	Guilan Agricultural and Natural Resources Research and Education Center	Biochemical Characterization of Cellulase Enzyme in Dociostaurus Maroccanus (Orthoptera: Acrididae)
Youssef Ettahiri Lahcen Bouna Brahim Akhsassi Ayoub chaoui Abdeljalil Benlhachemi	IBN Zohr University	Porous inorganic material : Synthesis, Characterization, and Application

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-2 | HALL-3**Ankara Local Time: 12:00–14:30****Meeting ID: 899 0040 8534 | Passcode: 001001****HEAD OF SESSION: Assoc. Prof. Dr. Hakan İNCİ**

Authors	Affiliation	Presentation title
Naima Melzi Yamina ammi Salah Hanini	University of Médéa	Prediction Of Diffusion Coefficient For Polar Binary Gas Using Multiple Linear Regressions
Osasona Kehinde K Adebisi Oluwaremilekun A. Oladele, Boluwatife I. Owolabi Marvellous T. Duntoye Blessing T.	University of Ilorin	Economic Analysis Of Noiler Production In Ilorin, Kwara State, Nigeria
Grecu Iulia Docan Angelica Dediu Lorena	University “Dunarea de Jos” of Galati	Assessment Of The Allometry Patterns In <i>Silurus Glanis</i> (L., 1758) Juveniles Reared Into A Small-Scale Ras
Imene Chetoui Safa Bejaoui Wafa Trabelsi Chaima Fouzai Mhamed El Cafsi Nejla Soudani	University of Tunis El Manar	Assessment Of Lead Exposure On Phospholipids Composition In <i>Mactra Stultorum</i> Digestive Glands
Adebisi Oluwaremilekun A. Adebisi Luke O. Jonathan Asuquo Henshaw Emmanuel E Oludare Olufunke T.	Department of Agricultural Economics and Farm Management University of Ilorin	A Gender Based Study On Covid 19 Pandemic And Lifestyle Behaviours Of People Living In Agrarian Communities In Developing Countries
Raja Ben Ahmed Mehrez Gammoudi	Université de Tunis-El Manar	<i>Placobdella</i> n. sp. (Hirudinea: Glossiphoniidae), a new Glossiphoniiformes leech from North Africa
Feriel Ghribi Safa Bejaoui Michel Marengo Jonathan Richir Imene Chetoui M'hamed El Cafsi Sylvie Gobert	University of Liege	Metal Toxicity And Health Problems Linked To The Consumption Of Ark Shells (<i>Arca Noae</i> L.) From A Tunisian Coastal Lagoon
Mehrez Gammoudi Raja Ben Ahmed Nawzet Bouriga	University of Tunis-El Manar	On The Diversity Of Free-Living Polyclads Flatworms Collected From The Lagoon Of Tunis
Le Tran Thanh Liem Pham Van Trong Tinh Nguyen Thi Bach Kim Nguyen Thi Kim Phuoc	Can Tho University	Research On The Financial Efficiency Of The Cultivated Maize On Paddy Rice Land Farming Model In Soc Trang Province, Vietnam
S. A. Adegoke Y. Lamidi	Kogi State University	An Assessment Of Multidrug Resistant Bacterial Status Of Ogane-Aji River, Anyigba, Kogi State

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-2 | HALL-4



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Kağan KÖKTEN

Authors	Affiliation	Presentation title
Elżbieta Patkowska	University of Life Sciences in Lublin,	Effect of biostimulators and living mulch on the healthiness of carrot (<i>Daucus carota</i> L.)
C.Vijai R.Murali	St.Peter's Institute of Higher Education and Research	Biotechnology industry in India
P Shivakumar Singh GM Vidyasagar	Palamuru University	A Comparative Antimycotic Activity Of Ethanolic Leaves Extracts Of <i>Carissa spinarum</i> L. From Palamuru University Campus And Gulbarga University Campus Of Two Diverse Climates
SZJ Zaidi M.S Shahbaz S.Hassan	University of the Punjab	Engineered Biosensors for the detection of viruses and cancer cells
Peruri Sailokesh Sathvic Jupudi Inumarthi Krishna Vamsi Vaibhav Kant Singh	Central University	Automatic Number Plate Recognition
Yerragondur Nikhil Reddy Kanneboina Mallesh Yadav Vaibhav Kant Singh	Central University	Human Activity Recognition
Priyanka Kumari Rohan Gupta Suraj Kumar Vaibhav Kant Singh	Central University	ML Approach For Detection Of Lung Cancer
Rachapalli naga Rama Krishna prasad Pyli satya sai Raghu ram Siriki dinesh Vaibhav Kant Singh	Central University	Text Summarization
Chandrashekhara Rajan Chauhan Vaibhav Kant Singh	Central University	Twitter Sentiment Analysis
Adegoke O. Folake Akoh Patrick Junior	Kogi State University	Android Based Clearance System For Graduating Student (A Case Study Of Kogi State University) Approach

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-2 | HALL-5



Ankara Local Time: 12:00–14:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Nafiz ÇELİKTAŞ

Authors	Affiliation	Presentation title
Israr Ahmad	University of Technology and Applied Sciences	Robust Adaptive Feedback Controller for the Suppression of Chaos in a Three-Dimensional Chaotic System
Hayedeh Gorjiana Nader Ghaffari Khalighb	Sari Agricultural Sciences and Natural Resources University	The influence of the surfactant nature and type on physicochemical properties and stability of the nanoemulsions prepared from peppermint essential oil stabilized with basil seed mucilage
Subhashish Dey	Gudlavalleru Engineering College	Removal of Hardness from Synthetic Water by Using Various Biosorbents
Soumia Mouffouk Chaima Mouffouk Hamada Haba	Université de Batna-1	Pharmacological properties of the medicinal species <i>Nonea vesicaria</i> Rchb.
Chaima Mouffouk Soumia Mouffouk Hamada Haba	Université de Batna 1	In vitro biological activities of the species <i>Linaria scariosa</i> Desf.
Dib Soulef Alim Yousra Chavane E. Fortas Zohra	Université de Batna 1	Obtention of <i>Lactarius deliciosus</i> mycelium ; a way for the conservation of this fragile edible mushroom
H'maida Khalihana Brini Lahoucine Fekhaoui Mohamed Mohamed Arahou	Université Mohammed V	Analyse De La Qualite Physico-Chimique (Cas De La Nappe Phreatique D'assa-Zag Au Sud Du Maroc)
Babatope Oluseun Odusina Oludare O. Osiboye Aderemi Timothy Adeleye	Tai Solarin University of Education	Preliminary phytochemical investigation and Antimicrobial Potentials of <i>Biden pilosa</i> Linn., <i>Emilia coccinea</i> (Sims)G. Don., <i>Synedrella nodiflora</i> Linn. and <i>Brysocarpus coccineus</i> Schum and Thonn. grown in Southwest Nigeria
Al Ali, K. Al Belushi, N Al Madani, R. Ahmad, A.	Sultan Qaboos University	Development of a Microprocessor based Workstation – to Enhance Learning
Mahfoudh Al-Hinai Abdullah Al-Hinai Ali- Al-Lawati Afaq Ahmad	Sultan Qaboos University	Simulation of testability and reliability levels probing tool for digital systems

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-3 | HALL-1



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assist. Prof. Dr. Ayman El Sabagh

Authors	Affiliation	Presentation title
Muhammad Bilal Akbar Yue Gong Yanjie Wang Abebe Reda Woldu Xuehua Zhang Tao He	Université Mohammed V	Role of TiO ₂ coating layer on the performance of Cu ₂ O photocathode in photoelectrochemical CO ₂ reduction
Yamina Ammi Cherif Si-Moussa Salah Hanini	University of Médéa	Bootstrap Aggregated Neural Networks for Predicting the Membranes Performance by Treating the Pharmaceutical Active Compounds
Nadeem Salamat Riaz Hussain Khan Muhammad Kamran	Khawaja Fareed University of Engineering & Information Technology	Revan Topological Indices of Some Polysaccharides
Fadwa Largo Redouane Haounati Hassan Ouachtak Naima Hafid Abdelaziz Ait Addi	Ibn Zohr University	Anionic and cationic dyes removal from aqueous medium using Turkey Sepiolite: adsorption kinetics, isotherms, and characterization
Ala Fulga	State University of Medicine and Pharmacy	Abts Scavenging Activity Of Taraxacum Officinale Roots
Saghouri El Idrissi Imane Kettani Rajae Ferrahi Moha Brhadda Najiba Ziri Rabea	University of Ibn Tofail	Study of resistance mechanisms to water stress in durum wheat: characterization of cultivars differing in their level of drought resistance
Abla Medjmedj Dounia Keddari	University Mentouri Brothers-Constantine1	Heavy metals contamination and accumulation in soil grown and plant (Cucumis melo) from industrial area of El-Hadjar (Annaba, Algeria)
Sachin Kaothekar S. Mishra S. Phadke	Prashanti Institute of Technology & Science	Effects of Neutral Collisions and Finite Electron Inertia on Thermal Instability of Two-Component Radiative Astrophysical Plasma in Inter Stellar Medium (ISM)
Nouioura Ghizlane Tourabi Maryem Derwich El Houssine	Université sidi Mohammed ben Abdellah	Antioxidant Activity In Extracts From Coriander Growing In The North Region (Morocco)
Akansha Suganeshwari G	VIT University	Prediction of Chronic Kidney Disease Using Machine Learning Algorithms

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-3 | HALL-2



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Faheem Shahzad Baloch

Authors	Affiliation	Presentation title
Ekaterina Vladimirovna Makhova	Russian State Social University	Functional Features Of Platelets In Physically Untrained First Mature Men
Nadezhda Viktorovna Vorobyeva	South-West state University	Platelet Activity In Dairy Calves Of The Dutch Breed
Elena Sergeevna Tkacheva	Vologda State Dairy Farming	Main Hematological Characteristics In Sows During Gestation
Nilesh Kumar Pathak	University of Delhi	Plasmonic Resonances and their Applications
S. H. Abbasi A. Mahmood	Dept. of Electrical and Computer Engineering	Proportional-Integral Control of an Electromechanical Covert Feather for a Flapping Wing UAV
S. H. Abbasi A. Mahmood	Dept. of Electrical and Computer Engineering	Modeling and Proportional-Integral Control of a Prosthetic Finger
Jale Atakishiyeva	National Nuclear Research Center	Application Potential Of Boron Carbide Nanoparticles On The Nuclear And Nanotechnology
Hussein R. Nayyef Salih K. Alwan Alsharifi Shathar A. Imran Alaamer	University of Southern Technical	Comparison performance of developed drip irrigation and flood irrigation on some soil physical properties, maize yield and growth
Raja Ben Ahmed Mehrez Gammoudi	Université de Tunis-El Manar	Ovary cord structure and oogenesis in the Erpobdellide Leech Trocheta africana (Clitellata, Annelida) from Tunisia
Juee Dhar	Indian Institute of Science Education and Research	Integrating Levels Of Spatial-Temporal Resolutions In Molecular Dynamics

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-3 | HALL-3



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Assoc. Prof. Dr. Hakan İNCİ

Authors	Affiliation	Presentation title
Utpal Singha Roy	P. R. Thakur Government College	A Study on Succession Pattern of Rotifer Species on Artificial Substratum (Polyurethane Foam Units) From A Freshwater Lake
T. Mesri Gundoshmian	University of Mohaghegh Ardabili	Evaluation of solar water desalination efficiency using phase change materials
Mahrui Saidalieva Mohiniso Hidirova	Research Institute for the Development of Digital Technologies and Artificial Intelligence	Artificial Intelligence and Regulatorika: how does it happen?
Alireza Moghaddasi Amirhossein Bgaherieh-Mashhadi	Faculty Member of Imamreza International University	The impact of product involvement and brand image on intent to buy with an emphasis on price and perceived values
Dahmani Abdennasser Ammi Yamina Hanini Salah	University Ahmed Zabana of Relizane	Use of the Artificial Neural Network and Meteorological Data for estimation Hourly Global Solar Radiation in Chlef, Algeria
Nisrine Nouj Naima Hafid Noureddine El Alem Igor Cretescu	IBN ZOHR University	Novel Biocoagulant for Treatment Optimization of Fish Processing Wastewater from a Moroccan Plant
Hamza Ighnih Redouane Haounati Hassan Ouachtak Naima Hafid Amane Jada Abdelaziz Ait Addi	Université Ibn Zohr	Fast and Highly Efficient Removal of MG Dye from Wastewater Using a Superb Eco-Friendly adsorbent nanocomposite: Equilibrium and Thermodynamic Studies
Khadija Bahend	Ibn Zohr University	Development and characterization of $M_x(PO_4)_y$ and $(MO_z)/M_x(PO_4)_y$ thin films for the electro-catalytic applications
Ahmad Sharif Aleye Agh	Gonbad Kavous University	A Study Of Travelling And Optical Solitons For Multidimensional Landau–Lifshitz–Gilbert System
Peer Mohamed Syed Ibrahim S.Charen Vishwa A.H. Nasreen Fathima Divya Kannan	B.Tech Electronics and Computer Engineering VIT Chennai	An Unsupervised Variational Auto-encoder Approach with Shallow Learning for Network Intrusion Detection System

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-3 | HALL-4



Ankara Local Time: 15:00-17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Bünyamin SÖĞÜT

Authors	Affiliation	Presentation title
Nijat Abbasov	Baku State University	EPR spectroscopy of hexagonal boron nitride (h-BN) nanocrystalline particles irradiated with various neutron fluxes.
Ammi Abderraouf Mennour Abdellah Menaâ Lazazi	University of Médéa	Design And Study Of An Earthen Dam (28.7 HM3), Located In Béni Slimane, Wilaya Of Médéa
Youssef Ettahiri Lahcen Bouna Brahim Akhsassi Ayoub chaoui Abdeljalil Benlhachemi	IBN ZOHR University	Synthesis Of Porous Kaolinite Based Geopolymer For Efficient Removal Of Methylene Blue From Wastewater
Y Annie Jerusha Syed Ibrahim S P	VIT University	A Survey on Addressing Class Imbalance in Artificial Intelligence Framework
Hung Huu Nguyen Kha Hoang Nguyen Tran Nguyen-Ho-Bao	Can Tho University	Survey On Nematodes In Chickens From Tien Giang Province In Vietnam
K.Fritah M.Khachane A.Benlhachemi B.Bakız A.Taoufyq Y.Nacı A.Bouddouch	University Ibn Zohr	Study Of Photocatalytic Activity In Visible Light Of A Bismuth-Based Catalyst Towards Methyl Orange
Oum Keltoum Mallem Fatma Zohra Benabid Ayse Celik Bedeloglu Foued Zouai Omer Yunus Gumus Djafer Benachour	Bursa Technical University	Improved Properties of PVC Composites Using Talc/Calcined kaolin Co-filler System
Dahmani Abdennasser Ammi Yamina Hanini Salah	University Ahmed Zabana of Relizane	Supervised artificial neural network-based method for prediction of solar radiation data: case study
Kratbi Fouad Ammi Yamina Hanini Salah	University of Médéa	Multiple Linear Regressions for predicting of the Passage of Organic Compounds through Nanofiltration and Reverse Osmosis Membranes

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

25.12.2021 | SESSION-3 | HALL-5



Ankara Local Time: 15:00–17:30



Meeting ID: 899 0040 8534 | Passcode: 001001

HEAD OF SESSION: Prof. Dr. Kağan KÖKTEN

Authors	Affiliation	Presentation title
Sunil Agrawal Tripti Dubey Sunil Sharma Sapna Awasthi	People's University	Human Capital Management, It's Perspective and Prospects
Kamal A. R. Ismail Antonio B. V. Leita Fatima A. M. Lino	State University of Campinas	PCM solidification between parallel plates for cooling applications
Nawzet Bouriga Rym ENNOURI Oumaima JEBALI Oumaima FEKIRI Sami Mili	University Tunis el Manar	Effects of Sundrying and smoking process on biochemical and microbiological quality of Portunus segnis, in the north of Tunisia
Toumana Daida Nawzet Bouriga Khawla Bouali Monia Trabelsi	University Tunis el Manar	Correlation between fatty acid composition and otolith shape of pelagic and benthic fish in northern Tunisia
Natela Borisovna Popkhadze	Head of Scholarly Information at Phassis Academy in Tbilisi	The Main Means Of Minimising Misfortunes Occurring Since The National Liberty Declared In 1991 By Our First President Zviad Gamsakhurdia - According To Some Publications
Ghanshyam Barman	Uka Tarsadia University	Advance Multifunctional Materials
Dona Shaji Amritha V Ariya Farsana K B Sreelakshmi I L Nivya Mariam Paul	Mar Athanasius College (Autonomous)	Current Trends And Benefits Of Probiotics- A Review
Sheema Salman Zafar Ghias Uddin	University of Peshawar	Composition and Biological Potential value of the Crude Extract of Curcuma Zedoria
Daniel Kazimir Kurzeluk	Useful Organisms Laboratory Entomology – Taxonomy and Histology	Catalogue Of The Cleridae (Coleoptera: Cleroidea) From The Arion-Panin” Entomological Collection Of The Research-Development Institute For Plant Protection
M.M.M. Jaradat	Qatar University	Extremal number of theta graphs

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

CONFERENCE GALLERY



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This screenshot shows a Zoom meeting interface. The main window displays a PowerPoint presentation titled "ISPEC". The slide content is as follows:

ISPEC

Bu çalışma, 2,4-D herbisitinin, balıkların beyin dokusu oksidan/antioksidan dengesini bozarak oksidatif strese ne olduğunu göstermiştir. GR, SOD ve MDA parametrelerinin, su sistemde toksikoloji çalışmalarında ve ekotoksikolojik belirmelerinde uygun ve güvenli indikatörler olarak değerlendirilebileceği sonucuna varılmıştır.

This study showed that 2,4-D herbicide caused oxidative stress disrupting the oxidant/antioxidant balance in the kidneys of fish was concluded that GR, SOD and MDA parameters can be evaluated as suitable and safe indicators in aquatic system toxicology studies and ecotoxicological risk determinations.

The right side of the screen shows a vertical stack of participant video feeds. Visible participants include: Doç. Dr. Seyhan SEYDOĞU, H-1 Ekrem SOYDEMİR, H-1/ MEHMET REŞİT TAYŞI, and a "Mute" button. A notification at the bottom of the video stack indicates "3 unassigned participants". The bottom of the screen shows the Zoom control bar with buttons for "Unmute", "Stop Video", "Participants", "Chat", "Share Screen", "Record", "Breakout Rooms", "Reactions", and "Leave Room".

This screenshot shows a Zoom meeting interface. The main window displays a PowerPoint presentation titled "THE EFFECT OF DIFFERENT PRIMING TIMES APPLIED TO ORIENTAL TOBACCO SEEDS ON SEEDLING DEVELOPMENT". The slide content includes the logo of Ege University (1955) and the following text:

THE EFFECT OF DIFFERENT PRIMING TIMES APPLIED TO ORIENTAL TOBACCO SEEDS ON SEEDLING DEVELOPMENT

Cafer Nisan
Doç. Dr. Sıdika EKREN
2021

The right side of the screen shows a vertical stack of participant video feeds. Visible participants include: H-1, Prof. Dr. Kağan Köken, Bingöl..., H1-Meltem TÜRKERİ, H1-Cafer Nisan, H-1, Zeynep Du..., and H-1, Zeynep Dumanoglu. A notification at the bottom of the video stack indicates "2 unassigned participants". The bottom of the screen shows the Zoom control bar with buttons for "Unmute", "Stop Video", "Participants", "Chat", "Share Screen", "Record", "Breakout Rooms", "Reactions", and "Leave Room".

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Koyunlarda Üreme Özellikleri

- Kuzey yarımkürede yer alan ülkemiz koşullarında, mevsime bağlı poliöstrüs gösteren koyunların özellikle yaz sonu (Batı Anadolu) veya sonbahar aylarında (Doğu Anadolu) üreme sezonuna girdikleri görülmektedir.
- Koyunlarda fizyolojik olarak; ortalama östrüs siklusu 16-17 gün, östrüs süresi 20-36 saat ve ovulasyon ise kızgınlık sonunda (24-26. saat) oluşur.

5 unassigned participants

ISPEC 8th INTERNATIONAL CONFERENCE ON AGRICULTURE, ANIMAL SCIENCES and RURAL DEVELOPMENT
24.12.2021
Bingol University, Bingol, Turkey

THE EFFECT OF ESTROUS PRESYNCHRONIZATION AND SYNCHRONIZATION APPLICATIONS ON SOME BLOOD PARAMETERS IN KIVIRCIK SHEEP

KIVIRCIK KOYUNLARINDA PRESENKRONİZASYON VE SENKRONİZASYON UYGULAMALARININ BAZI KAN PARAMETRELERİ ÜZERİNE ETKİLERİ

H-3, Nevzat SAAT
H-3, Dr. Metehan KUTLU
H-3, Tugçe AVCI
H-3, Erinc DİLMİÇ

CONFERENCE GALLERY

Recording... You are viewing H-4, RUNDABE.ATAÇ's screen View Options

Vajinal pH

- Kızgınlık döneminde vajinal pH değeri yükselmektedir. Koyunlarda ve keçilerde kızgınlık döngüsüne göre ortalama 5.6-7.1, 8.55-10.26 arasında değişir.
- Vajinal pH en yüksek düzeyde olduğunda aynı zamanda kızgınlık döneminde meydana gelen en düşük progesteron seviyesine denk gelir. Bu yumurtlamanın göstergesidir, kızgınlığın ve tohumlama için en uygun zamanın belirlenmesinde temel bir parametre olarak kullanılabilir.



Kızgınlık esnasında pH değerinin enfeksiyonlara karşı daha dayanıklı duruma getirilmesi ve bu nedenle vajina bu dönemde kolayca yerleşemez.

Unmute Stop Video Participants Chat Share Screen Pause/Stop Recording Breakout Rooms Reactions Leave Room

Recording Paused You are viewing H-4, Muhammed Baydemir's screen View Options

GİRİŞ

- Ana arının koloni tarafından kabul edilmesi hatta erken kabul edilmesi oldukça önemlidir. Örneğin ilkbahar sonlarında koloninin bir an önce ana arıya kavuşması bal mevsiminin verimli geçmesine etki edebilir.
- Sonbahar sonlarında ise koloninin bir an önce ana arıya kavuşması ile koloninin genç işçi arı nüfusu ile kış mevsimini geçirmesi sağlanabilir.

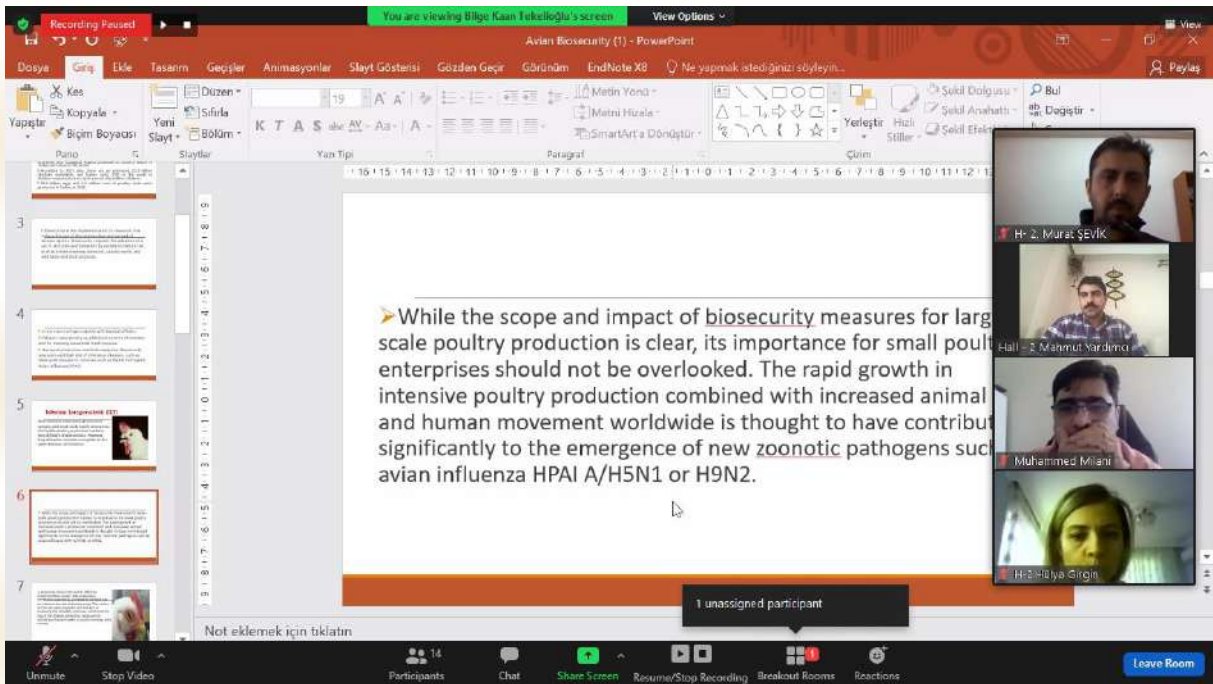
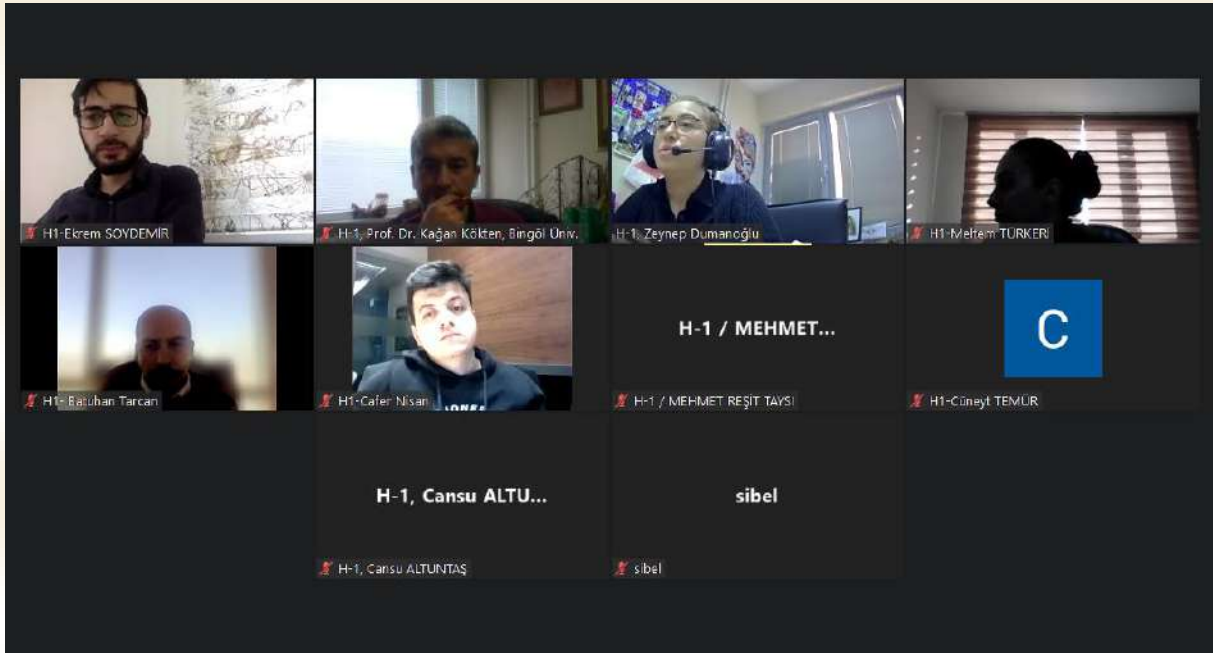
INTRODUCTION

- It is very important that the queen bee is accepted by the colony, even early. For example, at the end of spring, the colony's meeting with the queen as soon as possible may affect the productive honey season.
- At the end of autumn, the colony can be provided with the queen bee as soon as possible, and the colony can spend the winter season with the young worker bee population.

Windows'u etkinleştirin Windows'u etkinleştirmek için kişisel bilgisayarınıza gidin.

Unmute Stop Video Participants Chat Share Screen Resume/Stop Recording Breakout Rooms Reactions Leave Room

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Zoom Meeting - HALL-2

You are viewing Hall - 2 Mahmut Yardimci's screen

View Options

Recording Paused

BİNGÖL ÜNİVERSİTESİ
2007

8. ULUSLARARASI
TARIM, HAYVANCILIK ve KIRSAL KALKINMA KONGRESİ
24-25 Aralık 2021
Bingöl Üniversitesi
Bingöl, Türkiye

ISPEC
Institutional Science

GEBE BİR KOYUNDA DİYAFRAM FİTİĞİ OLGUSU
A CASE OF DIAPHRAGMATIC HERNIA IN A PREGNANT SHEEP

Dr. Öğr. Üyesi Ömer Faruk KELEŞ¹
Öğr. Gör. Mahmut YARDIMCI²
Doç. Dr. Turan YAMAN¹
Prof. Dr. Zübül YENER¹

¹ Van Yüzüncü Yıl University, Faculty of Veterinary Medicine, Department of Pathology, Van, Turkey.
² Muş Alparslan University, Bulancık Vocational School Department of Veterinary, Muş, Turkey.

Mute Stop Video

Participants Chat Share Screen Resume/Stop Recording Breakout Rooms Reactions

Leave Room

Redditing

You are viewing H-1, Onder's screen

View Options

Çizelge 4. Zencefil esansiyel yağının mısır dane yeminin *in vitro* rumen fermentasyon parametreleri üzerine etkisi

Parametreler	Zencefil esansiyel yağı, g/L RS					
	Kontrol (0)	0.2	0.4	0.8	1.2	1.6
pH	5.83 ^a	6.08 ^{ab}	6.11 ^{bc}	6.29 ^c	6.40 ^d	6.51 ^d
NH ₃ N, mg N/100 mL	31.96 ^a	30.19 ^b	27.99 ^c	26.21 ^d	22.67 ^e	21.66 ^e
TUYA, mmol/L	104.17 ^a	100.69 ^b	98.78 ^c	94.67 ^d	92.64 ^e	81.79 ^e
Asetik asit	49.93 ^a	48.04 ^b	46.99 ^b	45.70 ^c	44.74 ^{cd}	43.65 ^d
Propiyonik asit	27.90 ^a	27.34 ^a	27.36 ^a	26.02 ^b	25.99 ^b	21.30 ^c
Bütirik asit	17.66 ^a	17.37 ^a	17.09 ^{ab}	17.05 ^{ab}	16.36 ^b	12.24 ^c
AA/PA	1.79 ^c	1.75 ^{cd}	1.69 ^d	1.76 ^{cd}	1.72 ^{cd}	2.05 ^a

TUYA = %31
NH₃N = %37
Asetik asit = %25

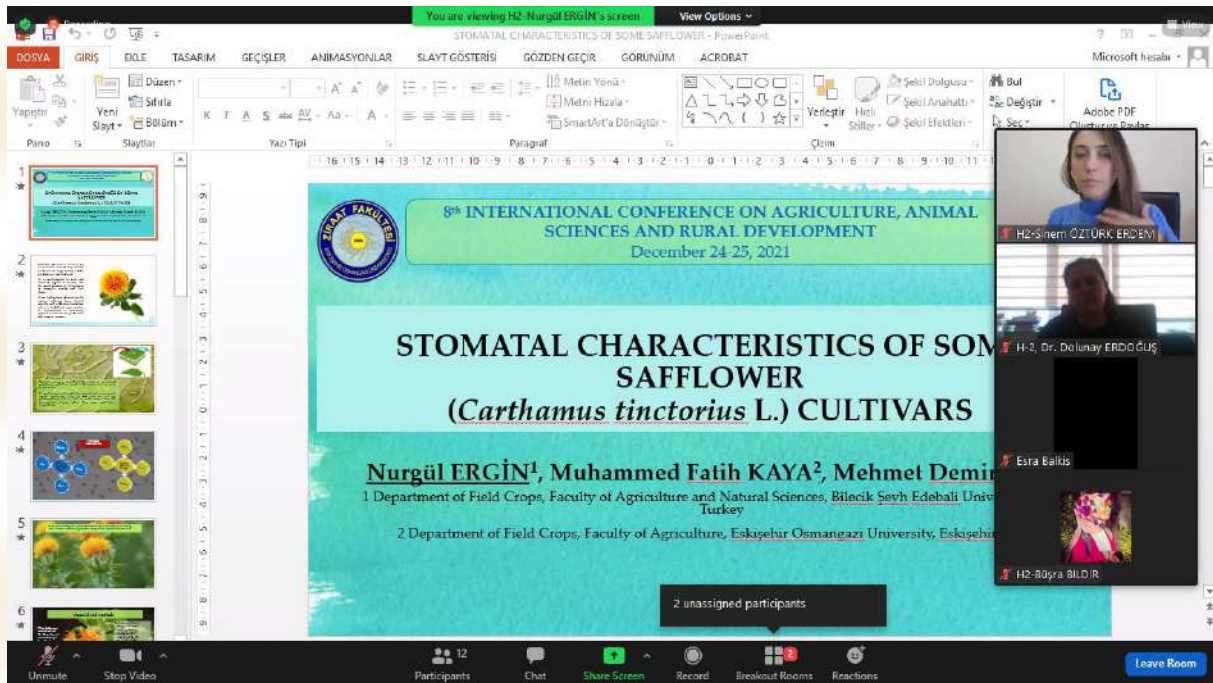
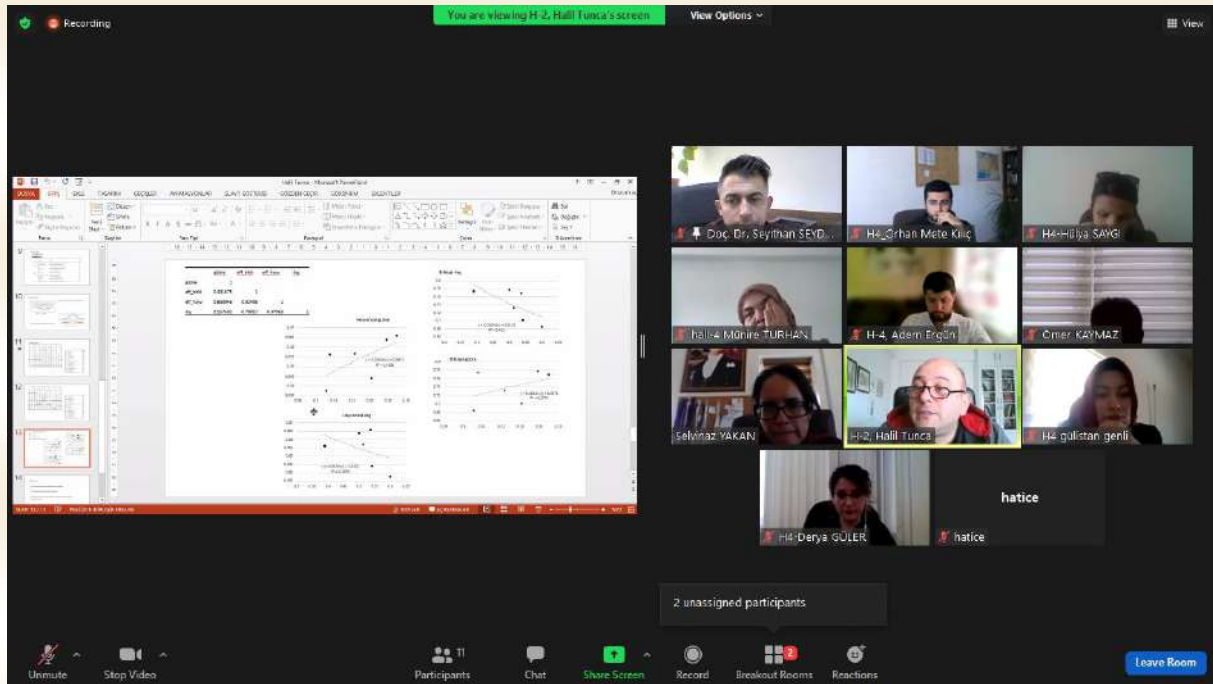
74.12.2021

Unmute Stop Video

Participants Chat Share Screen Record Breakout Rooms Reactions

Leave Room

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CONFERENCE GALLERY

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The shared content is fit to your screen. To see the original size, click "Original size" in the menu.

H-1, Cansu ALTUNTAŞ

Doc. Dr. Seyithan SEYDOĞU

H-1, Doç. Dr. Hakan İno

H-1, Batuhan Tölcü

H-1, Yegim BULAK

H-1, Onder

H-1, Fuat YETİŞSİN

H-1, Elzbieta Patkowska

H-1 Mehmet YA...

H-1 Mehmet YAMAN

observersibel

Dilfuza Jabborova

observersibel

Dilfuza Jabborova

1 unassigned participant

Unmute Stop Video Participants Chat Share Screen Record Breakout Rooms Reactions Leave Room

IPSC 8th INTERNATIONAL CONFERENCE ON AGRICULTURE, ANIMAL SCIENCES AND RURAL DEVELOPMENT

Hypotesis

Hipotez

Yerel donates fidelerinde diğtan prolin (PRO) uygulamasıyla kuraklık stresinin meydana getirdiği fotosentetik hasar hafifletilebilir.

Amaç

- Hücrelerarası CO₂ konsantrasyonu (Ci), fotosentez hızı (A), transpirasyon (E), gbi gaz değişim parametrelerindeki değişimler
- PS II' nin maksimum kuantum etkinliği (Fv/Fm) ve idirovelli içeriğindeki değişimler
- Hangi PRO konsantrasyonunun en iyi fotosentetik performansa göstereceği

Aim

To investigate

- Exogenous proline (PRO) pre-treatment can alleviate photosynthetic damage caused by drought stress in Arvin Şağat tomato seedlings.
- changes in gas exchange parameters such as photosynthesis rate (A), transpiration rate (E), intercellular CO₂ concentration (Ci) in response to drought stress with PRO application in Arvin Şağat tomato seedlings.
- changes in maximum quantum efficiency of PS II (Fv/Fm) and chlorophyll content

To determinate

- which PRO concentration will show the best photosynthetic performance

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SONUÇ VE DEĞERLENDİRME (CONCLUSION AND EVALUATION)

Kırsal bölgelerde biyogaz sistemleri kurulması ile

- İstihdam artacak,
- Çevre kirliliği azalacak,
- Sağlık ve hijyen koşulları iyileşecek,
- Isınma için kömür ve odun gibi maddelerin yakılmasından kaynaklı evin iç hava sahasını kirleten etkenler ortadan kalkacak,
- Tarımda organik fermente gübre kullanılmasından kaynaklı verim artışı sağlanacak ve gıda güvenliği artacaktır.

With the establishment of biogas systems in rural areas,

- Employment will increase,
- Environmental pollution will decrease,
- Health and hygiene conditions will improve
- The factors that pollute the indoor air space of the house due to the burning of materials such as; coal and wood for heating will be eliminated.
- Efficiency will increase and food safety will increase due to the use of organic fermented fertilizers in agriculture.

H-3, Orhan Karakaya

Doc. Dr. Seyithan SEYDOĞU

H-3, Gamze Kaya

H-3, İker Buğaz AVAZ

H-3, Tuğçe AVCI

H-3, Şeyma İNÇİ

H-3, Ezgi Canbaz

H-3, Zehra Gul Oğuz

H-3, Buğra BELTEKİN

H-3, Seda BİCE A...

H-3, Seda BİCE ATAĞI

H-3, Elif Kartal

H-3, Sema Gün

zehra belli

zehra belli

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1. INTRODUCTION

The idea of functional food was first introduced in Japan in 1984 with the term "FOOD" (Foods For Specified Health Use) to address insufficient natural resource problems. Today, functional foods are mostly used to prevent or treat diseases (Natl Assoc and Singh 2015, Singh 2015).

Functional foods that develop with interdisciplinary studies such as food engineering and health sciences; it can be defined as a nutritional element that is natural, contains substances such as vitamins and minerals, is suitable for daily consumption, and is beneficial to health (Edison 2009).

In addition to foods that naturally contain vitamins and minerals, foods that are added to the food with natural antioxidant substances have recently attracted a lot of attention as functional food.

H2-Nurgül ERGİN Doc. Dr. Seyithan SEYDOĞU H-2 AYDIN ŞUKRU BENGÜ

H2-Sinem ÖZTÜRK ERDEM H-2-Büya BİLDİR Halit 2 -Dr. Mürşide Yiğit

H-2, Dr. Dolunay ERDOĞUŞ Güneşobservers

H-2, Ali Karanfil Esra Balkis

Muhammed Milani

3 unassigned participants

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ŞEBINKARAHİSAR (ÇALIŞMA ALANI / STUDY AREA)

Geçim Kaynakları
Tarım ve Hayvancılık
Livelihood
Agriculture and Livestock

Yükseli / Elevation
1364 m
Yüzölçümü / Area
1396 km²

Yıllık Ortalamalar / Annual averages (1965-2017)
Toplam Yağış / Total Precipitation: 583.5 mm
Sıcaklık / Temperature: 9.13 °C
Bulutlu Günler / Cloudless Days: 126.10
Bulutlu Günler / Cloudy Days: 198.70

H-4 Bahadır ATMACA Doc. Dr. Seyithan SEY... H-4 ŞULE ERKOVAN

Prof. Dr. Kağan Koltu... Aysun Halit TUTAR

H4 Ferit İŞLEK H-4 Merve Macit H-4 Rıdvan UÇAR

H-4 Selim ÖZDEMİR hatice H 4 Büşra Kayan...

H 4 Mıhraban A... hatice H 4 Büşra Kayantag

H 4 Mıhraban A... hatice H4-Zeynep Du...

Hall 4 Nesrin K... Hall 4 Nesrin Karaca...

From H- 4, ŞULE ERKOVAN to Everyone
merhaba kağan ho cam

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Recording

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H1- S-3 Yeter ÇİLEŞİZ

Doç. Dr. Seyithan SEYDOĞU

H1-İlker YÜCE

H1-Mesut BUDAK

H1- Gülten Kaçak

H1-Tolga Karaköy-Sivas Bil

H1Önur KIRMIZIGÜL

H-1, Önder

H-1 MUAMMER...

H-1, observersibel

Alpaslan

H6 ERSİN KARA...

H-1, observersibel

Alpaslan

H6 ERSİN KARAKAYA

4 unassigned participants

31.5. Biyolojik Farklılaşma ve Oluşum

Biyolojik farklılaşma kavramı, organizmaların yaşam döngülerinde meydana gelen yapısal ve işlevsel değişiklikleri ifade eder. Bu süreç, gen ekspresyonunun kontrolü, epigenetik değişiklikler ve hücre farklılaşmasıyla gerçekleşir. Biyolojik farklılaşma, organizmaların çevreyle uyum sağlaması ve hayatta kalması için önemlidir.

31.5. Biyolojik Farklılaşma ve Oluşum

Biyolojik farklılaşma kavramı, organizmaların yaşam döngülerinde meydana gelen yapısal ve işlevsel değişiklikleri ifade eder. Bu süreç, gen ekspresyonunun kontrolü, epigenetik değişiklikler ve hücre farklılaşmasıyla gerçekleşir. Biyolojik farklılaşma, organizmaların çevreyle uyum sağlaması ve hayatta kalması için önemlidir.

Recording

You are viewing Hall-2: Sıddık KESKİN's screen

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HALİT ERHAN GÖÇMEN

Doç. Dr. Seyithan SEYDOĞU

HALİT ERHAN GÖÇMEN

Hall-2: Sıddık KESKİN

Güneşobserver

Güneşobserver

Reyyan KESKİN

H 2 - Cenap Yilm...

H 2 - Cenap Yilmaz

4 unassigned participants

31.5. Biyolojik Farklılaşma ve Oluşum

Biyolojik farklılaşma kavramı, organizmaların yaşam döngülerinde meydana gelen yapısal ve işlevsel değişiklikleri ifade eder. Bu süreç, gen ekspresyonunun kontrolü, epigenetik değişiklikler ve hücre farklılaşmasıyla gerçekleşir. Biyolojik farklılaşma, organizmaların çevreyle uyum sağlaması ve hayatta kalması için önemlidir.

CONFERENCE GALLERY

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• Türkiye'de kanatlı hayvan sektörü her geçen yıl sektörde yeni teknolojilerin ortaya çıkması ile birlikte gelişme göstermiştir. Türkiye'de olduğu gibi Konya ilinde de kanatlı sektörünün büyük bir çoğunluğunu etlik piliç ve yumurta tavukçuluğudur. Sektörde sorunların başında, yem sorunu ortaya çıkmaktadır. Yem üretiminin yetersiz olması ithalata bağımlılığı ortaya çıkarmakta bu durumda maliyetlerin yükselmesine neden olmaktadır. Ayrıca damızlık materyal üretimi maliyetli olması, hayvan hastalıkları, ihracatta yeni pazar ihtiyaçları diğer sorunlardır. İhracatın artırılmasında önemli rol oynayan lojistik altyapı geliştirilmelidir. Yem hammaddesi ve katkı maddelerinin üretimine yönelik teşvik ve destekleme programlarının oluşturulmalıdır. Türkiye'de her geçen gün artan nüfusa rağmen kanatlı tüketimi oldukça düşüktür. Bu durum ürün pazarlanmasında yaşanan aksaklıklar ve tüketicilerin bilgi eksikliklerinden kaynaklanmaktadır. Tüketime artırılması için, tavuk eti ve yumurtanın insan sağlığı açısından önemi ve avantajları tüketicilere anlatılmalıdır. Kanatlı hayvansal ürünlerin tüketimi konusunda televizyon kanallarında kamu spotları oluşturulmalı, reklamlar verilmeli ve konu ile ilgili uzmanlar getirilerek konferanslar düzenlenmelidir.

H-4 Bahadır ATMAÇCI Doç. Dr. Seyithan SEYDOĞLU H-4 ŞULE ERKOYUN

Prof. Dr. Kağan KÖkten, Bilişim Aysun Zeynep Dumanoğlu

H-4 Rıdvan UÇAR H-4 Selim ÖZDE... H-4 Merve Macit

H-4 Rıdvan UÇAR H-4 Selim ÖZDEMİR H-4 Merve Macit

hatice H-4 Çağrı Özyurt

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MONITORING OF IMPORTANT PARASITIC INSECTS OF HONEYBEES IN SERBIA

Academ. Res.Fell. Dr. Ivan Pavlovic¹, Ing.Milan Stevanovic², Dr Nemanja Zdravkovic³

¹Scientific Veterinary Institute of Serbia, Belgrade
²Academy of Beekeeping and Apiculture of Serbia, Belgrade

H-3, Ivan Pavlovic Doç. Dr. Seyithan SEYDOĞLU

H-3, Ivan Pavlovic Viliama Vasileva

R H3 observer zehra


H3-Radija KHEDIM 2 unassigned participants H3 observer zehra

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H4 Gheorghe Giurgiu Dogi Dr. Seythan SEYDOĞLU

Hall-4, Widya Pinitaka Bayu Putra Assoc. Prof. Dr. Hokan NCI


Ela H-4, Benghalem...

h4 observer hatice

1 unassigned participant

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Recording You are viewing Hall-5, Sara Kacimataj's screen View Options Remaining: 09:51:20 View



Hall-5, Kapka Mancheva Dogi Dr. Seythan SEYDOĞLU

Hall-5, Sara Kacimataj H5 Observer Gül...

H5 Observer Gülşah Efe

Hall-5, Dr. Talebi Dr Ashwini A. W...

Hall-5, Dr. Talebi Dr Ashwini A. W...

Shivangi Agnihotri charu vyas

Shivangi Agnihotri charu vyas

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ABSTRACTS



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**THE DRAWBACK OF CALLING MY/OUR REPUBLIC BY WORDS SAKARTVELO
AND 'GEORGIA' INSTEAD OF AIAKOLKHETI AND/OR
AIAKOLKHETIKARDUGEOGIA AT SCHOLARLY EVENTS INCLUDING
EXCIBITIONS**

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ABSTRACT

Despite the desire of many scholars living in our Republic called Sakartvelo officially in our native language called Kartuli ena - to revive officially its older names Aia and Kolkheti attested even in cuneiform scripts in texts written in 2000s BCE, the agricultural permanent exhibition of world's viticulture taking place in France since June 2017 has our younger name 'Georgia' in the inscriptions. Their text says that Georgia is the cradle of viticulture. The drawbacks of the words Georgia and Georgian are that these are not used in ancient times and when used in the first century by Strabo, the Elder Pliny, Tacitus and Pomponius Mela in their geographical descriptions they refer only to small several regions that are outside of our Republic nowadays in 2021. The director of the National Museum of Archaeology situated in Tbilisi supplied materials to that important exhibition. He is a biologist by education but well knows history inasmuch as his father was a famous historian. I shall quote materials from Wikipedia proving the basis of mentioning our country as Aiakolkheti and/or as Aiakolkhetikardugeorgia instead of Georgia when there is talk about very ancient agricultural events and artifacts connected to 8 000 years old history of viticulture of our country.

Key words: Aia, Aya, Aiakolkheti/Sakartvelo/Gurcistan/Gruzia/Georgia



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**CATALOGUE OF THE CLERIDAE (COLEOPTERA: CLEROIDEA) FROM THE „
ARION-PANIN” ENTOMOLOGICAL COLLECTION OF THE RESEARCH-
DEVELOPMENT INSTITUTE FOR PLANT PROTECTION**

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ABSTRACT

In the Arion-Panin” entomological collection of the Research-Development Institute for Plant Protection (RDIPP), a number of 76 pieces belonging to 9 (from a total of 28) checkered beetle species is conserved. This work aims to present a list of the conserved specimens, because of their importance, both historical and as Romanian biodiversity records. The collecting range of the studied specimens is comprised between 1898 – 1951, in those 53 years 76 pieces were collected, with a peak in 1937, the year from which a number of 21 pieces have been identified. The collectors are Sergius Panin, George Arion and Franz Salay. A remarkable presence is one specimen of *Tillus pallidipennis* Bielz, 1850, collected in the vicinity of Bucharest (Andronache forest), specimen which is the second one seen by the author in more than 15 years of checkered beetle study from 15 collections. Even if the local population from which the specimen was collected does not exist today, or even this was an accidental introduction (e.g. anthropochory), this record remains, however, an interesting one.

Key words: *Cleridae, Romania, Arion-Panin*



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**ASMA BİTKİSİNDE (*Vitis vinifera* L.) ABC PROTEİNLERİNDEN PDR ALT
AİLESİNİN BİYOİNFORMATİK VE İFADE ANALİZİ**

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ÖZET

ATP bağlayıcı kaset (ABC) taşıyıcı genleri, evrimsel olarak yüksek oranda korunmuş, tüm organizmalarda bulunan en büyük membran protein sınıflarından biridir. ATP hidroliz enerjisini kullanarak maddelerin içe ve dışa taşınmasında görev almaktadırlar. Plazma zarı, tonoplast, kloroplast, mitokondri ve peroksizomlar gibi bir bitki hücresinin zarlarında lokalizedirler ve çok sayıda işlevi yerine getirirler. Başlangıçta detoksifikasyon işlemlerine katılan taşıyıcılar olarak tanımlanmış daha sonra organ büyümesi, bitki beslenmesi, bitki gelişimi, abiyotik strese cevap, patojen direnci ve bitkinin çevresi ile etkileşimi için gerekli oldukları gösterilmiştir. Ökaryotik ABC taşıyıcılarının tipik bir yapısı, korunmuş iki alandan oluşur: bir transmembran alanı (TMD) ve bir nükleotit bağlama alanı (NBD). Ökaryot ABC taşıyıcıları, sekans benzerliği ve alan organizasyonuna göre yedi ana ailede (ABCA - ABCG) sınıflandırılır. PDR alt ailesi ABCG'nin tam yapı üyelerinden oluşur. Genel olarak, PDR'ler kutiküler lipidlerin üretimi veya taşınmasında görev almaktadır. ABA, JA, sitokininler ve oksinler gibi farklı hormonların taşınmasından sorumludurlar. Ayrıca, bitkilerde abiyotik ve biyotik strese karşı tepkilerde rol oynarlar. Bu çalışmada, *Arabidopsis thaliana*'ya ait ABCG alt ailesinde bulunan PDR sekansları kullanılarak *Vitis* genomu üzerinden BLAST yapılarak 33 VvABCG/PDR geni tespit edilmiş ve bu genlere ait sekanslar, lokasyon bilgileri, gen ve protein yapılarına ait veriler çıkartılmıştır. Elde edilen sekanslarla MEGA10 programı kullanılarak filogenetik ağaç oluşturulmuştur. *Vitis* genomu üzerinden tespit edilen 4 VvABCG/PDR geni, Ensemble Plant veri tabanında BLAST edilmiş ve tüm genlerin Ensemble Plant ID'leri tespit edilmiştir. STRING veri tabanı üzerinden analizler Ensemble Plant ID'si ile yapılmış ve 4 adet VvABCG/PDR proteininin etkileşime girdiği proteinler tespit edilmiştir. Elde edilen verilerde etkileşime girilen proteinlerin çoğu karakterize edilmiş olmadığından dolayı, Ensemble Plant üzerinden bu proteinlerin sekanslarına ulaşılmış ve *Arabidopsis thaliana* genomu üzerinde BLAST yapılarak *Arabidopsis* homologları ve UniProt veri bankası üzerinden homologlarının görevleri tespit edilmiştir. Bu çalışmada, farklı gelişim dönemlerinde alınan üzüm tanelerinden toplam RNAlar izole edilerek cDNA sentezinde kullanılmıştır. VvABCG/PDR gen ailesine ait VvABCG31, VvABCG32 VvABCG33 ve VvABCG34 genlerinin ifadeleri Real-time PCR yöntemi ile analiz edilmiştir.

Anahtar sözcükler: ABC Taşıyıcıları, ABC Proteinleri, ABCG, mRNA ifadesi, *Vitis vinifera*, Real-time PCR



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**EXPRESSION ANALYSIS OF PDR SUBFAMILY GENES OF ABC PROTEINS IN
GRAPEVINE (*Vitis vinifera* L.)**

ABSTRACT

ATP-binding cassette (ABC) transporter genes are one of the largest classes of membrane proteins found in all organisms, evolutionarily highly conserved. They are involved in the transport of substances by using the energy of ATP hydrolysis. They are localized in the membranes of a plant cell, such as the plasma membrane, tonoplast, chloroplast, mitochondria, and peroxisomes, and perform numerous functions. Initially identified as carriers involved in detoxification processes, they were later shown to be essential for organ growth, plant nutrition, plant growth, response to abiotic stress, pathogen resistance, and plant interaction with its environment. A typical structure of eukaryotic ABC transporters consists of two conserved domains: a transmembrane domain (TMD) and a nucleotide binding domain (NBD). Eukaryotic ABC transporters are classified into seven major families (ABCA - ABCG) based on sequence similarity and domain organization. The PDR subfamily consists of full length members of ABCG subfamily. PDRs are involved in the production or transport of cuticular lipids. They are responsible for the transport of different hormones such as ABA, JA, cytokinins and auxins. They are also involved in responses to abiotic and biotic stress in plants. In this study, 33 VvABCG/PDR genes were determined by BLAST on the *Vitis* genome using PDR sequences in the ABCG subfamily of *Arabidopsis thaliana*, and the sequences, location information, gene and protein structures of these genes were determined. Phylogenetic tree was constructed using the MEGA10 programme. 4 VvABCG/PDR genes identified on the *Vitis* genome were BLASTed in the Ensemble Plant database and Ensemble Plant IDs of all genes were determined. Analyzes on the STRING database were made with Ensemble Plant ID and the proteins interacting with VvABCGs were identified. Since most of the interacting proteins were not characterized, the functions of the *Arabidopsis* homologs were identified through the UniProt database by BLASTing on the *Arabidopsis thaliana* genome. In this study, total RNAs were isolated from grapes taken at different developmental stages and used in cDNA synthesis. Expressions of VvABCG31, VvABCG32, VvABCG33 and VvABCG34 genes belonging to VvABCG/PDR gene family were analyzed by Real-time PCR method.

Keywords: ABC Transporters, ABC Proteins, ABCG, mRNA Expression, *Vitis vinifera*, Real-time PCR



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**GENOTYPE X ENVIRONMENT INTERACTION AND YIELD STABILITY IN
GARDEN PEAS GENOTYPES**

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ABSTRACT

Pea (*Pisum sativum* L.) is an important legume grown as a garden and field crop throughout the temperate region of the world. It is also grown as a cool season crop. The growth and development of peas are determined by the interaction of genetic factors, the environment and agricultural practices. In the presence of a dynamic interaction between the genotype and the environment it is necessary to obtain detailed information on the behavior of each variety in relation to changes in environmental factors. Adaptability and stability assays are extremely important and necessary to identify and recommend appropriate genotypes for different environments. In plant selection, when the goal is to select or recommend genotypes for cultivation in soil-climatic specific areas, the study of the interaction between genotype and environment is of utmost importance. The specific reaction of plants depending on the growing conditions is of particular interest to both, breeders and farmers. It is important for the breeder to adopt methods in which the stability of the genotype is associated with a high average grain yield (or above ground mass). Currently, among the various methods for determining the ecological stability of genotypes, several types are used on the basis of regression, variance and non-parametric analysis, as well as graphical analysis (GGE biplot), allowing simultaneous analysis of genotypes on high average yield and stability. Our study aimed at to evaluate the phenotypic stability of pea samples by basic quantitative characteristics and to determine the possibility of their use in different climatic regions. The trial was performed during three consecutive years 2018–2020 at Maritsa Vegetable Crop Research Institute - Plovdiv, Bulgaria. Significant effect of the factors genotype-environment and environment interaction on all studied traits viz. plant height, root length, root weight, nodule number and nodule weight was established. The genotype factor was found an important for plant height and root weight traits. The effect of the environment was stronger than that of the genotype and the genotype-environment interaction. Samples 22/16-ob and 1/17-ob were defined as ecologically stable with a plant height above the average and the most promising according to the



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Ysi index (7+ and 8+). Genotypes Marsi ($Y_{si} = 8 +$) and B4-34 ($Y_{si} = 5 +$) have the highest height, but also highly variable. Shugar duarf ($Y_{si} = 9$) and Marsi ($Y_{si} = 5 +$) were distinguished by the root mass weight with the highest Ysi stability index, followed by Vechernitza ($Y_{si} = 6 +$).

The lowest stability index was found for 22/16-af ($Y_{si} = -1$) which showed the lowest root mass weight. A high positive and statistically significant correlation was found between the plant height and root weight only with the YSi index ($r = 0.79$).

The research leading to these results has received funding from the National Science Fund, Bulgaria [Grant KP-06-H26/12].

Keywords: Pea, Phenotypic Stability, Productivity



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**ENGINEERED BIOSENSORS FOR THE DETECTION OF VIRUSES AND CANCER
CELLS**

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ABSTRACT

Early diagnostic and effective therapy are two of the important benchmarks for the early detection of life threatening viruses and cancer cells. Exosomes from viral cells may be important candidates for reliable biomarkers for the detection evaluation of tumor. In this study, Human interferon $\alpha 2$ (IFN $\alpha 2$) and thymosin $\alpha 1$ (T $\alpha 1$) are therapeutic proteins used for the treatment of viral infections and different types of cancer. Both IFN $\alpha 2$ and T $\alpha 1$ show a synergic effect in their activities when used in combination. Furthermore, the therapeutic fusion proteins produced through the genetic fusion of two genes can exhibit several therapeutic functions in one molecule. In this study, we determined the anticancer and antiviral effect of human Interferon $\alpha 2$ -Thymosin $\alpha 1$ fusion protein (IFN $\alpha 2$ -T $\alpha 1$) produced in our laboratory for the first time. We discuss the candidature of exosomal biomarkers for the detection of cancers, which can be employed for indicative diagnostic and treatment responses by incorporating IFN $\alpha 2$ and T $\alpha 1$ with the cancer-derived exosomes on biosensors. Further electrochemical recognition of viral cells was done by chronamperometric studies which comprise integrated scientific development of bioelectrochemical engineering and important figure of merits related with electrochemical aspects. Furthermore, advanced research directions and aspects in using viral-derived exosomes and recombinant with therapeutic proteins for point-of-care (POC) testing and bio sensory technology will be presented.



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**HEAVY METALS CONTAMINATION AND ACCUMULATION IN SOIL GROWN
AND PLANT (*CUCUMIS MELO*) FROM INDUSTRIAL AREA OF EL-HADJAR
(ANNABA, ALGERIA)**

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ABSTRACT

Our study, conducted in the industrial area of El-Hadjar (Annaba, Algeria), aims to assess the impact of heavy metals on agricultural soil and vegetation (melon) just outside the steel complex. The assessment to cover the total contents, exchangeable and soluble. These metals were measured in the surface soil (0-20 cm) and long (20-40 cm) and the melon sheets. The results obtained confirm the presence of two elements (Ni and Zn) in all samples analysed (soil and vegetation). The total zinc measured in the soil is in relatively more by contribution to nickel. As for the soluble and exchangeable contents, Ni is more important than Zn.

Keywords: Industrial area (El-Hadjar), Heavy metals, Soil, *Cucumis melo*.



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**EFFECTS OF SUNDRYING AND SMOKING PROCESS ON BIOCHEMICAL AND
MICROBIOLOGICAL QUALITY OF *PORTUNUS SEGNIS*, IN THE NORTH OF
TUNISIA**

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ABSTRACT

This present study is based on the sun drying and smoking of the invasive blue crab *Portunus segnis*, with the aim of the valorizations of this species in north Tunisia. The objective of this study is to investigate the modifications made by smoking and sun drying on the hygienic and biochemical quality of crabs *Portunis segnis*. Crabs were divided into two groups, the first one was hot smoked while the second group was sun dried. Crabs subjected to hot smoking at 70 °C and sun drying at ambient temperature of 32 °C treatments were compared to fresh samples. Proximate composition dry weight basis showed that smoked products were highest in protein and lipids ($P < 0.05$) with lower levels in the solar drying process. Differences in the fatty acid



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compositions of the smoked, sun dried and fresh fillet were significant, with a decrease in (PUFAs) in the proportion of total fatty acids. PUFAs decreased significantly during the hot smoking process. The microbiological results showed that significant differences ($P < 0.05$) were found in microbial counts during storage between fresh crabs and drying and smoking crabs process. Therefore, mesophiles, Faecal coliforms, *Staphylococcus aureus*, and total coliforms increased in the fresh while there are decreased in sun drying and smoking crabs with higher counts in the solar drying process. This study may have potential in a circular and sustainable bio-economic strategy for the valorization and transformation of invasive species.

Keywords: *Portunus segnis*, Valorization, Sun drying, smoking, blue crab, North of Tunisia, Nutritional qualities, Saturated fatty acid, Polyunsaturated fatty acids.



CORRELATION BETWEEN FATTY ACID COMPOSITION AND OTOLITH SHAPE OF PELAGIC AND BENTHIC FISH IN NORTHERN TUNISIA

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ABSTRACT

The objective of this work is to study the correlation between fatty acid composition and otolith shape in four pelagic and benthic fish species in the northern region of Tunisia: *Chelon auratus*, *Chelon ramada*, *Trachinus radiatus*, *Trachinus draco*. The results of the otolithometric analysis showed that the intra-population and sex variability revealed a symmetry of otolith shape in males and females of the species studied. On the other hand, intra-population variability without distinction of sex detected an asymmetry between otoliths (right-left) with a ($P=0.0051$) only in *Trachinus radiatus*. The results of the fatty acid composition showed that the fatty acid profile varies according to sex. Indeed, SFA contents are higher in benthic species in contrast PUFA, which are the most abundant in pelagic species. The results obtained by AFD allowed the separation of two groups, namely pelagic and benthic fish, according to the morphology of otoliths and the profile of saturated and monounsaturated fatty acids. This explains the existence of a correlation, pelagic fish are characterized by small otoliths and a PUFA-rich fatty acid profile unlike benthic fish that have relatively large otoliths and a MUFA-rich fatty acid profile. The differences observed can be explained by the adaptation of these species to their living environments and by the contribution of the diet, which has a direct effect on the fatty acid profile.

Keywords: otoliths, pelagic fish, benthic fish, fatty acid, correlation, symmetry and asymmetry of otolith shape.



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**DEVELOPMENT OF A MICROPROCESSOR BASED WORKSTATION – TO
ENHANCE LEARNING**

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ABSTRACT

Microprocessor-based devices are being incorporated every day in consumer, automotive, and transit products. These devices are built to perform control and monitoring of functions that all exist around us. To build such systems we moved from Programmable peripheral Interface (PPI) to modern microcontrollers for real time applications. To keep the pace of learning it is essential to give hands-on sequential knowledge. With this aim this paper is designed out of a senior undergraduate project titled microprocessor based work station. The workstation comprises of various multipurpose experimental set-ups using PPIs, microcontrollers and some digital logic blocks. In some applications that require pulses from many pins of microcontrollers, it is better to use PPI to avoid data loss and safe usage of microcontrollers.



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**OBTENTION OF *LACTARIUS DELICIOSUS* MYCELIUM ; A WAY FOR THE
CONSERVATION OF THIS FRAGILE EDIBLE MUSHROOM**

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ABSTRACT

Mushrooms have always been consumed. They are rich in vitamins, fiber and amino acids. In some countries, they are eaten instead of meat. The most cultivated mushrooms in the world belong to the genera *Agaricus* (button mushroom), *Pleurotus* (oyster mushroom) and *Lentinula* (chitakee). Also, there are global development projects for the cultivation of edible mushrooms in countries still underdeveloped and in which famine is rampant. In Algeria, a large number of mushrooms are eaten by the local populations. The example of the button mushroom which is cultivated in Algiers (Birtouta). In the perspective of cultivating and promoting the mushrooms in our country, we were interested in studying a wild mushroom called *Lactarius deliciosus*. In the nature, this mushroom with nice taste is consumed by individuals, but without valuing it too much. *Lactarius* would be, according to the bibliography, a good source of proteins and carbohydrates. The aim of our current study is to obtain the mycelium of this mushroom in order to produce its fruiting bodies and so on conserve it. In materials and methods, the fruiting bodies of the wild mushroom were at first harvested from the forest (Tlemcen). The samples were disinfected and then crushed in order to obtain a homogeneous spore suspension. This suspension was spread on culture medium supplemented with antibiotics. The germination of the spores was monitored daily under an optical microscope. The primary fungal growths of the mushroom were conducted in a Petri dish. The obtained mycelium was subjected to varying physicochemical conditions in order to optimize its growth. It was then inoculated to several sterilized substrates (barley, vermiculite and perlite impregnated with culture medium) in order to define the one which would be the most suitable for culture. The results showed that the mycelium of the mushroom was obtained after 45 days of culture. The temperature, the pH and the culture medium allowing a good mycelial growth were respectively 25 °C and pH 7 (PDA medium). Vermiculite impregnated with culture medium was very favorable to the development of the mycelium. In conclusion, obtaining the mycelium from the wild edible mushroom was very successful. The colonization substrates were also determined. The inoculums obtained could be used to produce mushroom fruiting bodies.

Keywords: *Lactarius*, mycelium, culture medium, fruiting bodies.



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**ECONOMIC ANALYSIS OF NOILER PRODUCTION IN ILORIN, KWARA STATE,
NIGERIA**

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ABSTRACT

This study evaluated the economic analysis of Noiler production in Ilorin Metropolis, Nigeria. Data were collected using a structured questionnaire from 110 Noiler bird farmers. Data were analyzed using descriptive statistics, stochastic production function, and net farm income. Results showed that about (85%) of the Noiler farmers were male. The determinants of resource use efficiency result showed that drugs, feed, age, educational level and household size had negative coefficients which reduce resource use efficiency in Noiler production while the coefficients of stocking density, total labour, extension visits and cooperative membership were all positive and had a positive influence on resource use efficiency. The cost and return analysis showed that Noiler producers had a net farm income of ₦443,375.86 and average rate of return on investment of 1.58 per production cycle which shows that Noiler producers earns 58 kobo for every ₦1 invested. High costs of inputs and marketing of products were the major constraint facing the Noiler farmers.

Keywords: Noiler Production, Resource use efficiency, Costs and Returns, Constraints



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**A GENDER BASED STUDY ON COVID 19 PANDEMIC AND LIFESTYLE
BEHAVIOURS OF PEOPLE LIVING IN AGRARIAN COMMUNITIES IN
DEVELOPING COUNTRIES**

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ABSTRACT

We engaged a cross sectional survey to estimate the effect of Covid-19 pandemic on lifestyle behaviour of rural dwellers in Kwara and Osun States, Nigeria using a gender disaggregated data. We randomly sampled 400 rural dwellers in the two States. Structured questionnaire was used for data collection. Collected data were analyzed using descriptive statistics and correlation analysis. The effect of the pandemic was evaluated in short-term. Our findings showed that the mean age of male and female rural dwellers were 43.5 and 44.8 years; 25.9% of the male and female respondents practice agriculture as their primary occupation. Our result of the perceived changes to the major lifestyle behavior during the lockdown among rural dwellers showed that 67% and 77% of the male and female respondents have improved sleeping quality; 94% and 97% of the male and female respondents were unable to perform physical activity; while 39% and 32% of the male and female respondents have improved feeding and nutrition habit. Our findings also revealed that Covid-19 pandemic have both negative and positive effect on the lifestyle behaviours of male and female rural dwellers in the study area. Although evidence at short-term revealed that



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Covid-19 pandemic lockdown has the potential of influencing lifestyle behaviours either positively or negatively; evidence showed that there is a need to plan and invest on ways to maintain a correct lifestyle by providing reliable lifestyle information and effective interventions to individuals and communities especially the agrarian ones during the pandemic as it is a pressing need.

Keywords: Lockdown, sleep quality, food and nutrition habit, physical activity, smoking, alcohol consumption



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**PREDICTION OF DIFFUSION COEFFICIENT FOR POLAR BINARY GAS USING
MULTIPLE LINEAR REGRESSIONS**

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ABSTRACT

In the current study, a multiple linear regressions (MLR) have been used to develop predictive models for the estimation of molecular diffusion coefficients of 311 polar binary gas at multiple pressures over a large field of temperatures and substances. The quality and reliability of each method were estimated in terms of the correlation coefficient (R), mean square errors (MSE), Root Mean Square Error ($RMSE$) and in terms of External validation coefficients (Q^2_{ext}). A good correlations were found (root mean squared errors in the total databases were 0.5172 for MLR). The Comparison between the results of the multiple linear regressions and the empirical models showed the superiority of multiple linear regressions.

Keywords: Prediction, Molecular diffusion, multiple linear regressions.



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**BIOSENSORS FOR THE DETECTION OF VIRUSES AND PATHOGENS- AN
EMERGING TECHNOLOGY FOR POINT OF CARE DIAGNOSTICS**

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ABSTRACT

Early diagnostic and effective therapy are two of the important benchmarks for the early detection of life threatening viruses and pathogens. Exosomes from viral cells may be important candidates for reliable biomarkers for the detection evaluation of tumor. In this study, Human interferon $\alpha 2$ (IFN $\alpha 2$) and thymosin $\alpha 1$ (Ta1) are therapeutic proteins used for the treatment of viral infections and different types of cancer. Both IFN $\alpha 2$ and Ta1 show a synergic effect in their activities when used in combination. Furthermore, the therapeutic fusion proteins produced through the genetic fusion of two genes can exhibit several therapeutic functions in one molecule. In this study, we determined the anticancer and antiviral effect of human Interferon $\alpha 2$ -Thymosin $\alpha 1$ fusion protein (IFN $\alpha 2$ -Ta1) produced in our laboratory for the first time. We discuss the candidature of exosomal biomarkers for the detection of cancers, which can be employed for indicative diagnostic and treatment responses by incorporating IFN $\alpha 2$ and Ta1 with the cancer-derived exosomes on biosensors. Further electrochemical recognition of viral cells was done by chronamperometric studies which comprise integrated scientific development of bioelectrochemical engineering and important figure of merits related with electrochemical aspects. Furthermore, advanced research directions and aspects in using viral-derived exosomes and recombinant with therapeutic proteins for point-of-care (POC) testing and bio sensory technology will be presented.



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**BIOCHEMICAL CHARACTERIZATION OF CELLULASE ENZYME IN
DOCIOSTAUROS MAROCCANUS (ORTHOPTERA: ACRIDIDAE)**

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ABSTRACT

Dociostaurus maroccanus is an important pest of many agricultural crops with the ability to migrate, and it causes a lot of damage annually. Cellulose is the main constituent of the cell wall of plants. Cellulase is a digestive enzyme that destroys the plant cell wall. Therefore, the biochemical properties of cellulase in *Dociostaurus maroccanus*, as well as the effect of pH (3-12) and temperatures (15-75°C) on the activity of cellulase enzyme were investigated in the study. The results indicated that the optimum pH was 7 for cellulase activity in the gastrointestinal tract, and the optimum temperature was 55°C by increasing temperature. Increasing the temperature gradually decreases the activity of cellulase enzyme in the digestive tract of *Dociostaurus maroccanus* and sharply decreases at 65°C. According to the results, inhibiting this enzyme can disrupt the process of digestion and absorption in the gastrointestinal tract of the pest, and thus the pest can be controlled.

Keywords: Biochemical Characterization, Cellulase, *Dociostaurus maroccanus*, Digestive system.



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**DEGRADATION OF METHYL-PARATHION WITH COPPER(I) OXIDE
NANOPARTICLES**

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ABSTRACT

Organophosphate compounds (OPC) such as parathion or methyl-parathion are commonly used as pesticides, but these compounds pose a great risk to human health because they are substances that have neurotoxic effects. In Mexico, large amounts of OPC are applied annually as pesticides, all of them are neurotoxic. For example, in 2018 about 18 thousand tons of organophosphate pesticides were produced in Mexico. Of all the OPC, parathion and methyl-parathion stand out because they are the most neurotoxic; the latter explains their use as pesticides, they are very efficient in eliminating pests. Parathion is a prohibited substance while methyl-parathion (MP) is not prohibited but restricted according to the international agreement called the United Nations Rotterdam Convention, to which Mexico subscribed and entered into force in 2005. In Mexico, the greatest use of MP is in cotton, cabbage, beans, onion, tomato, corn, wheat, and soybean crops. Last year approximately 153 thousand tons of organophosphate pesticides were used worldwide. In this work, we would like report that copper (I) oxide (Cu_2O) NPs of different sizes (16, 29 and 45 nm) can be used for the chemical degradation of methyl-parathion, with the advantages that Cu_2O is a cheap, abundant, harmless, and reusable. The Cu_2O nanoparticles can be obtained using Benedict's reagent, with the variation of a water/dimethyl sulfoxide (DMSO) solvent mixture in order to obtain the different NPs sizes. We have also found that bulk Cu_2O can be used if NPs are not desired. Cu_2O in the form of nanoparticles has the advantage of increasing the surface area to volume ratio, which reduces the degradation time.

Keywords: Organophosphorus Pesticides, Methyl-Parathion, Copper(I) Oxide, Nanoparticles, Facet-dependent Degradation,



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**FATTY ACID DISTRUPTION IN *VENUS VERRUCOSA* GILLS AS RESPONSES TO
LEAD CHLORIDE TOXICITY**

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ABSTRACT

The present study aimed to investigate the effects of lead chloride (PbCl_2) exposure at graded concentrations on the gills of *Venus verrucosa*. Clams were randomly divided into four groups: group 1 served as control and groups D1, D2 and D3 were exposed to 1, 10 and 100 $\mu\text{g/L}$ of PbCl_2 respectively during 7 days. The exposure to PbCl_2 increased malondialdehyde, lipid hydroperoxide and hydrogen peroxide levels in a concentration-dependent manner. Results showed decreases in the contents of total lipids, saturated, monounsaturated and polyunsaturated fatty acids. Furthermore, a decrease in the amount of omega (ω -3), docosahexaenoic and eicosapentaenoic acids was noted. However, an increase of omega (ω -6) as well as arachidonic acid and its precursors' (linoleic and eicosadienoic acids) was observed. In conclusion, our investigation revealed that lipids and fatty acids alteration could be useful as bio-indicator of PbCl_2 toxicity.

Keywords: Accumulation, Lead chloride exposure concentrations, Fatty acids, Gills, Lipid peroxidation indices.



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**EXTRACTION, CHARACTERIZATION OF CHITOSAN FROM BLUE CRABS AND
THEIR USE AS A FOOD PRESERVATIVE IN STRAWBERRIES**

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ABSTRACT

The diversity of marine biomasses is a set of exploitable and renewable resources with application in several sectors. The blue crab was considered as a threat by the Tunisian fishermen in 2014, since it inflicted several damage especially to the nets. In addition, in 2017, the Tunisian State launched a plan to exploit and promote this species of crab. In the context of valuation, the chitin was isolated by a conventional chemical method from the shell blue crab. The efficiency of chitin extraction from *C. sapidus* was achieved with a yield of 27.6 %. Then, the chitosan was prepared by N-deacetylation of chitin with a yield of 16 %, leading to a degree of acetylation (DA) of 89.9 %. For *P.segnis* the yield of chitin was 31.2% while the chitosan yield was 20% and the degree of acetylation was 79.9%. After these analyzes, it can be deduced that chitosan has a high degree of purity and that it is considered effective for the preservation of strawberries in favor of its antioxidant and antimicrobial capacity.

Keywords: Blue crab shell, Chitosan, Antimicrobial potency, Antioxidant power, Mining, Deacetylation.



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**GENETIC VARIATION AND POPULATION STRUCTURE OF THE HERRING FISH
FROM THE TUNISIAN MARKETS**

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ABSTRACT

The herring was considered as good seafood that is essentially distributed and transformed in Egypt and Europe. In Tunisia this fish is imported smoked, tried or salted without no labeling or packaging. As safety and quality of food is a major concern nowadays, the purpose of this study is to avoid any type of commercial fraud. That's why this project relies on molecular food analysis



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tools to ensure the traceability of Herring fish. Genetic variation in a portion of the cytochrome b gene was extracted from different populations from Tunisian markets. Molecular analysis suggested that sequences of herring from central market belong to the *clupea harengus* coming from Netherland. This result was statistically supported by a higher bootstrap value (MP: 98 %). The obtained results have also shown that sequences of herring collected from Carrefour market are highly similar to the *clupea harengus* isolating coming from the Bay of Biscay ,France that was supported by a higher bootstrap value (MP: 73%). In this study, the results of the various researches are critically analyzed in order to possibly explain the effectiveness of molecular analysis in the monitoring of food products and the identification of some additional practices in the application of these studies techniques in the food industry.

Keywords: Herring, Cytochrome b, Tunisian markets.



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**CANNING BLUE CRABS MEAT: TRANSFORMATION PROCESSES AND SENSORY
CHARACTERIZATIONS**

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ABSTRACT

This study was planned to compare and value the blue crabs meat, *Portunus segnis* and *Callinectes sapidus*, into canned crab. The blue crab samples were washed thoroughly, peeled by hand, washed thoroughly, steamed, cooled, plucked flesh, spiced, cased and sterilized. Several recipes were prepared and only two recipes were fixed using sensory analysis one for *P. segnis* and the other for *C. sapidus*. The combined effects of sterilization and juicing on the biochemical quality, microbiological quality and sensory quality were evaluated. Sensory evaluation scores for taste, color, odor, appearance, and overall appreciation showed that recipes C and D were the most appreciated after canning process.

Keywords: Blue Crabs, Canning, Sensory characterization.



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**COMPARATIVE STUDY OF THE BIOCHEMICAL COMPOSITION IN *LIRA*
RAMADA MUSCLES**

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ABSTRACT

The aim of the present study was to analyze and compare the biochemical composition in the muscles of *L. ramada* collected from Bizerte lagoon (BL) and Bizerte coastal (BC) areas. Moisture, lipids, proteins and carbohydrates contents were increased significantly in the muscles of BL population. Moreover, the activities of malondialdehyde (MDA) and catalase (CAT) were increased in the same population. However, acetylcholinesterase activity tended to decrease in the muscles of *L. ramada* from BL. In conclusion, our investigation demonstrates that specimens from BL are more sensitive than those from BC.

Keywords: *Liza ramada*, pollution, Biochemical composition.



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**PROTECTIVE ROLE OF *PHYLLANTHUS AMARUS* LEAF EXTRACT AGAINST
MALARIA INDUCED PACKED CELL VOLUME, BODY WEIGHT AND RECTAL
TEMPERATURE REDUCTION IN MICE MODEL**

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ABSTRACT

To evaluate the general protective potential of ethanolic leaf extract of *Phyllanthus amarus* obtained from the south-west (SW), south-east (SE), and north-west (NW) geographical zones in Nigeria against loss of body weight, reduction in packed cell volume, and rectal temperature of *Plasmodium berghei* infected mice. Thirty-six mice were divided into 4 sets of 9 mice and randomized into 3 groups (A, B, C) of 3 mice per treatment for each test procedure. Three sets were treated with SWE, NWE, and SEE (of 125, 250, and 500 mg/kg each). While the remaining set was used as control. The extracts were able to prevent body weight loss, rectal temperature reduction, packed cell volume reduction and, survival time shortage than the respective negative control per ecological station. A significant dose-dependent PCV reduction effect was only observed in the prophylactic activities of the SWE and SEE. The higher dose (500mg/kg) of each of the three extracts produced a significant ($p < 0.05$) PCV reduction effect with its respective lower dose in the entire tested model. Even though the effect of the 500kg/mg extract-treated group might be less than the standard drug, there were no significant ($p < 0.05$) weight changes observed between them in the entire treated model. It is worth reporting that the use of the plant material to control malaria are safe and can reduce the overall pathogenic effect induced by malaria parasite in animal model, justifying the claimed use of the plant as an anti-malaria agent



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**MICROBIAL CONSORTIUM MEDIATED APPROACH FOR RESTORATION OF
HEAVY METAL CONTAMINATED SOIL**

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ABSTRACT

Global agricultural soil pollution by heavy metals represents one among the largest demanding challenging situations to sustainable improvement, with dangerous effects on human and ecosystem health; in view that soil is a non-renewable resource. Expanding industries, sewage slime, spillage of petrochemicals, animal manures, coal combustion, land application of fertilizers, and wastewater irrigation are the key sources of heavy metals soil contamination. Vegetation growing on these soils shows a reduction in yield, growth, and performance. Where this occurs, the challenging task is to lessen the amount of these chemical substances and gain agricultural soils appropriate for growing eco-friendly crops. Microbially mediated bioremediation is a promising nature-based innovating solution for remediating heavy metal contamination. A widely accepted green method that is mostly overall executed *in situ*; and suitable for the establishment/re-establishment of crops on treated soils. The microbial metabolism of indigenous microorganisms can be exploited for degradation. Integrating these revolutionary technologies with sustainable and profitable land use, ought to result in green and sustainable remediation strategies by figuring out future directions and research challenges for the bioremediation of agricultural soils. Focus on bioremediation approaches has been implemented to contaminated soil in agriculture sites and other sites for soil fertility and on the use of plants, assessments of microbial communities in urban soil and polluted agricultural soil, beneficial microorganisms in bioremediation, modeling management solutions, and case studies from the field.

Keywords: Agricultural Soil, Bioremediation, Environmental Pollution, Heavy metals, Microbial bioremediation, Sustainable Agriculture, Toxicity.



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BIOINOCULANTS FOR ALLEVIATING SALINITY STRESS IN PLANTS

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ABSTRACT

Agriculture is the backbone of every country. A nation that has flourished itself growing crops can be considered developed. In present times due to the growing population demand for food has increased and in this fast-paced life, the wait for the crops to be available at their own time has been neglected. So, to meet up the needs of a growing population, the methods used have imposed hazardous effects on nature as well as humankind, and animals. The Biotic and Abiotic factors are environmental factors that play a vital role in plant growth and productivity. Abiotic stress like drought, salinity environmental pollution has done major damage to the productivity of crops. According to the study by the United Nations Environment Program approximately 20 % of agricultural land and 50 % of total crop area in the world is under the salt-stress. Salinization of soil converts agricultural land to barren land. There is an estimate that every year 1-2% decrease in agricultural land. Salinity affects plant photosynthesis, protein synthesis, lipid metabolism. The growing population in the whole world demands a simple low-cost method to reduce the effect of salinity on lands. The tremendous use of chemical fertilizers has created environmental problems such as deterioration of soil quality and surface as well as groundwater quality. Reduced biodiversity and suppressed ecosystem function are side effects of using chemical fertilizers. Thus, to overcome this ecological crisis, Microorganisms that allow more increased nutrient availability in soil, can provide sustainable solutions for current and future agricultural scenarios. Microorganisms that are native in saline soil are having inherent properties such as tolerance to saline conditions and beneficial interaction with the plants, by synthesis of compatible solutes, production of plant growth-promoting hormones. These microorganisms improve the growth of plant growth involving in some important mechanisms of such as phosphate solubilization and of ammonia production, also as macronutrients, showing activity as bacterial chitinase, siderophores, HCN production. These rhizobacteria assist plant growth as they suppress hazardous effects of biotic stresses. Thus, the isolation of novel microorganisms may prove to bring a revolution in the agriculture field. This competent microorganism can be converted to biofertilizers and the local farmers can be helped by educating about this efficient environment safe biofertilizers

Keywords: Agriculture, Biofertilizer, Environment, Ecofriendly, Ecosystem, HCN, PGPR, Salinity, Soil



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**ON THE DIVERSITY OF FREE-LIVING POLYCLADS FLATWORMS COLLECTED
FROM THE LAGOON OF TUNIS**

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ABSTRACT

Polyclad are almost exclusively free-living marine Flatworms. The order Polycladida is divided in two sub-orders Acotylea and Cotylea based on the absence or presence of a sucker behind female genital pore (Lang, 1884). Members of the order Polycladida are known to have a highly branched intestine (Hyman, 1951). During last decade, this fauna have been the subject of many investigations in Tunisians waters. With respect to lagoon ecosystems in the Northern part of the country, a survey of Polyclads have been already made only in Ghar El Melh lagoon and Bizerta lagoon. No Inventory have been presented in the lagoon of Tunis, a natural lagoon located near the city of Tunis. Here, we investigate the Polyclads fauna of this transitional Mediterranean ecosystem. We present a checklist of collected species. We signalize for the first time the occurrence of *Imogine mediterranea* (Galleni, 1976), *Theama mediterranea* (Curini-Galletti, 2008) and *Prostheceraeus moseleyi* (Lang, 1884). In addition, Morphological and histological data for all species are given and data dealing with habitat and ecology of some species are offered.

Keywords: Polycladida- Tunisia-Taxonomy- Lagoon



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**ASSESSMENT OF THE ALLOMETRY PATTERNS IN *SILURUS GLANIS* (L., 1758)
JUVENILES REARED INTO A SMALL-SCALE RAS**

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ABSTRACT

This study describes the length-weight (LWR) relationships among experimental groups during a rearing experiment of European catfish juveniles conducted into a small-scale recirculating aquaculture system (RAS). The main goal of the experiment was to estimate the effect of initial size on weight gain in this fish species and to assess the fish welfare assuming that heavier fish at a given length are in better condition after the growth period. Establishing the fish condition is considered a simplified tool in assessing the fish welfare under the farming conditions provided by RAS because it indicates the tertiary or the whole-animal responses to stress with relevance in fish biomass analysed. The ten months old juveniles were distributed in two experimental variants, each one split in two replicas, and grown communally under the same technological conditions for 90 days. At the initial and the final moments of the experiment, the fish were measured to the nearest 0.5 cm for total length (TL) and weighed to the nearest 1 g for total weight (W). At the end of the experiment, the obtained equations for LWR in each group present “b” coefficients > 3.0, indicating an increase in the fish condition due to the boost in weight that exceeds the length increment. Also, the coefficients of determination (R²) are presented in our study, showing the percentage of the weight gain that can be attributed to the length addition.

Keywords: condition factor, length-weight relationship, *Silurus glanis* juveniles.



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**ASSESSMENT OF LEAD EXPOSURE ON PHOSPHOLIPIDS COMPOSITION IN
MACTRA STULTORUM DIGESTIVE GLANDS**

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ABSTRACT

Lead (Pb), non-essential metal, considered as one of the most abundant and toxic heavy metal in the aquatic system. It is original either from natural origin or from industrials effluents which can be accumulated by invertebrate taxa such as bivalves. The present study aimed to understand in the first time the impact of PbCl₂ exposure (1mg/L, 2.5mg/L and 5mg/L) during 5 days on phospholipids composition (PL) of *Mactra stultorum* digestive glands. Our findings showed a significant increase of PL contents in *M. stultorum* treated with all doses of PbCl₂. Following PbCl₂ exposure, our results revealed an increase, with a dose-dependent manner, of phosphatidylcholine (PC) and phosphatidylethanolamine (PE), phosphatidylinositol (PI) and phosphatidylserine (PS) contents in the digestive glands of all treated groups when compared to controls ($p < 0.001$). Thus, for all phospholipids fractions, remarkable and significant changes were recorded in (n-3), (n-6) polyunsaturated fatty acids (PUFA) and in essential fatty acids such as Eicosapentaenoic (EPA) and Docosahexaenoic (DHA) and Arachidonic (ARA) acids of treated animals. Our investigation confirmed the PbCl₂ toxicity on phospholipids fraction and their uses as an early sensitive bioindicator.

Keywords: *Mactra stultorum*, lead chloride, Phospholipids



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**REMOVAL OF HARDNESS FROM SYNTHETIC WATER BY USING VARIOUS
BIOSORBENTS**

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ABSTRACT

The presence of pollutants in aqueous solution particularly from hazardous heavy metals and metalloids is an important environmental and social problem. The hardness is one of the serious groundwater contaminants in rural areas. The hardness is regulated in drinking water quality primarily because excess amounts can cause disease. Hardness in both its gaseous and liquid form can be irritating to the eyes, respiratory tract and skin due to its alkaline nature. The biological effects of hardness in humans after acute exposures are dose-related depend on their concentration; the amount is taken by the body and duration of exposure. Biosorption is a physiochemical process that occurs naturally in certain biomass which allows it to passively concentrate and bind contaminants onto its cellular structure. It is metabolically passive process not require energy and amount of contaminants in sorbent can remove is dependent on kinetic equilibrium and composition of the sorbents cellular surface. Every biosorbent had different physical, chemical and biological properties for heavy metals removal by biosorption from the water. The biosorption process can be made economical by regenerating and reusing of biosorbent after removing the hardness contaminants. Various bioreactors can be used in biosorption for the removal of calcium and manganese ions from large volume of water.

Keywords: Hardness, Biosorptions, Kinetic equilibrium, Isotherm data and Regeneration.



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**PHARMACOLOGICAL PROPERTIES OF THE MEDICINAL SPECIES *NONEA
VESICARIA* RCHB.**

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ABSTRACT

The supplementation of the body by exogenous bioactive compounds is one of the new therapeutic strategies to prevent the appearance of cancers, oxidative, infectious and neurodegenerative diseases. In this context, many researchers are interested in medicinal plants as an alternative and important source of natural compounds. The aim of the present study is the evaluation of cytotoxic, hemolytic and antioxidant activities of the methanolic extract obtained from the species *Nonea vesicaria* (L.) Rchb. The total phenolic and flavonoid contents were quantified by Folin-Ciocalteu and trichloroaluminum methods respectively. The cytotoxic effect was tested by Brine shrimp lethality assay and the hemolytic activity was assessed by spectrophotometric test on human erythrocytes. Moreover, the antioxidant activity was determined by four different technics. The phytochemical screening revealed the presence of many classes of secondary metabolites, a moderate level of polyphenols and a low content of flavonoids was quantified in the crude extract. The methanolic extract showed a significant cytotoxic effect with a value of LC50 at 35.7 ± 0.5 $\mu\text{g/mL}$ and induced hemolysis in a dose-dependent manner with a value of EC50 at 175.6 ± 0.08 $\mu\text{g/mL}$. The results of antioxidant activities indicated an important effect in nonpolar systems especially in ferric thiocyanate test and β -carotene bleaching inhibition assay. The methanolic extract of *N. vesicaria* could constitute an important source of antioxidant and cytotoxic compounds but a prudent use is recommended in order to reduce the adverse effects related to the possible hemolysis.

Keywords: *Nonea vesicaria*, Cytotoxic, Antioxidant, Hemolytic activity.



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TEXT SUMMARIZATION

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ABSTRACT

Automatic text summarization (ATS) is nowadays researchers. Automatic text summarization is the approach of generating the subset of the main text. This subset of the main text represents the complete text and the main idea of the text. Automatic Text summarization is also known as Text summarization. ATS is the important field of Natural Language Processing (NLP) and Data Mining (DM). This includes the abstractive and extractive summaries of the text. This review paper provides the overview of various past researches and study in the field of Automatic Text Summarization.



ML APPROACH FOR DETECTION OF LUNG CANCER

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ABSTRACT

Lung cancer has repeatedly been found to be one of the fatal problems of all diseases that occur in humankind. It is also one of the most common types of cancer and contributes to death. The number of cases of lung cancer is increasing rapidly. There are about 70,000 cases annually in India. In most cases, the disease tends to be asymptomatic in the early stages, making it nearly impossible to detect. Therefore, early detection of cancer plays an important role in saving lives. Early detection can give patients a better chance of healing and recovery. Technology plays an important role in the efficient detection of cancer.



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HUMAN ACTIVITY RECOGNITION

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ABSTRACT

Human Activity Recognition is one of the main active research area in computer vision for various things like security surveillance, healthcare and human computer interaction. In this report, a total of thirty-two recent research papers of Human Activity recognition are referred. The review mainly covers three area of sensing technologies namely RGB cameras, depth sensors and wearable devices. It also discusses on the advantages and disadvantages of the above sensing technologies. The findings showed that RGB cameras have lower popularity when compared to depth sensors and wearable devices in HAR research. The report is made by studying on various existing techniques that have been brought together to form a working pipeline to study human activity in social gatherings. Firstly, Humans and their structure will be detected using Detectron2 model and then we go to second that was the motion of human and classifies it using LSTM and shows the action.



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AUTOMATIC NUMBER PLATE RECOGNITION

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ABSTRACT

In this era of fast-growing technologies, there is a huge demand among people for a secure lifestyle and traveling. In the past decade, the number of vehicles on road has been rapidly increased. keep the track of vehicles had become a very challenging task for the ministry of road and transport authority. Here ANPR (Automatic number plate recognition) comes into the scene. So ‘What is ANPR? It is a computer vision practice that allows devices to read license number plates of vehicles quickly and automatically, without any need for human interaction. Number plate recognition is an image processing technology that uses number(license) plates to identify the vehicle. The objective is to design an efficient automatic authorized vehicle identification system by latest technologies using the vehicle number plate. This system can be implemented on the entrance for security control of a highly restricted area like military zones or areas around top government offices e.g., Parliament, Supreme Court, etc. The ANPR system first detects the vehicle and then captures the vehicle image using a motion camera or anything else. The Vehicle number plate region is then converted into grayscale. The number plate is then extracted. Then, using KNN (K- Nearest Neighbors) algorithm is used to recognize the digits and the alphabets on the number plate. This data can be used to find the vehicle’s details such as the owner of the vehicle, place of registration, address, etc. The system is implemented using Python and its performance is tested on real images also. Automatic recognition of car license plate numbers became very important in our daily life because of the rapid increase of cars and transportation systems which make it an impossible task to be fully managed and monitored by humans, examples are so many like traffic monitoring, tracking stolen cars, managing parking toll, red-light violation



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enforcement, border, and toll booths, etc. Yet it's a very challenging problem, due to the dissimilarity of plate formats, different kinds of scales, rotations, and non-uniform illumination conditions during image acquisition. This paper mainly introduces an Automatic Number Plate Recognition System (ANPR) using Morphological operations and Edge detection Techniques for plate localization and characters segmentation. Artificial Neural Networks are used for character classification and recognition. These systems are based on different methodologies but still, it is an arduous task as some of the factors like high speed of the vehicle, non-uniform vehicle number plate, the language of vehicle number and different lighting conditions can affect a lot of steps in the overall recognition rate. Most of the systems work under certain limitations.



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**A COMPARATIVE ANTIMYCOTIC ACTIVITY OF ETHANOLIC LEAVES
EXTRACTS OF *CARISSA SPINARUM* L. FROM PALAMURU UNIVERSITY CAMPUS
AND GULBARGA UNIVERSITY CAMPUS OF TWO DIVERSE CLIMATES**

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ABSTRACT

A comparative antimycotic activity of ethanolic leaves extracts of *Carissa spinarum* L. from Palamuru university campus and Gulbarga university campus of two diverse climates reported. Antimycotic activity (Agar well diffusion technique) of ethanolic leaf extract of *Carissa spinarum* (Apocynaceae) was evaluated against mycotic fungi namely *Trichophyton rubrum*, *Microsporum gypseum*, dimorphic fungi such as *Candida albicans*, and saprophytic fungi like *Aspergillus flavus*, *Apergillus niger* and pathogenic bacteria like, *Stephylococcus aureus*, *E. coli*, *Bacillus subtilis*. Maximum antimycotic activity was observed against *M gypseum* (13 mm) followed by *T. rubrum* (11 mm), *C. albicans* (9 mm), *A. flavus* (8.4 mm), *A. niger* (8 mm). Among bacteria tested, *B. subtitis* showed maximum inhibition of 8.2 mm followed by *E. coli* (8 mm) and *S. aureus* (7.5 mm). The MIC was determined against all the test fungal and bacterial strains. The sensitivity of the test organisms varied with the species and strains. The study provides basis for the isolation and purification of anti-dermatophytic compounds from the leaves of *Carissa spinarum* L.

Key Words: Antimycotic activity, Minimum Inhibitory concentration, *Carissa spinarum* L.



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IN VITRO BIOLOGICAL ACTIVITIES OF THE SPECIES *LINARIA SCARIOSA* DESF.

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ABSTRACT

Recently, plant-derived extracts gained a considerable attention as skincare agents, because of their abilities to exert a broad spectrum of biological activities, including their power to absorb ultraviolet radiation, their antioxidant, anti-inflammatory and hemostatic properties. In this context we are interested in the evaluation of *in vitro* pharmacological activities of the methanolic extract obtained from the species *Linaria scariosa*, which is used by the local populations of Aures region (Algeria) for wounds healing, in order to confirm its traditional applications. The quantification of the total phenolic and flavonoid contents was performed spectrophotometrically using Folin-Ciocalteu and trichloroaluminum methods. The antioxidant activity was determined by four different assays including ferric reducing antioxidant power, total antioxidant capacity, ferric thiocyanate assay and the antioxidant activity by potentiometric method. Furthermore, the *in vitro* anti-inflammatory activity was assessed by albumin denaturation method, the photoprotective effect was evaluated by the mesurment of sun protection factor (SPF) and the hemostatic activity was carried out by the measurement of plasma re-calcification time (PRT). Results of the phytochemical screening showed that the methanolic extract contains several secondary metabolites known for their biological properties. Moderate contents of polyphenols and flavonoids were estimated. The MeOH extract possesses moderate antioxidant activities in various tested assays and had the ability to inhibit thermally-induced protein denaturation in a dose-dependent manner with a percentage of 40.98 % at 500 µg/ml. Moreover, this extract which was significantly shorten the clotting time compared to the control group had a great capacity to absorb UV radiations with a sun protection factor estimated at 38.46 ± 0.22 . Regarding its important photoprotective, hemostatic, antioxidant and anti-inflammatory proprieties, the methanolic extract from *L. scariosa* could be used in cosmetic formulations and as a skincare agent.

Keywords: *Linaria scariosa*, Photoprotective, Hemostatic, Antioxidant, Anti-inflammatory, Polyphenols.



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TWITTER SENTIMENT ANALYSIS

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ABSTRACT

This project on twitter sentiment analysis. In this project we have analyse the opinion of people on a particular topics as positive or negative feedback. In this project we develop a program for sentiment analysis to analyse the tweets. In sentiment analysis we classify the sentiments that are expressed in source of text format. Twitter sentiment data is useful to understand the opinion of the people on various topics. In this project we need datasets to train algorithms in a way such as it becomes capable of testing the tweets and it releases the requirements sentiments out of the tweets. We download dataset from kaggle. The dataset size is 238.8MB. It contains 800,000 tweets extracted using the twitter API. The tweets have been annotated (0 = negative, 4 = positive) and they can be used to detect sentiment.



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**IMPROVED PROPERTIES OF PVC COMPOSITES USING TALC/CALCINED
KAOLIN CO-FILLER SYSTEM**

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ABSTRACT

Rigid PVC has some drawbacks such as weak mechanical properties and low thermal stability. In order to enhance these aspects of PVC, the present study aims to develop PVC composite using a combination of talc and calcined kaolin as filler. For comparison, PVC/talc and PVC/calcined kaolin composites were also prepared and investigated. Calcined kaolin was modified with urea to increase its surface area (delamination). Also, surface of both fillers was coated with stearic acid so as to provide good compatibility with PVC. The composites were prepared by melt mixing using a Brabender plastograph. The FTIR-ATR and SEM results showed that the surface treatments improved the interface adhesion between the two phases and could promote talc and calcined kaolin particles uniformly dispersed in PVC matrix. Mechanical tests reveal that highest tensile strength, elongation at break and modulus were obtained with talc/calcined kaolin co-filler (synergistic effect). DSC results exhibited that Talc composite has the highest glass transition temperature (T_g) while the stearic acid coated fillers lead to a lower T_g. TGA thermograms pointed out that the thermal stability of PVC enhanced by introduction of delaminated calcined kaolin.

Keywords: PVC, composites, talc, calcined kaolin/urea, coated filler, Co-filler System, improved properties.



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**SUPERVISED ARTIFICIAL NEURAL NETWORK-BASED METHOD FOR
PREDICTION OF SOLAR RADIATION DATA: CASE STUDY**

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ABSTRACT

The objective of the present work is to predict hourly global solar radiation (HGSR) received on the horizontal surface using artificial neural network (ANN). The measured data of the year (2020) was provided by the (SODA) (Simple Ocean Data Assimilation) for Ain Sefra in the south-west region of Algeria. The best results were obtained with a 5/10/1 ANN model trained with Models' inputs are: average temperature, wind speed, relative humidity, atmospheric pressure, Rainfull. good organization of models was assessed using statistical tests including, correlation coefficient (R), root mean squared error (RMSE), considering a three-layer feedforward neural network with Levenberg–Marquardt training algorithm, a hyperbolic tangent sigmoid and linear transfer function at the hidden and the output layer, respectively The results showed that the model is more efficient to predict hourly global horizontal solar radiation over the south-west region of Algeria (Ain Sfera). The comparison of estimated data and measured ones showed a good agreement between them.

Key Words: artificial neural network; solar radiation data; prediction; Levenberg–Marquardt



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**Multiple Linear Regressions for predicting of the Passage of Organic Compounds through
Nanofiltration and Reverse Osmosis Membranes**

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ABSTRACT

The passage of organic compounds present in water through membranes is being more and more studied, to ensure the increasing demand for fresh water and to avoid contamination of water intended for consumption. Predictive models are increasingly used for the understanding of the relationship between the compounds of the complex systems on the first hand and to minimize the number of experiments on the second one. The aim of this study is to create model for the passage of organic compounds using multiple linear regressions. For this, we collected a database for 22 organic compounds and we used the following steps for the MLR model, pretreatment of database, creation of the MLR model, and analysis of the results obtained. As a result of this work, we developed predictive model with coefficient of correlation is 0.8244, for the MLR model, the root means square deviation (RMSE) equal to 10.4686 %

Key Words: Multiple Linear Regressions; Passage; Predicting; Organic Compounds; Membranes.



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**DESIGN AND STUDY OF AN EARTHEN DAM (28.7 HM³), LOCATED IN BÉNI
SLIMANE, WILAYA OF MÉDÉA**

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ABSTRACT

Since 2010, farmers have suffered from watering in the blessed town of Beni Slimane, located west of the south of the proving of Medea. This made us think of establishing a dam of medium capacity to meet the needs of farmers in order to avoid losses in the field of agriculture. After analyzing the results obtained by the National Dams and Transfers Agency (ANBT), we concluded that the slopes through which the waters of the EL-Malleh wadi flow, constitute a basin suitable for the construction of 'an earthen dam, which has been proven by geological, hydrogeological and geotechnical analyzes. It is on this basis that this report was produced which contains the study of the susceptibility of the area selected to receive this project, the emphasis being on the extent of the resistance of the dam to the various collapse mechanisms, taking into account economic and security aspects.

Keywords : Design; study; earthen dam; Béni Slimane; Médéa.



SYNTHESIS OF POROUS KAOLINITE BASED GEOPOLYMER FOR EFFICIENT REMOVAL OF METHYLENE BLUE FROM WASTEWATER

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Abstract

The major objective of this work was the valorization of Moroccan natural clays minerals from Bani mountain series located in the south of Anti-Atlas, to develop the porous geopolymer materials using in depollution of different dyes present in wastewater. The porous geopolymer are the alternative adsorbents materials characterizing by several physicochemical proprieties such as high porosity, specific surface area, and good thermal and chemical resistance. Our raw and preparing materials are characterizing by different techniques, namely X-ray Diffraction (XRD), Fourier Transformed Infrared (FTIR), Thermal Gravimetric coupled with Thermal Differential Analyses TG-TDA, surface specific area using nitrogen gas and applying the BET equation, measure of porosity by BJH method and Scanning Electron Microscopy (SEM). The results of these techniques show that all the samples taken from Bani Mountain are rich in kaolinite, muscovite and pyrophyllite clays minerals and the preparing geopolymers materials are the good adsorbents that is confirmed by important quantity of methylene blue (model of dye) retained in water medium that reached 120 mg per gram of geopolymer adsorbent.

Keywords: Clays, Kaolinite, Porous geopolymer, Adsorption.



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**NOVEL BIOCOAGULANT FOR TREATMENT OPTIMIZATION OF FISH
PROCESSING WASTEWATER FROM A MOROCCAN PLANT**

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Abstract

A novel liquid chitosan-based biocoagulant for treating wastewater from a Moroccan fish processing plant was successfully prepared from shrimp shells (*Parapenaeus longirostris*), the most abundant fish by-products in the country. The shells were characterized using scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, and Fourier transforms infrared spectroscopy. Using chitosan without adding acetic acid helps to minimize its negative impact on the environment. At the same time, the recovery of marine shellfish represents a promising solution for the management of solid fish waste. In order to test the treatment efficiency of the biocoagulant developed, a qualitative characterization of these effluents was carried out beforehand. The optimization process was conducted in two steps: jar-test experiments and modeling of the experimental results. The first step covered the preliminary assessment to identify the most influential operational parameters (experimental conditions), whereas the second step concerned the study of the effects of three significant operational parameters and their interactions using a Box–Behnken experimental design. The variables involved were the concentration of coagulant (X_1), the initial pH (X_2), and the temperature (X_3) of the wastewater samples, while the responses were the removal rates of turbidity (Y_1) and BOD₅ (Y_2). The regression models and response surface contour plots revealed that chitosan as a liquid biocoagulant was effective in removing turbidity (98%) and BOD₅ (53%) during the treatment. The optimal experimental conditions were found to be an alkaline media (pH = 10.5) and a biocoagulant dose of 5.5 mL in 0.5 L of fish processing wastewater maintained at 20 °C.

Keywords: biocoagulation; seafood processing wastes; fish by-products; industrial effluents; response surface methodology; Box–Behnken experimental design.



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**USE OF THE ARTIFICIAL NEURAL NETWORK AND METEOROLOGICAL DATA
FOR ESTIMATION HOURLY GLOBAL SOLAR RADIATION IN CHLEF, ALGERIA**

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ABSTRACT

Global solar radiation (GSR) data are desirable for many areas of research and applications in various engineering fields. However, GSR is not as readily available as air temperature data. Artificial neural networks (ANNs) are effective tools to model nonlinear systems and require fewer inputs. This study investigates the use of neural networks in modeling the hourly solar radiation in Chlef city, Algeria. feed-forward neural network (FFNN) model characterized by a similar structure (eight neurons in the input layer, one hidden layer, and one neuron in the output layer) is constructed with the aim of estimating the hourly solar radiation. A set of 43860 data points for NN were used to test the neural networks. 70%, 15%, and 15% of the total data were used for the training, the validation, and the test of the model. The correlation coefficients (R) values for all phases are 0.9855, root mean square error (RMSE) of 50.1209 (Wh/m²), and MAE of 32.1362 (Wh/m²). Results obtained indicate that the optimization strategy satisfies practical requirements. . Results obtained indicate that the optimisation strategy satisfies practical requirements. It can successfully be generalised for any location in the world and be used in other fields than solar radiation estimation.

Key Words: Estimation; Global Solar Radiation; artificial neural network; Chlef.



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ARTIFICIAL INTELLIGENCE AND REGULATORIKA: HOW DOES IT HAPPEN?

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ABSTRACT

In the last few years, artificial intelligence (AI) technologies has received increasing attention because of applying AI for better evaluation and visualization of big data, especially in biomedical research. The well-known IBM “Watson” AI system has failed in the personalized medicine market due to systematic errors in diagnosing and treatment tactics, but the opacity of algorithms do not provide an opportunity to found and eliminate errors. The issues of measurement and data acquisition are not elementary and are still being discussed. For example, it is impossible to obtain information about the functioning of a living system without serious interventions in its vital activity. There is a high dependence of existing AI technologies on data, while the AI itself has low capabilities for cognition. Thus, small changes in the input data, which do not lead to a distortion of human understanding, force machine learning systems to make gross mistakes. Our main idea is to simulate strong AI based on regulatorika methods and law. Regulatorika is the science that involves the study of interconnected activity of regulatory mechanisms based on the ORASTA concept which consists of the operator-regulator OR (capable to accept, recycle and transfer signals) and ASTA (active system with time average, carrying out a feedback loop in system for finite time). We consider regulatorika equations with delayed arguments, mixed equations and pantograph type equations. The methods, laws and mechanisms of living systems regulatorika make it possible to effectively analyze the biological systems regulatory mechanisms functioning at the norm and anomalies. The results of the developed approaches are applied to the quantitative analysis of the regulatory mechanisms of the functioning of nerve cells and the dynamics of the transformation of stem cells into brain cells. It is determined that there are the following states: rest, stationary state, Poincaré type limit cycles, dynamic chaos and “black hole” effect. Regularities for the origin of dynamic chaos, “r-windows” regions and prediction problems for the determination of destructive changes - “black hole” effect, are investigated. The revealed conditions of disturbances in the regulation of transformation of nerve cells, depending on external and internal factors, will help to develop new strategies for the treatment of diseases of the human central nervous system and can be useful in creating strong artificial intelligence.



EVALUATION OF SOLAR WATER DESALINATION EFFICIENCY USING PHASE CHANGE MATERIALS

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ABSTRACT

The main aim of the study is to make a test sample of conical solar water desalination (CSWD) and to investigate the effect of phase change materials (PCM) for solar thermal storage in the process of temperature changes of the CSWD and its output water volume and to test this type of desalination plant and evaluate its optimal conditions. In this study, a one-stage active CSWD was developed to investigate the factors affecting its efficiency. In order to absorb more solar energy to raise the water temperature and the possibility of using desalinated water in the early hours of the absence of the sun, the PCM material has been used in a heat transfer tray under the desalination tank. A linear parabolic collector is used next to the device, through which the copper pipes pass through and are connected to the copper pipes inside the heat transfer tray by a hydraulic hose. The fluid inside the collector tube is heated and transferred by a pump to the tubes inside the tray to transfer heat to the PCM. Also, to improve the performance and test the efficiency of the device, a fan was used in the outlet tank for condensing air condensate and by making a wind deflector for the device, the effect of wind on the desalination water outlet was investigated. Comparison of the device in two modes of using PCM and without using PCM showed that the use of paraffin had a positive effect on the efficiency of the device so that the average temperature difference between the device and the environment in this case was 21.64°C and the average outlet volume of water in this case was 251.17 ml. Comparison of the device in two modes of using a wind deflector and without a wind deflector showed that the use of a wind deflector had a positive effect and the average difference between the temperature of the device and the environment in the wind deflector mode was 15°C and the volume of outlet water in this mode was 120 ml. Comparing the device in two modes of using the fan at the output and without it showed that the fan has little effect on the performance of the device.

Keywords: phase change materials, solar water desalination, Solar Energy, Desalination



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PLASMONIC RESONANCES AND THEIR APPLICATIONS

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ABSTRACT

Plasmonic is the interaction of electromagnetic waves to the conduction electron of metal nanoparticle. Metallic nanoparticles supports surface plasmon resonances that can be tuned in desired range of electromagnetic spectrum. The tunability in plasmonic resonances highly depends on the morphology of chosen metallic particles. The motive of this most emerging branch of nanophotonics is to study and tune the surface plasmon resonances in different regimes of the electromagnetic spectrum that cover a broader range of applications. The various possibilities related to the size and shape of metal nanoparticles are analyzed to understand the physics of scattering, absorption, extinction, and surface plasmon resonances under the influence of the organic and inorganic surrounding environment that finds a variety of applications. To explore the plasmonic signature of metallic nanoparticles, a semianalytical as a well numerical approach has been used. In the semianalytical approach, the electrostatic approximation is used in which the Laplace equation has been solved to explain the electromagnetics of metal nanoparticles having different sizes and shapes. There are several numerical approaches like Discrete Dipole Approximation (DDA), Finite Difference Time Domain (FDTD), COMSOL Multiphysics, and Boundary Element Method (BEM) have been used to explain the optics of complex metal nanostructures. In this study, the boundary element method is used to explain the surface plasmon resonances and electromagnetic field profile of metal nanoparticles.

Keywords: Plasmon, SPR, Nanoparticle, Plasmonics, Metals



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**A STUDY ON SUCCESSION PATTERN OF ROTIFER SPECIES ON ARTIFICIAL
SUBSTRATUM (POLYURETHANE FOAM UNITS) FROM A FRESHWATER LAKE**

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ABSTRACT

Colonization of aquatic organisms on artificial substratum is significant to determine the pattern and rate of succession over a short period of time. Zooplankton being cosmopolitan in distribution and belonging to different animal taxa represent an excellent opportunity in this regard. In the present study polyurethane foam units (PFUs) of small equal cubic blocks of 4.5 cm x 7.2 cm x 7.4 cm size were submersed in water for colonization of rotifers in a large perennial opencast pit lake (Gunjan Ecological Park, Asansol, West Bengal, India; 23°66'56.67"N, 87°02'72.60"E). Eight PFU strings each containing three PFUs were submersed in a manner to remain suspended at 14 cm, 28 cm and 42 cm underneath the water surface. A single string was harvested each week to record the colonization of rotifers. Physicochemical conditions of the waterbody were also monitored throughout the study period. Correlation between various physicochemical parameters and rotifers revealed the association of various water parameters with the plankton communities. Eleven Rotiferan species population were observed to colonize the PFUs within a span of 60 days. Out of 11 Rotiferan species, most common were loricate forms of the genera *Brachionus*, *Filinia*, *Lepadella* and *Lecane*. However, as time progressed it was seen that the sessile forms or the forms having limited locomotion started to flourish; these mostly comprised of *Philodina* sp. Diversity indices were calculated to show the diversity of plankton communities at different depths. In the present study the highest single rotiferan species dominance was observed to appear after 60 days of colonization indicating the rotiferan community maturation period. Succession Rate Index (SRI) which was calculated weekly at different depths for rotifers gave differential values that represented the climax stage.



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**APPLICATION POTENTIAL OF BORON CARBIDE NANOPARTICLES ON THE
NUCLEAR AND NANOTECHNOLOGY**

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ABSTRACT

Over the past few years boron carbide and its various composites have been at the focus of both, theoretical and experimental studies worldwide. B_4C has a wide applications possibilities in the extreme environments due to the attractive physical and chemical stability. The materials have various physical properties due to the very large specific surface area (Specific Surface Area - SSA) in the nano sizes. Boron carbide also has own distinctive physical properties like other types of nano-size materials. Given these features, the effects of ionizing radiation on boron-based nanomaterials are widely investigated. The boron carbide B_4C or $B_{12}C_3$ (20 at.% C) should in fact be written $B_{12-x}C_x[C(C_{1-x}B_x)C]$ and consequently one boron is substituted (partially or completely with $x = 1$) by one carbon in the icosahedra. The implied crystallographic site is different according to various authors. These different studies have pointed out the particular role played by the $B_{13}C$, or $B_{12}CBC$ (13.33 at.% C) carbide, the crystallographic structure of which was determined by Will and coworkers. They have shown a planar B&C ring in the lattice which contributes to the great stability of the structure. Boron carbide or B_4C is used as a neutron absorbing control rod material in Light Water Reactors (LWR) of various designs. Indeed, in a French 1300 or 1450MW Pressurised Water Reactor (PWR), two-third of the control rod are made up of boron carbide pellets stacked in a steel tubular cladding, the whole sliding into a Zircaloy (zirconium alloy) guide tube. A severe accident, which might happen in a nuclear reactor in case of safety systems failure, could induce via core heat up in steam, interaction phenomena between core components, loss of core integrity, melt relocation and corium melt pool formation if other counteracting measures are not successful. One of the most important accident management measures to terminate such severe accident transient in a Light Water Reactor is the injection of water to cool down the uncovered degraded core. Corrosion-resistant steel with a high content of boron are the most commonly used construction materials for the manufacture of compact storage racks for spent nuclear fuel, due to the high absorption capacity of boron with respect to neutrons. Steel with a high content of boron has low ductility at both room and elevated temperatures, which leads to a high share defects by pressure treatment. Sufficiently large number of works devoted to the investigation and optimization of hot deformation of boron-containing stainless steels. However, a more effective material for the production of shelves can serve as metal-matrix composites (MMC) based on aluminum alloys reinforced with boron-containing particles, in particular of boron carbide (B_4C).



**PROPORTIONAL-INTEGRAL CONTROL OF AN ELECTROMECHANICAL
COVERT FEATHER FOR A FLAPPING WING UAV**

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ABSTRACT

Turbulence has been declared as a key factor for the loss of various Unmanned Aerial Vehicles (UAVs). To address this issue of turbulence, birds flight has been studied in detail. The research on avian flight has revealed that during high turbulence and gusts, birds adapt to an intermittent flight (non-flapping phases) in which birds extend their wings and glide. The covert feathers present beside primary feathers during these intermittent flights get activated to mitigate turbulence. This paper presents design of an electromechanical (EM) covert feather for a bio-inspired flapping wing UAV (FUAV). Bond Graph Modeling (BGM) approach is used for the detailed model and for the digital simulations of EM covert feather module. State space equations are computed to analyze the model internal dynamics and responses. Finally, Proportional-Integral (PI) Controller is designed for stabilization of covert feather model. Simulation studies depict results in desired ranges and therefore validate the proposed controller design.

Keywords: Bio-Inspiration, Turbulence, Gust Mitigation System, Covert Feather, Flapping Wing UAV, Bond Graph Modeling, Reduced Order Modeling, Simulation, Proportional-Integral Control



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PLATELET ACTIVITY IN DAIRY CALVES OF THE DUTCH BREED

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ABSTRACT

Platelet activity is very significant for the physiology of cattle hemostasis and metabolic processes in tissues. It has great biological significance in the process of active growth and development of animals. 43 calves of the Dutch breed, who had no violations, in their objective status, were taken under observation. Animals were examined at the age of 11 days, 15 days, 20 days, 25 days and 30 days. For this, standard biochemical, hematological and statistical research methods were used. Over the course of the observation, calves showed a tendency to weaken the process of platelet aggregation in vitro in vivo. This was accompanied by a tendency for them to grow inactive blood platelets in their blood. Against this background, the total value of active platelets and the number of platelet aggregates of all sizes in it decreased in calves in the blood. The revealed changes were caused in the observed calves by a developing weakening of the synthesis of thromboxane in platelets, a decrease in the content of adenosine phosphates in their granules and a decrease in the degree of their secretion. During the observation, the number of actin and myosin in the platelets of animals remained low and gradually decreased during the observation. The low degree of additional self-assembly of actin and myosin molecules during platelet aggregation in the examined calves underwent a slight weakening. With a holistic assessment of platelet activity in calves of the Dutch dairy breed, there is no doubt that they have a high degree of functional perfection of platelets, which provides the conditions for the optimum microcirculation necessary for the normal development of these animals.

Key words: calves, milk phase, dutch breed, platelets, aggregation, secretion.



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MAIN HEMATOLOGICAL CHARACTERISTICS IN SOWS DURING GESTATION

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ABSTRACT

Pregnancy is of great functional importance in ontogenesis in females of productive animals. This stage of ontogenesis is very important for the realization of their productive properties. This opinion is supported by long-term scientific observations on the intensification of a number of life processes in pigs at different ages. Under the conditions of gestation of sows, many parameters change, which is aimed at stimulating their adaptive mechanisms. The dynamics of hematological parameters of sows during pregnancy are of great importance. Finding out their characteristics can greatly help in continuing to clarify the conditions for keeping pigs conducive to the optimal course of gestation. Metabolism in pregnant sows completely determines the course of pregnancy. Despite the great biological role of these indicators, their standard values for pigs during gestation kept in different climatic conditions have not been definitively determined. In pregnant sows in Central Russia, the level of total protein and albumin remained within the normal range, slightly decreasing due to hemodelution. In these sows, during gestation, the level of urea increased somewhat, indicating the activation of the protein part of their metabolism. During gestation, sows were characterized by a slight decrease in the amount of triglycerides and cholesterol in the blood at a constant glucose level. During the observation period, the sows were characterized by a constant level of alkaline phosphatase activity and some increase in the level of gamma-glutamyl transferase activity. At the same time, an increase in the enzymatic characteristics of transaminases was noted in their blood with a constant level of enzymatic properties of lactate dehydrogenase and creatine kinase. The levels of monitored metabolites and the level of activity of a number of enzymes revealed in the study can be considered as normative for pregnant sows kept in the geographic conditions of Central Russia.

Key words: sows, blood, gestation, enzymes, metabolites, fertility.



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**ANTIOXIDANT ACTIVITY IN EXTRACTS FROM CORIANDER GROWING IN
THE NORTH REGION (MOROCCO)**

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ABSTRACT

Coriander (*Coriandrum sativum* L.; Umbelliferae) is widely distributed and mainly cultivated for the seeds. The seeds contain an essential oil (up to 1%) and the monoterpenoid, linalool, is the main component. Coriander seed is a popular spice and finely ground seed is a major ingredient of curry powder. The seeds are mainly responsible for the medical use of coriander and have been used as a drug for indigestion, against worms, rheumatism and pain in the joints. Recent studies have also demonstrated hypoglycemic action and effects on carbohydrate metabolism. Volatile components in essential oil, from both seeds and leaves, have been reported to inhibit growth of a range of micro-organisms; and inhibition of lipid peroxidation is reported as well. It is well known that herbs and spices possess antioxidant activity, and caffeic acid derivatives, flavonoids and terpenoids are suggested to be responsible for this effect. During recent years consumers have been more concerned about the addition of synthetic additives to food and the two most commonly used antioxidants, butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), have shown DNA damage induction. Therefore, there is an increasing interest in natural food additives, such as spices or spice extracts, which can function as natural antioxidants besides seasoning the food. Selection of a suitable extraction procedure can increase the antioxidant concentration relative to the plant material, and differences in antioxidant activity between the extracts indicate the polarity of the compounds mediating antioxidant effect. Several analytical methods have been developed to determine the antioxidant capacity of natural substances in vitro. They can be categorized into two groups: (i) assays for radical-scavenging ability and (ii) assays for lipid oxidation inhibitory



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effect. However, the total antioxidant activities of plant extracts cannot be evaluated by using one single method, due to the complex composition of phytochemicals as well as of oxidative processes. Therefore, the use of at least two methods should be employed in order to evaluate the total antioxidant activity. The aim of our study was to investigate the antioxidant activity of extracts of different polarity from both seeds and leaves of coriander. According to the recommendations, the antioxidant effects in three different bioassays were studied, besides determination of total phenolics.

Keywords : Essential oils; antioxidant activity; butylated hydroxytoluene (BHT), 2,2-diphenyl-1-picrylhydrazyl (DPPH); β -carotene bleaching; GC–MS.



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**EFFECTS OF NEUTRAL COLLISIONS AND FINITE ELECTRON INERTIA ON
THERMAL INSTABILITY OF TWO-COMPONENT RADIATIVE
ASTROPHYSICAL PLASMA IN INTER STELLAR MEDIUM (ISM)**

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ABSTRACT

The effect of friction of neutral, finite electron inertia and radiative heat-loss function on the thermal instability of viscous two-component plasma has been investigated incorporating the effects of permeability and thermal conductivity. A general dispersion relation is obtained using the normal mode analysis method with the help of relevant linearized perturbation equations of the problem and a tailored condition of thermal instability is obtained. It is found that the thermal condition of instability is tailored due the presence of radiative heat-loss function, thermal conductivity, finite electron inertia and neutral particle. For the case of longitudinal propagation it is clear that the condition of thermal instability is independent of the finite electron inertia, magnetic field strength, permeability and viscosity of two-components, but depends on the radiative heat-loss function, thermal conductivity and neutral particle. For transverse mode of propagation it is found that the condition of thermal instability depends on the finite electron inertia, magnetic field strength, radiative heat-loss function, thermal conductivity and neutral particles, but sovereign of permeability, and viscosity of two-components. From the curves we find that the temperature dependent heat-loss function, thermal conductivity and viscosity of two-components shows stabilizing effect, while density dependent heat-loss function, and finite electron inertia shows destabilizing effect. The effect of neutral collision frequency is destabilizing in longitudinal mode, but in transverse mode it shows stabilizing effect.

Key words: galaxies: star formation, thermal instabilities, plasmas, radiative transfer.



**ANIONIC AND CATIONIC DYES REMOVAL FROM AQUEOUS MEDIUM USING
TURKEY SEPIOLITE: ADSORPTION KINETICS, ISOTHERMS, AND
CHARACTERIZATION**

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ABSTRACT

Turkey Sepilote (TS) was used for the adsorption of MB and DR-23 from aqueous medium. Batch studies conducted to study the effect of pH (4.0–12.0), contact time (0–180 min), adsorbate concentration (5–800 mg L⁻¹ for DR-23 and 5–500 mg L⁻¹ for MB), and temperature (298–333 K). Turkey Sepiolite characterized by XRD, SEM, EDX, FTIR, X-ray Fluorescence, and BET analysis. The maximum adsorption capacities of MB and DR23 on TS were 124.9 and 649.37 mg g⁻¹, for MB and DR-23, respectively. The adsorption of MB and DR-23 was pH-dependent and maximum adsorption attained at pH 4.0 for DR-23 and pH 10.0 for MB at all temperatures. Adsorption kinetic data evaluated by using the PFO and PSO equations. Kinetic adsorption studies have shown that adsorption of MB and DR-23 follow, respectively, the pseudo-second order and the pseudo first-order kinetic models. The Langmuir, Freundlich, and Temkin nonlinear isotherms applied for the experimental data, and it observed that the experimental data well fitted and found to be in good agreement with the Langmuir for both dyes. The binding of MB and DR-23 onto the TS surface was through electrostatic interactions. Therefore, TS considered as efficient adsorbent material for MB and DR-23 from the aqueous phase.

Keywords: Adsorption, MB, DR-23 dye, Turkey Sepiolite, adsorption kinetics, isotherm, characterization.



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**ROBUST ADAPTIVE FEEDBACK CONTROLLER FOR THE SUPPRESSION OF
CHAOS IN A THREE-DIMENSIONAL CHAOTIC SYSTEM**

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ABSTRACT

This paper proposes a novel continuous-time robust direct adaptive controller to control the three-dimensional unknown chaotic system. It considers that the plant's nonlinear terms, exogenous disturbances, and model uncertainties are unknown and bounded; the controller design is independent of the system's nonlinear terms. It provides quick response, realizes oscillation-free, and rapid convergence of the state variable trajectories to the desired steady-state, and eradicates the effect of time-varying exogenous disturbances and model uncertainties. The controller also develops an analysis methodology for investigating the stability of the proposed closed-loop. These controller attributes flourish the robust performance of the closed-loop and establish smooth state vector convergence to zero. The Lyapunov direct stability analysis assures the global asymptotic robust stability of the closed-loop. This research work provides a detailed robustness and stability analysis based on the Lyapunov stability theory and suitable adaptive laws that estimate the upper bound of unknown external disturbances and model uncertainties. Computer simulations and comparative analysis are included to verify the theoretical findings.



**BOOTSTRAP AGGREGATED NEURAL NETWORKS FOR PREDICTING THE
MEMBRANES PERFORMANCE BY TREATING THE PHARMACEUTICAL
ACTIVE COMPOUNDS**

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ABSTRACT

The removal of pharmaceutical actives compounds (PhACs) by nanofiltration (NF) and reverse osmosis (RO) of paramount importance in membrane separation processes. However, modeling remains a difficult approach due to the strongly nonlinear performance of the removal mechanisms of organic molecules by NF/RO. The present work features the application of neural networks (single neural networks " SNN" and bootstrap aggregated neural networks " - BANN_(Staking of 30 networks) ") for prediction of the removal of 23 pharmaceutical active compounds (PhACs). Overall, the models proposed are able to accurately correlate 599 experimental data points gathered from the literature. According to the results, the BANN_(Staking of 30 networks) is a more powerful and effective computational learning machine than the SNN. The regression coefficients " R^2 " and the root mean squared error " $RMSE$ " for the BANN_(Staking of 30 networks) model are estimated to be 0.9672 and 3.2810%, respectively. Moreover, BANN_(Staking of 30 networks) model capabilities is showed to describe the removal of PhACS by NF/RO and its precision is compared to proposed previous models, where this comparison showed the superiority of our BANN model. The work with one class of organic compounds (PhACs) is more suitable for prediction performances NF/RO by BANN model.

Keywords : Bootstrap Aggregated Neural Networks; ; Pharmaceutical Active Compounds; Removal, Membranes.



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**CHITOSAN SEED PRIMING IMPROVES THE TOLERANCE TO WATER-
DEFICIT STRESS INDUCED BY POLYETHYLENE GLYCOL IN WHEAT
(*TRITICUM AESTIVUM L.*) SEEDLINGS**

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ABSTRACT

Chitosan is actually a cationic marine polysaccharide with exceptional bioactive properties that make it an excellent scavenger of reactive oxygen species. Seed priming treatments used in the study were hydro priming and chitosan priming (0.10, 0.25 and 0.50 %). Chitosan used as seed priming agent significantly increased the peroxidase, protease, non-reducing sugars, CMS and relative water content in seedling leaves under non-stress and osmotic stress conditions. However, catalase, α -amylase and total phenolics, reducing and total sugars decreased while SOD activity remained unchanged after chitosan seed priming. Under osmotic stress seed priming with 0.25 % chitosan was successful in undoing the stress induced increase in MDA content and bring the level back to that in non-stress condition. Osmotic stress increased the peroxidase, protease, α -amylase activities, total soluble proteins, malondialdehyde (MDA) contents, reducing and total sugars while dropped the relative water content in the leaves. Chitosan seed priming improved the osmotic stress tolerance of seedlings evident from adjusted antioxidants activities, soluble sugars, improved CMS and leaf RWC and reduced lipid peroxidation. Similarly, SNP priming significantly improved the CMS, RWC, TPC, proteins and reducing sugars while reduced the hydrolases (protease, α -amylase) activities and lipid peroxidation in seedlings providing evidence for lesser osmotic stress induced injury and improvement in stress tolerance. Collectively, enhanced capacity of primed seeds to scavenge free radicals by elevated antioxidants i.e. SOD, CAT and POD and rapid mobilization of stored carbohydrates, proteins and lipids by amylases, proteases and esterases during seed germination explained the beneficial effects of chitosan priming.

Keywords: Antioxidant, hydrolytic enzymes, chitosan seed priming



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**EFFECT OF ALOE VERA EXTRACT ON REDUCING AFLATOXIN B1 IN EGGS
OF LAYING HEN AND EGG YOLK**

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ABSTRACT

Aflatoxins (AFs) are natural mycotoxins produced by some fungal species. These toxin carcinogens. AFs are classified in to four groups AFB1, AFB2, AFG1 and AFG2. Aflatoxin B1 is Dangerous toxin among mycotoxins. This toxin not only causes cereal damage but also contaminate the animals feed. So it can easily enter the animal products such as meats, eggs and threatens the health humans and animals. It has been realized that AFB1 cannot be absolutely isolated from diet even many attempts have been made to limit exposure to AFB1. So, it is of immense importance to eliminate the negative effects on human health through the exposure of AFB1. The use of herbal extract to reduce or control aflatoxin B1 is safe method rather than chemical method. Due to the accumulation of aflatoxin residues in muscle and egg of chickens, and the antifungal and antioxidant effects of Aloe Vera, this study conducted to determine the effectiveness of Aloe Vera extract on inhibiting or reducing the amount of aflatoxin B1 in eggs and broiler chicken muscle. In this study, 28 laying hens 20 broiler chickens were randomly divided in to four groups: negative control, positive control, treated group with 100 ppm Aloe vera and 300 ppm Aloe vera. The chickens were fed with Aflatoxin B1 and Aloe vera extract for 28 day. The eggs of chicken and broiler chicken meat were collected on day 14 and 28 and, the residue amount of Aflatoxin B1 was measured by ELISA kit. The results of this study showed significant difference in reducing and inhibiting the accumulation of AFB1 in egg yolk (p-value <0.05), but no significant difference was observed in meat chicken muscle. This study shows that Aloe Vera extract is effective in inhibiting and decreasing AFB1 in egg yolk.

Key word: Aflatoxin B1, Aloe vera, Broiler chicken muscle



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**DEVELOPMENT AND CHARACTERIZATION OF $M_x(PO_4)_y$ AND $(MO_z)/M_x(PO_4)_y$
THIN FILMS FOR THE ELECTRO-CATALYTIC APPLICATIONS**

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ABSTRACT

Wastewaters from various industries, factories, laboratories, etc. are serious problems to the environment. The discharged wastes containing dyes are toxic to microorganisms, aquatic life, and human beings. In the recent decades, the removal of these toxic and dangerous organic compounds from the environment has generated an important interest. The objective of this work is to elaborate electrodes from thin films by the cathodic electrodeposition technique. The electrodes developed will be the objective of a morphological, structural and optical characterization, then will be used for an electro-catalytic application for the electro-degradation of organic pollutants. Two essential aspects have been treated through this work. First, we have successfully synthesized two electrodes by the eco-friendly electrodeposition technique. The electrodes produced are thin layers of zinc and barium phosphate electrodeposited on thin layers of zinc oxide successively, using FTO (Fluorine doped tin oxide) as a substrate. As a result two electrodes were produced noted: $Zn_3(PO_4)_2 \cdot 4H_2O/ZnO/FTO$ and $BaHPO_4/ZnO/FTO$. Then these electrodes were characterized. As a reminder that the characterization techniques used in this work are: X-ray diffraction (XRD), for the structural characterization and evaluation of crystal parameters, scanning electron microscopy (SEM) for the observation of the texture and morphology of the surface of the layer, and Fourier transform infrared spectroscopy (FTIR) in order to determine the characteristic vibrations of bonds. Second, we have studied and evaluated the electro-degradation performance of these electrodes using the organic pollutant rhodamine B. These two systems have been qualified as efficient electrodes for the electro-degradation of rhodamine B. The analyzes showed that the $BaHPO_4/ZnO/FTO$ electrode is more efficient than the $Zn_3(PO_4)_2 \cdot 4H_2O/ZnO/FTO$ electrode.

Key words: Thin film, electrodeposition, electro-degradation, rhodamine B, zinc phosphate, barium phosphate, zinc oxide, dye.



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ADVANCE MULTIFUNCTIONAL MATERIALS

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ABSTRACT

Multifunctional advance materials are the materials with superior thermal, mechanical, electrical, optical and catalytic properties. These materials exhibit properties of different materials when combined together to meet the requirement for diverse applications. Nanoparticles (NPs) with multifunctional properties like porous multifunctional materials, thermochromic and thermoelectric materials, shape memory materials, piezoelectric multifunctional materials, electrochromic, rheological, soft materials, magnetic and photochromatic materials have brought revolutionary change in the field of material science for advance applications. The potential of advance functional materials combine the different material property of new light-weight, multifunctional materials, such as polymer nanocomposites, foams, thin films, micropillars, thin wires and ribbons, are developed for micro applications, e.g. actuators, sensors, and other devices that enables these materials to be perfect to fulfill requirements for performance improvement of various gadgets. Stretchable multifunctional nanocomposites include carbon nanotubes, buckyballs and applications mainly for automobiles, aviation and in space technology applications. Polymer-based composites exhibit exceptional characteristics for advance applications. The low cost and easy processing, durability, flexibility, and excellent thermosensitivity makes thermoplastics, thermoplastic elastomers, and elastomer matrices can be combined with by reinforcement using thermally stable nanofillers to develop fire resistant material. The advance functional materials have opened new arena for modern technological development in future.

Keywords: multifunctional, materials, thermal, mechanical, nanocomposites,



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CURRENT TRENDS AND BENEFITS OF PROBIOTICS- A REVIEW

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ABSTRACT

Probiotics are “live microorganisms which when administered in adequate amount confer a health benefit to the host” as defined by WHO. They are very useful microorganisms that can help in maintaining balance of microflora in the digestive tract and this provide the benefit of prevention from various diseases to the host. Probiotics are frequently used in different kinds of products like dietary supplements, food and even drugs. Now a days probiotic is well known in the area regarding human application for preserving and maintaining health. *Lactobacillus* and *Bifidobacteria* are the most common probiotics used. Our gastrointestinal tract harbors a large number of commensal microbiota which forms a healthy population that protect the ecological niche by various mechanisms. These microorganisms habitat the GI tract and it is referred to as the gut microbiota. Fermented dairy products are most common, popular and efficient carrier used for administration into the body

Keywords: Probiotics, *Lactobacillus*, *Bifidobacteria*, Gut microbiota, Fermented dairy products,



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**PRELIMINARY PHYTOCHEMICAL INVESTIGATION AND ANTIMICROBIAL
POTENTIALS OF *BIDEN PILOSA* LINN., *EMILIA COCCINEA* (SIMS) G. DON.,
SYNEDRELLA NODIFLORA LINN. AND *BRYSOCARPUS COCCINEUS* SCHUM
AND THONN. GROWN IN SOUTHWEST NIGERIA**

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ABSTRACT

Leaves of four medicinal plants- *Biden pilosa*, *Emilia coccinea*, *Synedrella nodiflora* and *Brysocarpus coccineus* were subjected to maceration extraction method to obtain their crude extracts. The extracts were tested for the presence of alkaloid, saponin, tannin, flavonoids, terpenoids and steroid. The extracts were also tested for antimicrobial activities using gram positive and negative bacteria and Fungi- *Staphylococcus aureus*, *Staphylococcus typhi*, *Penicillium notatum*, *Aspergillus pneumonia*, *Pseudomonas aeruginosa*, *Candida albicans*, *Klebsiella pneumoniae*, *Rhizopus species*, *Escherichia coli* and *Bacillus subtilis* at concentration of 200 to 12.5 mg / mL. Saponin was present in all the extracts except *Brysocarpus coccineus*. Tannin was also present in all the extracts except *Synedrella nodiflora*. Alkaloids and steroids were present in *Synedrella nodiflora* while flavonoid and tannin were present in *Biden pilosa*. At concentration of 200 to 50 mg /ml, all the extracts showed significant activities against microorganisms used.

Keywords: Antimicrobial, phytochemical, microorganisms, medicinal.



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**PREDICTION OF CHRONIC KIDNEY DISEASE USING MACHINE LEARNING
ALGORITHMS**

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ABSTRACT

Chronic kidney disease (CKD) leads to deterioration of kidney performance and leads to kidney failure. Machine learning and data mining algorithms play a significant role in treating them by making accurate predictions and classifications. Early diagnostic methodology /algorithm is required to delay the progression of chronic kidney disease. In recent years, there has been an urgent need to predict chronic kidney disease in the early stage, which can prevent or stop the development of the disease to the next stage where kidney transplantation or dialysis can be avoided. Researchers employ various machine learning and data mining algorithms to predict chronic kidney diseases. In this paper, we do an empirical study of the various machine learning algorithms that provide the better decision based on classification and prediction. This paper provides a detailed study on how machine learning can help identify different types of chronic kidney diseases. Keywords- chronic kidney disease, machine learning, data processing, data classification, data mining.



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**STUDY OF RESISTANCE MECHANISMS TO WATER STRESS IN DURUM
WHEAT: CHARACTERIZATION OF CULTIVARS DIFFERING IN THEIR LEVEL
OF DROUGHT RESISTANCE**

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ABSTRACT

Water deficit is one of the main limiting factors in agricultural production. It is therefore important to optimize water supply according to the real needs of the crop, taking into account the environmental conditions. The objective of this study was to evaluate the effect of water stress on the yields parameters of thirteen durum wheat (*Triticum durum* Desf.) genotypes. The experiment was conducted in pots during year (2019-2020) to the open field in the Fes Sais region and in the greenhouse (INRA-Meknes-Morocco). The experimentation took place at the Experimental field of the National Institute of Agronomic Research of Douyet Fez (34°2N, 5°W, 416m) started in 10/12/ 2019. The soil is clayey-silt type, low in organic matter and has alkaline Ph. The experimental setup was a strip-plot with 2 replications. This year's crop year was characterized by low rainfall. Physiological, biochemical and yield parameters were measured. Drought caused an increase in proline, soluble sugars and glycine betaine content with a reduction in relative water content in all varieties. Genotypes differed greatly in their responses to different levels of water stress, especially with respect to the resistance mechanisms developed. The results concerning the yield in terms of grains reveal that lines V1,



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V4, V9 and V12 in front of the control variety V16 are the best performing lines with the highest yields compared to the other lines tested. Statistical analysis reveals the presence of a highly significant correlation between stomatal conductance (Cs) and relative water content RWC ($r=0,819^{**}$), stomatal conductance and yield ($r=0,737^{**}$). However, a highly significant negative correlation was found between proline and Cs ($r=-0.880^{**}$), and between proline and RWC ($r=-0.770^{**}$).

Keywords: Water deficit, tolerance, proline, glycine betaine, relative water content, stomatal conductance.



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**FUNCTIONAL ACTIVITY OF THE HEMOSTASIS SYSTEM IN NEWBORN CALFS
WITH SIGNS OF IRON DEFICIENCY, RECEIVED**

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ABSTRACT

As a result of its development, modern physiology has been able to accumulate a large amount of information about the functioning of systems and organs in many species of farm animals. The practical application of known physiological information is already yielding great positive results in terms of accelerating rearing and preventing diseases in different animals. The continuation of improving the methods of breeding and raising young cattle should take place taking into account constantly updated information about the characteristics of the vital activity of animals at any age. Their correct use in the course of working with young animals can quickly give positive results in terms of a significant intensification of the growth and development of animals. Unfortunately, it is still not always possible to ensure the proper optimum conditions for keeping and comply with all feeding norms for pregnant cows. In this regard, iron deficiency sometimes occurs in newborn calves. In the newborn calves taken into the study, with iron deficiency in the body, a weakening of the biological capabilities of the antioxidant defense of plasma and an increase in the intensity of lipid peroxidation processes in it were noted. These disorders were accompanied in them by an excessive increase in the hemostatic parameters of platelets and the activity of blood coagulation mechanisms with a decrease in the hemostatic properties of the vascular wall. In the study performed, ferroglucin was used in 38 newborn calves with signs of iron deficiency in the body. As a result, in these animals, it was possible to achieve an improvement in the general condition, normalization of the iron content in the blood, a slight increase in the antioxidant capabilities of plasma and the suppression of excessive lipid peroxidation in it. Against the background of the use of ferroglucin, the calves' increased blood coagulation activity, excessive platelet aggregation and weakened hemostatic capabilities of the vascular wall experienced a slight positive trend. The low dynamics of all the indicators taken into account in the study retained in animals that received ferroglucin, hemostatic disorders and a certain risk of developing microthrombosis, which could negatively affect the processes of their growth and the development of economically useful traits in them. This circumstance indicates the need to search for additional means of correcting hemostasis in calves with iron deficiency.

Key words: physiology, neonatal phase, calves, iron deficiency, hemostasis, ferroglucin.



MODELING AND PROPORTIONAL-INTEGRAL CONTROL OF A PROSTHETIC FINGER

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ABSTRACT

This paper presents design of a Prosthetic Finger comprising of DC motor actuated by power supply, gear, lead screw, spring and phalanges. To provide more accurate and detailed model for the digital simulation of prosthesis, the Bond Graph Modeling approach is used. Furthermore, state space equations are computed to analyze the model dynamics and responses. We simulated the model in MATLAB/Simulink and 20-SIM software for study of stability analysis and performance comparison. Finally, our model is synthesized with Proportional-Integral Controller so that the motion of phalanges could be controlled precisely and the Prosthetic Finger could mimic the movements of real finger more efficiently. Our simulation results demonstrate the applicability of the model towards active prosthetic, and help to understand central nervous system in physiologically coordinated movement.

Keywords: Modeling, Bond Graph, Simulation, Prosthetic Finger, Proportional-Integral Control



ROLE OF TiO₂ COATING LAYER ON THE PERFORMANCE OF Cu₂O PHOTOCATHODE IN PHOTOELECTROCHEMICAL CO₂ REDUCTION

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Abebe Reda Woldu
Xuehua Zhang
Tao He.**

ABSTRACT

TiO₂ is usually employed as a protective layer for Cu₂O in photoelectrocatalytic CO₂ reduction. However, the role of TiO₂ layer on CO₂ reduction activity and selectivity is still elusive. In this work, a systematic investigation is carried out to probe the impact of the deposition parameters of TiO₂ overlayer, including the temperature and thickness, on CO₂ reduction performance. Compositional and (photo-)electrochemical analysis is performed to explore the property of TiO₂ overlayers. Carrier behavior, including donor density and electron energy, and stability of TiO₂ are demonstrated to be influenced by atomic layer deposition conditions and thus play a role in controlling CO₂ reduction reaction. Specifically, as the thickness of the TiO₂ layer increases from 2 to 50 nm, the electron energy tends to be lowered accompanying the electron transfer mode from tunneling for TiO₂ thin layers to type II for thick TiO₂, leading to a decrease in CO₂ reduction selectivity. With an increase of the TiO₂ deposition temperature, the stability increases with a loss of conductivity. Cu₂O coated with 2 nm TiO₂ at 150 °C is proven to be the optimized candidate in this work for photoelectrochemical reduction of CO₂ to CO, HCOOH and CH₃COOH under an applied bias of -0.4 versus RHE.



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**EFFECT OF IRRIGATION AND NITROGEN RATES ON YIELD AND
QUALITY OF SOFT WHEAT**

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ABSTRACT

An experimental study was conducted in the field in the experimental station of Sidi el Aidi of the INRA of Settat. In order to evaluate the effect of different doses of nitrogen and irrigation on the yield and quality of soft wheat (*Triticum aestivum*). Three nitrogen treatments were tested on two hydric regimes (N0= 15 Kg/ha; N1=60 Kg/ha; N1= 120 Kg/ha) Bour, (N0= 15 Kg/ha; N1=100Kg/ha; N2= 200 Kg/ha) Irrigated on six Moroccan soft wheat varieties. The results of this study show that irrigation and nitrogen fertilization have a significant positive effect on biomass, grain yield and its components (number of grains/m² and thousand grain weight). The highest yield was recorded for the Achtar variety with the N2 nitrogen dose. The behavior of the varieties is very well marked on all the measured parameters. This result shows that the different varieties have different reactions to water supply and also to nitrogen fertilization. Indeed, several studies show that there is an effect of the variety on the water use efficiency (WUE) and nitrogen (NUE). These last parameters (WUE) and (NUE) require further study to determine the varieties with high WUE and high NUE

Keywords: Nitrogen fertilization, soft wheat, grain yield, biomass.



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**ANTIOXIDATIVE AND ANTI-OBESITY POTENTIAL OF BIOFORTIFIED
BROCCOLI (*Brassica oleracea* var. *italica*) SEEDLINGS ENRICHED WITH
PHENOLICS AND VITAMIN C**

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ABSTRACT

Due to the high demand for healthy food, various biofortification strategies are developed to improve the quality of food. A promising biofortification technique used to improve the content of healthy phytochemicals in plant food is the interspecific metabolite transfer. It relies on the transfer of specialized metabolites from donor plant extract to acceptor plant. In our study, broccoli (*Brassica oleracea* var. *italica*) seedlings were used as an acceptor plant, and as a donor of specialized metabolites, water extract of tea (*Camellia sinensis*) was used. To test the possibility of enhancing the transfer from donor plant extract through the acceptor plant cell membrane, known membrane permeabilizers, EDTA and Tween, were used in a combination with donor plant extract. Changes in the content of phenolic compounds in broccoli seedlings after the interspecific metabolite transfer were evaluated using spectrophotometric assays and high-performance liquid chromatography (HPLC). A 19% increase in total phenolic content compared to the control was observed in seedlings treated with tea extract in combination with EDTA. In seedlings treated with tea extract in combination with EDTA and Tween a 28% and 27% increase in catechin content was observed, respectively. Furthermore, using HPLC, an increase in vitamin C, flavonoid quercetin and alkaloid caffeine content was observed. Treated seedlings' extracts also displayed an increase in antioxidant capacity (AC). AC measured by DPPH revealed an increase in seedlings treated with tea and EDTA, AC measured by ABTS revealed an increase in seedlings treated with tea in combination with EDTA or Tween, and AC measured by FRAP revealed an increase in all treated samples, compared to control. It was also revealed that seedlings treated with tea and tea in combination with EDTA possess a higher pancreatic lipase inhibitory activity, suggesting their anti-obesity potential. Results point to interspecific metabolite transfer being a promising and eco-friendly biofortification strategy to improve the phytochemical content and bioactivity of broccoli seedlings.

Keywords: antioxidants, biofortification, broccoli, microgreens, phenolics



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**EFFECT OF BIOSTIMULATORS AND LIVING MULCH
ON THE HEALTHINESS OF CARROT (*DAUCUS CAROTA* L.)**

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ABSTRACT

The principles of good agricultural and horticultural practice, which considers both environmental protection and high yielding of plants, require modern methods of cultivation. The modern cultivation of horticultural plants uses, for example, cover crops, living mulches and biostimulators protecting the soil from degradation and the plants from plant pathogens and stress. The aim of the studies was to establish the effect of selected biostimulators (Asahi SL, Beta-Chikol, Timorex Gold 24EC) and living mulches from oats (*Avena sativa* L.) and buckwheat (*Fagopyrum esculentum* Mill.) on the healthiness of carrot (*Daucus carota* L.). A field experiment was conducted on Haplic Luvisol formed from silty medium loams. The experimental plant was carrot cv. Flakkese 2, grown on flat soil. In the experiment the following factors were investigated: two types of living mulch (oats, buckwheat), three biostimulators: Asahi SL (nitrophenols) - 0.1%, Beta-Chikol (a.s. chitosan) - 2.5%, Timorex Gold 24EC (the tea tree extract – *Melaleuca alternifolia* (Maiden & Betcher) Cheell) - 0.5% and Zaprawa Nasienna T 75 DS/WS (a.s. tiuram) - 0,5g·100g⁻¹ of seeds. The seeds of oats and buckwheat were sown between the rows, after five weeks since seeding the carrot. In the objects with biostimulators made three spraying were performed, every ten days. The seeds that were not dressed and not sprayed constituted the control. The number and healthiness of carrot seedlings and roots after harvest were determined. Plants with the symptoms of necrosis on the roots were taken for a laboratory mycological analysis. This analysis made it possible to determine the quantitative and qualitative composition of fungi infecting the underground organs of carrot. Oats, buckwheat and biostimulators had a positive effect on the healthiness of carrot seedlings and roots. The smallest number of infected seedlings was observed in experimental treatment with oats, Asahi SL and Beta-Chokol. The highest proportion of infected seedlings of carrot was found out in the control. *Alternaria dauci*, *Alternaria radicina*, *Fusarium culmorum*, *Fusarium oxysporum*, *Phytophthora* sp., *Rhizoctonia solani* and *Sclerotinia sclerotiorum* proved to be the most harmful towards the studied underground parts of carrot. Oats and Asahi SL proved to be the most effective in inhibiting the occurrence of the pathogenic fungi for *Daucus carota*.

Keywords: *Daucus carota* L., Biocontrol, Healthiness, Biostimulators, Living Mulch



THE BIO-ADSORPTION PROCESS FOR THE TREATMENT OF TEXTILE WASTEWATER USING AGRICULTURAL WASTE

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ABSTRACT

Pollutants of various types, acid, alkaline, and saline, are commonly found in aqueous discharges arising from the treatment of industrial goods. Regardless of their origin or production procedures, they can be a source of pollution that is difficult to control due to harmful compounds in the effluents emitted. Our research aims to reduce pollution through agricultural adsorption, which is based on an innovative technology. The bio-adsorption process has been identified as a method for eliminating synthetic dyes from textile manufacturing. The great potential for producing value-added goods from agricultural waste inspired us to conduct this research. Several techniques for removing organic and inorganic species have been investigated over the last two decades, including chemical oxidation (O'Connor et al., 2018; Othmani et al., 2019a), electrocoagulation (Doggaz et al., 2019a), electrocoagulation (Doggaz et al., 2019; Othmani et al., 2017), membrane separation (Poonguzhali et al., 2021). The most promising strategy is the use of various materials as adsorbents, which have higher effectiveness in wastewater treatment while producing less secondary contaminants. Biosorption is a critical process that is both efficient and cost effective. For the removal of harmful chemicals from wastewater, this approach primarily employs the adsorption process / mechanism. How efficient is the adsorption technique using agricultural waste for the treatment of textile wastewater ?

Key words :

Textile industries, wastewater, agricultural waste, dyes, adsorption, pollution.



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**ANALYSIS OF THE CURRENT FARMING SITUATION AND FINANCIAL
EFFICIENCY OF THE CULTIVATED MAIZE ON PADDY RICE LAND FARMING
MODEL IN SOC TRANG PROVINCE, VIETNAM**

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ABSTRACT

The research was conducted to analyze the current farming situation and financial efficiency of growing maize on paddy rice land farming model in Vietnamese Mekong delta under the case study in Chau Thanh district, Soc Trang province. Data of the study were collected from 45 households growing maize on rice land by convenient sampling method. The methods were used, including descriptive statistics, cost-benefit, and correlation regression analysis. Research results showed that the model farming of cultivated maize on rice land brought high production efficiency. The average corn yield per hectare/crop was an average of 21273 corn fruits/ha. The total cost of corn cultivation per hectare/crop was an average of 24749000 VND/ha. The profit without family labor was an average of 36370000 VND/ha/growing season. The profit included family labor households ranging from -3470000 to 83027000 VND/ha/ growing season. The corn productivity model depended on many factors in which hired labor and agrochemicals dose were positively correlated. The profit model turned on seed, hired labor, agrochemicals dose, and family labor costs. Besides these advantages, corn production in the district also faces many difficulties, including the price of inputs and output, the consumption of the market, and low technology production of the household scale.

Keywords: Cultivated maize on rice land, financial efficiency, Soc Trang province



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**PLACOBDELLA N. SP. (HIRUDINEA: GLOSSIPHONIIDAE), A NEW
GLOSSIPHONIIFORMES LEECH FROM NORTH AFRICA**

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ABSTRACT

The phylogenetic relationships of species in the genus *Placobdella* Blanchard, 1893 (Annelida: Glossiphoniidae) were recently studied by (Kivist et al, 2021 in press). Currently, there are 24 species belonging to the genus *Placobdella* (Kivist et al., 2021 in press). The most remarkable diversity is observed in North and Central America (Richardson et al., 2017). The Palearctic region remains very poorly studied with only one described species; the type species of the genus: *Placobdella costata* Moore, 1953 (Richardson et al., 2017). However, this number is likely to increase shortly as the classification of the genus continues to be refined and new taxa are still being discovered and described (Oceoguera-Figueroa and Siddall, 2008; Jimenez and Oceoguera-Figueroa, 2009; Dennis et al., 2017; Kvist, 2017; Siddall et al., 2016; Kvist et al, 2021 in press). Here we describe morphology and provide molecular markers (COI, 12S, 28S, and histone H3) for the newly discovered Tunisian-Algerian *Placobdella*. It is diagnosed as belonging to this later genus on the basis of the following synapomorphies: (1) placobdellid ocular morphology (1 obvious pair of ocelli plus another smaller coalesced pair), (2) 2 pairs of compact salivary glands, (3) 1 pair of sac-like called mycetomes and by (4) possessing bilobed ovaries (Sawyer, 1986; Siddall et al, 2005). *Placobdella costata* specimens were recorded previously by several authors (e.g. Blanchard, 1908; Seurat 1922; Ben Ahmed et al. 2008; Ben Ahmed et al, 2015a; Ben Ahmed et al, 2015b). However, these records may refer to the new species represented herein. In fact, *Placobdella costata* sensu lato were thought to be widely distributed in Tunisia and Algeria and they were originally assigned to this taxon on the basis of morphological criteria (Ben Ahmed et al, 2015).

Key word: *Placobdella*, new species, North africa.Ah



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**SIMULATION OF TESTABILITY AND RELIABILITY LEVELS PROBING TOOL
FOR DIGITAL SYSTEMS**

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ABSTRACT

Integrated circuits (ICs) are reaching to such a complexity that it is hard to imagine. Very Large Scale Integration (VLSI) technology, cannot guarantee for defect-free fabrication process. Built-In-Self-Test (BIST) for VLSI circuits and Boundary Scan Architecture are proven techniques for Design for Testability (DFT). Studying testing strategies for digital combinational and sequential circuits, the paper ends with design for testability guiding rules and possible challenges and difficulties that need development and research in the testing problem. This paper presents an efficient general purpose software tool based on MATLAB is developed to compute the testability parameters of combinational digital circuits of any level of complexity. The tool is developed based on controllability and observability analysis at each node and path of the circuit. In addition the associated reliability with respect to testability is computed to develop methods to classify the nodes of a logic circuit into safe and susceptible categories. This developed tool in turn will lead as guide for the designs of secure digital systems for highly sensitive applications.



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**ANALYSE DE LA QUALITE PHYSICO-CHIMIQUE (CAS DE LA NAPPE
PHREATIQUE D'ASSA-ZAG AU SUD DU MAROC)**

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Résumé

La province d'Assa-Zag se caractérise par un climat désert-aride et ses cours d'eau sont temporaires et sont alimentés par des précipitations (La pluviométrie moyenne annuelle est 100 mm). De ce fait, l'impact des sécheresses dû à des pluies irrégulières sur les ressources hydriques nous oblige à protéger l'eau souterraine à cause de la principale source d'eaux pour la consommation et l'irrigation. Dans le but de viser à fournir suffisamment d'informations sur la qualité des eaux souterraines en prélevant des échantillons d'eau dans des sites dispersés de notre zone d'étude pour évaluer la qualité physico-chimique des eaux en référence avec des normes marocaines et internationales (OMS), nous avons effectué, un suivi mensuel durant 6 mois. Les résultats obtenus décrivent la situation préoccupante de l'état de la nappe phréatique, menacé particulièrement par les activités anthropiques.

Mots clés: Eau souterraine, Nappe phréatique, Qualité, Puits, Physico-chimie, Activités anthropiques..



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**COMPARISON PERFORMANCE OF DEVELOPED DRIP IRRIGATION AND
FLOOD IRRIGATION ON SOME SOIL PHYSICAL PROPERTIES, MAIZE YIELD
AND GROWTH.**

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ABSTRACT

A field experiment was conducted in clay-textured soils with the aim of comparing the developed drip irrigation method and flood irrigation in some soil physical properties and the growth of maize yield (saline distribution, weighted diameter ratio) . The study included two treatments, the developed drip irrigation and flood irrigation. The experiment was designed according to the Randomized Complete Block Design (RCBD) system with three replications for each treatment. The movement of salts was studied at two depths (0-20cm) (20-40cm). The aforementioned soil physical properties studied in the experiment were estimated, as well as some special indicators were measured for growth of maize yield. The results showed, that the salts movement increased as we moved away from the source of the drip, as the electrical conductivity ratios decreased near the drippers in the first depth (0-20cm) compared to the depth (20-40cm), while it was found that the treatments irrigated using drip irrigation gave washing And the salt distribution is less than the treatments that are irrigated by the flood irrigation method. Following the developed drip irrigation method raised the values of the average weighted diameter, which amounted to 0.216 mm compared to 0.187 mm for the flood irrigation treatment, respectively. While the developed drip irrigation method had an important role in raising the base tip rate as it reached 9.87 compared to 8.49 cm.hr⁻¹ for immersion irrigation treatments. The studied characteristics of maize plant growth (plant height, surface area, leaf surface area index and corn yield) increased with the developed drip irrigation treatment, which gave (189.5 cm, 1045.78 cm², 0.697 and 5.4 t.ha⁻¹), respectively, compared with (170.4 cm, 983.23 cm², 0.654 and 4.6 t.ha⁻¹) in flood irrigation.

Keywords: maize, drip irrigation , flood irrigation, irrigation depths.



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**FAST AND HIGHLY EFFICIENT REMOVAL OF MG DYE FROM WASTEWATER
USING A SUPERB ECO-FRIENDLY ADSORBENT NANOCOMPOSITE:
EQUILIBRIUM AND THERMODYNAMIC STUDIES**

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ABSTRACT

The industrial effluents resulting from the textile activities of the tannery or the printing industry often present an important dyes pollutant load which is difficult to biodegrade. Their removal from aqueous solutions by conventional techniques proves in certain cases ineffective. In this work, we studied the adsorption process in batch system for removal a cationic and anionic dye using a new nanocomposite based on clay mineral and iron oxide. The iron oxide are synthesized by co-precipitation and nanocomposite adsorbent are synthesized utilizing a simple technique involving a sonication-induced exfoliation process, followed by chemical scrolling reactions. The synthesized adsorbent was characterized by various analytical techniques such as X ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), X-ray Energy Dispersive Spectroscopy (EDS), Scanning Electron Microscopy (SEM), high-resolution transmission electron microscopy (HRTEM) and BET. The batch adsorption test was applied to study the ability of the adsorbent to remove malachite green (MG) dye from aqueous solution. The obtained results revealed that the adsorption process was highly dependent on physicochemical parameters such as the mass of adsorbent, flow rate, concentration and pH of



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the solution. The adsorption process of MG dye by nanocomposite based clay mineral adsorbent was described by the kinetic model pseudo-second order and Langmuir isothermal model. Thus, these results show that the clay nanocomposite can be used as a superb adsorbent of hazardous dyes in wastewater.

Keywords: Adsorption, nanocomposite, clay mineral, MG, malachite green, kinetics



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**THE IMPACT OF PRODUCT INVOLVEMENT AND BRAND IMAGE ON INTENT
TO BUY WITH AN EMPHASIS ON PRICE AND PERCEIVED VALUES**

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ABSTRACT

The purpose of this research was to study the impact of product involvement and brand image on buying with focus to trust, price and value as mediation variable. The product of this study was Mashhad carpet. This research is an applied and correlational study. The statistical population of this research is all Mashhad Carpet Company customers in Mashhad. The sampling method in this research is available and the sample size is determined based on the number of explicit and hidden variables in the research. Finally, 198 questionnaires were analyzed. A questionnaire was used for gathering data. The reliability of the questionnaire was assessed by Cronbach's alpha and its validity was verified by factor analysis. The hypothesis test has been done by structural equation modeling and Smart PLS software. The research results show that all research hypotheses have been confirmed. Also, these results indicate that the perceived value has had the most impact on intent to buy. Also product involvement has a big impact on brand image.

Keywords: product involvement, brand image, price, perceived value, trust, intent to buy



CLASS IMBALANCE METHODS ON ARTIFICIAL INTELLIGENCE TECHNIQUES: A SURVEY

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ABSTRACT

Network Intrusion Detection Systems (NIDS) are operated on Artificial Intelligence algorithms and network traffic to classify the data from normal to malicious. Most of the network data is imbalanced in nature. When the distribution of the network data is uneven, it is said as imbalanced dataset. Malicious cyber-attacks oftentimes hide in imbalanced data under the normal data. Imbalanced data comprises of majority and minority classes. The data exhibits the obfuscation making it back-breaking for the Network Intrusion Detection Systems (NIDS) to classify and categorize the network data. This paper researches few machine learning and deep learning approaches that were put to deal with imbalanced network traffic, the challenges involved and possible solutions from various models. Well-organized algorithms will be efficient enough to pass out the class-imbalance problem. We, in this paper compare and conclude between the approaches using Accuracy, Precision, Recall, F1-measures to wind up the performance the algorithms towards the NSL-KDD dataset.

Keywords: Class Imbalance, Imbalanced Network traffic, NIDS, Deep Learning, Machine Learning, NSL-KDD, Artificial Intelligence



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INFLUENCE OF FEED TYPE AND PERIOD ON EGG QUALITY TRAITS

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ABSTRACT

The study was conducted between November and December 2018, to determine the influence of feed type and period on egg quality traits. A total of 246 commercial laying hens were used for the study. The experimental birds were managed in battery cages system and fed *ad-libitum*. The parameters recorded were egg weight (EW), egg length (EL), egg width (EWd), shell thickness (ST), shell weight (SW), yolk weight (YW), yolk length (YL) and albumen weight (AW). Data generated were analyzed using analysis of variance. The overall mean EW, EL, EWd, ST, SW, YW, YL and AW were 56.73 kg, 53.18 mm, 44.47 mm, 0.49 mm, 7.71 kg, 14.15 kg, 36.08 mm and 34.78 kg. Feed type had no effect on all traits observed. However, significantly higher EW, EL, EWd, YW and AW were observed in the morning period than afternoon hours (57.74 ± 0.42 vs 55.71 ± 0.49 kg; $P < 0.01$, 58.64 ± 0.49 vs 53.73 ± 0.61 mm; $P < 0.001$, 46.51 ± 0.52 vs 42.44 ± 0.65 ; $P < 0.05$ and 35.69 ± 0.34 vs 33.86 ± 0.41 kg; $P < 0.001$). For shell thickness, the latter period had higher value than the former (0.56 ± 0.02 vs 0.42 ± 0.02 kg; $P < 0.001$). The study revealed that feed type had no influence on egg quality traits and the results obtained for morning period was high compared to the afternoon hours.

Keywords: feed type, egg quality trait, laying hens, period



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**SUSTAINING WATER BALANCE AND VARIOUS PHYSIOLOGICAL TRAITS IN
CUCUMIS SATIVUS L. BY FOLIAR APPLICATION OF CHITOSAN IN THREE
SOWING DATES GROWN UNDER HOT ENVIRONMENT**

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ABSTRACT

Heat stress is a major issue in tropical and subtropical regions of the world where vegetable crops are grown. Utilizing genetic diversity, two tolerant (L3466 and Desi-cucumber) and two susceptible (Suyo Long and Poinsett) were grown under field conditions in three sowing times (15th March, 1st April, and 15th April). Chitosan (200 ppm) was exogenously applied on foliage at 30 days' post sow (DPS) and then twice more in one-week intervals. During present research, the maximum summer temperature recorded in May was 47.8°C, 48.0°C in June, and 46.1°C in July, respectively. Chitosan had a greater effect on heat tolerant genotypes than heat sensitive genotypes. In the first sowing date, the heat tolerant genotypes treated with chitosan had lower water loss; Desi-cucumber had the lowest water loss with a transpiration rate of 2.97 mmol m⁻² s⁻¹ followed by L3466, transpiration rate of 3.07 mmol m⁻² s⁻¹, respectively. During the third sowing date, non-treated Poinsett had the highest transpiration rate of 4.38 mmol m⁻² s⁻¹



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followed by Suyo Long with $4.18 \text{ mmol m}^{-2} \text{ s}^{-1}$, respectively. Heat sensitive genotypes had higher transpiration rates, lost more water at high temperature which led to wilting of plants in the 3rd sowing date. In this study, chitosan treatment increased the yield potential by improving the heat tolerance in cucumber plants under field conditions.

Keywords; cucumber, heat stress, chitosan, water potential, photosynthesis



PCM SOLIDIFICATION BETWEEN PARALLEL PLATES FOR COOLING APPLICATIONS

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ABSTRACT

The energy storage in the phase change material, such as water, is a well-accepted technology and is expanding in several engineering and building applications. In this study, a thermal model based on pure conduction to describe the solidification process in a parallel plate storage system is developed. For the solution of this model, the governing equations for the solid and liquid phases and the interface moving are discretized using the finite difference approximation and totally implicit approach with variable time step. The computational code representing the thermal model for the phase change process around the parallel plates was tested and validated against available numerical and experimental results, showing good agreement. The energy stored, interface position, interface velocity and the time for complete solidification are presented and discussed in terms of the temperature of the cold plate and the distance between the plates. As the temperature on the surface of the plate decreases, there is a reduction in the time to complete phase change and a higher solidification rate. However, increasing the distance between the plates contributes to a longer time for complete solidification. The contribution of this study through the adopted model and solution method aims at a provisional way of obtaining an evaluation of this type of storage configuration and expanding its use in commercial applications and scientific research, in addition to predicting its thermal performance parameters quickly and accurately.

Keywords: solidification, energy storage, parallel plates, phase change material.



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EXTREMAL NUMBER OF THETA GRAPHS

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ABSTRACT

For a set of graphs S , let $HH(n; S)$ denote the class of non-bipartite Hamiltonian graphs on n vertices that does not contain any graph of S as a subgraph and $h(n; S) = \min\{EE(G) : G \in HH(n; S)\}$ where $EE(G)$ is the number of edges in G . In this work we determine $h(n; S)$, where $S = \theta_k$ for sufficiently odd large n . Our result confirms the conjecture made by Bataineh for $k = 3$. AMS subject classifications [2010]: Primary 05C35; Secondary 05C38, 05C45.

Keywords: Turán number, theta graph, extremal graph.



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**GENETIC DIVERSITY IN MOROCCAN APPLE CULTIVARS REVEALED WITH
SSR MARKERS**

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ABSTRACT

Genetic diversity of 27 apple genotypes cultivated in four geographical regions of Morocco was screened using 26 simple sequence repeat (SSR) primers. These SSR loci yielded a total of 195 polymorphic SSR alleles in ranging size of 78 to 209 bp. The obtained values for the average number of alleles per locus (7.5), effective numbers of alleles (4.62), shannon's information index (1.66), expected heterozygosity (0.76), observed heterozygosity (0.74) and polymorphism information content (0.76), showed a high level of polymorphism and suggest that Moroccan apple cultivars have significant genetic diversity. The principal coordinate analysis and UPGMA dendrogram suggested the presence of four well-defined groups, which was confirmed later by model based population structure. Furthermore, strong genetic differentiation between these four groups was also detected compared with other studies ($F_{ST}=0.28$). Most of the individuals segregated into the four groups showed a membership coefficient greater than 0.80, which indicate their better genetic integrity. After comparing SSR profiles and genotypes names, we conclude that the problem of homonyms and/or labeling errors appear in the studied genotypes. However, based on genetic profiles, two individuals (Naour 1/Naour 2 and Laakri 5/Laakri 6) found to be duplicated. Also, the results show that some cultivars with the same name are grouped in different clusters suggesting the existence of possible homonymy. Lastly, the present work confirms the usefulness of SSR markers for the elimination of duplications and characterization of diversity and hybrid characters of cultivars within the species *Malus*. However, we suggest that this work could serve as basic information to assess the apple germplasm in Morocco.

Keywords: *Malus* × *domestica*, SSR markers, genetic diversity, Apple, Morocco



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**CAN PLATELET TO LYMPHOCYTE RATIO PREDICT EARLY-ONSET FETAL
GROWTH RESTRICTION IN PREECLAMPTIC WOMEN?**

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ABSTRACT

Preeclampsia PE is an ominous pregnancy syndrome of undetermined aetiology that implicit maternal and fetal well-being; fetal growth restriction FGR is one of its complications. Inflammation theory was proposed as a cause of PE. Platelets to lymphocyte ratio PLR is an inflammatory biomarker tested in PE. We aimed to examine the value of PRL as a marker for FGR in early-onset PE. A cross-sectional study was conducted in the University hospital, Baghdad/Iraq. Enrolling 40 preeclampsia women over one year. All were diagnosed with early-onset PE (<32weeks). We recorded demographic criteria, and from *blood*, we estimated platelet indices, including counts, distribution width, mean platelet volume, and PLR. And by *Doppler* measurements, we evaluated the fetal weight percentile EFW and amniotic fluid index AFI, the pulsatility index, and resistance index (PI and RI). Upon analysis, the mean age of the study participant was 27 ± 2.6 years, mean systolic and diastolic blood pressure was 16 ± 5.2 and 105.2 ± 4.7 mm/Hg, respectively. Out of 40 cases, only 7 Fetuses were FGR. by linear regression; the PLR mean value (7.86 ± 1.75) inversely correlated with AFI and EFW as $r = -98,97$, $P = 0.001$ respectively. PLR positively correlated with PI and RI as $r = 99,98$, respectively, $P < 0.001$. ROC calculated PLR cut off value (< 7.49) that distinguished FGR babies; at 100, 80% sensitivity and specificity. The strong and significant correlations of PLR to FGR parameters with an area under the curve of 0.9 make it a reliable biomarker for FGR screening. Furthermore, it's quick, simple warranting more research for its application in clinical practice.

Keywords: Preeclampsia, fetal growth restriction, Platelet to lymphocyte ratio



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**RESPONSES OF GINGER PLANT GROWTH, PHYSIOLOGICAL PROPERTIES
AND YIELD BY MINERAL FERTILIZERS**

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ABSTRACT

Ginger is a very much interested and economically important crop to all farmers, consumers, stakeholders, dieticians have attracted growing interest among both dietitians and consumers due to its large amount of uses, like medicinal and high nutritional value ayurvedic medicine. In the present study the effect of mineral fertilizers on ginger plant growth, physiological properties and yield. A field experiment was conducted at the Surkhandarya scientific experimental station of the vegetable, melon crops and potato research Institute. The experiment was conducted by four treatments included T1 – Control, T2 - $N_{75}P_{50}K_{50}$ kg/ha, T3 - $N_{125}P_{100}K_{100}$ kg/ha and T4 – $N_{100}P_{75}K_{75}+B_3Zn_6Fe_6$ kg/ha. The results showed that the T-3 increased significantly plant growth parameters such as plant height, leaf number, and leaf length and leaf width as compared to the control treatment. Maximum number of plant growth indicators was recorded with T-4 which resulted in plant height, leaf number, leaf length and leaf width increase over the control. Compared to the control, T3 - $N_{125}P_{100}K_{100}$ kg/ha increased the chlorophyll a, chlorophyll b, total chlorophyll, and carotenoid content and relative water content. Moreover, T-4 significantly enhanced plant physiological properties (chlorophyll a, chlorophyll b, total chlorophyll, and carotenoid content and relative water content), and yield (fresh ginger rhizome). Combined macro-micro nutrient fertilizer ($N_{100}P_{75}K_{75}+B_3Zn_6Fe_6$ kg/ha) enhanced ginger growth, plant physiological properties and yield can be used as a great potential for in the agricultural fields.

Keywords: Ginger; Plant Growth, Total Chlorophyll Content, Relative Water Content, Yield.



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**INTEGRATING LEVELS OF SPATIAL-TEMPORAL RESOLUTIONS IN
MOLECULAR DYNAMICS**

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ABSTRACT

Multiscale simulations refer to methods where different simulation hierarchies are combined and linked to obtaining an approach that simultaneously addresses properties of a given system at several levels of resolution and consequently on several time and length scales. Different simulation hierarchies give us varying spatial-temporal complexity, and computational expense to tinker around with, with different pros and cons to each; all-atom simulations help look into details that the coarse-grained counterpart just cannot realistically, like the energetics or physical properties like viscosity, in maybe membrane - protein system, while coarse-grained structures help simulate significantly larger trajectories, due to the obvious simplification. Here the aim is to discuss coarse-grained simulation models that are linked to a higher resolution atomistic description. It is shown that by coarse-grained simulation in combination with an efficient back mapping methodology one can obtain well-equilibrated long time and large length scale atomistic structures. We will discuss the different types in which the multiscale simulations can manifest. Some recent developments and applications of the same would also be discussed.

Keywords: literature review, molecular dynamic simulations; coarse-grained simulations; atomistic simulations; membrane – protein system



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**THE ROLE OF THE GUT-BRAIN AXIS IN NEUROMUSCULAR DISEASES
IN PARALYZED DOGS**

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ABSTRACT

The gut microbiota is the complex community of microorganisms that live in the digestive tract of humans and animals. Animal models have been instrumental in linking the regulation of fundamental neural processes, such as neurogenesis and myelination, to microbiome activation of microglia. It has been found that the gut microbiota and food ingredients can influence systemic inflammation, oxidative stress, glycemic control, tissue lipid content. Changes in the composition of the gut microbiota due to diet, medication or disease are correlated with changes in circulating cytokine levels, some of which may affect brain and nervous system function. The gut microbiota also releases molecules that can directly activate the vagus nerve, which transmits information about the state of the intestines to the brain. This interaction between the microbiota and the gut-brain axis appears to be bidirectional, namely by signaling from the gut microbiota to the brain and from the brain to the gut microbiota via neural, endocrine, immune, and humoral connections. The gut-brain axis can influence various neurological disorders and it is possible that dysbiosis in the intestinal tract may lead to disorders of the transmission of nerve controls on the neuromuscular plaque. There are many food ingredients that in certain combinations can be administered to resolve dysbiosis of the microbiome. To arrive at these observations, the authors examined how Polenoplasmin and diet solve paralysis in dogs. In conclusion, the link between the health of the microbiome and the health of the brain shows how microorganisms in the gut solve paralysis.

Keywords: microbiome, intestinal dysbiosis, neuroimmunomodulation, paralysis, dog



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**INTEGRATED MARKETING COMMUNICATION STRATEGY ON THE
PURCHASE OF MEDICINAL PLANTS PRODUCTS: Qualitative Study on Farming
Women's Group in the City of Tangerang Selatan, Banten Province, Indonesia**

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ABSTRACT

Medicinal plants as plants are used for medicinal purposes and are the original ingredients in the manufacture of herbal remedies. The tendency of Indonesian people to consume traditional drugs is quite significant and certainly can not be separated from the lifestyle of 'back to nature'. The benefits of medicinal plants can come from roots, stems, yams, to leaves. One type of herbal medicine can have different properties in treating various diseases. Medicinal plants can also be developed and processed for various needs such as food or beverage industry, as cosmetic ingredients and used in the traditional spa industry. Because of its many uses for treatment, herbal plants have become a fairly alluring commodity. Many drug companies have glanced at medicinal plants. The traditional medicine industry whose basic ingredients are herbal plants has begun to develop. This research focuses on integrated marketing communication in medicinal crop commodities in farming communities, especially women farmers' groups. The research question raised is 1) What is the public's view of medicinal plants? 2) What is the attitude of the community towards the cultivation of medicinal plants? 3) What is the marketing strategy in the sale and purchase of medicinal plants in the community? 4) How is the effort of the peasant women's group in marketing the medicinal plant products it strives for? This research is about the social life of the community in the cultivation of medicinal plants so that the right method used is qualitative research methods with the collection of data collection procedures through in-depth interviews, focus group discussions and direct observation of groups of peasant women in South Tangerang City where there is still widely available land potential to breed medicinal plants. The study found 5 strategies that are right for the success of integrated marketing communication on the purchase of medicinal plant products, namely direct marketing through social networks, educate people to understand the best of herbal medicine from medicinal plants, intensive communication with prospective buyers and show the natural nature of herbal medicine, holding a general discussion group about medicinal plants at various opportunities. This research adds to the treasures of science about marketing management through integrated communication. The results of this study encourage people to return to the nature in the field of medicine.

Keywords – herbal medicine, Integrated Marketing Communication, women farmer's group, nature, medical plants. Keywords – Art product, artshop, Marketing, strategy, rivalry



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**ENHANCEMENT OF PLANT GROWTH, USING PLANT GROWTH-PROMOTING
RHIZOBACTERIA (PGPR) ASSOCIATED WITH PLUM TREES (*PRUNUS
DOMESTICA*)**

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ABSTRACT

Plants interact with a great variety of microorganisms that inhabit the rhizosphere playing critical roles in several aspects of plant growth. In this study, we performed a screening of bacteria associated with the rhizosphere of *Prunus domestica* trees to identify bacterial strains with plant growth-promoting activity. Ten strains isolated from the rhizosphere of *P. domestica* showed multiple in vitro plant growth promoting rhizobacteria (PGPR) activity such as the production of indole acetic acid, hydrogen cyanide, ammonia, solubilization of phosphates and antifungal activity against *Verticillium dahliae* and *Fusarium oxysporum* f.sp. *melonis*. In



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planta, they significantly increased the growth (stem length, number of leaflets, leaf area and root weight) and biochemical (nitrate reductase activity, proline and chlorophyll content) parameters of tomato, Furthermore, PGPR isolates remarkably increased seed germination. 16S rRNA sequencing identified strains Pr7 and Pr8 as *Pseudomonas stutzeri* and *Bacillus toyonensis*, respectively. Since these two PGPR inoculants exhibited multiple traits beneficial to the examined host plants, they may be applied in the development of safe, and effective seed treatments as an alternative to chemical fungicides and fertilization.

Keywords: Plant growth promoting Rhizobacteria, Seedling growth, *Prunus domestica*.



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REVAN TOPOLOGICAL INDICES OF SOME POLYSACCHARIDES

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ABSTRACT

Polysaccharides are polymeric carbohydrates made up of lengthy sequences of monosaccharide unit's linkages by glycosidic bonds. Natural sources include animals, plants, algae, and microbes. They have a wide range of functional qualities and are critical to life's survival. These polysaccharides are comprised as storage polysaccharides (such as starch and glycogen) and structural polysaccharides. they can be broken down into monosaccharides or oligosaccharides. Plants contain starch, while cellulose and chitin can be found in the cell walls of plants, fungi, and other creatures. In this article, we compute Revan topological indices of some polysaccharides. Polysaccharides are biomaterials with great biocompatibility, biodegradability, and low toxicity, therefore these indices will be useful in research.

Keywords: Polysaccharide, Amylose, Amylopectin, Revan topological indices, hyper revan topological indices, modified revan indices.



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**AN UNSUPERVISED VARIATIONAL AUTO-ENCODER APPROACH WITH
SHALLOW LEARNING FOR NETWORK INTRUSION DETECTION SYSTEM**

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ABSTRACT

With the rise of cybercriminals and hackers who attack and enter networks, the intrusion into networks has become greater. It's one of the most essential tasks in cybersecurity defense applications. Most of the previous work uses either a deep neural backbone or traditional machine learning classification algorithms. When these traditional models are applied to standard updated benchmark dataset such as NSL-KDD, detection rates and model precision were not the best due to class imbalance. This work applies variational autoencoders as a process of pertaining prior to classification. As a supplementary layer of information, the result of the first step of the variational autoencoders is added to help the model prevent overfitting. The second step is a superficial learning with the help of logistical regression. Variational autoencoders facilitate feature selection and solve any class imbalance problems with an unsupervised approach, with the added benefit of generating new records when needed.

Keywords - variational autoencoders, autoencoders, intrusion detection system, deep learning, unsupervised deep learning, shallow learning



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**COMPOSITION AND BIOLOGICAL POTENTIAL VALUE OF THE CRUDE
EXTRACT OF CURCUMA ZEDORIA**

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ABSTRACT

Curcuma Zedoaria is a perennial herb commonly known as white turmeric belonging to the Zingiberaceae family and cultivated throughout tropical countries. Due to the presence of many Phytoconstituents Zedoaria plant is traditionally used in Ayurveda and other folk medicines for the treatments of different ailments like allergic, inflammation, microbial diseases, menstrual disorders, dyspepsia, flatulence, ulcer, and cancer. The methanolic extract of the fresh rhizomes of C.zedoaria were fractionated into numerous organic solvents and to evaluate their biological activities such as antimicrobial, cytotoxic, antioxidant, urease enzyme inhibiting, Leishmanicidal, anticancer and antitumor which showed significant activities. From the potential crude extract two phthalate esters, were purified and identified by the column and GC chromatography which showed significant activity against selected microbial pathogens like antimicrobial, antioxidant, and cytotoxic. The finding of our research confirmed the medicinal value of C. zedoaria and other complementary uses make it doubly attractive for incorporation in commercial-scale for the development of primary health care system. Methyl -2-ethylhexylphthalate 1, 2-benzendicarboxylic acid, mono (2-ethylhexyl) ester

Keywords: Curcuma Zedorina, White turmeric, GC-MS, Leishmanicidal, cytotoxic,



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DEVELOPMENT OF COMPUTER

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ABSTRACT

The development and use of computer applications in education is a major focus of today's educational policies because computers are actively employed to improve the quality and outcomes of learning. This study examines the knowledge-based society' skills and competencies, as well as the function and effect of computer applications in the teaching and learning processes. Using Microsoft Power Point to create and deliver electronic presentations to audiences is an excellent example of interactive teaching; these electronic presentations shown on multimedia projectors in the classrooms allow everyone to participate in the conventional learning strategy. The use of computer devices in the classroom will have an impact on advancements in technology as well as teaching and learning methodologies. Computer technology has advanced in all aspects of human managerial tasks in recent years, since it includes all aspects of media for interactive involvement. Developments in science and technology have highlighted the importance of computers in the context of information management, often known as information technology (IT). Many students in the most remote parts of the world have been impacted by computers. It is pointless to dispute that computer have complete influence over the lives of typical students, whether they graduate or not. In this study, we described the applications, uses of computers and their importance to teaching and learning in a global educational context.

Keywords: Development, Education, Computer, Knowledge-based, technology, information technology, teaching and learning



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POROUS INORGANIC MATERIAL: SYNTHESIS, CHARACTERIZATION, AND APPLICATION

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ABSTRACT

The major objective of this work was the valorization of Moroccan natural clays minerals from Bani mountain series located in the south of Anti-Atlas, to develop the porous geopolymer materials using in depollution of different dyes present in wastewater. The porous geopolymer are the alternative adsorbents materials characterizing by several physicochemical proprieties such as high porosity, specific surface area, and good thermal and chemical resistance. Our raw and preparing materials are characterizing by different techniques, namely X-ray Diffraction (XRD), Fourier Transformed Infrared (FTIR), Thermal Gravimetric coupled with Thermal Differential Analyses TG-TDA, surface specific area using nitrogen gas and applying the BET equation, measure of porosity by BJH method and Scanning Electron Microscopy (SEM). The results of these techniques show that all the samples taken from Bani Mountain are rich in kaolinite, muscovite and pyrophyllite clays minerals and the preparing geopolymers materials are the good adsorbents that is confirmed by important quantity of methylene blue (model of dye) retained in water medium that reached 120 mg per gram of geopolymer adsorbent.

Keywords: Clays, Kaolinite, Porous geopolymer, Adsorption.



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**AN ASSESSMENT OF MULTIDRUG RESISTANT BACTERIAL STATUS OF
OGANE-AJI RIVER, ANYIGBA, KOGI STATE**

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ABSTRACT

Surface aquifers can be useful for different purposes however they can act as fomites. The multidrug resistance pattern of bacteria from Ogane-Aji River was assessed. Samples were taken from the river at two different points (Point A with a depth of 10 cm and point B with a depth of 45 cm). These samples were analyzed by the most probable number (MPN) of which point B had more MPN index/ml (180) than point A which had 79 MPN/index/ml. The bacterial isolate obtained were identified by standard microbiological methods. The isolates obtained were tested for their resistance to nine foreign antibiotics and 20 indigenous antibiotics using the disk agar diffusion method. The organisms most frequently isolated from the samples included those of the genera *Staphylococcus*, *Bacillus*, *Enterobacter*, *Pseudomonas*, *E. coli*, *Klebsiella*, *Streptococcus* and *Salmonella*. Percentage resistance to all the foreign antibiotics by the isolates were obtained {*Staphylococcus* sp. (55.5%), *Bacillus* sp. (66.6%), *Enterobacter* sp. (77.8%), *Streptococcus* sp. (88.8%), *Pseudomonas* (66.6%), *E. coli*, *Klebsiella* (77.8%), *Streptococcus* (88.8%) and *Salmonella* (88.8%) while percentage resistance to all the indigenous antibiotics were *Staphylococcus* sp.(30%), *Streptococcus* sp.(20%), *Bacillus* sp. (70%), *Enterobacter* sp. (60%), *Pseudomonas* (50%), *E. coli* (50%), *Klebsiella* (40%) and *Salmonella* (20%)}. All the isolates were found to be multidrug resistant and the presence of such organisms in this body of water which is used for many purposes within the area suggest a means whereby these organisms and the multidrug resistance properties can spread through the population in contact with the river.

Keywords: agar diffusion, antibiotics, bacteria, multidrug resistant.



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**ANDROID BASED CLEARANCE SYSTEM FOR GRADUATING STUDENT (A
CASE STUDY OF KOGI STATE UNIVERSITY) APPROACH**

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ABSTRACT

An android-based online clearance system is a research work that will help build an effective information management for schools. It is aimed at developing a system for making clearance after graduation. The designed android application will serve as a more reliable and effective means of undertaking students clearance, remove all forms of delay and stress as well as enable you understand the procedures involved as well as how to do your clearance online. This project work made use of data collected from the university, materials and journals from various authors, an android application was developed to effectively achieve the aims of this project. The methodology used in this work is the object oriented analysis and design methodology (OOADM). In this project, the implementation of the computer-based system was carried out using PHP, JAVA, SDK, and MYSQL for the database. In conclusion, the work met all the objectives intended. It is, however, recommended for use by all tertiary institutions.

Keywords: Android-based, online clearance, information management, OOADM



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**CONTROL STUDY OF THE ASYNCHRONOUS CAGE MOTOR WITHIN THE
UNIT (LAC) SIDER -ANNABA**

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ABSTRACT

The DC machine was also the most used in the field of variable speed and especially with the development of the automatic and power electronics; however this machine is limited in power and speed. In addition, its collector requires frequent maintenance and limits its use in a corrosive or explosive environment. The synchronous machine, for its collector problem is little used in contrast to its counterpart with permanent magnets. The latter remains little used because of its high price. For its simplicity, robustness, lack of maintenance and cost, the asynchronous cage machine has a wide range of applications, especially in variable speed drives. However his mathematical model is non-linear and strongly coupled. This work is part of an investigation of this machine in terms of its modeling and linearization by the application of a control strategy called the Direct Control of the Couple. Direct torque control is based on the orientation of the "vector" statoric flow by direct action on the state of the voltage inverter switches. The determination of the control sequence applied to the inverter switches is generally based on the use of hysteresis regulators whose function is to check the state of the system.

Keywords: control, torque, statoric flow, inverter, modeling, etc.



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**A SPECIFICALLY DESIGNED TOOL TO SPREAD MORTAR ON FLOOR FOR
TILE INSTALLATION**

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ABSTRACT

The purpose of this project is to design a tool that can aid bricklaying process in a way that can improve the efficiency of the process by reducing the usage of mortar and producing well-spread mortar on floors. Most bricklayers find bricklaying process inconvenient, time-consuming and tedious duty to the difficulty of spreading mortar on floors in order to meet the standards required by construction protocols. Thus, this project aims to tackle this issue by introducing a specifically modified tool that can help bricklayers perform the routine in a more efficient manner. It has been proposed that this tool will be tested in a field work by several volunteers and the process will be observed by several experienced and expert construction specialists who will assess the quality of this tool based on a set of criteria. If the tool proves to be practical and the approach is deemed feasible to be applied in a larger scale, there is a potential for such tool to be further developed and ultimately, commercialized in the construction industry.

Keywords: floor tiles, tile installation, bricklaying, mortar.



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**FEATURES OF PLATELET ACTIVITY IN BLACK-AND-WHITE CALVES
DURING THE PHASE OF DAIRY-PLANT NUTRITION**

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ABSTRACT

Despite the great biological importance of platelet activity, its state in cattle of different breeds and different ages has been studied rather poorly. This creates the need for additional studies of platelet functions, including in black-and-white calves. To assess the activity of platelets in black-and-white calves during the phase of dairy-plant feeding. 44 black-and-white calves at the age of 31 days, obtained from healthy cows as a result of 2-3 calving, were taken under observation. The calves were observed during the dairy-plant feeding phase and were examined five times during this time. The generally accepted hematological and statistical research methods were used. In calves, by the 45th day of life, an acceleration of platelet aggregation was noted in response to strong and weak inductors, which disappeared by the end of the observation. The number of platelet aggregates circulating in the blood increased in calves by the 45th day, and then gradually decreased to the previous level. These changes in the observed calves were based on a short-term 18.2% increase in thromboxane synthesis in platelets by the 45th day of their life due to reversible activation of cyclooxygenase by 13.0% and thromboxane synthetase by 19.1%. Also, an increase in platelet aggregation in the observed calves was due to a short increase in the content of adenosine phosphates in their platelets and the activation of their secretion, as well as due to a reversible increase in the content of actin in them by 21.9% and myosin by 30.5%. In black-and-white calves, at the beginning of the phase of dairy-plant nutrition, a short-term increase in platelet activity develops. It is based on the rapidly eliminating strengthening of the mechanisms that ensure adhesion, aggregation and secretion in platelets in calves that have begun to consume plant feed.

Keywords: calves, phase of dairy-plant nutrition, black-and-white breed, platelets, aggregation, secretion.



STUDY OF PHOTOCATALYTIC ACTIVITY IN VISIBLE LIGHT OF A BISMUTH-BASED CATALYST TOWARDS METHYL ORANGE

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ABSTRACT

Today, pollution has become a major challenge on a global scale. The remedy lies in the pre-treatment of industrial waste before it is discharged into nature. Heterogeneous photo-catalysis is a promising alternative for the treatment of organic pollutants in water. It consists in producing highly reactive species called free radicals when a semiconductor is activated by light radiation. The majority of the catalysts used in photodegradation are transition metal oxides [1], [2]. Among these oxides, the bismuth-based compounds are of considerable interest because of the very interesting physicochemical properties that is a semiconductor, with a band gap of 2.72 eV [3]. It could be used in the photodegradation of organic compounds in aqueous medium under visible light [4]. In this work, we have synthesized a bismuth-based compound by co-precipitation reaction and characterized it by different analytical techniques: X-ray diffraction, scanning electron microscopy and Fourier transform infrared spectroscopy, in order to evaluate its photo-catalytic efficiency towards methyl orange. From the structural point of view, the XRD analysis shows that the synthesized powder is well crystallized and that no secondary phase appears. FT-IR analysis reveals the presence of characteristic bands of the bismuth-based compound. The SEM micrograph indicated that the bismuth-based compound formed by uniform spherical particles. Photocatalytic test display that the oxide prepared by the co-precipitation reaction exhibit good photocatalytic activity for methyl orange, such that 98% of dye was degraded after 180 minutes under visible light irradiation.

Keywords: Heterogeneous photocatalysis, Methyl orange, Bismuth-based, Pollutant.



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**FUNCTIONAL FEATURES OF PLATELETS IN PHYSICALLY UNTRAINED FIRST
MATURE MEN**

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Low physical activity at any age weakens the muscular system and inhibits the work of internal organs. However, the effect of hypodynamia on the blood of mature men cannot be considered fully studied, which indicates the need for further research. It is especially necessary to study the effect of low physical activity in men of the first mature age on platelet function. To examine the effect of low physical activity on platelet aggregation in men of the first mature age. The survey group consisted of 26 men of the first mature age who deliberately refuse regular physical activity throughout their lives. The subjects underwent functional tests and recorded platelet aggregation. The results were processed by the methods of variation statistics. All men had low physical capabilities during the examination. This was manifested in a lowered level of their power, speed and coordination capabilities. All examined had a similar severity of platelet aggregation, which was at the upper limit of the norm. The control of platelet aggregation in response to a weak and strong inducer indicated an acceleration of this process in comparison with the average age norm. The number of inactive platelets in the blood of the examined was somewhat reduced. The total number of active forms of platelets in their blood tended to exceed the age norm. In addition, the number of free small and large platelet aggregates in the blood of physically non-exercising men exceeded the level of generally known age indicators. A physically inactive lifestyle provides in men of the first mature age a low level of strength, speed and coordination capabilities and leads to an increase in platelet aggregation, forming a risk of thrombotic manifestations in them.

Keywords: platelets, men, first mature age, physical inactivity, low physical activity.



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ABTS SCAVENGING ACTIVITY OF *TARAXACUM OFFICINALE* ROOTS

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Taraxacum officinale roots (TOR) exhibit many promising biological activities, but their content and functions are still debated. **study** was to evaluate the antioxidant activity of *Taraxacum officinale* roots. Roots were harvested in May 2017 from a natural habitat (47° 4' 8" North, 28° 40' 47" East), desiccated 2 weeks, pulverized, extracted in 50% of ethanol (24h) and filtered (Whatman No.1). Antioxidant activity was evaluated in triplicate by ABTS (2,2-azinobis-(3 ethylbenzothiazoline)-6-sulfonic acid) assay (Synergy H1 reader, USA) in comparison to Rutin (3',4',5,7-Tetrahydroxy-3-[α-L-rhamnopyranosyl-(1→6)-β-D-glucopyranosyloxy]flavone)(Sigma). The ABTS scavenging activity (I) was counted as follow:

$$I(\%) = \frac{\text{Abs } 734\text{nm}_0 - \text{Abs } 734\text{nm}_1}{\text{Abs } 734\text{nm}_0} \times 100,$$

where: Abs 734nm₀ – absorbance of control solution (ABTS+potassium persulfate); Abs 734nm₁ – absorbance of tested extract after incubation (A₀ (immediately), 15min, 30min). The IC₅₀ and Spearman rank (r_s) computation was made by GraphPad software 8.0.

TOR ethanolic extracts: 469 mg/L (A₀-3.13%, A₁₅-1.63%, A₃₀-3.12%), 938 (A₀-4.68%, A₁₅-5.46%, A₃₀-5.53%), 1875 (A₀-17.97%, A₁₅-38.30%, A₃₀-48.45%), 3750 (A₀-36.60%, A₁₅-69.90%, A₃₀-80.43%), 7500 (A₀-72.11%, A₁₅-93.51%, A₃₀-93.81%), 15000 (A₀-91.81%, A₁₅-92.01%, A₃₀-91.47%), 30000 (A₀-91.04%, A₁₅-91.93%, A₃₀-91.98%). The IC₅₀: A₀- 4171, A₁₅-2272, A₃₀-1900. Correlations: I(%) vs TOR concentration (r_s=0.90, p=0.001), I(%) vs time of action (r_s=0.17, p=0.1). The ABTS scavenging activity of Rutin: 23.44 µg/ml (A₀-6.58%, A₁₅-22.20%, A₃₀-33.94%), 46.88 (A₀-1.78%, A₁₅-19.09%, A₃₀-24.86%), 93.75 (A₀-5.97%, A₁₅-27.08%, A₃₀-30.91%), 187.5 (A₀-16.79%, A₁₅-45.12%, A₃₀-44.79%), 375 (A₀-35.19%, A₁₅-69.05%, A₃₀-73.65%), 750 (A₀-60.53%, A₁₅-91.69%, A₃₀-94.15%), 1500 (A₀-84.87%, A₁₅-93.30%, A₃₀-93.70%), 3000 (A₀-90.64%, A₁₅-91.73%, A₃₀-92.05%). The IC₅₀: A₀-468.3, A₁₅-158, A₃₀-125.9. Correlations: I(%) vs Rutin concentration (r_s=0.85, p=0.001) and I(%) vs time of action (r_s=0.34, p=0.002). TOR exhibits a great ABTS scavenging activity. The increase of plant's extract concentration rises up antioxidant activity.



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**SURVEY ON NEMATODES IN CHICKENS FROM TIEN GIANG PROVINCE IN
VIETNAM**

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Poultry production plays an important role to improve the incomes of small-scale farmers. In Vietnam, native chickens were commonly raised to combine the use of agriculture byproducts. many infectious diseases causes chicken mortality; nevertheless the nematode infection is still not concerned. A cross-sectional study was carried out in Tien Giang, Vietnam, from August to November 2021 to assess the prevalence of nematodes in chickens. A total of 366 fecal samples were collected from under 30 to over 90 day-old chickens. The presence of nematodes was detected by the morphological analysis. The findings revealed that chickens in the investigated area were infected with nematodes an infection rate of 18.85% (69/366).The prevalence of nematodes infection in under 30 day-old- chickens (29.67%) was higher than that in 90 day-old chickens (10.59%). Chickens were kept in households and dewormed showed a lower infection rate of nematodes (4.62%) than that were not dewormed (35.09%). The infection rate of nematodes in the hybrid Noi, hybrid Tre, and Binh Dinh breeds was 39.45%, 13.29%, and 6.14%, respectively. Based on the egg morphological characteristics of nematodes, four species were detected including *Arcaidia galli* (4.37%), *Heterakis* sp. (1.91%), *Cappilaria* sp. (3.83%), *Strongylosides avium* (8.74%). These nematodes are an impediment to chicken production in Tien Giang province. It is necessary to consider preventive strategies.



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**PHYSIOLOGICAL ACTIVITY OF PLATELETS IN PIGLETS DURING THE MILK
FOOD PHASE**

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Modern pig farming is a lucrative agricultural sector that provides high quality food for the population of many countries around the world. The growing demand for pork requires further improvement of options for accelerating the rearing and comprehensive improvement of the pig population. This is facilitated by the acquisition of new knowledge on the physiology of growth and development of these animals. Their knowledge helps to improve the conditions for breeding, raising and keeping pigs. It becomes clear that an important component of maintaining the overall viability of the pig's organism is the hemostasis system, which in many respects ensures the preservation of its viability. Platelets are a very physiologically important component of the hemostasis system. The dynamics of their activity can significantly affect microcirculation, and, consequently, the activity of anabolic processes in the entire growing organism of piglets, including during the phase of dairy-plant nutrition. To trace the dynamics of platelet activity in piglets during the phase of dairy-plant feeding. 37 piglets of the large white breed, which are in the phase of dairy-vegetable nutrition, were examined. Piglets were examined and examined at the age of 21 days, 25 days, 30 days, 35 days and 40 days. Piglet platelets were subjected to a standard washing and resuspension procedure. Then, cholesterol concentration, malondialdehyde and acylhydroperoxide levels, actin and myosin content, ADP level and the severity of its secretion were assessed in piglets' platelets using traditional methods. The activity of aggregation with a number of inducers of this process in the plasma, standardized by the number of platelets in it (up to 200×10^9 platelets/l), was determined in piglets using the visual micromethod. The results were processed by Student's t-test. The level of cholesterol in the composition of piglets' platelets during the phase of lacto-vegetable feeding increased, which was $0.62 \pm 0.009 \mu\text{mol} / 10^9$ platelets by the 40th day of life. At the same time, the intensity of lipid peroxidation in piglets in the platelets gradually decreased. The content of actin and myosin in inactive platelets of piglets increased during the observation period. At the



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same time, their additional formation increased in the course of platelet aggregation. An increase in the level of ADP (by 12.5%) and an increase in its secretion (by 14.1%) were noted in platelets of piglets during the phase of dairy-plant feeding. In piglets aged 21 days, the process of platelet aggregation with collagen occurred in 29.0 ± 0.08 s. With increasing age, this indicator accelerated in them, amounting to 24.5 ± 0.05 s by the end of observation. A comparable acceleration of the platelet aggregation process in them was noted in response to ADP (by 15.2%) and to ristomycin (by 13.3%). Later, there was platelet aggregation in response to thrombin (by the end of the phase 36.0 ± 0.07 s) and aggregation with adrenaline (by the end of the phase 85.0 ± 0.06 s). During the phase of dairy-plant feeding, piglets have an increase in the hemostatic capacity of platelets. This is due to their membrane changes that affect the activity of platelet receptor functions and all intracellular mechanisms that ensure the process of platelet participation in hemostasis. The found increase in platelet activity in piglets during the third phase of early ontogenesis is aimed at ensuring the optimum of their viability by creating the level of microcirculation and hemostasis necessary for metabolism, required by the body of piglets at this age.

Key words: piglets, platelets, phase of lacto-plant nutrition, aggregation, hemostasis.



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**SELECTION OF SUBSTRATE THICKNESS AND INITIAL BIOMASS FOR
CULTURING *Limnodrilus hoffmeisteri* CLAPAREDE, 1862 (OLIGOCHAETA,
ANNELIDA)**

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ABSTRACT

Limnodrilus hoffmeisteri is aquatic invertebrates, belonging to the class Oligochaeta and family Tubificidae. They are distributed in fish ponds, river and wastewater ditches. *L. hoffmeisteri* worms are favorite food for young fish, aquatic insects, leeches, and crayfish. They are used as an important live food for young fishes. In many aquaculture farms, *L. hoffmeisteri* worms are widely cultured as a fish food. Optimal culture conditions in substrate thickness and initial biomass are not known for culture of *L. hoffmeisteri*. So, two experiments were conducted to improve our knowledge of culture methods for *L. hoffmeisteri*. Firstly, the density and biomass of *L. hoffmeisteri* were evaluated when they were cultured in different substrate thickness. Result of the experiment showed that both biomass and density of *L. hoffmeisteri* were highest ($148.5 \pm 7.4 \text{ mg/cm}^2$ and $56 \text{ individual/cm}^2$, respectively) in the treatment of 1 cm substrate thickness and lowest ($90.2 \pm 5.0 \text{ mg/cm}^2$ and $32 \text{ individual/cm}^2$, respectively) in the treatment with substrate thickness of 4cm. In the second experiment, the density and biomass of *L. hoffmeisteri* were also evaluated when initial biomass levels were 1, 10, 20, and 30 mg/cm^2 . Result of the experiment indicated that increasing level of biomass and density was fastest. They reached a maximum ($199.57 \pm 10.46 \text{ mg/cm}^2$ and $85 \pm 5 \text{ individual/cm}^2$, respectively) at the 5th week in the treatment that inoculation biomass was 30 mg/cm^2 .



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**A STUDY OF TRAVELLING AND OPTICAL SOLITONS FOR
MULTIDIMENSIONAL LANDAU–LIFSHITZ–GILBERT SYSTEM**

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ABSTRACT

In this paper, we study the different types of new soliton solutions to the Landau–Lifshitz–Gilbert equation with the aid of Kudryashov method. Then, we get some special soliton solutions for Chiral nonlinear Schrodinger equation. Without the Gilbert damping term, we present a travelling wave solution with a finite energy in the initial time. The parameters of the soliton envelope are obtained as a function of the dependent model coefficients.

Keywords: Landau–Lifshitz–Gilbert equation, soliton, Kudryashov method.



SOYA, AYÇİÇEĞİ VE BUNLARIN KARIŞIM SİLAJLARININ FERMANTASYON VE SİNDİRİLEBİLİRLİK ÖZELLİKLERİ

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ÖZET

Bu çalışma soya, ayçiçeği ve %15 soya + %85 ayçiçeği, %30 soya + %70 ayçiçeği, %45 soya + 55% ayçiçeği karışımı silajlarının fermentasyon ve sindirim özelliklerini belirlemek için gerçekleştirilmiştir. Bu amaçla her bir karışım için 120 litrelik plastik varillerde 5'er adet olmak üzere toplam 25 adet silaj hazırlanmıştır. 90 günlük inkübasyon sonunda açılan silajların ham besin madde içerikleri ve fermentasyon özellikleri incelenmiştir. Silajların sindirim özelliklerini belirlemek için 5 adet 2 yaşlı, ortalama 30-35 kg ağırlığında akkaraman erkek toklu kullanılmıştır. Bu hayvanların bakım, besleme, yem tüketimi, gübre toplama, örnekleme ve analiz işlemleri klasik sindirim metodu ile gerçekleştirilmiştir. Karışımlardaki soya miktarı artışına bağlı olarak kuru madde, organik madde ham protein değerleri artmasına rağmen, ham yağ, ADF ve NDF değerleri düşmüştür. En düşük pH, asetik asit, propiyonik asit ve en yüksek Fleig puanı %30 soya + %70 ayçiçeği silajlarından elde edilmiştir. En düşük bütirik asit değeri ise %15 soya + %85 ayçiçeği karışımında tespit edilmiştir. En yüksek bütirik asit, laktik asit, ham yağ, NDF ve en düşük kuru madde, ham protein değerleri ayçiçeği silajlarında belirlenmiştir. Soya silajının kuru madde, organik madde ve ham protein sindirimleri diğer silajlardan daha yüksek olmuştur. %30 soya + %70 ayçiçeği karışım silajında ham yağ sindirimi en yüksek olurken, en yüksek ADF sindirimi %15 soya + %85 ayçiçeği karışımında ve en düşük NDF sindirimi ayçiçeği silajında gerçekleşmiştir. Sonuç olarak, ayçiçeğine farklı oranlarda soya eklenmesiyle yüksek kaliteli silajlar elde edilmiştir. Fleig puanlamasına göre en iyi sonuçlar %30 soya + %70 ayçiçeği karışım silajlarından, sindirim değerleri açısından ise %45 soya + %55 ayçiçeği karışımı en iyi değerlere sahip olmuştur.

Anahtar kelimeler: Soya, ayçiçeği, silaj, fermentasyon, sindirilebilirlik



**FERMENTATION AND DIGESTIBILITY CHARACTERISTICS OF
SOYBEAN, SUNFLOWER AND THEIR MIXTURE SILAGES**

ABSTRACT

This trial was executed to conclude fermentation characteristics and in vivo digestibility of silages made with green herbage of soybean, sunflower, soybean-sunflower mixtures at different rates as %15soybean+%85sunflower, %30 soybean+%70sunflower, %45 soybean+55%sunflower. For this purpose, a total of 25 silages, 5 for each mixture, were prepared in 120 liter barrels. After 90 days of incubation, crude nutrient contents, volatile fatty acids and fermentation properties of silages were investigated. In order to determine the digestive properties of silages, 5 two-year-old Akkaraman ram with an average weight of 30-35 kg were used. The maintenance, feeding, feed intake, feces collection, sampling and analysis of these animals were carried out with the classical digestion method. In mixtures, although dry matter, organic matter and crude protein value were increased depend on increasing of soybean ratio, ether extract; acid detergent fiber and neutral detergent fiber were decreased. The lowest pH, acetate, propionate and the highest Fleig values were determined in %30 soybean+%70sunflower and the lowest butyrate value was in %15soybean+%85sunflower silages. The highest, butyrate, lactate, ether extract, neutral detergent fiber and the lowest dry matter, crude protein were described in sunflower silages.

Digestibilities of dry matter, organic matter and crude protein were higher in soybean silages than others. Whereas digestibility values of ether extract were the highest in %30 soybean+%70sunflower, the highest acid detergent fiber were in %15soybean+%85sunflower and the lowest neutral detergent fiber were in sunflower silages. Consequently, ensiling with adding different amounts of soybean into sunflower was caused to obtain high quality silages. According to the fleig value the best results were taken in %30 soybean+%70sunflower silage but to terms of digestibility, %45 soybean+55%sunflower can be better.

Key Words: Soybean, sunflower, silage, fermentation, digestibility



LAVANTA (*Lavandula officinalis* L.) BİTKİSİNİN ÖNEMİ VE TOHUMLARININ BAZI MORFOLOJİK ÖZELLİKLERİ

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ÖZET

Lamiaceae familyası önemli tıbbi ve aromatik bitki ailelerinden birisidir. Dünyanın pek çok yerinde yetişebilme özelliğine sahip olan bu bitkilerin en önemli gen merkezlerinden birisi de Türkiye'dir. Ekonomik anlamda kıymetli bitkilerin yer aldığı bu familyanın bir diğer üyesi de Lavanta (*Lavandula officinalis* L.)dır. Sıcaklığa ve kuraklığa dayanıklı bitkilerden olan lavanta hem tohumla hem de çelikle üretilmektedir. Ekonomik önemi olan Lavanta, pek çok sektör (kozmetik, uçucu yağ, sağlık, süs bitkisi vb.) tarafından değerlendirilmektedir. Ayrıca kaliteli bal üretimi ve arı popülasyonlarının devamlılığı açısından özellikle yetiştirilen bitkiler içerisinde yer almaktadır. Bu çalışmada, lavanta (*Lavandula officinalis* L.) bitkisine ait tohumlar Ege Üniversitesi Ziraat Fakültesi Tarla Bitkileri ve Bingöl Üniversitesi Ziraat Fakültesi Biyosistem Mühendisliği Bölümlerinin laboratuvarlarında incelenmiştir. Bu bitkiye ait tohumlara ait şekil-boyut, yüzey alan, ortalama aritmetik ve geometrik çap, küresellik ve bin tane ağırlıkları gibi bazı morfolojik özellikleri saptanmıştır. Çalışma süresi boyunca tohumlar, oda sıcaklığında kapalı ve karanlık bir ortamda depolanmıştır. Araştırma, kontrollü şartlar altında tamamlanmıştır. Elde edilen değerlere göre; tohumların uzun ve oval bir yapıda; ortalama 2.068 mm uzunluk, 0.944 mm genişlik 1.646 mm² yüzey alan ölçülerine 0.0352 g bin tane ağırlığına sahip olduğu belirlenmiştir.

Anahtar Kelimeler: Tıbbi ve aromatik bitkiler, Lavanta, *Lavandula officinalis* L., Tohum özellikleri



**THE IMPORTANCE OF LAVENDER (*Lavandula officinalis* L.) AND SOME
MORPHOLOGICAL FEATURES OF ITS SEEDS**

ABSTRACT

Lamiaceae family is one of the important medicinal and aromatic plant families. One of the most important gene centers of these plants, which have the ability to grow in many parts of the world, is Turkey. Another member of this family, which includes economically valuable plants, is the Lavender (*Lavandula officinalis* L.) plant. Lavender, which is one of the heat and drought resistant plants, can be produced both with seeds and cuttings. Lavender, which has economic importance, is evaluated by many sectors (cosmetics, essential oil, health, ornamental plants, etc.). In addition, it is among the plants grown especially in terms of quality honey production and the continuity of bee populations. In this study, the seeds of the lavender (*Lavandula officinalis* L.) plant were examined in the laboratories of Ege University Faculty of Agriculture Field Crops and Bingöl University Faculty of Agriculture Biosystem Engineering Departments. Some morphological characteristics of the seeds of this plant such as shape-size, surface area, average arithmetic and geometric diameter, sphericity and thousand grain weights were determined. During the study period, seeds were stored at room temperature in a closed and dark environment. The research was completed under controlled conditions. According to the obtained values; the seeds have a long and oval structure; It was determined that it has an average length of 2.068 mm, a width of 0.944 mm, a surface area of 1.646 mm² and a thousand grain weight of 0.0352 g.

Keywords: Medical and aromatic plants, Lavender, *Lavandula officinalis* L., Seed characteristics



ÇUKUROVA BÖLGESİNDE KURU TANEYE YÖNELİK BEZELYE ÇALIŞMALARI

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ÖZET

Bezelye, içerdiği yüksek orandaki (%20-30) protein miktarı ile insan beslenmesinde önemli yere sahip bir baklagil bitkisidir. Ayrıca unu, yüksek protein değeri ile bebek mamalarının yapımında kullanılmaktadır. Bezelye bir baklagil bitkisi olarak, toprağı azotça zenginleştirmekte ve yüksek protein oranı ile atıkları da hayvan yemi olarak değerlendirilebilmektedir. Ülkemizde daha çok taze sebze olarak tüketilmekle beraber, konserve ve dondurulmuş gıda olarak da kullanılmaktadır. Dünyada ise taze tüketiminin yanında kuru tane olarak üretilip tüketilen önemli bir baklagil bitkisidir. Ülkemizde kuru tane olarak bezelye tüketme alışkanlığı çok yaygın değildir. İnsan beslenmesinde önemli bir yere sahip olan bezelye yerel gen kaynaklarının değerlendirilmesi de son derece önemlidir. Ülkemiz bu yerel kaynaklar bakımından oldukça zengindir. Bu nedenle kuru bezelye tarımının ülkemizde yaygınlaşmasını sağlayıp, alternatif bir gıda kaynağı olarak kuru bezelye tüketimi ve üretimine farkındalık yaratmak oldukça önemlidir. Bu çalışmada, Doğu Akdeniz Tarımsal Araştırma Enstitüsü Müdürlüğü tarafından tescil ettirilen ve üreticiye sunulan Irmak01 ve Deren kuru bezelye çeşitlerine ait teknik değerlendirmeler yapılmıştır.

Anahtar Kelimeler: Baklagil, kuru bezelye, ıslah, çeşit



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PEA STUDIES ON DRY GRAIN IN CUKUROVA REGION

ABSTRACT

With its high (20-30%) protein content, pea is a legume plant that has an important place in human nutrition. In addition, its flour is used in the production of baby foods with its high protein value. As a legume plant, pea enriches the soil with nitrogen and its high protein content can be used as animal feed. Although it is mostly consumed as a fresh vegetable in our country, it is also consumed as canned and frozen food. In the world, it is an important legume plant produced and consumed as dry grain as well as fresh consumption. In our country, the habit of consuming dry peas is not very common. It is also very important to evaluate local gene resources of peas, which have an important place in human nutrition. Our country is very rich in terms of these local resources. For this reason, it is very important to make dry pea agriculture widespread in our country and to raise awareness about the consumption and production of dried peas as an alternative food source. In this study, technical evaluations of Irmak01 and Deren dry pea varieties registered by the Eastern Mediterranean Agricultural Research Institute and presented to the producer were made.

Keyword: Legume, dry pea, breeding, variety



SÜT SIĞIRLARINDA ANTI-MÜLLERIAN HORMON (AMH) VE DÖLVERİMİ PERFORMANSI İLİŞKİSİ

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ÖZET

Çiftlikler için sürüde kalma süresi ve dölverimi performansı sürdürülebilirlik ve karlılık için büyük önem arz etmektedir. Anti-Müllerian hormon (AMH), kanda kolaylıkla tespit edilebilir ve çiftlik hayvanlarında dölverimi ile yakından ilişkili olduğu tespit edilmiştir. İlk olarak farelerde fetal cinsiyet belirlenmesinde rol oynayan bir hormon olarak bulunan AMH, Transforme edici büyüme faktörü (TGF- β) beta ailesine bağlı, 140 kDa ağırlığında, yarılanma ömrü 1,5 gün olan bir glikoproteindir. Erkek cinsiyetli embriyoların gelişimi sırasında testisteki Sertoli hücrelerinden salgılanan AMH, Müller kanalın (paramesonefrik kanal) gelişimini engeller. Dişi embriyolarda AMH oluşumu ise ovaryumdaki primordial foliküllerin aktivasyonu ile olur. Antral dönem öncesine kadar artan plazma AMH konsantrasyonu antral dönemin başlamasıyla azalır. Düşük AMH düzeyine sahip ineklerin yetersiz reproduktif performansa bağlı olarak sürüden çıkarılma oranı yüksek AMH düzeyine sahip ineklere göre daha fazladır. Antral Folikül Sayısı (AFS) reproduktif performans için önemli bir parametre olup yüksek antral folikül sayısına sahip sığırlar daha yüksek bir ovaryum rezervine sahiptir. AMH antral foliküllerin granuloza hücrelerinden sentezlendiğinden dolayı plazma AMH düzeyi dölverimi performansı açısından bir biyomarker özelliği sergilemektedir. AMH düzeyleri bakımından sınıflandırılan inekler arasında gebelik başına suni tohumlama oranı, açık gün sayısı, buzağılama aralığı açısından gruplar arasında bir fark bulunmazken, yüksek plazma AMH seviyesine sahip ineklerde 30-65. günler arasındaki embriyonik kayıplar daha az ve toplam gebelik oranı daha yüksek bulunmaktadır. AMH düzeyi parite ve hayvanın türüne göre değişiklik gösterirken, ineğin somatik hücre sayısı ve gebeliğin erken dönemindeki beslenme yetersizlikleri yavrunun AMH düzeyini düşürmektedir. Embriyo transferi için yapılan çalışmalarda yüksek AMH düzeyine sahip sığırlar ile toplanabilir ve yaşayabilir embriyo sayıları arasında pozitif korelasyon saptanmıştır. Bu derlemenin amacı kalıtım derecesi yüksek olan ve östruslar arasında stabilite arz eden Anti-Müllerian hormonunun ineklerde dölverimi ve sürdürülebilirlik biyomarkeri olarak kullanılabilirliğinin incelenmesidir.

Anahtar Kelimeler: Anti-Müllerian Hormon, Reproduction, Süt Sığırları, Antral Folikül Sayısı



**THE RELATIONSHIP BETWEEN ANTI-MÜLLERIAN HORMONE (AMH) AND
FERTILITY PERFORMANCE IN DAIRY CATTLE**

ABSTRACT

Reproductive performance and herd life are very important for sustainability of dairy farms. Anti-Müllerian hormone (AMH) can be easily determined in blood and has been found to be highly correlated with fertility in farm animals. Anti-Müllerian hormone, which was first found as a hormone that plays a role in fetal sex determination in mice and is a glycoprotein with a half-life of 1.5 days, weighing 140 kDa, linked to the Transforming growth factor beta (TGF- β) family. AMH synthesized from Sertoli cells in the testis during the development of male embryos inhibits the development of the Müllerian duct (paramesonephric duct). The formation of AMH in female embryos occurs with the activation of primordial follicles in the ovary. The existence of AMH in female embryos occurs with the activation of primordial follicles in the ovary. Plasma AMH concentration, increases until the pre-antral period then decreases with the initiation of the antral period. Cows with lower AMH levels are more likely to be expelled from the herd due to poor reproductive performance than cows with higher AMH levels. Antral Follicle Count (AFC) is an important parameter for reproductive performance, and cattle with a high antral follicle count have a higher ovarian reserve. Since AMH is synthesized from the granulosa cells of antral follicles, plasma AMH level reveals a biomarker feature in terms of fertility performance. Cows with higher AMH levels, have less embryonic death between 30-65 days of pregnancy and also have higher pregnancy rates. While AMH level varies according to parity and animal species, dam's somatic cell count and nutritional deficiencies in early pregnancy decreases the AMH level of the offspring. Several studies have been reported that there is a positive correlation was found between the number of collectible and viable embryos in cattle with high AMH levels. The objective of this review is to investigate the use of Anti-Müllerian hormone, which has a higher heritability level, as a biomarker of fertility and sustainability in dairy cattle.

Keywords: Anti-Müllerian Hormone, Reproduction, Dairy Cattle, Antral Follicle Count



GEBE BİR KOYUNDA DİYAFRAM FITIĞI OLGUSU

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ÖZET

Diyafram fıtığı, diyaframda doğuştan veya sonradan oluşan bir açıklıktan karın boşluğundaki organların göğüs boşluğuna geçmesi olarak tanımlanmaktadır. Diyaframdaki defekt kongenital olmakla birlikte çoğu kez sonradan oluşmaktadır. Sonradan oluşan defektler genellikle abdominal basıncın artması sonucu şekillenmektedir. Karın boşluğundaki organlar göğüs boşluğuna geçmesine rağmen, fıtıklaşan bağırsakların strangulasyonu (boğumlanması) nadirdir. Diyafram fıtığı hayvanlarda, özellikle kedi ve köpeklerde yaygın olarak görülmektedir. Bu vakanın materyalini Van Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Patoloji Anabilim Dalı'na solunum güçlüğü nedeniyle öldüğü bildirilen 4 yaşında Akkaraman gebe bir koyunun nekropsisi yapıldı. Yapılan sistemik nekropside, diyaframda 5 cm genişliğindeki açıklıktan ince bağırsağın bir bölümünün göğüs boşluğuna geçtiği görüldü. Göğüs boşluğuna geçen bağırsak bölümlerinin akciğerin sol diyaframatik lobun ventralinde plöral fibröz bir doku ile sarılmış olarak lokalize olduğu saptandı. Bu bağırsak bölümlerinin karakteristik olarak sucuk görünümünde koyu kırmızı renkte gangrenoz yapıda olduğu saptandı. Bu bağırsak bölümlerinin sol göğüs boşluğunun paryetal plöra arasındaki fibrino purulent bir eksudatla adezyon olduğu dikkati çekti. Sol diyaframatik akciğer lobunda ise yer yer atelektazik alanlar görüldü. Bu fıtıklaşma nedeniyle, karın boşluğunda kolonların yer değiştirerek rumenin üzerine geldiği ve peritonitis sonucu adezyon olduğu belirlendi. Ayrıca koyunun 3 aylık gebe olduğu tespit edildi. Yapılan mikroskopik incelemede ise yırtık diyafram kas kenarlarında fibrözis olduğu gözlemlendi. Sol diyaframatik akciğerde geniş atelektazik alanlar ile invagine bağırsak bölümlerinde şiddetli nekrotik ülseratif hemorajik enteritis saptandı. Ayrıca bağırsak villuslarında şiddetli atrofi görüldü. Nekropsi bulguları ve histopatolojik incelemeler sonucunda, gebe bir koyunda saptanan diyafram fıtığının gebelik sürecinde artan intra abdominal basıncın etkisiyle diyafram kasında gelişen bir defekten geliştiği düşünülmektedir. Tanımlanan bu vaka gebe koyunlarda saptanan diyafram fıtığına Türkiye'den bildirilen ilk vakadır.

Anahtar Kelimeler: Diyafram Fıtığı, Koyun, Bağırsak



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A CASE OF DIAPHRAGMATIC HERNIA IN A PREGNANT SHEEP

ABSTRACT

Diaphragmatic hernia is defined as the passage of organs in the abdominal cavity into the chest cavity through a congenital or acquired opening in the diaphragm. Although the defect in the diaphragm is congenital, it is later acquired. Acquired defects are usually formed as a result of increased abdominal pressure. Although the organs in the abdominal cavity pass into the chest cavity, strangulation (strangulation) of herniated intestines is rare. Diaphragmatic hernia is common in animals, especially cats and dogs. In this case, a necropsy was performed at Van Yuzuncu Yil University, Faculty of Veterinary Medicine, Department of Pathology **due to** death of a 4-year-old Akkaraman pregnant sheep due to respiratory distress. At necropsy, it was observed that a part of the small intestine had passed into the chest cavity through the 5 cm long thslit in the diaphragm. It was determined that the intestinal sections pass into the chest cavity were localized in the ventral of the left diaphragmatic lobe of the lung, surrounded by a pleural fibrous tissue. It was determined that these intestinal sections were characteristically sausage-like, dark red in color and gangrenous. It was noted that these intestinal sections were adhesion with a fibrino purulent exudate between the parietal pleura of the left thoracic cavity. In the left diaphragmatic lung lobe, atelectasis areas were seen in places. Due to this herniation, it was determined that the colons in the abdominal cavity were displaced and came over the rumen and adhered as a result of peritonitis. It was determined that the sheep was 3 month spregnant. Microscopically, fibrosis was observed at the left part of diaphragm muscle. Large areas of atelectasis in the left diaphragmatic area of the lung and severe necrotic ulcerative hemorrhagic enteritis were detected in the invaginated bowel parts. In addition, severe atrophy of intestinal villi was observed. As a result of necropsy findings and histopathological examinations, it is thought that diaphragmatic hernia detected in a pregnant sheep develops from a defect in the diaphragm muscle duet ot increased intra-abdominal pressure during pregnancy. This described case is the first reported case from Turkey of diaphragmatic hernia detected in pregnant sheep.

Keywords: Diaphragmatic Hernia, Sheep, Intestine



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**THE STUDIES ON *SARDA SARDA* (ACTINOPTERI: SCOMBRIFORMES:
SCOMBRIDAE) IN TURKISH SEAS FROM PAST TO PRESENT**

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ABSTRACT

The Scombridae is a family of the order Scombriformes and contains 54 species in 15 genera worldwide, for the present. 10 of these species [*Auxis rochei* (Risso, 1810), *Euthynnus alletteratus* (Rafinesque, 1810), *Katsuwonus pelamis* (Linnaeus, 1758), *Orcynopsis unicolor* (Geoffroy Saint-Hilaire, 1817), *Sarda sarda* (Bloch, 1793), *Scomber colias* (Gmelin, 1789), *Scomber scombrus* (Linnaeus, 1758), *Scomberomorus commerson* (Lacepède, 1800), *Thunnus alalunga* (Bonnaterre, 1788), *Thunnus thynnus* (Linnaeus, 1758)] exist in Turkish Seas. Atlantic bonito (*Sarda sarda* Bloch, 1793), an epipelagic marine fish, is distributed along tropical and temperate coasts of the Atlantic Ocean, the Mediterranean, and the Black Sea and migrates from the Aegean Sea to the Black Sea through the Çanakkale and Istanbul straits for purpose of the feeding and reproduction in spring season ever year. Reverse migration in order to overwinter to the Marmara and Aegean Seas starts in late fall. The while, it is caught by handlines, encircling nets, and purse-seine. For this reason, *Sarda sarda* is one of the most important commercial species for Turkish fisheries. The present study uncovers the information about the atlantic bonito (*Sarda sarda* Bloch, 1793) from past to present for Turkish seas.

Keywords: Atlantic bonito, Fisheries, *Sarda sarda*



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**KIVIRCIK KOYUNLARINDA ÖSTRUS PRESENKRONİZASYON VE
SENKRONİZASYON UYGULAMALARININ BAZI KAN PARAMETRELERİ
ÜZERİNE ETKİSİ**

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ÖZET

Bu çalışmada Kıvırcık ırkı koyunlarda östrus presenkronizasyon ve senkronizasyon uygulamalarının bazı kan parametreleri üzerindeki etkisini incelemek amaçlandı. Çalışmada klinik olarak sağlıklı 30 baş koyun kullanıldı. Koyunlar, kontrol (cont; n=10), östrus senkronizasyonu (sync; n=10) ve östrus presenkronizasyon+senkronizasyonu (pre+sync; n=10) olmak üzere rastgele üç gruba ayrıldı. Denemede kullanılan koyunların önlerinde her zaman ulaşabilecekleri taze yem ve su bulunduruldu. Koyunlar, klinik olarak sağlıklı koçlar (n=3) ile birlikte barındırıldı. Cont grubundaki koyunlara her hangi bir uygulama yapılmadı. Sync grubuna çalışmanın başlangıcından itibaren 14-21. günler arasında intravaginal medroksiprogesteron asetat (MAP) uygulandı. Pre+sync grubuna ise hem 0-7 hem de 14-21. günler arasında MAP uygulandı. Deneyin 0. gününden itibaren birer hafta aralıklarla (0-7-14-21. günler) alınan kan örneklerinde hematolojik parametreler [lökosit (WBC), eritrosit (RBC), hematokrit (HCT), haemoglobin (HGB), trombosit (PLT), Ortalama alyuvar hemoglobini (MCH), ortalama eritrosit haemoglobin konsantrasyonu (MCHC) ve ortalama alyuvar hacmi (MCV)] belirlendi. Çalışmanın 0 ve 7. günlerinde Pre+sync grubunda WBC ve lenfosit (Lym) değerlerinin kontrol grubuna göre daha düşük olduğu belirlendi ($p<0.05$). 0 ve 21. günlerdeki ölçümler arasında, pre+sync grubunda nötrofil (Neu) sayısı uygulamalara bağlı olarak azalırken ($p<0.05$), diğer gruplarda değişmedi ($p>0.05$). Pre+sync grubundaki hayvanlarda HCT değerleri 14. gündeki analizlerde diğer gruplardan daha yüksek tespit edildi ($p<0.05$). Yine 14. gündeki analizlerde, WBC ve Lym değerleri pre+sync grubunda diğer gruplara oranla daha az bulundu ($p<0.05$). Bütün gruplar ve ölçümler dikkate alındığında, tekrarlanan intravajinal sünger uygulamalarının (pre+sync) WBC, Neu, Lym ve HCT değerleri hariç diğer kan parametrelerinde önemli bir değişikliğe neden olmadığı belirlendi. Sonuç olarak kısa/uzun veya tekrarlı östrus senkronizasyon protokollerinin kan parametrelerini önemli derecede etkilemediği belirlendi.

Anahtar Kelimeler: Kan parametreleri, koyun, Kıvırcık, presenkronizasyon, senkronizasyon.



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**THE EFFECT OF ESTROUS PRESYNCHRONIZATION AND
SYNCHRONIZATION APPLICATIONS ON SOME BLOOD PARAMETERS IN
KIVIRCIK SHEEP**

ABSTRACT

In this study, it was aimed to examine the effects of estrus presynchronization and synchronization practices on some blood parameters in Kivircik sheep. Thirty (30) clinically healthy sheep were used in the study. Sheep were randomly divided into three groups as control (cont; n=10), oestrus synchronization (sync; n=10), and oestrus presynchronization+synchronization (pre+sync; n=10). Fresh feed and water were always available to the sheep used in the experiment. Sheep were housed with clinically healthy rams (n=3). No application was performed to the sheep in the Cont group. Intravaginal medroxyprogesterone acetate (MAP) was administered to sync group between 14-21 days of the experiment. On the other hand, MAP was applied to the pre+sync group, both in 0-7 and 14-21 days. In blood samples which were taken at one-week intervals (days 0-7-14-21) from day 0 of the experiment, hematological parameters [leukocyte (WBC), erythrocyte (RBC), hematocrit (HCT), hemoglobin (HGB), platelet (PLT), Mean red blood cell hemoglobin (MCH), mean erythrocyte hemoglobin concentration (MCHC), and mean red blood cell volume (MCV)] were determined. On days 0 and 7, WBC and lymphocyte (Lym) values were found lower in the Pre+sync group compared to the cont group in the present study ($p<0.05$). Between the measurements on days 0 and 21, the number of neutrophils (Neu) in the pre+sync group decreased depending on the treatments ($p<0.05$), however it did not change in the other groups ($p>0.05$). HCT values were found higher in the pre+sync group than the other groups in the analyzes on the 14th day ($p<0.05$). In the analyzes of 14th day, WBC and Lym values were also found lower in the pre+sync group compared to the other groups ($p<0.05$). When considering all groups and measurements, it was determined that repeated intravaginal sponge applications (pre+sync) did not cause any significant change in blood parameters except WBC, Neu, Lym and HCT values. In conclusion, it was determined that short/long or repeated oestrus synchronization protocols did not significantly affect blood parameters in sheep.

Keywords: Blood parameters, sheep, Kivircik, pre-synchronisation, synchronisation.



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**İVESİ İRKİ KOYUNLARDA SERUM PROGESTERON KONSANTRASYONU İLE
ERKEN GEBELİK TEŞHİSİ**

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ÖZET

Sunulan çalışmada sezon dışında östrüs uyarımı yapılan İvesi ırkı koyunlarda gebelik teşhisi amacıyla aşım sonrası 17. günde alınan serum progesteron konsantrasyonu (P4) ile erken gebelik teşhis doğruluğunun tespit edilmesi amaçlandı. Çalışmada bir önceki aşım sezonunda gebe kalıp doğum yapmış, mevsimsel anöstrüs döneminde bulunan, genital organlarında klinik sorun belirlenmeyen ve postpartum 60-90. günler arasında bulunan 2-5 yaş aralığındaki sağlıklı 91 baş İvesi ırkı koyun kullanıldı. Aşımı kabul eden koyunlar östrüste olarak kabul edildi. Ultrasonografik muayenelerde real-time B-mode ultrason cihazı (Mindray DP-50) ve 6,5 MHz'lik linear rektal prob (Mindray 65EL60EA) kullanıldı. Çalışmada koyunlara aşımdan sonraki 36.-46. günler arasında transrektal yolla gebelik muayenesi yapıldı. Aşımdan 17 gün sonra gebelik teşhisi amacıyla P4 seviyesi belirlendi. P4 değeri ve ultrasonografik yöntemle gebelik teşhisi karşılaştırılarak gebelik teşhis doğruluğu hesaplandı. Gebelik Teşhisi Doğruluğu (%): “(Gebe + Boş + Östrüs Göstermeyen Boş) - (Yanlış Pozitif + Yanlış Negatif) / Toplam Koyun Sayısı” olarak tanımlandı. İki farklı gebelik muayene sonuçları kuzulama sonuçlarıyla doğrulandı. İstatistiksel olarak iki ayrı gebelik muayene yöntemi arasındaki uyum Kappa testi ile değerlendirildi. Çalışmada aşım sonrası 36-46 günleri arasında yapılan USG muayenesinde 40 baş koyun gebe, 28 koyun boş, 23 koyun östrüs göstermeyen boş, 0 baş koyun yanlış pozitif, 0 baş koyun yanlış negatif olarak tespit edildi. Gebelik teşhisi doğruluğu %100 olarak tespit edildi. Hayvanların takibi esnasında 2 koyunda (48. gün) 1 koyunda (39. gün sonrası) geç embriyonik - erken fetal ölüm gerçekleşti. Aşım sonrası 17. gün serum P4 değerine göre 1,30 ng/ml den düşük olanlar boş, yüksek olanlar ise gebe olarak kabul edildi. Geç embriyonik - erken fetal ölümler dahil (3 koyun) P4 değerine göre 45 baş koyun gebe, 26 koyun boş, 20 koyun östrüs göstermeyen boş, 0 baş koyun yanlış pozitif, 5 baş koyun yanlış negatif olarak tespit edildi. Gebelik teşhisi doğruluğu % 94,5 (86/91) olarak tespit edildi. Yanlış negatiflerin embriyonik ölümlerden kaynaklandığı düşünüldü. İki muayene yöntemi arasında çok iyi/güçlü düzeyde uyumluluk olduğu tespit edildi (Kappa=0,89). Sonuç olarak, ivesi ırkı koyunlarda aşım sonrası 17. günde serum P4 düzeylerinin tespiti ile ultrasonografik muayene yöntemine yakın düzeyde gebelik teşhisi yapılabildiği ve gebeliğin daha erken sürede tespit edilerek boş geçen günleri azaltabilecek bir teşhis yöntemi olduğu kanısına varıldı.

Anahtar Kelimeler: Gebelik Teşhisi, İvesi Koyun, Progesteron, Ultrasonografi



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**EARLY PREGNANCY DIAGNOSIS IN AWASSI EWES BY SERUM
PROGESTERONE CONCENTRATION**

ABSTRACT

In the present study, it was aimed to determine the accuracy of early pregnancy diagnosis with the serum progesterone concentration (P4) collected on the 17th day post-mating in Awassi ewes that were induction of estrus during the non-breeding season. A total of 91 Awassi-bred lactating ewes, clinically healthy, 2–5 years old with 45–50-kg body weight having 60–90 days postpartum, were used. Ewes mating with rams were considered to be in estrus. Pregnancies were determined with transrectal real-time B Mod ultrasonography (Mindray DP-50) with a linear rectal probe (Mindray 65EL60EA) on days 36–46 following mating. The P4 level was determined for the diagnosis of pregnancy with the blood collected 17th day post-mating. Pregnancy diagnosis accuracy was calculated by comparing P4 value and pregnancy diagnosis by ultrasonographic method. It was defined as; Pregnancy Diagnosis Accuracy (%): “(Pregnant + Empty + Empty No Estrus) - (False Positive + False Negative) / Total Number of Ewes. The results of two different pregnancy diagnosis were confirmed by lambing results. Statistically, the compatibility between two different pregnancy diagnosis methods was evaluated with the Kappa test. In the present study, the ultrasonography examination performed between on the 36-46th days post-mating, 40 ewes were found to be pregnant, 28 ewes were empty, 23 ewes were not showing estrus, 0 ewes were false positive, and 0 ewes were false negative. Pregnancy diagnosis accuracy was found to be 100%. During the follow-up of the ewes, late embryonic - early fetal death occurred in 2 ewes (48th day after mating) and 1 ewe (39th day after mating). According to the serum P4 value on the 17th day after mating, those with a serum P4 value lower than 1.30 ng/ml were considered empty, and those higher were considered pregnant. According to the P4 value, including late embryonic and early fetal deaths (3 ewes), 45 ewes were found to be pregnant, 26 ewes were empty, 20 ewes were not showing estrus, 0 false positives, and 5 false negatives. Pregnancy diagnosis accuracy was 94.5% (86/91). False negatives were thought to result from embryonic deaths. A strong agreement was found between the two diagnosis methods (Kappa=0.89). It was concluded that by determination of serum P4 levels on the 17th day post-mating in Awassi ewes, pregnancy diagnosis can be made at a level close to the ultrasonographic diagnosis method. It is also concluded that it is a diagnostic method that can reduce the empty days by detecting the pregnancy earlier.

Keywords: Pregnancy Diagnosis, Awassi Ewes, Progesterone, Ultrasonography



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KÜRE HAYVANCILIĞINDA YAPILAN SUNİ TOHUMLAMALARIN İSTATİSTİĞİ

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ÖZET

Küre ilçesi gerek yer altı gerekse yer üstü zenginlikleri ile Kastamonu'nun 60 km kuzeyinde yer almaktadır. İlçe ekonomisinde hayvancılığın katkısı, madencilik ve ormancılıktan sonra üçüncü sırada yer bulmaktadır. Üreme biyoteknolojilerinde yapılan araştırmalar ve suni tohumlama uygulamalarında elde edilen başarılı sonuçlar hayvancılık sektörüne birçok kazanım sağlamıştır. Ülkemizde olduğu gibi Küre ilçesinde de son yıllarda giderek artan suni tohumlama uygulamaları sayesinde kaliteli kültür ırkı sığır sayısı giderek artmıştır. Küre ilçesinde büyükbaş işletme sayısı yaklaşık olarak 463 adettir. Bu işletmelerdeki hayvan sayısı toplam 3025 olup yaklaşık olarak işletme başına 6,5 adet hayvan düşmektedir. Bu altı adet hayvanın 4,7'sini dişi hayvanlar, yaklaşık %27'sini ise erkek hayvanlar oluşturmaktadır. Küre ilçesinde görev yapan Veteriner Hekimlerin son 3 yılda yaptıkları suni tohumlama uygulamaları incelendiğinde 2018 yılında yapılan tohumlamalar içinde birinci tohumlamanın yıl içinde atılan tohumlamalara oranı %91'dir. 1. tohumlamada buzağı doğum başarı oranı da %46,3'tür. 2. tohumlamanın toplam tohumlamalara oranı %7,3 iken 2. tohumlamalarda buzağı doğma başarı oranı da %3,77'dir. 2019 yılında ise 1. tohumlamaların toplam tohumlamalara oranı %87,7 iken 1. tohumlamalarda buzağı doğum başarı oranı ise %41,3'tür. 2. tohumlamaların toplam tohumlamalara oranı %10,2 iken 2. tohumlamada buzağı doğum başarı oranı %6,4'tür. 2020 yılında ise 1. tohumlamanın yıl içindeki toplam tohumlamalara oranı %82 iken 1. tohumlamada buzağı doğum başarı oranı %41'dir. 2. tohumlamaların toplam tohumlamalara oranı %14 iken 2. tohumlamada buzağı doğum başarı oranı ise %6,5'dur. Veteriner hekimlerin toplamda bir buzağı için sarf ettikleri payet oranı yaklaşık olarak 2'dir. Tüm bu bilgiler ışığında hayvanların bakım ve beslenmesinin iyileştirilmesinin yanı sıra infertiliteye neden olan hastalıkların tespiti için genital sistem muayenelerinin düzenli olarak yapılması tohumlama başarı oranını önemli derecede arttıracakı düşünülmektedir. Tohumlama başarı oranının artırılması da hem Küre hem de Ülke ekonomisine katkı sağlayacaktır.

Anahtar Kelime: Hayvancılık, Küre, Suni Tohumlama



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STATISTICS OF ARTIFICIAL INSEMINATION IN KÜRE BREEDING

ABSTRACT

Küre district is located 60 km north of Kastamonu with its underground and aboveground riches. The contribution of animal husbandry to the community's economy ranks third after mining and forestry. Successful results obtained in researches in reproductive biotechnology and artificial insemination applications have provided many gains to the livestock sector. As in our country, the number of high-quality culture breed cattle has increased gradually, thanks to the increasing artificial insemination practices in the Küre district in recent years. The number of cattle holdings in the Küre district is approximately 463. The number of animals in these enterprises is 3025 and around 6.5 animals per farm. Of these six animals, 4.7 are female animals, and approximately 27% are male animals. When the artificial insemination practices of the veterinarians working in the Küre district are examined in the last three years, the ratio of the first insemination to the inseminations made during the year among the inseminations made in 2018 is 91%. The calf birth success rate in the first insemination is 46.3%. While the ratio of the second insemination to the total insemination is 7.3%, the success rate of calving in the second insemination is 3.77%. In 2019, while the ratio of the first inseminations to the total insemination was 87.7%, the calf birth success rate in the first insemination was 41.3%. While the ratio of the second insemination to the total insemination is 10.2%, the calf birth success rate in the second insemination is 6.4%. In 2020, while the ratio of the 1st insemination to the total insemination in the year is 82%, the calf birth success rate in the 1st insemination is 41%. While the ratio of the second insemination to the total insemination is 14%, the calf birth success rate in the second insemination is 6.5%. The rate of straws used by veterinarians for a total calf is approximately 2. In light of all this information, it is thought that regular examination of the genital system for the detection of diseases that cause infertility and improving the care and nutrition of animals will significantly increase the success rate of insemination. Increasing the success rate of insemination will also contribute to the economy of both the Küre and the Country.

Keywords: Livestock, Küre, Artificial Insemination



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KASTAMONU'DA YAPILAN HAYVANCILIĞA SUNİ TOHURLAMANIN ETKİSİ

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ÖZET

Dünya’da ve Ülkemizde yaşanan son gelişmeler tarım ve hayvancılığın önemini bir kez daha öne çıkarmıştır. Kastamonu İli hem Osmanlı Devletinde hem de Türkiye Cumhuriyeti kurulduktan sonra yeraltı ve yerüstü zenginlikleri ile her daim ön plana çıkmaktadır. İlimiz yüzölçümünün 2/3’ünü kaplayan ormanları, temiz ve bol su kaynakları gerek büyükbaş gerekse küçükbaş hayvancılığın yapılmasına olanak vermektedir. Hayvancılığın yanı sıra İl yüzölçümünün %28’ini tarım alanları oluşturmakta olup buğday, arpa, çeltik, siyez gibi birçok tarım ürününün yanı sıra şekerpancarı, sarımsak, patates gibi sanayi bitkileri üretimiyle tarım sektörü hem hayvancılık sektörüne hem de ülke ekonomisine katkı sağlamaktadır. Türkiye’de ve dolayısıyla Kastamonu’da süt sığırcılığının gelişimi hayvanların bakım ve beslenmesinin yanında en önemli husus, kaliteli süt sığırcı üretimini arttırmaktır. Kaliteli süt sığırlarının üretiminin artırılması için yapılan çalışmalar genellikle süt veriminin fazla olduğu sığır ırklarından üreme teknolojileri sayesinde yerli ırk hayvanlarla melezleme çalışmaları yapılarak olmaktadır. Yapılan bu üreme teknolojilerinin başında olan ve uygulamada en çok kullanılan üreme teknolojisi suni tohumlama uygulamalarıdır. Yapılan suni tohumlama uygulamaları erkek hayvan bakım ve besleme maliyetlerini azaltır, cinsel yolla geçen hastalıkların önlenmesine yardımcı olur ve sürü idaresini kolaylaştırarak damızlık hayvan üretimini artırır. Kastamonu İlinde son yıllarda yapılan suni tohumlamalar sayesinde sağılan saf kültür sağmal inek sayısı 2004 yılında 14.774 adetken 2012 yılında 38.720’ye 2019 yılında ise 71.949’a kadar arttırmıştır. Bunla paralel olarak saf kültür sağmal ineklerden elde edilen süt miktarı da 2004 yılında 58.032 ton iken 2019 yılında yaklaşık 5 kat artarak 282.616 tona yükselmiştir. Yerli sağmal hayvan sayısı da 2004 yılında 37.737 iken 2019 yılında 7.338 adete kadar gerilemiştir. İlimizde suni tohumlama ile birlikte sağmal ineklerde yerli hayvan popülasyonundan kültür ırkı hayvan popülasyonuna dönüşüm sağlanmaya çalışılmıştır. İlimizde Kooperatifler ve Üretici Birlikleri sayesinde suni tohumlama ve daha ileri üreme teknolojileri kullanılarak hem et-süt hem de genetik özellikler bakımından kaliteli hayvan ırkları üretimi arttırılmıştır. Arttırılan kaliteli hayvan ırkları sayısı sayesinde hem Kastamonu hem de Türkiye ekonomisine büyük katkılar sağlanmıştır. Bu derlemede kullanılan bilgiler, Kastamonu’da 2004-2019 yılları arasında süt sığırcılığı ve süt üretimine ilişkin TÜİK verilerinden ve damızlık sığır yetiştiriciliği derneği arşivlerinden yapılan suni tohumlama sayılarından elde edilmiştir. Elde edilen bu bilgiler ışığında Kastamonu ilinde bulunan hayvancılık işletmelerinde ileri üreme teknolojilerinin faydaları ortaya konularak yaygınlaştırılması amaçlanmaktadır.

Anahtar Kelime: Kastamonu, Sığır, Suni Tohumlama,



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THE EFFECT OF ARTIFICIAL INSEMINATION TO LIVESTOCK IN KASTAMON

ABSTRACT

Recent developments in the world and our country have highlighted the importance of agriculture and animal husbandry. Kastamonu always came to the fore with its underground and aboveground riches in the Ottoman Empire and after establishing the Turkish Republic. Forests covering 2/3 of the surface area of our province; clean and abundant water resources allow both cattle and sheep farming to be done. In addition to animal husbandry, agricultural regions make up 28 percent of the province's surface area. The agricultural sector contributes to the livestock and the country's economies by producing industrial crops like sugar beet, garlic, and potatoes and various farm products like wheat, barley, paddy, and einkorn. The development of dairy cattle in Turkey and, therefore, in Kastamonu, besides the care and feeding of animals, the most crucial issue is to increase the production of quality dairy cattle. Studies to increase the production of quality dairy cattle are generally carried out by crossbreeding with domestic breed animals, thanks to the breeding technologies of cattle breeds with a high milk yield. Artificial insemination is the most used reproductive technology at the beginning of these reproductive technologies. Artificial insemination practices reduce male animal care and feeding costs, help prevent sexually transmitted diseases, and increase breeding animal production by facilitating herd management. Through the artificial inseminations carried out in Kastamonu in recent years, the number of pure culture dairy cows milked increased from 14,774 in 2004 to 38,720 in 2012 and 71,949 in 2019. In parallel with this, while the amount of milk obtained from pure culture dairy cows was 58,032 tons in 2004, it increased by approximately five times and reached 282,616 tons in 2019. While the number of domestic dairy animals was 37,737 in 2004, it decreased to 7,338 in 2019. Artificial insemination has been used widely in our province to turn the domestic animal population into the culture breed animal population in dairy cows. Using artificial insemination and more modern reproductive technologies, our province's Cooperatives and Producer Unions have improved the production of quality animal breeds in terms of both meat-milk and genetic qualities. The economy of both Kastamonu and Turkey has significantly benefited from the increased number of high-quality animal breeds. The information used in this review was obtained from TUIK data on dairy cattle and milk production in Kastamonu between 2004-2019 and the number of artificial inseminations made from the archives of the breeding cattle breeding association. In the light of this information obtained, it is aimed to promote the use of advanced reproductive technologies in livestock enterprises in Kastamonu province by demonstrating the benefits.

Keywords: Kastamonu, Cattle, Artificial Insemination



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**ÇUKUROVA BÖLGESİNDEKİ ARI İŞLETMELERİNDE BAZI VİRAL ARI
HASTALIKLARININ EPİDEMİYOLOJİSİ**

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ÖZET

Türkiye, coğrafi konumu, arazi yapısı ve zengin bitki örtüsü bakımından oldukça önemli bir arıcılık potansiyeline sahiptir. Ülkemiz 8.179.085 milyon arı koloni varlığı ile dünya da 3.sırada yer alırken 104.077 ton bal üretimi ile dünya da ikinci sırada yer almaktadır. Dünyada kovan başı ortalama bal üretimi (20,6 kg) iken ülkemiz de ise kovan başı ortalama bal üretimi (12,7 kg)'dır. Hem dünya bal ticaretindeki payımız hem de koloni başına bal üretimimiz dikkate alındığında, ülkemizin sahip olduğu mevcut arıcılık potansiyelinden yeteri kadar faydalanamadığımız ortaya çıkmaktadır. Bunun nedenlerinden biriside ekonomik kayba ve yüksek düzeyde koloni ölümlerine sebep olan arı hastalık ve zararlılarıdır. Son zamanlarda yapılan çalışmalar koloni sönmesi olaylarının büyük bölümünde arı viruslarının rol aldığına işaret etmektedir. Bal arılarında, dünya genelinde yapılan çalışmalarda arıların yaşamlarını, üretimlerini etkileyen ve aynı zamanda ani ölümlerine de neden olan 24 virüs tespit edilmiştir. Bu çalışma da önemli koloni kayıplarına sebep olan 6 viral hastalık etkenlerinden; Akut arı felçi virüsü (ABPV), Siyah kraliçe hücre virüsü (BQCV), Kronik arı felçi virüsü (CBPV), Deforme kanat virüsü (DWV), Kaşmir arı virüsü (KBV) ve Torba yavru çürüklüğü virüsü (SBV) varlığı moleküler olarak araştırılması amaçlanmıştır. Bu çalışma; 2018-2020 yılları arasında Çukurova bölgesindeki koloni kayıpları gözlenen arı işletmelerindeki kovanlardan yapılmıştır. 2018 yılında 80, 2019 yılından 65 ve 2020 yılından 13, toplam 158 adet numuneden ABPV, BQCV, CBPV, DWV, KBV ve SBV viruslarının varlığı araştırıldı. Gelen ergin arı örneklerinde RT-PCR tekniği ile analiz yapılmıştır Yapılan analizler sonucunda 158 arı işletmesinde; ABPV 9 işletmede, BQCV 89 işletmede, CBPV 4 işletmede, DWV 90 işletmede, SBV 45 işletmede ve KBV ise hiçbir işletmede rastlanmadı. Yine yapılan çalışmada 19 işletmedeki arılarda 2 virus, 64 işletmedeki arılarda 3 virus ve 3 işletmede de 4 virus etkenine aynı anda rastlanmıştır. Sonuç olarak; Arı viral hastalıklarının mücadelesinde kovanlardaki hijyenik ve sağlık tedbirlerini riayet edilmesi, güçlü kovanların oluşturulması ve arı parazitleri ile mücadele edilmesi gerekmektedir.

Anahtar Kelimeler: Balarısı, ABPV, BQCV, CBPV, DWV, KBV, SBV



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**EPIDEMIOLOGY WITH SOME VIRAL BEE DISEASE IN BEE FACILITIES IN
ÇUKUROVA REGION**

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ABSTRACT

Turkey has a very important beekeeping potential in terms of its geographical location, land structure and rich vegetation. While our country ranks 3rd in the world with its 8,179,085 million bee colonies, it ranks second in the world with 104,077 tons of honey production. While the average honey production per hive in the world is (20.6 kg), the average honey production per hive in our country is (12.7 kg). When both our share in world honey trade and honey production per colony are taken into account, it becomes clear that we cannot sufficiently benefit from the current beekeeping potential of our country. One of the reasons for this is bee diseases and pests that cause economic loss and high colony deaths. Recent studies indicate that bee viruses play a role in most of the colony extinction events. In studies conducted around the world, 24 viruses have been identified in honeybees that affect the life and production of bees and also cause their sudden death. In this study, 6 viral disease factors that cause significant colony losses; It is aimed to molecularly investigate the presence of acute bee paralysis virus (ABPV), Black queen cell virus (BQCV), Chronic bee paralysis virus (CBPV), Deformed wing virus (DWV), Kashmir bee virus (KBV) and Sacbrood virus (SBV). This work; It was made from the beehives in the bee enterprises where colony losses were observed in the Çukurova region between the years 2018-2020. The presence of ABPV, BQCV, CBPV, DWV, KBV and SBV viruses was investigated from 80 samples in 2018, 65 from 2019 and 13 from 2020, a total of 158 samples. Incoming adult bee samples were analyzed by RT-PCR technique. As a result of the analysis, in 158 bee enterprises; ABPV found in 9 enterprises, BQCV in 89 enterprises, CBPV in 4 enterprises, DWV in 90 enterprises, SBV in 45 enterprises and KBV in none of the enterprises. Again, in the study, 2 viruses were found in bees in 19 enterprises, 3 viruses in bees in 64 enterprises, and 4 virus agents in 3 enterprises were found simultaneously. As a result; In the fight against bee viral diseases, it is necessary to comply with the hygienic and health measures in the hives, to create strong hives and to fight against bee parasites.

Keywords: Honeybee, ABPV, BQCV, CBPV, DWV, KBV, SBV



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**BESİ SİĞIRLARINDA ÜRETİM VE KALİTE ÖZELLİKLERİ İÇİN GENOM
DESTEKLİ SELEKSİYON VE DİZİLEME TEKNOLOJİSİNDEKİ İLERLEMELER**

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ÖZET

Fenotipe dayalı ve pedigrî kayıtları ile desteklenmiş olan geleneksel seleksiyon metotları özellikle de süt sığırcılığında belirli bir düzeyde başarılı olmuştur. Ancak besi sığırcılığında geleneksel seleksiyon metodlarıyla kesim sonrası saptanabilen özelliklerin belirlenmesi, hem uzun süre gerektirmekte hem de ekonomik açıdan kayıplara yol açabilmektedir. Bu nedenle moleküler genetik çalışmalar, birçok özelliğin hayvan daha canlıyken ortaya konulabilmesine ve bu verilerin erken seleksiyonda kullanılabilmesine olanak sağlamaktadır. Sığır genomunda yaklaşık üç milyar nükleotit ve 30 milyonun üzerinde tek nükleotit polimorfizmi (single nucleotide polymorphism: SNP) vardır. Genomda ortalama her 100 nükleotitten biri bir SNP'dir. SNP temelli genotiplendirme, mikrosatellitler ile karşılaştırıldığında otomatikleştirilmiş, nispeten ucuz, verimli (çoğu lokus okunur) ve yüksek oranda tekrarlanabilir (farklı laboratuvarlar arasında) olması nedeniyle işaretleyici-yardımlı seleksiyon (marker-assisted selection: MAS) programlarında tercih edilir hale gelmiştir. MAS araştırmaları kapsamlıdır ancak uygulamaları sınırlı olmuştur ve genetik kazançtaki artışlar düşüktür. Bunun temel nedenlerinden biri, besi hayvanı üretiminde ilgilenilen özelliklerin beklenenden çok daha kompleks olmasıdır. Fenotip üzerinde küçük etkileri olan binlerce genin etkili olduğu poligenik kalıtım dinamikleri (bu etkiler genellikle istatistiksel olarak anlamlı olamayacak kadar küçük olması nedeniyle göz ardı edilmiştir) MAS uygulamalarının yerini genom-destekli seleksiyon uygulamaları almıştır. Et kalitesi gibi farklı ırklarda ve aynı ırkın farklı bireyleri arasında çok değişiklik gösteren kantitatif özelliklerin belirlenmesinde doğru seleksiyon modellerinin ve bu modellerin moleküler genetik bilgi ile desteklenmesi daha da büyük önem kazanmaktadır. Bu bağlamda besi sığırı genetiğinde oldukça önemli unsurlardan birisi kantitatif karakter lokuslarıdır (Quantitative trait loci: QTL). QTL haritalama çalışmaları, ilgili fenotipte etkili QTL'yi tespit etme anlamında başarılı olmuştur. Sığır yetiştiriciliğinde önemli fenotipik karakterlerle ilişkili QTL'lere ait bilgiler tanımlanmış ve oldukça kapsamlı veri setleri (örneğin; CattleQTLdb) oluşturulmuştur. Et verimi ve kalitesine etkili QTL ve ilgili kromozomlar karşılaştırmalı olarak değerlendirilmiştir. Bu bağlamda, karkas kalitesi için kromozom 2, 10, 11 ve 13; yağlılık için kromozom 1, 2, 5, 6, 14, 22 ve 25; yağ asidi kompozisyonu için 4, 11, 13, 20, 21, 25, 28 ve özellikle 19; et rengi için kromozom 3, 13 ve 24; et tekstür özellikleri için başta kromozom 7 ve 29 olmak üzere 3, 10, 22, 23 ve 28 önemli QTL bölgeleri olarak tanımlanmıştır. Ancak haritalama çalışmalarının tekrarlanabilirliği genellikle düşüktür, yani QTL pozisyonları bir çalışmadan diğerine değişiklik göstermektedir. Bunun bir nedeni, QTL'lerin çoğunluğunun çok küçük etkilere sahip olmasıdır. Bu, çok sayıda belirtecin test edilmesiyle birleştirildiğinde, önemli belirteçlerin tahmini etkisinin olduğundan fazla tahmin edilmesine (Beavis etkisi) neden olmaktadır. Genomik seleksiyon, yeni ıslah programları tasarlamak ve genetik değerlendirme için yeni belirteçlere dayalı modeller



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geliştirmek için moleküler genetik belirteçlerden yararlanan umut verici bir yaklaşımdır. Bu bağlamda güncel moleküler teknolojiler ve yeni nesil dizileme (Next Generation Sequencing: NGS) temelli yaklaşımlar daha güvenilir ve etkili metotların geliştirilmesine olanak sağlamıştır. Bu çalışmada, besi sığırcılığında güncel moleküler genetik yaklaşımlar, yeni geliştirilen genotiplendirme metotları ve seleksiyon uygulamaları karşılaştırmalı olarak değerlendirilmiştir.

Anahtar Kelimeler: Sığır yetiştiriciliği, Sığır eti üretimi, Genetik iyileştirme, Genomik seleksiyon, Tüm genom dizilimi



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**FRONTIERS IN GENOME-ENABLED SELECTION AND ADVANCES IN
SEQUENCING TECHNOLOGY FOR PRODUCTION AND QUALITY TRAITS IN
BEEF CATTLE**

ABSTRACT

Traditional selection methods based on phenotype and supported by pedigree records have been successful to a certain extent, especially in dairy cattle. However, the determination of traits that can be detected after slaughter with traditional selection methods requires a long time and may cause economic losses in beef cattle. Thus, molecular genetic studies allow many characteristics to be revealed while the animal is still alive and these data can be used in early selection. There are about three billion nucleotides in the bovine genome, and there are over 30 million single nucleotide polymorphisms (SNPs), or one of every 100 nucleotides is a SNP. Considering that SNP-genotyping became automatized, relatively cheap, efficient (most loci are read), and highly reproducible (among different laboratories), compared to microsatellites; it has become preferred in marker-assisted selection (MAS) programs. Research towards MAS has been extensive but implementation has been limited and increases in genetic gain have been small. One of the main reasons is that the traits of interest in livestock production are much more complex than expected. Because of the polygenic inheritance dynamics in which thousands of genes with small impacts (these effects are usually too small to be statistically significant and so are ignored) on the phenotype are effective, MAS applications have been replaced by genome-assisted selection applications. Accurate selection models and supporting these models with molecular genetic information have become even more important in determining quantitative characteristics such as meat quality, which vary greatly in different breeds and between different individuals of the same breed. In this context, one of the very important elements in beef cattle genetics is quantitative trait loci (QTL). The QTL mapping step was successful in the sense that most mapping studies detected QTL. Information on QTLs associated with important phenotypic characters in cattle breeding has been identified and very comprehensive datasets (e.g. CattleQTLdb) have been implemented. QTL and related chromosomes effective on meat yield and quality have been evaluated comparatively. In this context, chromosomes 2, 10, 11, and 13 for carcass quality; chromosomes 1, 2, 5, 6, 14, 22, and 25 for fatness; 4, 11, 13, 20, 21, 25, 28, and especially 19 for the fatty acid composition; chromosomes 3, 13 and 24 for beef color; especially chromosome 7 and 29, 3, 10, 22, 23, and 28 for meat texture characteristics were defined as important QTL regions. But the repeatability of the mapping studies is generally low, i.e., QTL positions vary from one study to the next. One reason for this is that the majority of QTL have very small effects. This, combined with testing a large number of markers, results in an overestimation of the predictive effect of important markers (the Beavis effect). Genomic selection is a promising approach to utilizing molecular genetic markers to design novel breeding programs and to develop new markers-based models for genetic evaluation. In this context, current molecular technologies and next-generation sequencing (NGS) based approaches have enabled the development of more reliable and effective methods. In this study, current molecular genetic approaches, newly developed genotyping methods, and selection practices were evaluated comparatively concerning beef cattle breeding.

Keywords: Cattle breeding, Beef production, Genetic improvement, Genomic selection, Whole-genome sequence



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**TÜRKİYE'DEKİ İBBS-2 BÖLGELERİNİN TARIMSAL ETKİNLİĞİNİN
HESAPLANMASI**

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ÖZET

Günümüzde yapılan önemli tartışmalardan biri, gıda güvenliği ve tarımda sürdürülebilir büyümenin sağlanmasıdır. Tarım sektörünün ekonomik ve sosyal yapı içerisinde önemli bir paya sahip olduğu Türkiye gibi ülkelerde adil bir gelir dağılımının sağlanması ve çevre ve insan sağlığı gibi konular da ön plana çıkmaktadır. Uluslararası Gıda Politikaları Araştırma Enstitüsü yaptığı çalışmalarda nüfus, gelir ve kentleşme süreçlerinde yaşanan gelişmelerin gıda ürünleri talebini ciddi oranda arttıracaklarını, bununla birlikte başta tarımsal arazi olmak üzere üretim faktörlerinin önemli bir kısmının üretim sürecinden çekileceğini ortaya koymaktadır. Bu nedenle ekonomik, sosyal ve demografik dönüşüm sağlayarak tarımsal üretimi arttırmaya yönelik politikaların önemi giderek artmaktadır. Tarım sektöründe yapısal dönüşüm sağlayarak istikrarlı büyümenin sağlanmasındaki temel nokta ise kaynakların optimal şekilde dağıtılması ve bunu sağlayacak politikaların istikrarlı bir şekilde uygulanmasıdır. Bir başka deyişle, sektörde istikrarlı büyümenin sağlanması tarımsal etkinlik/verimliliğin artırılması ile mümkündür. Bu nedenle çalışma Türkiye'deki tarımsal etkinliğin hesaplanmasına odaklanmaktadır. Literatürde etkinlik hesaplanmasında sıklıkla kullanılan yöntemlerden biri Veri Zarflama Analizidir (VZA). VZA, merkezi eğilimler yerine en iyi teknoloji altında oluşturulan etkin üretim sınırına dayanmaktadır. Bir başka deyişle etkinlik analizindeki matematiksel programlama yaklaşımıdır. VZA'ya yöneltilen en önemli eleştiriler ise etkin üretim sınırından yaşanan tüm sapmaların etkinsizlik olarak tanımlanması ve elde edilen sonuçların istatistiksel çıkarsamalara sahip olmamasıdır. Bu nedenle çalışmada Simar ve Wilson (1998,2000) tarafından geliştirilen Bootstrap VZA yöntemi kullanılmıştır. Çalışmada tarımsal etkinlik, İBBS-2 düzeyi ele alınarak 2015-2020 dönemi için hesaplanmıştır. Etkinlik hesaplaması bitkisel üretim ve hayvansal üretim için ayrı ayrı yapılmıştır. Bitkisel üretimin çıktı olarak kullanıldığı modelde kullanılan girdi değişkenleri, tarımsal alan, işgücü, biçerdöver, pulluk, ekim makinası, gübre dağıtım makinası ve su pompasıdır. Hayvansal girdinin çıktı olarak kullanıldığı modeldeki girdi değişkenleri ise tarımsal alan, işgücü, büyükbaş ve küçükbaş hayvan sayısı ve süt sağım makinesidir. Analiz sonuçlarına göre bitkisel üretimde etkinlik skorları 0.69 ile 0.77 arasında değişmektedir. Bitkisel üretimde etkinliği en yüksek olan bölgeler TR52, TR51 ve TRC1'dir. Bunun yanında incelenen bütün dönem boyunca en düşük etkinlik düzeyine sahip olan bölge TR82'dir. Diğer taraftan hayvansal üretimdeki etkinlik skorları 0.84 ile 0.86 arasında değişmektedir. Bu sonuç hayvansal üretimde bölgeler arasındaki etkinlik farklılıklarının bitkisel üretime kıyasla çok daha az olduğunu göstermektedir. TR32, TR51, TRA2, TR82 ve TR71 hayvansal üretimde en yüksek etkinliğe sahip olan bölgelerdir. TR63 ve TR41 ise en düşük etkinlik değerlerine sahip olan bölgelerdir.

Anahtar Kelimeler: Tarımsal etkinlik, Bootstrap Veri Zarflama Analizi, Türkiye, İBBS-2



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**MEASURING OF AGRICULTURAL EFFICIENCY OF NUTS-2 REGION IN
TURKEY**

ABSTRACT

One of the important debates today is food security and ensuring sustainable agricultural growth. In countries like Turkey, where the agricultural sector has an important share in the economic and social structure, topics such as ensuring a fair income distribution and environment and human health are also important. The International Food Policy Research Institute reveals in its researches that the developments in population, income and urbanization processes will significantly increase food products' demand, and that a significant part of the production factors, especially agricultural land, will be withdrawn from the production process. For this reason, the importance of policies to ramp up agricultural production by providing economic, social and demographic transformation is getting increase. The key point in ensuring stable growth by providing structural transformation in the agricultural sector is the optimal distribution of resources and the stable implementation of policies that will ensure this. In other words, ensuring stable growth in the sector is possible by increasing agricultural efficiency/productivity. Therefore, the study focuses on the measuring of agricultural efficiency in Turkey. In the literature, Data Envelopment Analysis (DEA) is one of the most commonly used methods in measuring efficiency. DEA is based on the efficient production frontier appointed under the best technology rather than central trends. In other words, it is a mathematical programming approach in efficiency analysis. The most important criticisms related to DEA are that all deviations from the efficient production frontier are defined as inefficiency and the obtained results do not have statistical inferences. Because of that the Bootstrap DEA method developed by Simar and Wilson (1998,2000) was employed in the study. In the study, agricultural efficiency was measured for the 2015-2020 period by considering the NUTS-2 level. Efficiency measuring was made separately for crop production and animal production. Input variables used in the model where crop production as output are agricultural area, labour, combine harvester used in production, plow used in production, sowing machine used in production, fertilizer spreader used in production and water pump. Input variables used in the model where animal production as output are agricultural area, labour, number of cattle, number of small cattle and milking machine. According to results of the analysis, the efficiency score in crop production vary between 0.69 and 0.77. The region with highest efficiency score in crop production are TR52, TR51 and TRC1. In addition, TR82 has the lowest efficiency score the whole period. On the other hand, the efficiency score in animal production vary between 0.84 and 0.86. This result shows that the efficiency differences between regions in animal production are much less than in crop production. TR32, TR51, TRA2, TR82 and TR71 are the regions with the highest efficiency in animal production. Also TR63 and TR41 are the regions with the lowest efficiency score.

Keywords: Agricultural productivity, Bootstrap Data Envelopment Analysis, Turkey, NUT-2



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**RASYONLARA FARKLI DOZ ENZİM (GRINDAZYM GP 5000) İLAVESİNİN
BROYLERLERİN BESİ VE KARKAS ÖZELLİKLERİ ÜZERİNE EKİSİ**

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ÖZET

Bu araştırma mısır ağırlıklı broyler rasyonlarına enzim ilavesinin besi gücü ve karkas özelliklerine etkisini incelemek amacıyla yapılmıştır. Araştırmada 162 broyler civciv kullanılmıştır. 6 hafta süren denemede mısır ağırlıklı rasyonlara 0, 0.5 ve 1 kg / ton enzim (Ksilanaz: 12.000 ün/g, β -glukanaz: 5.000 ün/g ve Pektinaz: 7 ün/g) ilaveli 3 farklı rasyon hayvanlara yedirilmiştir. Canlı ağırlık artışları tüm haftalarda önemsiz bulunmuştur. Ancak enzim ilavesi arttıkça son haftada gruplarda nispi bir artış sağlanmıştır. 6. haftada 1 kg/ton enzim ilavesiyle canlı ağırlık artışı 365.47 g'dan 466.76 g'a yükselmiştir. Kümülatif olarak bakıldığında yine aynı nispi artış olup, toplam ağırlık artışı 1849.32 gramdan 1965.21 grama yükselmiştir. Yem tüketimleri ve yemden yararlanma bakımından gruplar arasındaki farklılıklar önemsiz bulunmuştur. Kümülatif olarak yem tüketimleri incelendiğinde enzim ilavesi yem tüketimini nispi olarak azaltmış ve yem tüketimini 3681.91 gramdan 3624.03 grama düşürmüştür. Yine yemden yararlanma değerleri kümülatif olarak incelendiğinde, nispi bir iyileşme söz konusu olup yemden yararlanma değeri 1.99'dan 1.84' düşmüştür.

Mısır ağırlıklı rasyonlarına enzim ilavesinin yaşama gücü ve altlıktaki nem oranı üzerindeki etkisi önemsiz bulunmuştur. Ancak ilave enzim oranı arttıkça yaşama gücünde bir iyileşme ve nem oranında ise bariz bir düşüş gözlenmiştir. Karkas özellikleri incelendiğinde; kanat ağırlığı hariç, rasyonlara 1 kg / ton enzim ilavesiyle but, sırt ve göğüs ağırlıklar önemli ($P<0.05$) şekilde artmıştır. Kanat ağırlığında ise nisbi bir artış görülmüştür. Karkas ağırlıkları 6. hafta sonunda sırasıyla 1277.67 gr, 1339.78 gr ve 1462.33 gr olarak bulunmuştur. But ağırlıkları sırasıyla 364.44 gr, 385.78 gr ve 411.11 gr, Sırt ağırlıkları 282.33 gr, 309.22 gr ve 331.44 gr, göğüs ağırlıkları 397.11 gr, 385.89 gr ve 465.33 gr ve kanat ağırlıkları ise 151.57 gr, 161.44 gr ve 167.56 gr bulunmuştur. Rasyonlara 1 kg / ton enzim ilavesinin taşlık, ciğer ve abdominal yağ üzerine etkisi önemli ($P<0.05$) bulunmuştur. Sırasıyla taşlık ağırlıkları 36.11 gr, 34.44 ve 43.22 gr, ciğer ağırlıkları 41.67 gr, 40.89 gr ve 53.56 gr, abdominal yağ ağırlıkları ise 22.78 gr, 28.56 gr ve 37.78 gr olarak bulunmuştur. Sonuç olarak mısır ağırlıklı broyler rasyonlarına 1 kg/ton enzim ilavesinin etkisi olumlu bulunmuştur.

Anahtar Kelimeler: Mısır, Enzim, Broyler, Performans



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AFFECTION OF ADDITIONAL DIFFERENT DOSE ENZYME (GRINDAZYM GP 5000) TO RATIONS ON FEEDING AND CARCASS CHARACTERISTICS OF BROILER

ABSTRACT

This research was carried out to examine the effect of enzyme supplementation on maize broiler diets on fattening power and carcass characteristics. In this study, 162 broiler chickens were used. Chickens were fed for 6 weeks on 3 different diets containing maize with enzyme preparations by 0, 0.5 and 1 kg / tons. Live weights gains were found not significant in the all weeks. Body weight gains were insignificant in all weeks. Live weight gain increased from 365.47 g to 466.76 g with the addition of 1 kg/ton enzyme in the 6th week. When looked at cumulatively, it is the same relative increase and the total weight gain increased from 1849.32 grams to 1965.21 grams. Feed intake and feed efficiency was not significant at the all groups. When the feed consumptions were examined cumulatively, the addition of enzyme decreased feed consumption relatively and decreased the feed consumption from 3681.91 grams to 3624.03 grams. Again, when the feed efficiency values are analyzed cumulatively, there is a relative improvement and the feed efficiency value has decreased from 1.99 to 1.84.

The effect of enzyme supplementation on maize diets on viability and moisture content of the litter was insignificant. However, as the amount of added enzyme increased, an improvement in viability and a significant decrease in moisture were observed. Carcass characteristics weights significantly increased ($P<0.05$) with addition 1 kg/ tons enzyme to the maize based ration except wings weights. A relative increase in wing weight was observed. Carcass weights were found as 1277.67 g, 1339.78 g and 1462.33 g, respectively, at the end of the 6th week. Leg weights were found to be 364.44 gr, 385.78 gr and 411.11 gr, back weights 282.33 gr, 309.22 gr and 331.44 gr, breast weights 397.11 gr, 385.89 gr and 465.33 gr, and wing weights 151.57 gr, 161.44 gr and 167.56 gr, respectively. The effect of 1 kg / ton enzyme addition to the rations on gizzard, liver and abdominal fat was significant ($P<0.05$). The gizzard weights were 36.11 gr, 34.44 and 43.22 gr, liver weights were 41.67 gr, 40.89 gr and 53.56 gr, and abdominal fat weights were 22.78 gr, 28.56 gr and 37.78 gr, respectively.

As a result, the effect of addition 1 kg/ton enzyme to ration based maize was found possitive,

Keywords: Maize, Enzyme, Broiler, Performance



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ETLİK PİLİÇ KARMALARINA PORTAKAL KABUĞU (*Citrus sinensis* L.) UÇUCU YAĞI İLAVESİNİN BROYLER PERFORMANSI, BAZI KAN ARAMETRELERİ VE İNCE BAĞIRSAK MİKROFLORASINA ETKİLERİ

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ÖZET

Bu araştırmada, etlik piliç karmalarına portakal kabuğu (*Citrus sinensis* L.) uçucu yağı (PKUY) ilavesinin besi performansı, bazı kan parametreleri ve ince bağırsak mikroflorasına etkisi incelenmiştir. Araştırmada, 432 adet etlik civciv kullanılmış ve deneme 6 hafta sürdürülmüştür. Etlik piliç karma yemlerine kontrol (1. Grup), 50 mg/kg (2. Grup), 100 mg/kg (3. Grup) ve 150 mg/kg (4. Grup) PKUY ilave edilmiş ve 4 farklı rasyon kullanılmıştır. Etlik piliç karmalarına PKUY ilavesinin canlı ağırlık üzerine etkisi 1. ve 5. haftalar hariç, önemli ($P<0.05$) bulunmuştur. PKUY dozları arttıkça canlı ağırlık artmış ve 150 mg/kg'lık doz en yüksek ağırlığı sağlamıştır. Deneme sonunda en yüksek ağırlık 2646.16 g ile 150mg/kg PKUY dozu ilave edilen grupta görülürken, en düşük ağırlık 2555.38 g ile kontrol grubunda gözlenmiştir. Yem tüketimleri bakımından farklılıklar 2. hafta hariç, önemli ($P<0.05$) bulunmuştur. Son haftada sadece 150 mg/kg PKUY dozu kontrol grubuna göre yem tüketimini önemli bir şekilde düşürmüştür. En düşük yem tüketimi 4.grup (150mg/kg)'ta 4546.67 g olarak gerçekleşirken, en yüksek yem tüketimi ise kontrol grubunda 4727.35 g olarak gerçekleşmiştir. Karmalara 150 mg/kg PKUY ilavesi, yemden yararlanmayı önemli derecede ($P<0.05$) iyileştirmiştir. 6.haftada kontrol grubunda 1.85 olan yemden yararlanma değeri 150 mg/kg PKUY ilavesi ile 1.72'e düşmüştür. Karkas ağırlığı, karkas randımanı, but, sırt, kanat, göğüs, abdominal yağ ve kalp ağırlıkları PKUY dozları arttıkça önemli ($P<0.05$) düzeyde artmıştır. Karkas ağırlıkları bakımından gruplar arasındaki farklılıklar önemli ($P<0.05$) bulunmuştur. En yüksek ağırlık 150 mg/kg doz ilaveli 4. grupta 1834.97 g olurken, en düşük ağırlık ise kontrol grubunda 1752.60 g olarak gerçekleşmiştir. Kolesterol ve albumin değerleri bakımından gruplar arasındaki farklılıklar önemli ($P<0.05$) bulunmuştur. Karmalara 150 mg/kg PKUY ilavesinin kolesterol, albumin ve E.coli oranını önemli ($P<0.05$) derecede düşürürken, Salmonella, Lactobacillus ve Enterococcus oranları üzerindeki etkisi ise önemsiz ($P>0.05$) bulunmuştur. Sonuç olarak, karmalara 150 mg/kg PKUY ilavesinin broyler performansı, kan değerleri ve ince bağırsak florası üzerine olumlu etkilerinin olduğunu söylemek mümkündür.

Anahtar Kelimeler: Portakal Kabuğu Uçucu Yağı (*Citrus sinensis* L.), Etlik Piliç, Performans, Kan Parametreleri, İnce Bağırsak mikroflorası



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**EFFECTS OF THE SUPPLEMENTATION OF ESSENTIAL OIL ISOLATED FROM
ORANGE PEEL (CITRUS SINENSIS L.) TO BROILER DIETS ON THE
PERFORMANCE, SOME BLOOD PARAMETERS AND MICROFLORAS OF
SMALL INTESTINE**

ABSTRACT

In this study, the effects of essential oil isolated from orange peel (OEO) added to broiler diets on the fattening performance, some blood parameters and microfloras of small intestine were examined. In the research, 432 broiler chickens were used and the experiment lasted for six weeks. In the experiment, 0 (1st group), 50 (2nd group), 100 (3rd group) and 150 mg/kg (4th group) of OEO (*Citrus sinensis* L.) were added to broiler diets and 4 different diets were used. The effect of OEO added to broiler diets on the live weights were found significant ($P<0.05$), except for 1st and 5th weeks. The more the doses of the OEO were the more the live weights increased, the dose of 150 mg/kg had the maximum increase. At the end of the experiment, the highest weight was observed in the group with 2646.16g and 150mg/kg PKUY added, while the lowest weight was observed in the control group with 2555.38g. Feed intake was found significant ($P<0.05$), except for the 2nd week. The addition of 150 mg/kg of OEO improved the feed efficiency ($P<0.05$). While the lowest feed consumption was 4546.67 g in the 4th group (150mg/kg), the highest feed consumption was 4727.35 g in the control group. Addition of 150 mg/kg PKUY to the mixes significantly ($P<0.05$) improved feed conversion. At the 6th week, the feed efficiency value, which was 1.85 in the control group, decreased to 1.72 with the addition of 150 mg/kg PKUY. Carcass weight, carcass yield, things, breast, back, wing, abdominal fat and heart weights significantly increased ($P<0.05$) as OEO dose added to diets increased. Differences between groups in terms of carcass weights were significant ($P<0.05$). While the highest weight was 1834.97 g in the 4th group with 150 mg/kg dose addition, the lowest weight was 1752.60 g in the control group. The difference among the groups in relation with cholesterol and albumine was found significant ($P<0.05$). The addition of 150 mg/kg of OEO to broiler diets decreased the ratio of *E.coli*, salmonella and albumin significantly ($P<0.05$) but salmonella, lactobacillus and enterococcus were not significant ($P>0.05$). As a result, it is possible to say that the addition of 150 mg/kg PKUY to the mixes has positive effects on broiler performance, blood values and small intestinal flora.

Keywords: Orange Essential Oil (*Citrus sinensis* L.), Broiler, Performance some blood parameters and microfloras of small intestine



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**KUŞBURNU (*Rosa canina*) GENOTİPLERİNDE BAZI MEYVE ÖZELLİKLERİNİN
BELİRLENMESİ**

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ÖZET

Türkiye sahip olduğu ekolojik ve bitki çeşitliliği bakımından dünyada ender ülkeler arasında yer almaktadır. Bitki çeşitliliğin ülke geneline geniş bir yayılım göstermesi farklı ekolojilerde çoğu bitki türünün hem doğal hem de ekonomik olarak yetişmesine imkân sağlamıştır. Anadolu'nun merkezinde yer alan Kayseri ilinde 2020 yılında yürütülen bu çalışmada Talas ili Alidağı bölgesinde belirlenen 9 farklı kuşburnu (*Rosa canina*) genotipinde bazı meyve özelliklerinin belirlenmesi amaçlanmıştır. Çalışmada meyve ağırlığı, meyve boyu ve eni, L, a, b renk parametreleri incelenmiştir. Bütün parametrelerde genotipler arasında geniş varyasyonlar tespit edilmiş olup, meyve eni değerleri 10,75 mm (Genotip 5) ile 13,53 mm (Genotip 1) arasında, meyve boyu değerleri 14,83 mm (Genotip 1) ile 26,64 mm (Genotip 8) arasında, meyve ağırlığı ise 1,13 g (1,13) ile 2,11 g (Genotip 2) arasında değişkenlik göstermiştir. Renk parametrelerinde ise L değeri 45,47 (Genotip 5) ile 57,19 (Genotip 8) arasında, a değeri 29,28'den (Genotip 8) 44,35'e (Genotip 5) kadar, b değeri ise 34,39 (Genotip 1) ile 51,13 (Genotip 8) arasında farklılık göstermiştir. Elde edilen sonuçların özellikle kuşburnu türünün korunması noktasında, bu tür ile yapılacak ıslah çalışmaları ve yeni diğer çalışmalar için yol gösterici nitelikte olabileceği öngörülmektedir.

Anahtar Kelimeler: Bitki çeşitliliği, kuşburnu, *Rosa canina*, varyasyon, genotip



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DETERMINATION OF SOME FRUIT CHARACTERISTICS IN ROSEHIP (*Rosa canina*) GENOTYPES

ABSTRACT

Turkey is among the rare countries in the world in terms of its ecological and plant diversity. The wide spread of plant diversity throughout the country has allowed most plant species to grow both naturally and economically in different ecologies. In this study conducted in 2020 year, it was aimed to determine some fruit characteristics in 9 different rosehip (*Rosa canina*) genotypes detected in Alidagi region of Talas province in Kayseri province in central Anatolia. Fruit weight, fruit length and width, L, a, b color parameters were investigated in the study. Wide variations were detected between genotypes in all parameters. Fruit width values are between 10.75 mm (Genotype 5) and 13.53 mm (Genotype 1), fruit length values are between 14.83 mm (Genotype 1) and 26.64 mm (Genotype 8), and fruit weight values are from 1.13 g (1.13) to 2.11 g (Genotype 2). In color parameters, L values of genotypes range from 45.47 (Genotype 5) to 57.19 (Genotype 8), a value from 29.28 (Genotype 8) to 44.35 (Genotype 5), b values differed between 34.39 (Genotype 1) and 51.13 (Genotype 8). As a result of the study, it is foreseen that the findings may be guiding for breeding studies and other new studies with this species, especially in the point of preservation of the rosehip species.

Keywords: Plant diversity, rosehip, *Rosa canina*, variation, genotype



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**IĞDIR İLİ LYGAEIDAE (HEMIPTERA) TÜRLERİ
THE LYGAEIDAE (HEMIPTERA) SPECIES OF IĞDIR PROVINCE**

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ÖZET

Iğdır ili Lygaeidae (Hemiptera) faunasını saptamaya yönelik yapılan bu çalışma 2017 ve 2020 yılları arasında sürdürülmüştür. Yapılan bu çalışmada, farklı lokalitelerden örnekler toplanmış ve tanımlanmıştır. Teşhis sonucunda Lygaeidae (Hemiptera) ait, beş altfamilyaya bağlı 12 cinse ait 16 tür tespit edilmiştir. Bunlar arasında; **Heterogastrinae** Stål, 1872 altfamilyasına ait bir tür, **Lygaeinae** Schilling, 1829 altfamilyasına ait beş tür, **Orsillinae** Stål, 1872 altfamilyasına ait bir tür, **Oxycareninae** Stål, 1862 altfamilyasına ait iki tür ve **Rhyparochrominae** Amyot and Serville, 1843 altfamilyasına ait dört tür tanımlanmıştır. Türlerin cins düzeyinde dağılımları ise şöyledir; **Heterogaster** Schilling, 1829 cinsine ait iki tür, **Arocatus** Spinola, 1837, cinsine ait bir tür, **Lygaeus** Fabricius, 1794, cinsine ait iki tür, **Spilostethus** Stål, 1868, cinsine ait bir tür, **Tropidothorax** Bergroth, 1894, cinsine ait bir tür, **Nysius** Dallas, 1852, cinsine ait bir tür, **Metopoplax** Fieber, 1860, cinsine ait bir tür, **Oxycarenus** Fieber, 1837, cinsine ait bir tür, **Emblethis** Fieber, 1860, cinsine ait bir tür, **Paromius** Fieber, 1860, cinsine ait bir tür, **Rhyparochromus** Hahn, 1826, cinsine ait bir tür ve **Xanthochilus** Stål, 1872, cinsine ait bir tür olmak üzere toplam 16 tür Iğdır ilinden tespit edilmiştir. Bunlar arasından **Heterogaster artemisiae** Schilling, 1829, **Lygaeus equestris** (Linnaeus, 1758) ve **Xanthochilus minusculus** (Reuter, 1885) türlerinin en yoğun ve en yaygın türler oldukları belirlenmiştir. Ayrıca incelenen her bir tür için Türkiye'deki yayılışları, örnek sayıları ve toplanma yerleri ile ilgili etiket bilgileri de verilmiştir.

Anahtar Kelimeler: Hemiptera, Lygaeidae, Fauna, Türkiye



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THE LYGAEIDAE (HEMIPTERA) SPECIES OF İĞDIR PROVINCE

ABSTRACT

In this study conducted to determine Lygaeidae (Hemiptera) fauna of İğdir province between the years of 2017 and 2020. The collected materials from different localities were identified, and faunistic records of 16 species belonging to 12 genera of five subfamilies are given. Among these one species of the subfamily **Heterogastrinae** Stål, 1872; five species of the subfamily **Lygaeinae** Schilling, 1829; one species of the subfamily **Orsillinae** Stål, 1872; two species of the subfamily **Oxycareninae** Stål, 1862 and four species of the subfamily **Rhyparochrominae** Amyot and Serville, 1843 are listed. The distribution of species according to genus is as follows; two species belonging to **Heterogaster** Schilling, 1829, one species belonging to **Arocatus** Spinola, 1837, two species belonging to **Lygaeus** Fabricius, 1794, one species belonging to **Spilostethus** Stål, 1868, one species belonging to **Tropidothorax** Bergroth, 1894, one species belonging to **Nysius** Dallas, 1852, one species belonging to **Metopoplax** Fieber, 1860, one species belonging to **Oxycarenus** Fieber, 1837, one species belonging to **Emblethis** Fieber, 1860, one species belonging to **Paromius** Fieber, 1860, two species belonging to **Rhyparochromus** Hahn, 1826 and two species belonging to **Xanthochilus** Stål, 1872 are recorded in this study from, İğdir provinces of Turkey. Among them **Heterogaster artemisiae** Schilling, 1829, **Lygaeus equestris** (Linnaeus, 1758) and **Xanthochilus minusculus** (Reuter, 1885) has been found the most intensive and widespread species. In addition, distributinal data of the species in Turkey, the number of species collection locality information and for each of species investigated were given.

Keywords: Hemiptera, Lygaeidae, Fauna, Turkey



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**KURAKLIK STRESİNE MARUZ KALMIŞ ARTVİN-ŞAĞŞAT (YEREL) DOMATES
FİDELERİNDE DIŞTAN PROLİN ÖN UYGULAMASININ FOTESİNTETİK
PERFORMANS ÜZERİNE ETKİSİ**

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ÖZET

Bitki büyümesi kuraklık, tuzluluk veya sıcaklık gibi abiyotik stres faktörlerinden ciddi şekilde etkilenmektedir. Kuraklık, tüm dünyada özellikle tarımsal ürünler ve sebze üretimini sınırlamasının yanı sıra, fotosentezi engelleyen en önemli çevresel faktörlerden biridir. Bu nedenle, kuraklık stresine fotosentez cevapları onlarca yıldır çalışma ve tartışma konusu olmuştur. Mevcut çalışmada kuraklık stresine maruz bırakılan Artvin-Şavşat (yerel) domates fidelerinde dıştan farklı konsantrasyonlarda prolin (PRO) ön uygulamasının fotosentetik hasarı iyileştirme mekanizmasının araştırılması amaçlandı. Bu amaç doğrultusunda, çalışmanın ilk aşamasında altı haftalık domates fidelerine kökten 14 gün boyunca 0.5 mM, 5 mM ve 10 mM olmak üzere üç farklı konsantrasyonda PRO ön muamelesi yapılmıştır ve daha sonra fideler üç gün boyunca kuraklık olarak %10 PEG₆₀₀₀ stresine maruz bırakıldı. Domates fidelerinde gaz değişim parametrelerinden net fotosentez hızı (A) transpirasyon (E), hücreler arası CO₂ konsantrasyonu (Ci) ile klorofil ve floresans parametresindeki (Fv/Fm, PS II'nin maksimum kuantum etkinliği) değişimler belirlendi. Bulgulara göre, kontrole (stres uygulanmayan fideler) göre kuraklık stresi koşullarında Şavşat domates fidelerinde net fotosentez hızı, transpirasyon oranı ve hücreler arası CO₂ konsantrasyonunun azaldığı tespit edildi. PRO uygulanmış fidelerde ise (0.5, 5 ve 10 mM) P_N, Tr ve Ci'yi arttırdığı görüldü. Ayrıca, kuraklık stresi koşullarında klorofil miktarı ve Fv/Fm olumsuz etkilendiği belirlendi. Stres koşullarında PRO uygulanmış fidelerde ise hem klorofil miktarının hem de fotosistem II etkinliğinin arttığı saptandı. Özellikle kuraklık stresi altında 0.5 mM PRO uygulamasının fotosentetik hasarı iyileştirmede diğer PRO uygulamalarına göre daha etkili olduğu tespit edildi. Sonuç olarak, kuraklık koşullarında dıştan uygulanan PRO uygulamasının fotosentetik hasarı hafiflettiği, klorofil sentezi ve fotosentezin devamlılığının sağlanmasına yardımcı olduğu tespit edildi.

Anahtar Kelimeler: Kuraklık, Stres, *Solanum lycopersicum*, Prolin, Tolerans



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**EFFECT OF EXOGENOUS PROLINE APPLICATION ON PHOTOSYNTHETIC
PERFORMANCE IN DROUGHT STRESS ARTVIN-ŞAVŞAT (LOCAL) TOMATO
SEEDLINGS**

ABSTRACT

Plant growth is severely affected by abiotic stress factors such as drought, salinity or temperature. Drought is one of the most important environmental factors preventing photosynthesis, as well as limiting the production of agricultural products and vegetables all over the world. Therefore, photosynthetic responses to drought stress have been the subject of study and discussion for decades. In the current study, it was aimed to investigate the photosynthetic damage recovery mechanism of proline (PRO) pre-treatment at different exogenous concentrations in Artvin-Şavşat (local) tomato seedlings exposed to drought stress. For this purpose, in the first stage of the study, six-week-old tomato seedlings were pre-treated with PRO at three different concentrations of 0.5 mM, 5 mM and 10 mM for 14 days to the root, and then the seedlings were exposed to 10% PEG₆₀₀₀ stress as drought for three days. The changes in gas exchange parameters such as photosynthesis rate (A), transpiration rate (E), intercellular CO₂ concentration (Ci), and chlorophyll and fluorescence parameters (Fv/Fm, maximum quantum efficiency of PS II) were determined in tomato seedlings. According to the findings, net photosynthesis rate, transpiration rate and intercellular CO₂ concentration decreased in Şavşat tomato seedlings compared to the control (non-stressed seedlings) under drought stress. It was observed that A, E and Ci increased in PRO-treated seedlings (0.5, 5 and 10 mM). In addition, it was determined that the content of chlorophyll and Fv/Fm were negatively affected under drought stress condition. Both chlorophyll content and photosystem II activity was increased in PRO treated seedlings under stress conditions. Especially, it was determined that 0.5 mM PRO treatment was more effective than other PRO treatments in ameliorating photosynthetic damage under drought stress. As a result, it was revealed that the exogenous PRO application alleviated photosynthetic damage, provided chlorophyll synthesis and continuity of photosynthesis in drought conditions.

Keywords: Drought, stress, *Solanum lycopersicum*, Proline, Tolerance



ASETON O-(4 KLOROFENİLSÜLFONİL) OKSİM MADDESİNİN ANTİOKSİDAN SİSTEM ENZİMLERİYLE ETKİLEŞİMİNİN MOLEKÜLER DOCKİNG YÖNTEMİYLE İNCELENMESİ

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ÖZET

Artemia salina ve *Rattus norvegicus*'un asetil kolin esteraz enzimi üzerinde malathion zehirlenmesi ile yaptıkları çalışmada isatin ve oksim türevlerinin malathion inhibisyonuna karşı önemli bileşenlere sahip olduğunu, güvenli olduğunu ve kolin esteraz enzimini yeniden aktive ettiği belirlenmiştir. Bu ve buna benzer birçok çalışmada oksim türevlerinin metabolizma ve enzimlerin çalışması üzerinde olumlu etkileri gösterilmiştir. Aseton O-(4-klorofenilsülfonil)oksim (AkfsO)'ın tarafımızca yapılan bazı invivo çalışmalarda abiyotik streslerin metabolizma üzerine olumsuz etkilerini hafiflettiği belirlendi. Bu çalışma ile AkfsO'nun SOD, Katalaz, Glutatasyon redüktaz, Glutatasyon-s-transferaz Dehidroaskorbat redüktaz ve Mono dehidroaskorbat redüktaz ile etkileşimi moleküler docking yöntemiyle incelendi. Enzimlerin AkfsO maddesi ile etkileşimlerini göstermek için UCSF Chimera ve AutoDock Vina kullanılarak yerleştirme analizleri yapıldı. Cu/z n Süperoksit dismutazın (PDB ID:2APS), Katalazın (PDB ID:1A4E), Glutatasyon redüktazın (PDB ID:1XAN), Glutatasyon S-transferazın (PDB ID:1GTA), Dehidroaskorbat Redüktazın (PDB ID:5EVO) ve Monodehidroaskorbat redüktazın (PDB ID:5JCI) enzimlerinin X-ışını kristalografik 3D yapıları Protein Veri Bankasından (PDB) indirildi. İndirilen enzim yapıları, Chimera aracına yüklendi ve tüm standart dışı olanlar kaldırıldı. AkfsO'nun 2 boyutlu yapısı ChemDraw Ultra 12.0 üzerinde çizilerek ChemBio3D ile 3 boyutlu yapıya dönüştürülmüş ve bileşiklerin 3 boyutlu yapıları Avogadro yazılımı ile optimize edildi. Optimize edilmiş yapılar UCSF Chimera aracına yüklendi. Enzimlerin grid boyutu bir konfigürasyon dosyasına yazıldı ve docking'e gönderildi. Optimize edilmiş AkfsO kenetlenmeye tabi tutuldu ve AutoDock Vina'daki her molekül için on maruziyet oluşturuldu. Etkileşimler Biovia Discovery Studio Visualizer kullanılarak görselleştirildi. Elde edilen bulgular ışığında AkfsO maddesinin incelenen antioksidan enzimlerinin apoenzim kısmını oluşturan aminoasitlerin bir çoğu ile farklı bağlar oluşturmak suretiyle enzimlerin konformasyonel yapısında önemli değişikliklere neden olduğu ve AkfsO'nun herbir antioksidan enzime farklı bir ilgisinin olduğu belirlendi. AkfsO'nun antioksidan sistem enzimleri ile meydana gelen bu etkileşimlerinin, daha önce yapmış olduğumuz mısır bitkisinin abiyotik streslerin olumsuz etkilerinin hafifletilmesinde önemli bir etkisinin olduğunu göstermektedir.

Anahtar Kelimeler: Antioksidan sistem, Aseton O-(4 klorofenilsülfonil) Oksim, Docking



**INVESTIGATION OF THE INTERACTION OF ACETON O-(4
CHLOROPHENYLSULFONYL) OXYME WITH ANTIOXIDANT SYSTEM
ENZYMES BY MOLECULAR DOCKING METHOD**

ABSTRACT

In the study of *Artemia salina* and *Rattus norvegicus* with malathion poisoning on acetyl choline esterase enzyme, it was determined that isatin and oxime derivatives have important components against malathion inhibition, are safe and reactivate the choline esterase enzyme. In this and many similar studies, the positive effects of oxime derivatives on metabolism and the functioning of enzymes have been showed. It was determined that acetone O-(4-chlorophenylsulfonyl)oxime (AcpsO) alleviated the adverse effects of abiotic stresses on metabolism in some in vivo studies performed by us. In this study, the interaction of AcpsO with SOD, Catalase, Glutathione reductase, Glutathione-S-transferase Dehydroascorbate reductase and Mono dehydroascorbate reductase was investigated by molecular docking method. Docking analyzes were performed using UCSF Chimera and AutoDock Vina to demonstrate the interactions of enzymes with AcpsO substance. Cu/zn Superoxide dismutase (PDB ID:2APS), Catalase (PDB ID:1A4E), Glutathione reductase (PDB ID:1XAN), Glutathione S-transferase (PDB ID:1GTA), Dehydroascorbate Reductase (PDB ID:5EVO), and Monodehydroascorbate X-ray crystallographic 3D structures of reductase (PDB ID:5JCI) enzymes were downloaded from the Protein Data Bank (PDB). The downloaded enzyme constructs were loaded into the Chimera tool and all non-standard ones were removed. The 2D structure of AcpsO was drawn on ChemDraw Ultra 12.0 and converted into a 3D structure with ChemBio3D, and the 3D structures of the compounds were optimized with Avogadro software. Optimized artifacts were loaded into the UCSF Chimera tool. The grid size of the enzymes was written to a configuration file and sent to the docking. Optimized AcpsO was subjected to docking and ten exposures were generated for each molecule in AutoDock Vina. Interactions were visualized using Biovia Discovery Studio Visualizer. In the light of the findings, it was determined that AcpsO caused significant changes in the conformational structure of the enzymes by forming different bonds with many of the amino acids that make up the apoenzyme part of the antioxidant enzymes studied, and that AcpsO has a different relationship to each antioxidant enzyme. These interactions of AcpsO with antioxidant system enzymes show that the maize plant, which we have done before, has an important effect on alleviating the adverse effects of abiotic stresses.

Keywords: Antioxidant system, Acetone O-(4 chlorophenylsulfonyl) Oxime, Docking



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**MARMARA BÖLGESİ KABAKGİL ÜRETİM ALANLARINDA CUCUMIS MELO
ENDORNAVIRUS ENFEKSİYONU VE GENETİK ÇEŞİTLİLİĞİ**

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ÖZET

Kabakgıl bitkilerinde enfeksiyona neden olan çok sayıda virüs hastalığı vardır. Bu virüs hastalıklarından bir tanesi cucumis melo endornavirus (CmEV)'dir. CmEV enfeksiyonu dünyadaki farklı ülkelerden bildirilmesine rağmen, ülkemizdeki enfeksiyonu son yıllarda tespit edilmiştir. Ayrıca viral etmenin enfeksiyonu ülkemizde sadece Manisa ve İzmir illerinde tespit edilmiş olup, CmEV enfeksiyon durumu ve izolatlarının genetik çeşitliliğinin diğer illerimizdeki durumu bilinmemektedir. Bu bağlamda, belirtilen literatür boşluğunun doldurulması amacı ile Güney Marmara Bölgesi'ni (GMB) oluşturan Çanakkale, Balıkesir ve Bursa illeri kabakgıl üretim alanlarından 2021 yılı içerisinde virüs ve virüs benzeri symptom gösteren 71 bitkiden örnekler alınmıştır. Toplanan örnekler ters transkripsiyon-polimeraz zincir reaksiyonu (RT-PCR) ile CmEV'ye spesifik primer çiftleri kullanılarak testlenmiştir. Testlemeler sonucunda 31 bitkide CmEV enfeksiyonu tespit edilmiştir. Ayrıca, gerçekleştirilen testlemeler sonucunda dünyada ilk kez karpuz bitkisinde CmEV tespit edilmiştir. CmEV izolatlarının genetik çeşitliliğinin araştırılması amacı ile 6 izolat (Her bir ilden 2'şer izolat olacak şekilde izolat seçimi gerçekleştirilmiştir.) coğrafik orijinleri ve elde edildikleri konukçular göz önünde bulundurularak seçilmiştir. Seçilen izolatların polyprotein gen bölgesinin 413 nükleotitik kısmı RT-PCR ile amplifiye edilmiştir. Elde edilen RT-PCR ürünlerini purifiye edilerek hizmet alımı yolu ile çift yönlü olacak şekilde sekans analizleri gerçekleştirilmiştir. Gerçekleştirilen çoklu sekans analizleri sonucunda GMB CmEV izolatlarının kendi içlerinde ve gen bankasında bulunan diğer Türk izolatları ile %94-99 benzerliğe sahip olduğu görülürken, dünyanın farklı ülkelerinden elde edilen izolatlar ile %10'a varan farklılıklara sahip oldukları belirlenmiştir. İzolatların filogenetik ilişkilerinin araştırılması sonucunda ise Türk CmEV izolatlarının birbirleri ile yakın ilişkili olduğu belirlenmiş ve ayrıca Türk izolatlarının büyük bir çoğunluğunun oluşturulan filogenetik ağaçta ayrı bir kümelenme içerisinde olduğu tespit edilmiştir.

Anahtar Kelimeler: CmEV, Virüs, RT-PCT, Enfeksiyon



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**PREVALENCE AND GENETIC DIVERSITY OF CUCUMIS MELO
ENDORNAVIRUS INFECTING CUCURBIT PLANTS IN SOUTH MARMARA
REGION OF TURKEY**

ABSTRACT

There are many virus diseases infecting cucurbit plants. One of them is cucumis melo endornavirus (CmEV). While the presence of CmEV was known in different countries, its presence was newly reported in Turkey. Moreover, CmEV was reported only from Manisa and İzmir provinces in Turkey so far. And, its presence and genetic diversity are unknown in the other provinces of Turkey. In this context, to determine those unknowns, 71 samples from different cucurbit species showing virus and virus-like symptoms were collected from Çanakkale, Balıkesir, and Bursa provinces constituting the Southern Marmara Region (SMR) in 2021. The samples were tested by reverse transcriptase-polymerase chain reaction using CmEV specific primer pair. And, 31 were found to be infected with CmEV. Furthermore, to the best of our knowledge, CmEV was the first time found in watermelon plants as a new natural host for the world. For further analyses, 6 CmEV isolates (2 isolates from each province) were selected among the infected ones for molecular characterization studies, considering the geographic origin and host cucurbit species. The 413 bp part of the polyprotein gene region of the selected isolates was amplified by RT-PCR, purified, and bidirectionally sequenced. As a result of the multiple sequence analysis performed, it was determined that SMR CmEV isolates showed 94-99% sequence similarity among themselves and other Turkish isolates in the GenBank, while the genetic difference rate increased up to 10% with world isolates. As a result of the phylogenetic analysis of SMR CmEV isolates, it was found that the isolates were closely related to the majority of other Turkish isolates in the Genbank and it was determined that they constitute a separate clade apart from the world isolates.

Keywords: CmEV, Virus, RT-PCT, Infection



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**BİNGÖL İLİNDEN TEMİN EDİLEN BALLARIN KİMYASAL İÇERİĞİNİN
DEĞERLENDİRİLMESİ**

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ÖZET

2014 yılında Bingöl'ün merkeze bağlı ve ilçelerine bağlı toplam 16 köyündeki arılıklardan elde edilen ballarda element analizi, C4 şekeri, Diastaz, HMF ve nem miktar tayini yapılmıştır. Demir, bakır, çinko, potasyum, sodyum, kobalt, nikel, mangan minerallerine sağlığı yakından ilgilendirdikleri için ve en çok takip edilen diğer bazı kalite kriterlerine bakılmıştır. Toplamda demir $16,97 \pm 7.84$, bakır 0.18 ± 0.24 , çinko 5.08 ± 2.17 , potasyum $256,98 \pm 51.20$, sodyum $40,61 \pm 21,92$, kobalt 6.63 ± 3.01 , nikel 7.06 ± 5.97 , mangan 4.61 ± 1.80 ppm olarak tespit edilmiştir. Baldaki kalite kriterlerinden olan C4 şekeri $2,31 \pm 1,36$, diastaz enzimi $19,18 \pm 2.48$, hidroksi metil furfural (HMF) $39,08 \pm 5.13$ ve yüzde nem miktarı da $15,53 \pm 0.76$ olarak kaydedilmiştir. Balda mineral analizi AAS tekniği, HMF ve diastaz kolorimetrik metodlarla ve C4 şekeri IR-MS tekniği ile yapılmıştır. Demir; hemoglobin, miyoglobin ve sitokromlar gibi fizyolojik olarak önemli moleküllerin yapısına katılmakla beraber bir çok enzimin kofaktörü olarak görev yapar. Demir eksikliğinde ülkemizde de sıkça rastlanan anemi gelişir. Bakır; birçok enzimin yapısına katılır ve demir emiliminde görev alır. Kan ve sinir sistemi için gerekli bir mineraldir. Bakır eksikliğinde de anemi gelişebilir. Çinko; alkol dehidrogenaz, karbonik anhidraz, laktat dehidrogenaz gibi bazı enzimlerin yapısına katılır. A ve E vitamini, hücre bölünmesi, protein sentezi, yaraların iyileşmesi metabolizmasında görevlidir. Potasyum; intrasellüler sıvının baskın katyonudur ve sinir iletiminde de görevlidir. Sodyum; ekstrasellüler sıvının hakim katyonudur ve osmotik basıncın stabilitesinde büyük rol alır. Kobalt; B12 vitaminin yapısına katıldığından dolayı alyuvar üretimi için ihtiyaç duyulur. Nikelin; hücre membranının korunması ve nükleik asit metabolizmasında görev aldığına inanılmaktadır. Mangan; kemik ve kıkırdak mukopolisakkaritlerinin sentezinde görevlidir. Hücrede mitokondri civarında yoğun bulunması oksidatif fosforilasyonda da görevli olduğunu düşündürmektedir. Hidroksi metil furfural (HMF); hatalı ısı işlem gören ve uzun süre bekleyen balları ayırt etmede kullanılan bir kalite göstergesidir. Diastaz; nişastayı parçalayan enzimlerden biridir ve baldaki önemli kalite kriterlerindendir. Nem yüzdesi; bir çok gıdada olduğu gibi balda da fazla olması istenmeyen bir durumdur. C4 şekeri; bala dışarıdan şeker ilavesini tespit etmekte kullanılan ve karbon izotoplarının tespitine dayanan bir yöntemdir. Baldaki mineral zenginliği dengeli beslenme ve takviye gıda olarak bal kullanımının önemini bir kez daha ortaya koymaktadır. C4 şekeri, HMF, diastaz ve yüzde nem gibi kalite kriterlerinin de Türk Gıda Kodeksi ve AB normlarını taşıdığı tespit edilmiştir.

Anahtar Kelimeler: Balda mineral, C4 şekeri, HMF, Diastaz, Nem



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**EVALUATION OF CHEMICAL CONTENT OF HONEY PROCURED FROM
BINGOL PROVINCE**

ABSTRACT

In 2014, elemental analysis, C4 sugar, Diastase, HMF and moisture content were determined in honey obtained from apiaries in 16 villages of Bingöl and its districts. Iron, copper, zinc, potassium, sodium, cobalt, nickel, manganese minerals, as they are closely related to health and some of the most followed quality criteria were examined. In total, iron 16.97 ± 7.84 , copper 0.18 ± 0.24 , zinc 5.08 ± 2.17 , potassium 256.98 ± 51.20 , sodium 40.61 ± 21.92 , cobalt 6.63 ± 3.01 , nickel 7.06 ± 5.97 , manganese 4.61 ± 1.80 ppm detected. C4 sugar, which is one of the quality criteria in honey, was recorded as 2.31 ± 1.36 , diastase enzyme as 19.18 ± 2.48 , hydroxy methyl furfural (HMF) as 39.08 ± 5.13 and percent moisture content as 15.53 ± 0.76 . Mineral analysis in honey was made by AAS technique, HMF and diastase colorimetric methods and C4 sugar by IR-MS technique. Iron; Although it participates in the structure of physiologically important molecules such as hemoglobin, myoglobin and cytochromes, it acts as a cofactor of many enzymes. Anemia, which is common in our country, develops in iron deficiency. Copper; It participates in the structure of many enzymes and takes part in iron absorption. It is an essential mineral for the blood and nervous system. Anemia can also develop in copper deficiency. Zinc; It participates in the structure of some enzymes such as alcohol dehydrogenase, carbonic anhydrase, lactate dehydrogenase. Vitamins A and E are involved in cell division, protein synthesis, and wound healing metabolism. Potassium; It is the predominant cation of intracellular fluid and is also involved in nerve conduction. Sodium; It is the dominant cation of the extracellular fluid and plays a major role in the stability of osmotic pressure (1). Cobalt; Since it participates in the structure of vitamin B12, it is needed for the production of red blood cells (2). Nickel; It is believed to be involved in cell membrane protection and nucleic acid metabolism. Manganese; It is involved in the synthesis of bone and cartilage mucopolysaccharides. Its dense presence around mitochondria in the cell suggests that it is also involved in oxidative phosphorylation. Hydroxy methyl furfural (HMF); It is a quality indicator used to distinguish honey that has been treated incorrectly and has been waiting for a long time. Diastasis; It is one of the enzymes that break down starch and is one of the important quality criteria in honey. Moisture percentage; As in many foods, it is undesirable to have too much in honey. C4 sugar; It is a method that is used to detect the addition of sugar from the outside and is based on the determination of carbon isotopes. The mineral richness in honey once again reveals the importance of balanced nutrition and the use of honey as supplementary food. It has been determined that quality criteria such as C4 sugar, HMF, diastase and percent moisture also meet the Turkish Food Codex and EU norms.

Keywords: Mineral in honey, C4 sugar, HMF, Diastase, Moisture



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**BİTKİ PARAZİTİ NEMATODLARA KARŞI BİTKİLERİN DAYANIKLILIK
MEKANİZMALAR**

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ÖZET

Dünyada tarımsal üretim alanlarında bitkiler çeşitli hastalık ve zararlı etmenler (virüs, bakteri, fungus, nematod vb) tarafından saldırıya uğramaktadırlar. En gelişmiş organizmalar olan insanlara ve hayvanlara göre bitkiler daha sade bağışıklık sistemlerine sahiptirler. Bitkilerde zararlılara tepki olarak ortaya çıkan dayanıklılık, zararlının üzerinde yaşayabildiği konukçu bitki ile zararlı arasındaki ilişkiler açısından değerlendirilmektedir. Bitki paraziti nematodlar ile mücadeleye karar verirken konukçu ile olan ilişkisini tespit etmek önemli bir unsurdur. Son zamanlarda Dünyada kimyasal pestisitlere kısıtlamaların artması ile birlikte, bitki paraziti nematodlar ile mücadelede konukçu dayanıklılığının önemi giderek artmıştır. Bu çalışmada bitki paraziti nematodlara karşı konukçu bitkilerin geliştirdiği dayanıklılık mekanizmaları incelenmiş olup, söz konusu zararlılar ile mücadeledeki önemi araştırılmıştır.

Anahtar Kelimeler: Nematod, dayanıklılık, zararlı, mücadele, mekanizma



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**RESISTANCE MECHANISMS OF PLANTS AGAINST TO PLANT PARASITIC
NEMATODES**

ABSTRACT

Plants are attacked by various diseases and harmful factors (virus, bacteria, fungus, nematode, etc.) in agricultural production areas all over the world. Plants have simpler immune systems than humans and animals, which are advanced organisms. Resistance in plants in response to pests is evaluated in terms of the relationships between the host plant and the pest. When make a decision about to control plant parasitic nematodes, it is important to determine its relationship with the host. With the recent increase in restrictions on chemical pesticides in the world, the importance of host resistance has increased in the control against plant parasitic nematodes. In this study, resistance mechanisms created by host plants against plant parasitic nematodes were examined and its importance in pest control has been investigated.

Keywords: Nematode, resistance, pest, control, mechanism



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**KARANTİNAYA TABİ BİTKİ PARAZİTİ NEMATODLAR VE KARANTİNA
UYGULAMALARI**

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ÖZET

Nematodlar, basit çok hücreliler arasında yer alan segmentsiz solucanlardır. Diğer organizmalara göre yaşama ortamı en geniş canlı gruplarından birisidir. Birçok yaşama alanında yoğunluk açısından ilk sırada yer almaktadırlar. Tarımın olduğu bütün alanlarda nematodlar karşımıza çıkmaktadır. Bitkilerde beslenerek zarar oluşturan bitki paraziti nematodlar çok hücreli hayvansal organizmaların % 80'ini oluşturan Nemata şubesi içinde yer almaktadırlar. Pek çok bitki paraziti nematod türü bitkilerde önemli ekonomik kayıplara yol açmaktadırlar. Tarımsal üretimde nematodlardan kaynaklı ürün kaybının % 10-20 olduğu bildirilmektedir. Bitki paraziti nematodlar çok geniş bir konukçu dağılımına sahip olmakla birlikte en önemli konukçuları arasında sebzeler, meyveler, çeltik, çilek, patates ve bağ bulunmaktadır. Birçok bitki, karantinaya tabi tohum, fidan sertifikasyonu açısından önemli nematod türlerine konukçuluk yapmaktadır. Bu nematod türleri mücadelelerinin zor olması, toprak ve üretim materyalleri ile taşınmaları gibi nedenlerden dolayı son derece önemlidir. Karantina listelerinde yer alan bu türlerin toleransları "0"dır. Nematodların büyük bir çoğunluğu kendi hareketleri ile toprakta yılda yaklaşık 1 m yol alabilirler. Bitki paraziti nematodların bir tarladan diğerine veya bir bölgeden diğer bir bölgeye yayılmaları, sulama suyu, bulundukları toprakların insan, hayvan ve tarım araçları ile taşınması ya da bulaşık bitkilerle veya üretim materyalleri ile olmaktadır. Nematodlar çok fazla çoğalma kapasitesine sahiptirler. Ayrıca bazı dayanıklı dönemlerinde konukçuları olmasa da uzun yıllar toprakta canlılıklarını koruyabilmekte ve konukçusu ile karşılaştığında tekrar çoğalarak ekonomik kayıplara yol açacak yoğunluğa ulaşabilmektedirler. Bu nedenlerden ötürü bir nematod türünün bir alana bulaştıktan sonra oradan tamamen temizlenmesi çok mümkün olamamaktadır. Dolayısıyla nematod mücadelesinde en dikkat edilmesi gereken nokta temiz alanlara bulaşmanın önlenmesidir. Bu da ancak yasal düzenlemeler ile mümkün olabileceğinden dünyada olduğu gibi ülkemizde de karantina uygulamalarına özel önem verilmektedir. Aynı şekilde bulaşık alanlarda bulunan karantinaya tabi bitki paraziti nematodların eradikasyon çalışmaları için mevcut mücadele yöntemlerinin yeterli olmaması, kimyasal mücadele yöntemlerinin maliyetinin yüksek ve çevreye zararlı olması gibi nedenlerle bulaşmayı önleyici yasal tedbirlerin alınması önemlidir. Bu bildiride ülkemiz karantina listelerinde yer alan bitki paraziti nematod türlerinin tanımı, yaşayışı ve mücadelelerinin yanı sıra karantina mevzuatı ve karantina uygulamaları ile ilgili bilgiler aktarılacaktır.

Anahtar Kelimeler: Bitki paraziti nematodlar, karantina, sertifikasyon



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**QUARANTINE PLANT PARASITIC NEMATODES AND QUARANTINE
PRACTICES**

ABSTRACT

Nematodes are non-segmented worms among the simple multicellular. Compared to other organisms, the living environment is one of the largest living groups. They are in the first place in terms of density in many living areas. We meet nematodes in all areas of agriculture. Plant parasitic nematodes, which cause damage by feeding on plants, are included in the phylum of Nemata, which constitutes 80% of multicellular animal organisms. Many plant parasitic nematode species cause significant economic losses in plants. It is reported that the product loss due to nematodes in agricultural production is 10-20%. Plant parasitic nematodes have a wide host distribution, but the most important hosts include vegetables, fruits, rice, potatoes and vineyards. Many plants host nematodes that are important for quarantined seed and seedling certification. These nematode species are extremely important because they are difficult to control and they are transported with soil and production materials. The tolerances of these species in the quarantine lists are "0". Nematodes can travel about 1 m per year in the soil by their own movements. The spread of plant parasitic nematodes from one field to another or from one region to another is through irrigation water, transportation of the soils by people, animals and agricultural vehicles, or by contaminated plants or production materials. Nematodes have a very high reproductive capacity. In addition, although they do not have a host in some durable periods, they can maintain their vitality in the soil for many years. If they meet their hosts, they can multiply again and reach a density that will cause damage. For these reasons, it is not possible for a nematode species to be completely removed from an area after it has been infected. Therefore, the most important point in nematode control is to prevent contamination of clean areas. Since this can only be possible with legal regulations, special attention is given to quarantine practices in our country as well as in the world. Likewise, it is important to take legal measures to prevent contamination due to reasons such as the inadequacy of existing control methods for the eradication of plant parasitic nematodes in contaminated areas, the high cost of chemical control methods and the harmful nature of the environment. In this paper, information about the identification, life and control of plant parasitic nematode species in our country's quarantine lists, as well as quarantine legislation and quarantine practices will be presented.

Keywords: Plant parasitic nematodes, quarantine, certification



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YEMEKLİK TANE BAKLAGİLLERDE TOHUM CANLILIĞI VE GÜCÜ

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ÖZET

Yemelik tane baklagillerin ekolojik istekleri incelendiğinde, Türkiye'nin hemen her tarafında yetiştirilebilecek bir baklagil bitkisi olduğu görülmektedir. Tarımın en önemli girdisi tohumdur. Tohumun niteliği doğrudan ürünün verimliliğini etkilemektedir. Tarımsal üretimin arttırılmasında canlı ve güçlü tohum kullanılması çok önemlidir. Tohum; en dışta besin dokuyu çevreleyen tohum kabuğu, makro ve mikro besinler ihtiva eden besin doku ve yeni bir bitki oluşturabilecek canlılığa sahip embriyodan oluşan bitki generatif organıdır. Tohumun yeni bir bitki oluşturabilmesi için canlılığının sürmesi, sağlıklı bir bitki oluşturabilmesi için gücünün yeterli olması gerekir. Yemelik tane baklagillerde; tohum gücünün değerlendirilmesinde kullanılan, ISTA tarafından onaylanmış ve tavsiye niteliğindeki testler ile tohum fizyolojisi ve teknolojisi araştırmalarında kullanılan çeşitli güç testleri ve son yıllarda baklagillerde bu konular ile ilgili yapılan çalışmalar bu makalede özetlenmiştir.

Anahtar Sözcükler: Canlılık, güç, tohum, yemelik tane baklagil



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SEED VIGOUR AND VIABILITY IN PULSES

ABSTRACT

Pulses ecological requirements when examined, it is seen as a legume crops can be grown in almost every part of Turkey. The most important input of agriculture is seed. Seed quality directly affects crop yield. It is very important to use vivid and strong seeds in increasing agricultural production. Seed; apart from that, it is a plant generative organ consisting of the seed coat surrounding the nutrient tissue at the outermost, nutrient tissue containing macro and micronutrients, and an embryo that has the vitality to form a new plant. In order for a seed to create a new plant, it must maintain its viability and must have sufficient vigour to create a healthy plant. ISTA approved and advisory tests for pulses used in the evaluation of seed vigour, various vigour tests used in seed physiology and technology research, and studies on these issues in pulses in recent years are summarized in this article.

Keywords: Pulses, seed, viability, vigor



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**ARI ÜRÜNLERİNDEN PERGA VE PROPOLİS İLE KIRMIZI PANCAR TOZUNUN
NİTRİT İÇERMEYEN VEYA NİTRİT ORANI AZALTILMIŞ TAVUK SUCUĞU
ÜRETİMİNDE KULLANIMININ ÜRÜN ÖZELLİKLERİ ÜZERİNE ETKİLERİ**

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ÖZET

Bal arıları topladıkları polenleri bir miktar bal ve kendi salgıladıkları enzimlerle karıştırarak muhafaza etmektedirler. Bu karışım, farklı enzimler, mikroorganizmalar, nem ve sıcaklığın etkisiyle kimyasal değişikliğe uğramaktadır. Depolanan bu karışıma perga (arı ekmeği) adı verilmektedir. Propolis ise arıların kovan içi boşlukları doldurmak amacıyla çeşitli bitkilerin salgılarından topladıkları reçinemsî bir madde olarak tanımlanmaktadır. Perga ve propolis zengin besin içeriğine sahiptir ve yüksek oranda biyoaktif bileşenler içermektedir. Bu çalışmada, tavuk sucuğu üretiminde nitrit kullanımına alternatif olarak, sağlık üzerine çok sayıda olumlu etkileri bulunan, propolis ve perga ekstraktının kırmızı pancar tozu ile birlikte kullanımının etkilerinin incelenmesi amaçlanmıştır. Çalışmada tavuk sucuğu formülasyonunda kırmızı pancar tozu kullanımının amacı üründe cazip kırmızımsı rengi sağlamaktır. Bu amaçla K: 150 ppm sodyum nitrit; PE1: %1 perga ekstraktı+%0,2 pancar tozu; PE2: %0,5 perga ekstraktı+75 ppm sodyum nitrit+%0,2 pancar tozu; PR1: %1 propolis ekstraktı+%0,2 pancar tozu; PR2: %0,5 propolis ekstraktı+75 ppm sodyum nitrit+%0,2 pancar tozu; PT:%0,2 pancar tozu olmak üzere 6 farklı örnek grubu hazırlanmıştır. Sucuk örneklerinde üretim sonrası ilk gün kimyasal kompozisyon (nem, yağ, protein ve kül), pH, renk ölçümü, TBARS, kalıntı nitrit ve duyuşal değerlendirme analizleri gerçekleştirilmiştir. PE1, PR1 ve PR2 sucuk örneklerinin nem içeriğinin, kontrol örneğine göre önemli düzeyde yüksek olduğu saptanmıştır. Sucuk üretiminde kullanılan tüm katkıların örneklerin rengine koyulaşmaya ve sarı tonunda artışa neden olduğu belirlenmiştir. Örneklerin *L** değerlerinde azalma, *b** değerlerinde ise artış tespit edilmiştir. Kullanılan katkıların örneklerin pH ve TBARS değerleri üzerinde önemli bir farklılık oluşturmadığı saptanmıştır. Propolis ekstraktı içeren sucuk örneklerinde (PR1 ve PR2) diğer örneklerle kıyasla en düşük kalıntı nitrit içeriği belirlenmiştir. Perga ekstraktının örneklerin bazı duyuşal özelliklerini geliştirdiği gözlenmiştir. Nitekim, PE2 örneğinin duyuşal değerlendirme ile belirlenen görünüm, renk ve lezzet puanlarının kontrol örneğine kıyasla daha yüksek olduğu saptanmıştır. Bunun yanında yüksek düzeyde propolis ekstraktı içeren PR1 örneğinin lezzet ve genel kabul puanlarının kontrol örneğine kıyasla daha düşük olduğu belirlenmiştir. Bu çalışmada elde edilen veriler doğrultusunda, tavuk sucuğu formülasyonunda, incelenen ürün özellikleri bakımından propolis ve perga ekstraktının kırmızı pancar tozu ile birlikte nitrit ikamesi olarak kullanımının mümkün olabileceği sonucuna varılmıştır.

Anahtar Kelimeler: Tavuk sucuğu, nitrit, perga, propolis, pancar tozu.



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**THE EFFECTS OF USAGE OF PERGA AND PROPOLIS WHICH ARE BEE
PRODUCTS WITH BEETROOT POWDER IN THE PRODUCTION OF NITRITE-
FREE OR NITRITE RATIO REDUCED CHICKEN SAUSAGE**

ABSTRACT

Honeybees store the pollen they collect by mixing it with some honey and the enzymes that their secretions. This mixture undergoes chemical changes due to the action of different enzymes, microorganisms, humidity and temperature. Stored this mixture is called perga (bee bread). Propolis, on the other hand, is defined as a resinous substance that bees collect from the secretions of various plants to fill the cavities in their hive. Perga and propolis have a rich nutritional content and contain a high amount of bioactive components. In this study, it was aimed to examine the effects of using propolis and perga extract that have many beneficial effects on health with beetroot powder as an alternative to the use of nitrite in chicken sausage production. The purpose of using red beetroot powder in the chicken sausage formulation was to provide an attractive reddish color in the product. For this purpose, six different sausage formulations were prepared containing K: 150 ppm sodium nitrite; PE1: 1% perga extract+0.2% beetroot powder; PE2: 0.5% perga extract+75 ppm sodium nitrite+0.2% beetroot powder; PR1: 1% propolis extract+0.2% beetroot powder; PR2: 0.5% propolis extract+75 ppm sodium nitrite+0.2% beetroot powder; PT:0.2% beetroot powder. Proximate composition (moisture, fat, protein and ash), pH, color measurement, TBARS, residual nitrite and sensory evaluation analyses were performed in the sausage samples after production on the first day. The moisture contents of PE1, PR1 and PR2 samples were detected to be significantly higher than that of the control sample. It was determined that all the additives used in the sausage production caused a darkening and yellowish color in the samples. Additives caused a decrease in L^* values and an increase in b^* values. There was no significant difference between the pH and TBARS values of the samples. The lowest residual nitrite content was determined in the sausage samples which contain propolis extract (PR1 and PR2) compared to that of the other samples. It was observed that perga extract improved some sensory properties of the samples. Hence, it was determined that the appearance, color and taste sensory evaluation scores of the PE2 sample were higher compared to the control sample. However, the taste and overall acceptance scores of the PR1 sample that contain high levels of propolis extract were detected lower in comparison with those of the control sample. According to the data obtained in this study, it was concluded that it is possible to use propolis and perga extract with red beetroot powder as nitrite substitute in chicken sausage formulation in terms of the product properties examined.

Keywords: Chicken sausage, nitrite, perga, propolis, beetroot powder.



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**VAN GÖLÜ HAVZASI ASTRAGALUS L. CİNSİNE AİT ENDEMİK TÜRLERİN
FİLOGENETİK İLİŞKİLERİNİN BELİRLENMESİ**

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ÖZET

Astragalus L. cinsi Türkiye Florası'nda teşhis açısından sorunlu cinslerin başında yer almaktadır. Bu cins 469 takson içermekte ve bu taksonların 217'si endemik türlerden oluşmaktadır. Çalışma 2019 yılında, Van Gölü Havzası'ndan toplanan *Astragalus* L. cinsine ait endemik türlerin filogenetik ilişkilerinin belirlenmesi amacıyla yürütülmüştür. *Astragalus* L. cinsine ait 82 takson toplanmış bu taksonların 19 tanesinin endemik, 2 tanesinin de nadir olduğu tespit edilmiştir. çalışmada örneklerden izole edilmiş genomik DNA'lardan ITS bölgelerinin çoğaltılması için evrensel ITS4 ve ITS5 primerleri kullanılmıştır. Bu primerler yardımıyla, rDNA'da yer alan ITS1, 5,8S ve ITS2 bölgeleri PCR yoluyla çoğaltılmıştır. DNA dizilemesi yapılan *Astragalus* L. cinsine ait taksonların genom bilgileri farklı programlar (SnapGene, CLC DNA Workbench) ile analiz edilmiştir. *Astragalus* L. cinsine ait taksonlardan elde edilen DNA dizileri, National Center for Biotechnology Information (NCBI) Gen bankasına kayıtları yapılarak dünyadaki tüm araştırmacıların kullanımına sunulmuştur. Bu çalışmada, nrDNA ITS bölgesi uzunluğunun 669 ile 687 baz çifti arasında değiştiği tespit edilmiştir. Sonuçlarımız, evrensel ITS4 ve ITS5 primerleri ile elde edilen dizilerden türetilen en kararlı ikincil yapının, filogenetik ağaç ile kombinasyon halinde kullanıldığında *Astragalus* L. cinsine ait taksonların tanımlanması için etkili bir araç olduğunu kanıtlamıştır.

Keywords: *Astragalus* spp., ITS , Molecular phylogeny,



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**DETERMINING PHONETIC RELATIONS OF ENDEMIC SPECIES OF
ASTRAGALUS L. IN THE VAN LAKE BASIN**

ABSTRACT

Astragalus L. genus, one of the most comprehensive genera in the world, is represented by nearly 2900 taxa. *Astragalus* L. genus is one of the most challenging genus in terms of identifying in the Flora of Turkey. This genus includes 469 taxa and 217 of these taxa are endemic species. The study was carried out in 2019 to determine the phylogenetic relationships of endemic species belonging to the genus *Astragalus* L. collected from the Van Lake Basin. 82 taxa belonging to the genus *Astragalus* L. were collected, 19 of which were found to be endemic while 2 of them were rare. In the study, universal ITS4 and ITS5 primers were used to amplify ITS regions from genomic DNAs isolated from samples. By means of these primers, ITS1, 5.8S and ITS2 regions in rDNA were amplified by PCR. The genome information of the taxa of the genus *Astragalus* L. whose DNA was sequenced were analysed with different programs (SnapGene, CLC DNA Workbench). Then, DNA sequences obtained from taxa belonging to the genus *Astragalus* L. were registered in the National Center for Biotechnology Information (NCBI) Genbank and made available to all researchers in the world. In this study, it was also determined that the length of the nrDNA ITS region varied between 669 and 687 base pairs. The results of the study indicated that the most stable secondary structure derived from sequences obtained with the universal primers ITS4 and ITS5 when used in combination with the phylogenetic tree, is an effective tool for the identification of taxa of the genus *Astragalus* L.

Keywords: *Astragalus* spp., ITS, Molecular phylogeny



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**GÜMÜLCİNE'DE (YUNANİSTAN) TARIM ALANLARINDAKİ
NEMATOD FAUNASININ ARAŞTIRILMASI**

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ÖZET

Gümülcine, Yunanistan'ın Trakya Bölgesi'nde bulunan ve Türklerin yoğun olarak yaşadığı bir şehirdir. Yunanistan'daki önemli tütün üretim merkezlerinden biri olan Gümülcine'de tarım önemli bir geçim kaynağıdır. Nematodlar yeryüzünde en fazla bulunan omurgasız gruplardan biri olup biyoçeşitlilik ve tür zenginliği açısından eklembacaklılar ile rekabet eder. Ekosistemlerde önemli bir trofik çeşitliliğe ve yoğunluğa sahip olan bu organizmalar toprak biyotik topluluğunun da başlıca üyeleridir. Birçok tür serbest yaşayıp, bakteri veya fungus sporları ile beslenirken, diğerleri predatör veya bitki paraziti olabilir. Bu çalışmada nematod faunasını belirlemek için, 2019-2020 yıllarında Gümülcine'ye bağlı iki farklı köyde bulunan tütün, arpa, zeytin, soğan, fasulye ve karpuz üretim alanlarından toplam 28 adet toprak örneği alınmıştır. Toprak örnekleri Çanakkale Onsekiz Mart Üniversitesi, Ziraat Fakültesi, Bitki Koruma Bölümü, Nematoloji Laboratuvarı'na getirilmiştir. Nematodlar topraktan Baermann huni yöntemi ile izole edilerek mikroskop altında teşhis edilmiştir. Elde edilen sonuçlara göre Gümülcine'deki farklı üretim alanlarından alınan toprak örneklerinde en yoğun bulunan nematod türlerinin; *Aphelenchus avenae*, *Aphelenchoides* spp., *Dorylaimus* spp., *Paratylenchus* spp., *Tylenchus* spp. ve saprofit olduğu belirlenmiştir. Saprofit nematodlar örnekleme yapılan bütün alanlardan elde edilirken, *Meloidogyne* spp. ve *Helicotylenchus* spp. sadece zeytin, *Merlinius* spp. ise sadece tütün yetiştirilen alanlardan elde edilmiştir. Nematodların tarım alanlarındaki dağılımı, nematod cinsine ve beslenme gruplarına bağlı olarak insan faaliyetlerinin de etkisi ile değişiklik gösterebilir.

Anahtar Kelimeler: Biyoçeşitlilik, nematod dağılımı, toprak ekolojisi



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**INVESTIGATION OF NEMATODE FAUNA IN AGRICULTURAL AREAS
IN GÜMÜLCİNE (GREECE)**

ABSTRACT

Gümülcine is a city located in Thrace Region of Greece where Turks live intensely. Agriculture is an important source of income in Gümülcine, which is one of the important tobacco production centers in Greece. Nematodes are one of the most abundant invertebrate groups on the face of the earth and rival the arthropods in biodiversity and species abundance. These organisms, have a significant trophic diversity and population in ecosystems, are also the main members of the soil biotic community. Many species are free-living, feeding on bacteria or fungal spores, whereas others are predatory or plant parasitic. In this study to determine the nematode fauna, a total of 28 soil samples were collected from tobacco, barley, olive, onion, bean, and watermelon production areas in two different villages of Gümülcine in 2019-2020. Soil samples were brought to Nematology Laboratory of Department of Plant Protection, Faculty of Agriculture, University of Çanakkale Onsekiz Mart. Nematodes were extracted from soil by using Baermann's funnel technique and identified under the microscope. According to the results, the most common nematode species found in soil samples taken from different production areas in Gümülcine were identified as; *Aphelenchus avenae*, *Aphelenchoides* spp., *Tylenchus* spp., *Dorylaimus* spp., *Paratylenchus* spp. and *saprophytic nematodes*. Saprophytic nematodes were obtained from all sampling areas, while *Helicotylenchus* spp., *Meloidogyne* spp. were obtained only from olive and *Merlinius* spp. was obtained only from tobacco production areas. Spatial distribution of nematodes in agricultural areas may vary with the effect of human activities, depending on the nematode species and feeding groups.

Keywords: Biodiversity, nematode distribution, soil ecology



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AMFİBİLERİN TARIMA FAYDALARI ÜZERİNE BİR ARAŞTIRMA

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ÖZET

Kurbağalar, ya da bilimsel adıyla amfibiler, insanlığa ve içerisinde yaşadıkları ekosistemlere muazzam faydalar sağlayan eşsiz canlılardır. Dünya üzerinde kayıt altına alınmış 7170'den fazla tür ile temsil edilen ve günümüzde ne yazık ki insan kökenli faaliyetler dolayısıyla çarpıcı bir hızla azalmakta olan omurgalılarıdır. IUCN (Uluslararası Doğa Koruma Birliği) verilerine göre, soyu tükenme tehlikesiyle karşı karşıya olan omurgalıları içerisinde %41'lik oranla en yüksek tehlike düzeyine sahiptirler. Biraz da bu sebepten, ne denli eşsiz canlılar olduklarına dair farkındalık yaratarak çok geç olmadan korunmalarına katkı sağlamak biz bilim insanlarının sorumluluğundadır. Türden türe değişiklik gösterse de amfibilerin kendilerini toprağa gömerek korunma veya yaşama eğilimleri vardır. Bazı türleri kuraklık veya yüksek sıcaklık gibi olumsuz koşullardan kaçınmak için kendilerini gömme davranışı sergilerken bazı türler yaşamının büyük çoğunluğunu gömülü halde geçirmektedir. Bu davranışın tarım yönünden faydalarına bakacak olursak, yüzeydeki ve yeraltındaki yaşam alanları arasındaki hareketleri ve yeraltı oyuk sistemlerinde yaptıkları değişiklikler toprağı havalandırır, ayrıca organik madde ve nem yönünden toprağı zenginleştirir. Buna bağlı olarak da toprak verimliliğini arttırmırlar. Daha da önemlisi, amfibiler, yaşam alanları içerisindeki böcek türlerini avlayarak beslenen genel avcılardır. Tükettikleri türler içerisinde ise çekirgeler, salyangozlar, patates böceğı, danaburnu ve benzeri tarım zararlıları da bulunur. Bu özellikleri de onları tarım zararlıları için çok düşük maliyetli ve çevre dostu biyolojik mücadele unsurları yapar. Böylece pestisit ve insektisitlerin yarattığı kirliliğe sebep olmaksızın ve bu kimyasallara harcanacak büyük paralar harcanmaksızın üretime önemli zararlar veren tarım zararlıları ile kurbağalar yardımıyla mücadele edilebilir. Bu kapsamda kurbağalar, tarımsal üretime olası katkıları keşfedilmiş fakat kullanımı göz ardı edilmiş, zengin bir potansiyele sahiptir diyebiliriz.

Anahtar Kelimeler: Su Kurbağaları, Kara Kurbağaları, Tarıma sağladıkları faydalar



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**AN INVESTIGATION FOR BENEFITS OF THE AMPHIBIANS ON
AGRICULTURE**

ABSTRACT

Frogs, or amphibians as they are scientifically called, are unique creatures that provide tremendous benefits to humanity and the ecosystems in which they live. They are vertebrates that are represented by more than 7170 recorded species in the world and are decreasing at a striking rate today due to anthropogenic activities. According to IUCN (International Union for The Conservation of Nature) data, they have the highest level of endangerment, with 41%, among vertebrates in danger of extinction. Partly for this reason, it is our responsibility as scientists to raise awareness about how unique creatures they are and contribute to their protection before it's too late. Although it depends on species, amphibians have a tendency to protection or live by burying themselves in the soil. While some species exhibit burying behavior to avoid adverse conditions such as drought or high temperatures, some species spend the majority of their lives buried. If we look at the agricultural benefits of this behavior, their movement between surface and underground habitats and changes in underground burrow systems aerate the soil, as well as enrich the soil in terms of organic matter and moisture. As a result, they increase soil productivity. More importantly, amphibians are general predators that prey on insect species within their habitat. Among the species they consume, there are also grasshoppers, snails, potato beetles, calendula, and similar agricultural pests. These characteristics also make them highly cost-effective and environmentally friendly biological control elements for agricultural pests. In this way, agricultural pests that cause significant damage to production can be combated with the help of frogs, without causing the pollution created by pesticides and insecticides and without spending large amounts of money to be spent on these chemicals. In this context, we can say that frogs have a rich potential whose possible contributions to agricultural production have been discovered but their use has been neglected.

Key Words: Frogs, Toads, Their benefits to the agriculture



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**DEĞİŞİK SULAMA REJİMLERİ ALTINDA MAŞ FASULYENİN SU VERİM
İLİŞKİSİ**

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ÖZET

Maş fasulyenin (*Mungbean (Phaseolus mungo L.)*), kuraklığa eğilim gösteren iklim ve kurak topraklarda ana, geç dönem veya ara ürün olarak kullanılabilme potansiyeli ve tanelerinin zengin protein, nişasta, vitamin ve mineral madde içeriği gibi özellikleri sebebiyle bölge tarım sistemine dâhil olabilir ve teşvik edilebilir. Bu araştırma Kahramanmaraş ilinde damla sulama sistemiyle farklı stratejilerde ve tohum sıklığında sulanan maş fasulyesi bitkisinde su-verim ilişkilerinin belirlenmesi amacıyla yapılmıştır. Burada, tek tohum sıklığına (3 kg da⁻¹) ilişkin sonuçlar verilmiştir. Araştırmada dört farklı sulama rejimi (Tam sulama, (TS); Kısıntılı sulamalar, (KS50, KS75) ve Yarı ıslatmalı (PRD50) sırasıyla TS'nin %50, 75 ve 50'sini alan) test edilmiştir. Parseller ayrılmış bloklar ve tesadüf dağılmış parseller deneme desenine göre üç tekrarlamalı olarak düzenlenmiştir. Tam sulama konusuna 662 mm sulama suyu uygulanmıştır. Mevsimlik su tüketim değerleri TS, KS75, KS50 ve YIS50 konularında sırasıyla, 670, 558, 439, 440 mm ve tane verimi ise 899, 752, 597 ve 497 kg ha⁻¹ olarak belirlenmiştir. En yüksek sulama suyu kullanım randımanı (IWUE) ve su tüketim randımanı (WUE) KS50 konusunda sırasıyla, 1.41 ve 1.36 kg ha⁻¹ mm⁻¹ bulunmuştur. Verim tepki etmeni η ise 1.12 olmuştur. TS konusu verim açısından en başarılı konu olmuş, KS50 ve YIS50 aynı su miktarlarını almış olmasına rağmen, YIS50 konusundan en düşük verim elde edilmiştir. Çalışma sonuçları Kahramanmaraş koşulları altında maş fasulyesi bitkisinin sulanmasında su kısıntısına gidilmesinin verimi önemli ölçüde azalttığını göstermiştir.

Anahtar Kelimeler: Maş fasulye, Kısıntılı sulama, Su-verim ilişkisi, Kahramanmaraş



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**YIELD-WATER RELATIONSHIPS OF MUNGBEAN (*Phaseolus mungo* L.) UNDER
VARIOUS IRRIGATION REGIMES**

ABSTRACT

Mung bean (Mung bean (*Phaseolus mungo* L.) may be included in the agricultural system of the region due to its potential to be used as a main, late or intermediate product in drought-prone climate and arid soils and its grains have rich protein, starch, vitamin and mineral substance content. This research was carried out to evaluate the effect of various irrigation regimes applied with surface drip irrigation system and different seed densities on the water-yield relationship on mung bean in Kahramanmaraş. Here, the results with related to one seed density (3 kg da^{-1}) was given. Four different irrigation regimes (Full irrigation, (FI); deficit irrigations, (DI50, DI75) and Partial Root-zone Drying (PRD50) which received, respectively 50, 75, and 50% of FI) were tested. The plots were arranged according to the separated blocks and randomized plots design with three replications. The highest amount of irrigation water was applied FI (full irrigation) with 662 mm. Seasonal water consumption and grain yield values were determined as 670, 558, 439, 440 mm and 899, 752, 597 and 497 kg ha^{-1} for FI, DI75, DI50 and YIS50, respectively. The highest irrigation water use efficiency (IWUE) and water consumption efficiency (WUE) for KS50 were found to be 1.41 and 1.36 $\text{kg ha}^{-1} \text{ mm}^{-1}$. Yield response factor (k_y) was determined as 1.12. FI was the most successful treatment for yield, although DI50 and YIS50 were received the same amount of water, the lowest yield was obtained from YIS50. The results of the study showed that deficit irrigation of mung bean plant significantly reduced the yield under the Kahramanmaraş conditions.

Keywords: Mung bean, Deficit irrigation, Yield-water relationships, Kahramanmaraş



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KANATLI YETİŞTİRİCİLİĞİNDE REFAH

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ÖZET

Bu gün dünya geneli değerlendirildiğinde artan nüfus hızına bağlı olarak gıda ihtiyacının da aynı oranda arttığı görülmektedir. Buna bağlı olarak bu hıza ayak uydurmaya çalışan gıda üretim endüstrisi de üretim stoklarını geçtiğimiz yüzyılda büyük oranda arttırmıştır. Tavuk etinin ve yumurtasının besin değerinin yüksek, üretim maliyetlerinin düşük olması nedeniyle kanatlı yetiştiriciliği sektörünün diğer sektörler ile kıyaslandığında çok hızlı bir büyüme ile öne çıktığı görülmektedir. Bu büyüme neticesinde artan üretim yoğunluğuna karşın, aynı zamanda hayvanların refah seviyelerinde düşmelere neden olmuştur. Önceki yüzyıllarda yapılan küçük çaplı üretim de insan hayvan etkileşimi üst düzeyde ve hayvanların takibi daha kolayken, günümüz yetiştiricilik sistemlerinde bu durum mümkün olmamaktadır. Kanatlı yetiştiriciliği yeni nesil üretim şekillerinde her ne kadar iyileştirmeler yapıp refah seviyeleri arttırılmaya çalışılsa da gelecek dönemler de mevcut koşulların daha da iyileştirilmesi amacıyla daha büyük gelişmeler sağlanması kaçınılmaz olacaktır. Bu çalışma da; günümüz koşullarında kanatlı yetiştiriciliğinin refah unsurları açısından değerlendirilerek kanatlıların refahına yönelik uygulamaların incelenmesi amaçlanmıştır.

Anahtar Kelimeler: Kanatlı yetiştiriciliği, refah, üretim



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WELFARE IN POULTRY BREEDING

ABSTRACT

Today, when the world wide is evaluated, it is seen that the need for food has increased at the same rate depending on the increasing population rate. Accordingly, food production industry working at this speed has accelerated the production stocks of the food production industry in the past century. Due to the high nutritional value of chicken meat and eggs and low production costs, it is seen that the poultry farming sector stands out with a very rapid growth when compared to other sectors. Despite the increased production intensity as a result of this growth, it also caused a decrease in the welfare level of the animals. While human-animal interaction was at a high level and it was easier to follow animals in small-scale production in previous centuries, this is not possible in today's farming systems. Although improvements are made in the new generation production methods of poultry farming and efforts are made to increase welfare levels, it will be inevitable to provide greater developments in order to improve the current conditions in the coming periods. In this study; In today's conditions, it is aimed to examine the applications for the welfare of the poultry by evaluating the welfare elements of poultry breeding.

Keywords: Poultry breeding, welfare, production



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**SIÇANLARDA PAKLİTAKSELİN NEDEN OLDUĞU HEPATOKSİSİTE VE
NEFROTOKSİSİTE ÜZERİNE SİLİMARİN'İN TERAPÖTİK ETKİLERİ**

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ÖZET

Paklitaksel (PAX), çeşitli kanserlerin tedavisinde kullanılan yaygın bir kemoterapötik ajandır. Düşük doz PAX'ın inflamasyon, renal ve hepatik fibrozis, cilt hastalıkları, akson rejenerasyonu, koroner arter restenozu, ekstremitte kurtarma gibi kanser dışındaki durumlarda da kullanılabileceğini gösteren çalışmalar mevcuttur. Ne yazık ki, PAX tedavisi karaciğerde metabolize olduğu ve safra yoluyla atıldığı için böbrek ve karaciğer üzerinde ciddi yan etkilere neden olur. Bunun yanı sıra, önceki çalışmalar PAX toksisitesinin reaktif oksijen türlerini (ROS) arttırdığını bildirmiştir. Günümüzde kemoterapötik ilaçların neden olduğu yan etkileri azaltmak ve kanser önleyici etkilerini artırmak için doğal antioksidanlar kullanılmaktadır. Silymarin (SİL), birçok faydası ve tıbbi özelliği olduğu bildirilen doğal bir flavonoiddir. Bu çalışma, sıçanlarda PAX ile indüklenen karaciğer ve böbrek hasarlarına karşı SİL'nin terapötik etkisini araştırmayı amaçlamaktadır. Sıçanlara ard arda 5 gün boyunca intraperitoneal (i.p.) yolla 2 mg/kg PAX ve ardından ardışık 10 gün boyunca oral olarak 200 mg/kg SİL uygulandı. SİL tedavisi, serum alanin aminotransferaz (ALT), aspartat aminotransferaz (AST), üre, kreatinin ve C-reaktif protein (CRP) düzeylerini azaltarak PAX'ın neden olduğu karaciğer ve böbrek dokusu hasarını hafifletti. SİL ayrıca süperoksit dismutaz (SOD), katalaz (CAT) glutatyon peroksidaz (GPx) ve glutatyon (GSH) gibi antioksidan enzim aktivitelerini artırarak ve ACR ile indüklenen karaciğer ve böbrekte malondialdehit (MDA) seviyesini azaltarak



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oksidatif stresi azalttı. Ek olarak, SİL, PAX ile tedavi edilen sıçanların karaciğer ve böbrek dokularındaki nükleer faktör kappa B (NF- κ B), interlökin-6 (IL-6) ve sistein aspartat spesifik proteaz-3 (kaspaz-3) ekspresyon seviyelerini zayıflatırken, B hücreli lenfoma-2 (Bcl-2) ve aquaporin-2 (AQP2) seviyelerinde artışa neden oldu. Yapılan çalışmanın sonuçları, SİL'nin sıçanlarda PAX ile indüklenen karaciğer ve böbrek hasarını iyileştirebileceğini gösterdi.

Anahtar Kelimeler: Apoptoz, hepatotoksisite, nefrotoksisite, oksidatif stres, paklitaksel, silimarin



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**THERAPEUTIC EFFECTS OF SILYMARIN ON PACLITAXEL-INDUCED
HEPATOTOXICITY AND NEPHROTOXICITY IN RATS**

ABSTRACT

Paclitaxel (PAX) is a common chemotherapeutic agent used in treating various cancers. There are studies showing that low-dose PAX can also be used in cases other than cancer such as inflammation, renal and hepatic fibrosis, skin diseases, axon regeneration, coronary artery restenosis, and limb salvage. Unfortunately, PAX therapy causes serious side effects on the kidney and liver as it is metabolized in the liver and excreted through the bile. Besides, previous studies have reported that PAX toxicity increases reactive oxygen species (ROS). Today, natural antioxidants are used to reduce the side effects caused by chemotherapeutic drugs and to increase their anti-cancer effects. Silymarin (SIL) is a natural flavonoid that has been reported to have many benefits and medicinal properties. This study aims to investigate the therapeutic effect of SIL against PAX-induced liver and kidney damages in rats. The rats received intraperitoneal (i.p.) 2 mg/kg body weight PAX for 5 consecutive days and then, were administered orally 200 mg/kg body weight SIL for consecutive 10 days. SIL treatment attenuated the PAX-induced liver and kidney tissue injury by reducing serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), urea, creatinine and C-reactive protein (CRP) levels. SIL also decreased oxidative stress by increasing antioxidant enzyme activities, such as superoxide dismutase (SOD), catalase (CAT) glutathione peroxidase (GPx), and glutathione (GSH), and decreasing malondialdehyde (MDA) level in the ACR-induced liver and kidney tissues of rats. In addition, SIL attenuated nuclear factor kappa B (NF- κ B), interleukin-6 (IL-6), and cysteine aspartate specific protease-3 (caspase-3) expression levels, whereas caused an increase in B-cell lymphoma-2 (Bcl-2) and aquaporin-2 (AQP2) levels in the liver and kidney tissues of the rats treated with PAX. The results of this study indicated that SIL could ameliorate the PAX-induced liver and kidney damage in rats.

Keywords: Apoptosis, hepatotoxicity, nephrotoxicity, oxidative stress, paclitaxel, silymarin



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**DETECTION OF AGRICULTURAL LAND CHANGES THROUGH MACHINE
LEARNING AND HIGH RESOLUTION SATELLITE IMAGERIES**

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ABSTRACT

Land cover and land use (LCLU) change is a well-known global phenomenon, which mostly eventuates due to triggering effects of anthropogenic activities especially in still developing countries, as well as some natural causes. Arable (productive agricultural) lands are fragile against this continuous process since they are converting into urban related structures as a common result. Thus, determination of the changes has a key role in decision chains for conservation of agricultural ecosystems and sustainability of production. The study aimed to determine short term changes in agricultural lands against urbanization process around recently developing area of Canakkale province, Turkey, using one of the most widely used machine learning algorithm of random forest classification, and high resolution satellite imagery of Sentinel-2. Imageries were acquired in dry seasons of 2015 and 2021, which represent initial and current coverages of Sentinel-2, to eliminate the differences in production pattern and illumination conditions. Used imageries have 13 bands with different spatial resolutions (10 m, 20 m, and 60 m). Together with three visible bands with 10 m spatial resolution, four red-edge and three infrared spectral bands with 20 m spatial resolution were resampled into 10 m prior to the classification process, and a total of 10 bands were used. Training samples for supervised classification were collected from five main LCLU classes including agricultural land (A), forest (F), other vegetation (O), urban structure (U), and water surface (W). Accuracy assessments were conducted to determine the reliability of classifications, and accuracies of 150 stratified randomized points were controlled through Google Earth application. Findings of the study revealed that there were considerable amount of conversions from agricultural lands into urban related structures within a short-term period of seven years, and these changes could be accurately identified via random forest classification in the specified area of interest.

Keywords: Agricultural Land, Change Detection, Machine Learning, Satellite Imageries.



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**TARIMSAL ARAZİ DEĞİŞİMLERİNİN MAKİNE ÖĞRENMESİ VE YÜKSEK
ÇÖZÜNÜRLÜKLÜ UYDU GÖRÜNTÜLERİ İLE BELİRLENMESİ**

ÖZET

Arazi örtüsü ve arazi kullanım (AÖAK) değişimi iyi bilinen küresel bir olay olup, doğal sebeplerin yanı sıra, özellikle gelişmekte olan ülkelerde yoğunlukla insan kaynaklı aktivitelerin tetiklemesiyle gerçekleşmektedir. Genel bir sonuç olarak ekilebilir (üretken tarımsal) araziler, bu sürekli işleyen süreç karşısında kentsel yapılara dönüştükleri için kırılğan yapıdadırlar. Bu nedenle söz konusu değişimlerin belirlenmesi, tarımsal arazilerin korunması ve üretimin sürdürülebilirliği açısından karar zincirlerinde kilit role sahiptir. Çalışmada, Çanakkale ilinin yeni gelişen alanındaki kentleşme süreci karşısında tarımsal arazilerdeki değişimlerin, en çok kullanılan makine öğrenme algoritmalarından biri olan rassal orman sınıflaması ve yüksek çözünürlüklü Sentinel-2 görüntüleri kullanılarak belirlenmesi amaçlanmıştır. Görüntüler, Sentinel-2' nin ilk ve güncel tarihleri olan 2015 ve 2021 yıllarını kapsayan ve üretim deseni ile ışıklanmadaki farklılıkların elimine edilmesi için yaz sezonunda çekilen görüntülerdir. Kullanılan görüntüler farklı yersel çözünürlüklerde bantlar içerir (10 m, 20 m ve 60 m). Görünür bölgeden 10 m yersel çözünürlüğe sahip bantlarla birlikte 20 m yersel çözünürlüğe sahip dört kırmızı-köşe ve üç kızılötesi bant sınıflama öncesinde 10 m çözünürlüğe dönüştürülmüş ve toplam on bant kullanılmıştır. Kontrollü sınıflama için eğitim örnekleri beş ana AÖAK sınıfından toplanmış olup bunlar tarımsal arazi (T), orman (O), diğer vejetasyon (D), kentsel yapı (K) ve su yüzeyi (S) sınıflarıdır. Doğruluk analizleri sınıflamanın güvenilirliğinin test edilmesi amacıyla, sınıf büyüklüğüne göre rastgele dağıtılmış 150 noktanın doğruluğunun Google Earth uygulaması üzerinden kontrol edilmesi ile yapılmıştır. Çalışma bulguları, yedi yıllık kısa zaman aralığında tarımsal arazilerden kentsel yapılara önemli miktarda dönüşüm olduğunu ve çalışılan alandaki bu değişimlerin rassal orman sınıflaması ile yüksek doğrulukta belirlenebildiğini göstermiştir.

Anahtar Kelimeler: Tarımsal Arazi, Değişim Belirleme, Makine Öğrenmesi, Uydu görüntüleri.



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**MARJİNAL TOPRAKLARDA ENERJİ BİTKİSİ OLARAK YETİŞTİRİLEBİLECEK
ALTERNATİF BİTKİLER**

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ÖZET

Dünya nüfusunun hızla artması ile birlikte insanoğlunun gıdaya ve enerjiye olan ihtiyacı artmaktadır. Enerji arzının artmasına bağlı olarak enerji kaynaklarının kullanımında artış meydana getirmektedir. Bu artış çevreyi kirletmekle beraber fosil yakıt rezervlerinin sürekli olarak azalmasına da sebep olmaktadır. Fosil yakıt rezervlerinin azalması ve çevresel kirliliğin artması sonucunda günümüzde insanoğlu fosil yakıtlara alternatif olan yenilenebilir enerji kaynaklarına yönelmektedir. Yenilenebilir enerji kaynaklarından biri olan biyoyakıt (biyodizel, biyoetanol ve biyogaz) kaynaklarının en önemlisini enerji bitkileri oluşturmaktadır. Son zamanlarda enerji bitkilerinin yetiştiriciliği, ıslahı ve adaptasyonu konularında yapılan çalışmalar hem dünyada hem de Türkiye’de artmakta ve bu artışla birlikte gıda üretiminde kullanılamayan ama enerji bitkisi olarak yetiştirilebilecek bitkiler ile ilgili araştırmalarda artmaktadır. Bu araştırma, bilinen ve yetiştiriciliği yapılan enerji bitkilerine alternatif olarak marjinal topraklarda yetiştirilebilecek olan 5 farklı enerji bitkisi [Virjinya ebegümeci (*Sida hermaphrodita* Rusby), Yabani enginar (*Cynara cardunculus*), Sabır otu (*Agave* sp.), Sibirya karaağacı (*Siberian elm*), Uzun buğday çimi (*Tall wheatgrass*)] Türkiye’de alternatif enerji bitkileri olmaları konusunda birbirleriyle kıyaslanmış ve karakteristik özellikleri ortaya konularak değerlendirilmiştir.

Anahtar Kelimeler: Marjinal alan, Biyokütle, Alternatif bitki, Biyoyakıt



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**ALTERNATIVE PLANTS GROWN AS AN ENERGY PLANT IN MARGINAL
SOILS**

ABSTRACT

The need of human beings for food and energy with the rapid growth of the world population has been increasing. The increase in the supply of energy leads to an increase in the use of energy resources. This increase also causes fossil fuel reserves to decrease continuously as well as to pollute the environment. Because of decreasing fossil fuel reserves and the increasing in environmental pollution, humankind is now turning to renewable energy sources which are alternative to fossil fuels. The most important source of biofuels (biodiesel, bioethanol and biogas), one of the renewable energy sources, are energy plants. Recently, cultivation of energy crops, studies on breeding and adaptation issues has been increasing both in Turkey and other countries, and the studies on energy plants, cannot be used in food production but energy crops, has been increasing. In this review, we have identified five different energy plants [Virginia Hibiscus (*Sida hermaphrodita* Rusby), Wild artichoke (*Cynara cardunculus*), Patience herb (*Agave* sp.), *Siberian elm*, *Tall wheatgrass*] were compared with each other, set forth the characteristics features and evaluated about alternative energy plant in Turkey.

Keywords: Marginal area, Biomass, Alternative plant, Biofuel



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THE EFFECT OF COLORS IN BIOLOGICAL SYSTEMS

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ABSTRACT

Color is a physical phenomenon which is formed by the reflection of light waves on objects and which provides a stimulating effect in the brain after reaching the eye. The color varies depending on the pigments in composition of substances. Colors evoke emotional and aesthetic values through stimulating brain waves, nervous system functions and hormonal activities. Although everything animate and inanimate in nature has a color, living beings have a color language that works based on their light perception systems. In order to survive, every living being needs to be aware of the meanings of the colors in its environment. From past to present, people have been using colors for various purposes such as to beautify, to be admired, to impress and to express their feelings. Since colors emit energy, they have been increasingly used in medicine for therapeutic purposes to achieve physiological and psychological balance. In addition, colors have been a symbolic communication tool in different geographies and cultures since ancient times. Colors are an indispensable part of the life of all living beings, not just of people. Most animals need to use colors to find food. Colors found in animal parts such as skin and scales absorb heat, thereby helping them to survive. In addition, thanks to their colors that are compatible with the environment, animals can hide from their enemies or scare them. Colors also play a role in recognizing the mates or offspring. For example, mother birds understand the nutritional needs of their young thanks to the color of their beaks while chicks know the arrival of food by recognizing their mother in this way. Male peacocks use their bright and colorful feathers to impress their females. The reason why flowers that do not have a nervous system are colorful is to increase the probability of reproduction by attracting the insects, especially wild bees, and birds for pollination. Thus, it is impossible to imagine a life without color. These facts indicate that colors have the potential to make physical and chemical changes for living beings. In the present study, the effects of colors on various living beings are discussed.

Key words: Color, Light, Pigment, Biological system.



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RENKLERİN BİYOLOJİK SİSTEMLERDEKİ ETKİSİ

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ÖZET

Renk, ışık dalgalarının cisimlere çarpıp yansıması ile oluşan ve göze ulaştıktan sonra beyinde uyarıcı etki sağlayan fiziksel bir olay olup; maddelerin yapısında bulunan pigmentlere bağlı olarak çeşitlilik göstermektedir. Renkler; beyin dalgalarını, sinir sistemi fonksiyonlarını ve hormonal aktiviteleri harekete geçirerek; duygusal ve estetik değerleri uyandırmaktadır. Doğada canlı ve cansız her şeyin bir rengi olmakla beraber; canlılar ışığı algılama sistemlerine göre işleyen bir renk diline sahiptirler. Her canlının yaşamını sürdürebilmesi için yaşadığı ortamdaki renklerin anlamlarını bilmesi gerekir. Geçmişten günümüze insanlar renkleri; güzelleşmek, beğenilmek, etkilemek ve duygularını anlatmak gibi çok çeşitli amaçlarla kullanmaktadırlar. Renklerin yaydığı enerjiden faydalanılarak; fizyolojik ve psikolojik dengeyi sağlamak için tıpta tedavi amaçlı kullanımı da giderek artmaktadır. Ayrıca renkler çok eski çağlardan beri değişik coğrafya ve kültürlerde simgesel bir iletişim aracı da olmuştur. Renkler, sadece insanların değil; bütün canlıların yaşamının vazgeçilmez bir parçasıdır. Hayvanların çoğu besin bulabilmek için renklerin yardımına ihtiyaç duyarlar. Deri, pul veya kürk gibi oluşumlarında bulunan renkler; ısıyı soğurarak hayatta kalmalarını sağlar. Ayrıca ortamla uyumlu renkleri sayesinde düşmanlarından saklanabilir veya onları korkutabilirler. Renkler, canlıların eşlerini veya yavrularını tanımlarında da rol oynamaktadır. Örneğin anne kuşlar yavrularının besin ihtiyaçlarını, gagasının rengi sayesinde anlar; yavru da annesini bu şekilde tanıyarak besinin geldiğini bilir. Erkek tavus kuşları da parlak ve renkli tüylerini dişilerini etkilemek amaçlı kullanırlar. Sinir sistemi olmayan çiçeklerin, rengarenk olmalarının nedeni ise; öncelikle yabancılara ve kuşlar başta olmak üzere pek çok böceği cezbederek üreme ihtimallerini artırmaktır. Anlaşılabileceği üzere renksiz bir hayat düşünülmesi imkansızdır. Bu sonuçlar, renklerin canlılarda fiziksel ve kimyasal değişiklik yapabilecek potansiyele sahip olduklarına işaret etmektedir. Çalışmamızda renklerin çeşitli canlılar üzerindeki etkilerine değinilmiştir.

Anahtar Kelimeler: Renk, Işık, Pigment, Biyolojik sistem.



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**EPR SPECTROSCOPY OF HEXAGONAL BORON NITRIDE (h-BN)
NANOCRYSTALLINE PARTICLES IRRADIATED WITH VARIOUS NEUTRON
FLUXES.**

Nijat Abbasov

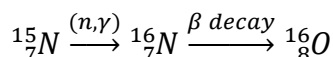
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ABSTRACT

Paramagnetic centers in the nanocrystalline boron nitride (h-BN) particles were comparatively studied before and after neutron irradiation. Electron Paramagnetic Resonance (EPR) spectroscopic analyzes were performed in the broad range of magnetic field from 0.05- 0.55 T (500 - 5500 Gauss). The range of 0.3270 - 0.3370 T was additionally swept, where more paramagnetic centers were observed. The nature of the new paramagnetic centers formed as a result of neutron transmutation in the BN nanoparticles were examined by EPR spectra. Formation mechanism of V_B and V_N vacancies has been studied in detail by neutron transmutations. Over the past few years, boron nitride and its various types of composites are widely investigated by world scientists. BN has a wide range of applications in the extreme conditions due to attractive physical and chemical resistivity. In general approach, boron nitride is a wide band semiconductor material. Simultaneously, extreme stability under the influence of temperature and pressure is the main characteristic properties of this material. Heretofore, the several polytypes of boron nitride are known. Hexagonal, rhombohedral, amorphous, cubic, etc. modifications of boron nitride compounds can be shown as example. Among these, the hexagonal structure (h-BN) is the more widely used and applied modification of boron nitride. Therefore, the h-BN polytype was chosen as a research object in this study. Usually, defects formed under the certain external influences (such as ionizing radiation) are repeatedly exceed other defects. In this case, the defects or paramagnetic centers formed by neutron irradiation are many times more than natural state and clearly visible. In the presented work, different paramagnetic centers and defects formed in the h-BN nanoparticles under the influence of neutron flux were studied by EPR spectroscopy method.

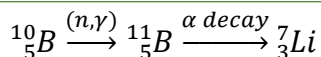
When irradiated with neutrons, the B and N atoms that make up nanocrystalline BN particles undergo isotope transformations. Naturally, each of the B and N atoms has two stable isotopes. Each of these stable isotopes can form a different isotope by capturing a neutron. However, here the effective cross-section and absorption capacity of N isotopes is many times less than that of B atoms (effective absorption cross-section for N isotopes is 1.8 barn). As a result, we assume that the changes in the N isotopes are so small that they do not affect the spectrum. Although inside the sample



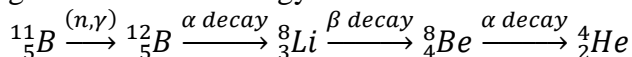
such transformations are also possible. However, the efficiency of this transformation is very low compared to B isotopes, which results in its neglect. The pipe naturally has two isotopes, and each has different effective cross-sections and adsorption capacity (naturally B10 19.9% and B11 80.1% isotopes). The interaction of each isotope with neutrons can lead to the formation of different isotopes. B 10 isotope has a very large effective cross-section of 3890barn compared to others, and is converted to B 11 isotope by capturing a neutron. In this case, under the influence of thermal neutrons.



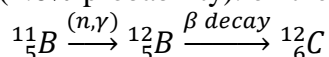
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transformation can occur as. On the other hand, the stable isotope B 11 has an effective absorption cross-section of relatively low, such as 760 barn, and the neutron is converted into the isotope B 12 by binding, which can be converted into two types of isotopes depending on the energy of the falling neutron. If the energy of the neutrons is sufficient,



such as nuclear conversion (1.6% probability). on the other hand



such as nuclear conversion (98.4% probability). Due to the large effective cross-section and the fact that the neutron adsorption capacity is many times higher, the B10 isotope will capture more neutrons. In this case, although the mass fraction of the B10 isotope in nanocrystalline BN particles is small, it can be said that the most probable process is the formation of Li7 isotopes with nuclear transformations according to expression (1). In this case, the new signals generated by radiation can be associated with Li7 isotopes. However, it should be noted that the concentration of the B11 isotope in nanocrystalline BN particles is quite high (80.1% in natural boron) and the probability of obtaining the C12 isotope by expression (3) is also high (98.4%).

Results. As a result of neutron radiation, two strong signals were observed in the EPR spectra of BN nanoparticles at the values corresponding to the free electron of the factor g. It has been found that the concentration of C12 isotopes increases as a result of nuclear transformations during neutron radiation.

C12 atoms interact strongly with N atoms to form nitrogen voids. The resulting nitrogen gaps form the basis of the triple boron centers and have been observed in the EPR spectrum as a strong signal corresponding to the free electron. Another signal was identified as a signal from a boron center with an increase in the concentration of the B11 isotope as a result of neutron capture. At the same time, during relatively high doses of 4E15 and 2E16 n / cm², VB gaps or defects occur as a result of nuclear transformations going in different directions during radiation with neutrons, which was observed with a symmetrical signal in the EPR spectrum.



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**INFORMATION NEEDS OF WILDLIFE HUNTERS IN KWARA STATE:
IMPLICATION FOR EXTENSION SERVICE DELIVERY IN NIGERIA**

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ABSTRACT

Access to accurate, timely and reliable information has crucial roles in production efficiency of wildlife hunters. An understanding of information needs could propel actors in the agricultural information business to provide information that will meet the needs. To this end, the present study investigated the information needs of wildlife hunters in Kwara State, Nigeria. A three-stage sampling technique was used to select 120 respondents for the study. Primary data collected with the use of interview schedule were analysed using descriptive and inferential statistical tools. The result revealed that hunters' group ($M = 2.48$) and consultation with older/experienced hunters ($M = 2.02$) were the prominent channels of information accessible to the hunters. Information on market situation ($M = 2.16$), games search techniques and ethics ($M = 2.07$) and hunting locations ($M = 1.98$) were the major areas of information needs of the hunters. Also, lack of awareness of extension information source ($M = 1.96$), inaccessibility of extension workers ($M = 1.86$) and trust of the information source ($M = 1.79$) were the major identified obstacles to accessing information from extension channels. The study further showed that age of the hunters, level of education and years of experience have a significant relationship with their information needs at $p < 0.05$. The study concluded that the hunters have ample information needs and recommends that an arm of extension service operation should be devoted to wildlife with the mandate of hunters' education on vital areas of wildlife management for improved livelihood.

Keywords: Extension Service Delivery, Information Needs, Wildlife Hunters



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**AN ATTEMPT TO A CLASSIFICATION OF PLANT COMMUNITIES WITH THE
PARTICIPATION OF *FRAXINUS ORNUS* L. IN BULGARIA**

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ABSTRACT

The purpose of this study is to make an inventory of the data from the studies on phytocenoses with diagnostic participation of *Fraxinus ornus* L. in Europe and Bulgaria and to present an up-to-date syntaxonomic classification of this type of communities for the territory of the country. As a result of the study of the communities with the participation of flowering ash, 19 associations of 4 classes, 5 orders and 7 unions were established, of which the greatest diversity of these communities is observed in the class *Quercetea pubescentis* and in the type Xerophytic and mesoxerophytic, microthermal and mesothermal vegetation in the xerothermic oak belt and in the hilly plains. Most of the communities form habitats of conservation importance, included in national and international legislative documents related to their protection. Over 50% of these habitats fall into the categories of "endangered" and "potentially endangered". The presented classification will help in the future studies on the communities involving flowering ash, forecasting their dynamics in natural plantations and artificial stands and applying effective silvicultural systems to restore indigenous vegetation types.

Key words: phytocenoses, derivative vegetation, shrubs, xerophytes, thermophilic oaks.



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**ТІСТІ ЖОҢЫШКАНЫҢ ФИТОХИМИЯЛЫҚ ЖӘНЕ БИОЛОГИЯЛЫҚ
ҚАСИЕТТЕРІН ЗЕРТТЕУ**

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Аннотация: Қазақстанда дәріханаларда сатылатын дәрі-дәрмектердің негізгі пайыздары шетелден қымбат бағамен келеді, сондықтан жаңа отандық препараттарды зерттеу және жасау сонымен қатар жергілікті жабайы шикізаттарды өзекті пайдалану қазіргі таңдағы мәселе болып табылады. Тісті жоңышқа муколитикалық, невралгия ауруын емдеу үшін халықтық дәрі-дәрмектер де қолданылады, кардиоспаз және ұйқының бұзылуы кезінде де көптеп қолданылады.

Сондықтан флавоноидтарға сапалық және сандық сынақтар жүргізіліп, биологиялық қасиеттері зерттелінді.

Зерттеу мақсаты: тісті жоңышқа, фитохимиялық зерттеу, оқшаулау және өсімдіктен ББЗ құрылысын анықтау, биологиялық алынған сығындылар мен компоненттердің қасиеттерін зерттеу.

Материалдар мен әдістер: Зерттеу объектісі-жер үсті тісті жоңышқа бөліктері, және келесі әдістер қолданылды: фитохимиялық зерттеу әдістері, физикалық, химиялық, физика-химиялық және спектрлік әдістер, биологиялық әдістер және нәтижелерді статистикалық өңдеу.

Алынған нәтижелер: тісті жоңышқа, *Melilotus dentatus*. Тісті жоңышқа тұзды және шалғынды жерлерде жаксы өседі. Тісті жоңышқа Ресейдің еуропалық бөлігінде, Украинада кең таралған, сонымен қатар Беларусь, Балтық жағалауында, Кавказ, Шығыс және Батыс Сібір, Қазақстан, Орта Азия елдерінде.

Біз түрлі әдістер және талдаулар жүргіздік, фитохимиялық зерттеулер және сандық көрсеткіштер анықталды: ылғалдылығы; жалпы күл; ерімейтін күл, сондай-ақ флавоноидтарға сапалы және сандық сынақтар жүргізілді, алкалоидтар, таниндер, эфир майлары, полисахаридтер және биологиялық қасиеттерін зерттеу үшін сығындылар бөлінді.

Кілтті сөздер: фитохимиялық зерттеу, тісті жоңышқа, биологиялық әдістер, статистикалық өңдеу.



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**ОҢТҮСТІК ҚАЗАҚСТАН ФЛОРАСЫНЫҢ КІРПІЛІ ШЫРМАУЫҚ ӨСІМДІГІН
ФИТОХИМИЯЛЫҚ ЖӘНЕ ФАРМАКОГНОСТИКАЛЫҚ ЗЕРТТЕУ**

**PHYTOCHEMICAL AND PHARMACOGNOSTIC STUDY OF THE LOACH OF
THE SNAKE PLANT OF THE FLORA OF SOUTH KAZAKHSTAN**

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Аннотация

Шөптен жасалған жаңа дәрі -дәрмектерді алу мәселесі қазіргі фармацияның өзекті мәселелердің бірі болып табылады. Бұл мәселені енгізілген жаңа дәрілік заттардың сапасын жақсарту арқылы шешуге болады. Дәрілік өсімдіктер - дәрілік шикізат пен маңызды дәрілік пепараттардың бағалы табиғи көзі болып табылады.

Дәрілік өсімдіктер ретінде қолданылатын өсімдіктердің саны өте көп. Бірақ олардың кейбір бөлігі ғана ең маңызды, жиі қолданылатыны ресми деп танылаған және қазіргі фармакопеге енгізілген.

Шырмауық –жараларды емдеуге арналған тамаша өсімдік. Өсімдік улы.

Халық медицинасында жаңадан жиналған өсімдікті қолдану тиімдірек деп есептеледі, себебі кептірілген шикізат құрамындағы әсер ететін белсенді заттардың көп бөлігін жоғалтады.

Зерттеу мақсаты. Кірпілі шырмауықтың морфологиялық және анатомиялық ерекшеліктерін зерттеу. Кірпілі шырмауық өсімдік шикізатының сапалық көрсеткіштерін анықтау. Биологиялық белсенді заттардың құрамына сапалық талдау жүргізу. Кірпілі шырмауық жапырағының спирттік сығындысының уыттылығын анықтау.

Материалдар мен әдістер. Кірпілі шырмауық шикізаты Оңтүстік Қазақстан облысының Түлкібас ауданының машат шатқалында өсімдіктің жаппай гүлдені



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кезеңінде жиналды. Талдау жүргізу үшін өсімдіктің ауада кептірілген ұсақталған бөліктері алынды.

Анатомиялық зерттеулер жалпы қабылданған әдістерге сәйкес жүргізілді. Талдау объектілері-өсімдіктің кептірілген жапырақтары. Жапырақтары алдын-ала 1 күн жылы суға қалдырылды, содан кейін жапырақтары матаның жұқа қабатына дейін мұқият тазартылды. Өсімдіктің микропрепараттары ылғалды түрде қарастырылды. Кесінділерді қарау және суретке түсіру "MEIJI TECHNO" микроскопының көмегімен (7x1, 5x4,5; 7x1, 5x20; 7x1, 5x40 үлкейту) орындалды. Суреттер "AdobePhotoshop 7,0"бағдарламасында компьютерде өңделді. Жапырақтарын араған кезде үстіңгі эпидермистің түтікшелі құрылымы бар жасушалары көрінеді. Мұртшалар эпидермистің екі жасушасымен қоршалған. Түктері ұзын бір клеткалы қарапайым. Жүргізілген эксперименттік зерттеулердің нәтижелері бойынша біз кірпілі шырмауық шикізатының сапасының келесі сандық көрсеткіштерін алдық: ылғалдылық – 0,1578%, жалпы күлі – 4,4613%, хлорсутек қышқылының 10% ерітіндісінде ерімейтін күлі-30,76%.

Бензолмен толтырылған құрғақ өсімдік шикізаты үш күнге қалдырылды, алынған сығындыны сүзіп, бензолмен бірнеше рет төмен қысымда роторлы буландырғышта айдадық. Біз нәтижесінде еріткішсіз таза 18,0г сығынды алдық. Құрғақ өсімдік шикізатынан алынған сығындының шығымы - 15% - ды құрады.

Кілтті сөздер: кірпілі шырмауық, дәрілік өсімдіктер, шикізат, жапырақ, сығынды.



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**THE MAIN MEANS OF MINIMISING MISFORTUNES OCCURRING SINCE THE
NATIONAL LIBERTY DECLARED IN 1991 BY OUR FIRST PRESIDENT ZVIAD
GAMSAKHURDIA - ACCORDING TO SOME PUBLICATIONS**

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ABSTRACT

Many authors criticize the national authorities of our republic and especially their foreign political advisors for most activities they performed causing the decline of the level of life of the population at large compared to the level observed before the declaration of liberty from the USSR in April 1991. In my opinion, the first and the foremost great mistake was the maintenance of the principal mistake of the founders of our republic in 1918 headed by Mr. Noe Jordania - that did not foresee necessity of choosing the oldest name Aia Kolkheti for our republic to be used in all languages. He loved to call it La Georgie in French and Georgia in English ignoring the fact that those names were attributed to our area several thousand years later than the words Aia and Kolkheti. The reason seems to be simple: the founders of our republic in 1918 lacked proper education and they had unrealistically exaggerated impression on their personal possibilities. Our Country is unfortunately still officially called various names in various languages. In our native language it still is Sakartvelo as in Noe Jordania's times, in English it still is Georgia, in Russian it is Gruzia. According to many persons this was and is the abnormal situation causing many misunderstandings, inaccuracies and mistakes. Even the General Secretary of the United Nations Organization reprimanded our government's delegation on this strange situation, but even the reprimand of the General Secretary of the United Nations Organization did not change our government's official stance of having several official names for our Republic in various modern languages. Having this strange situation in mind, many professors living in the modern capital of our country – Tbilisi - signed the Petition to the government of our country that in order to avoid those drawbacks they considered that the name *Sakartvelo* would be the best word to be officially chosen as the name of our Country in all languages. Years have passed, our heads of government have been changed by elections since the publication of that petition, but nothing has been changed yet: our government has not officially adopted the word *Sakartvelo* as the only word to be officially used as the name for our republic in all modern languages.. Nevertheless the change is necessary. In my opinion, the word proposed in that petition has a drawback: the word *Sakartvelo* is not the popular name in scholarly literature. I propose a combination of other two names: Aia and Kolkheti as Aiakolkheti to be officially used as the name of our republic, of our nation//ethnicity and of our language. Both words Aia and Kolkheti are dear to the international scholarly world and the schoolchildren even in the USA are taught bits of early world history, geography and literature about Aia Kolkheti as the area of the famous Golden Fleece connected to the story of our pharmacist Medea – the daughter of our king of Aia Kolkheti that ruled our nation so well that he is still universally loved among our nation and praised internationally during more than 3000 years to these days. Medea as the good ruler of the kingdom Ariana renamed into the kingdom of Medea – Media during and/or after her good rule there in lands situated around the Caspian Lake/Caspian "Sea" was praised in World History written by Herodotus that was from the city called Halicarnassus and visited that area called Media in 430 BCE.



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HUMAN CAPITAL MANAGEMENT, IT'S PERSPECTIVE AND PROSPECTS

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ABSTRACT

Employees are the real asset of an organization. An organization cannot survive without employees. The organization works with the help of people who, in their own way, contribute to its success and productivity. Employees spend most of the day in offices struggling. It is difficult to achieve the goals and objectives of the organization.

Keywords: Human Capital, Resources, Organization



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**MANAGEMENT OF BARRED SPINY EEL *MACROGNATHUS PANCALUS*
(HAMILTON, 1822) IN THE GAJNER BEEL, WETLAND ECOSYSTEM USING
LENGTH-BASED INDICATORS AND FISHERIES REFERENCES POINT**

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ABSTRACT

For the first time, we revealed the management approach of *Macrognathus pancalus* (Hamilton, 1822) using length-based indicators and fisheries references point emphasizing on growth pattern, form factor (a_{30}), growth co-efficient (k), asymptotic length (L_{∞}), age at zero length (t_0), growth performance index (ϕ), life-span (t_{max}), size at first sexual maturity (L_m), age at sexual maturity (t_m), spawning season, peak spawning season, length at first recruitment, optimum catchable length (L_{opt}), fishing mortality (F); natural mortality (M), total mortality (Z), exploitation rate (E), maximum sustainable yield (MSY) in the Gajner Beel of northwestern Bangladesh. A total of 1218 individuals of *M. pancalus* were sampled during January to December 2018 using cast net and square lift net. Total length (TL) and body weight (BW) were measured by digital slide calipers and digital balance, respectively. To calculate the L_m , empirical maximum length based model were considered and L_{opt} was calculated based on L_{∞} . The overall b value of LWR (TL vs. BW) indicated positive allometric growth ($b > 3.0$) in both males and females. The calculated a_{30} was 0.0051 and 0.0056 for male and female, respectively. The L_m was 9.74 cm for male and 11.16 cm for female in TL. The calculated L_m , t_{max} , t_m , ϕ , L_{∞} , W_{∞} , and L_{opt} were 9.74 and 11.16 cm, 4.84 and 4.76 years, 0.83 and 0.84 year, 2.26 and 2.60, 17.15 and 19.86cm, 23.20 and 41.40g & 9.65 and 11.14cm for male and female of *M. pancalus*. Based on gonadosomatic index (GSI), L_m was 11.20 cm in TL when GSI was 6.5% for female. The spawning season was May to August, where the peak spawning season was June-July. The length at first recruitment for overall sexes was 7.00 cm in TL. The calculated M , F , and Z were 0.95 and 0.97 year⁻¹, 1.29 and 1.51 year⁻¹, & 2.24 and 2.48 year⁻¹ for males and females populations of *M. pancalus*. The E was 58% and 61% while the maximum sustainable yield was 46% and 49%, indicating 12% fishing pressure should be reduced for males and females. Over exploitation is one of the key factors for declining of this species in the Gajner Beel. Therefore, these results of this study would be very effective for developing of sustainable management policies and protection of *M. pancalus* in the Gajner Beel and adjoining ecosystems.



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**PROSTITUTION HANDLING STRATEGIES IN HIV/AIDS PREVENTION BASED
ON LOCAL WISDOM: BANYUWANGI REGENT REGULATION NO. 45 YEAR
2015**

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ABSTRACT

Background: The influence of modernization which gives negative effects of globalization which leads to one of the increasing prostitution. Banyuwangi regency one of the areas affected by the negative effects of globalization is the increase of prostitution that has been utilized into business opportunities. Business prostitution perpetrators not only women but has penetrated to men, this resulted in the opening of the entrance of HIV / AIDS in Banyuwangi Regency. The Regency Government has attempted to anticipate the rise of HIV / AIDS incidents which is the effect of the proliferation by issuing Banyuwangi Regent Regulation no. 45 years 2015 on prevention and control of HIV / AIDS. With the enactment of the local regulation is expected as a legal paying in the implementation of HIV / AIDS prevention in Banyuwangi Regency so that it can reduce and reduce the incidence of HIV / AIDS in Banyuwangi Regency.

Objectives: To illustrate the strategy for achieving policy implementation in the handling of prostitution in HIV / AIDS prevention efforts in Banyuwangi Regency based on Banyuwangi Regent Regulation No.45 year 2015.

Methods: The research is a qualitative research using descriptive approach based on Health Policy perspective.

Results: Prostitution handling strategy in HIV / AIDS prevention efforts based on Banyuwangi Regent Regulation no. 45 of 2015 implemented through: Local regulations governing HIV / AIDS prevention policies, policy strategies for the handling of prostitution in HIV / AIDS prevention efforts, the handling of prostitution and the handling of discrimination against people living with HIV / AIDS.

Keywords: Strategy of Prostitution handling , HIV / AIDS prevention, Banyuwangi Regent's Regulation, Banyuwangi Regency.



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**EVALUATION OF HEAVY METALS LEVELS IN WATER, SLUDGE, AND SOIL
SAMPLES FROM KOSOVO'S DRINI BARDH RIVER**

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ABSTRACT

The goal of this study is to evaluate the amounts of heavy metals in the water, sediment, and soil of aquatic sources in the Drini i Bardh river. According to the study's findings, the examined area is directly impacted by the geological composition of the rocks (clastic, alluvium, proluvium, glaciogene and lake sediments). The findings indicated that there were significant changes in the concentrations of heavy metals at various sediment, soil and water sample locations. The safety of drinking water is compromised by a variety of pollutants, both chemical and microbial. Sampling and measurements took place in September 2018. We measured physical and chemical elements like as temperature, pH, EC, TDS, and main ions (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+ , NO_2^- , Cl^- , NO_3^-) to obtain accurate and representative data. The amounts of ten elements in water, sludge and soil samples were determined using inductively coupled plasma optical emission spectroscopy (ICP-AES)-(As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn). The study indicates that we are dealing with mild contamination from these elements in the river, but in order to reach a clear conclusion, it is prudent to do additional research in the study_area.

Keywords: water, pollution, sludge, soil, ICP-AES technique



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**FATTY ACID COMPOSITION , QUANTIFICATION OF TOTAL TOCOPHEROLS
AND ANTIOXIDANT ACTIVITY OF LIPID EXTRATS FROM ALGERIAN *FICUS
CARICA* FRUIT**

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ABSTRACT

Ficus carica L. (family: Moraceae) is one of the oldest knowing trees in the world. It is native to Africa, Asia and Europe and today it is almost spreading in all continents (Al-Snafi, 2017). Different parts of the tree were traditionally used in dietary or as treatment for illness (Oliveira et al., 2009). The aim of this study was to determine the fatty acids (FA) of different lipids classes, tocopherols content and to evaluate the antioxidant activity of three fig oil cultivated in Algeria. The *ficus carica* oils were olive-green in colour, liquid at room temperature, the oil content of the three samples were ranged from 2.13 to 7.25%. From our results, we observe that neutral lipids occupy a very important proportion in the crude extract compared to glycolipids and phospholipids. The major unsaturated fatty acids for different classes lipid were linoleic acid followed by oleic acid, while the main saturated fatty acids were palmitic. Unsaturated FA showed a preference for the internal position. Linoleic and oleic acids occurred predominantly in the sn-2 position as generally found in vegetable oils. The tocopherol content of the oils ranged from 583.69 to 1085.48mg/10g of Total lipids and from 173.47to 324 mg/10g for Neutral lipids. The data of antioxidant capacities determined by using 1,1-diphenyl-2-picrylhydrazyl (DPPH), show that the level of the antioxidant activity was significantly compared to synthetic antioxidants. Also, it was demonstrated for the first time that the studied oils possessed a good antioxidant activity which may be associated with their alleged health benefits.

Keywords- *Ficus carica* oil, Fruits, fatty acids (FA), tocopherols, antioxidant activity



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**CLIMATE CHANGE AND INDIAN LEGAL FRAMEWORK:
AN ANALYTICAL VIEW**

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ABSTRACT

Anthropogenic activities lead to an increase in the green house gas emission in to the environment, which in effect causes global warming, consequently resulting in complete change in climate pattern. India stands fifth in the emission of green house gases in the world. After a prolonged discussion for a century, majority of scientific organizations, International bodies such as IPCC agreed the fact that, global warming is a serious issue and anthropogenic emissions of greenhouse gases is the one of the major source behind this. IPCC has concluded that there is a likelihood that failure to achieve the proposed two degree Celsius limit will result in a climate “tipping point”, unleashing irreversible non-linear, exponential, long-term impacts and adverse effects. The international community has created several international instruments including the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 for dealing with the issue of global warming and climate change. Though India is a part of two most important instruments such as the Kyoto protocol and UNFCCC, India does not owe any legal obligation to reduce Green House Gas emission. However, the Government of India has adopted several voluntary measures to minimize the emission of Green house gases. India has planned to depend on renewable energy sources, adopted new green technologies and established new ministries and administrative agencies. India adopted a “National Action Plan on Climate Change” (NAPCC) in 2008 outlining existing and future policies and programmes directed at climate change mitigation, adaptation and knowledge management. From pre-independent period onwards India started fight against global warming, to cope up with the move India has started legislation in issues related with global warming. To further strengthen the commitment towards protection of environment, immediately after the participation of Stockholm Conference in 1962, India has amended its Constitution, through 42nd Amendment Act and thereby introduced two specific provisions such as Article 48 A and 51 A (g). Thus the protection of environment and natural resources becomes one of the constitutional obligation of the Country and duty of every citizens in the country. Subsequently in order to fulfill this Constitutional obligation the Indian Government has enacted several legislations like Water



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Act, Air Act, Environment Protection Act and Biodiversity Act, etc. So also the Indian judiciary through its activist role have given several landmark decisions for the purpose of controlling the environmental pollution and for the protection and conservation of environment. All these legislations and judicial pronouncements are one way or other dealing with the issue of climate change by protecting and conserving the environment as well as by preventing the pollution. This paper seeks to examine the scope of these legislations and judicial decisions in the protection and preservation of natural environment thereby preventing climate change and reducing its adverse effects.

Key words: Indian Constitution, Articles, Amendment, Climate Change, global warming, emission.



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**EFFICIENT UTILIZATION OF ECO-FRIENDLY BIOCHAR-DERIVED
MATERIALS**

**FOR SUSTAINABLE ENVIRONMENTAL REMEDIATION
OGUNLESI OLUWAGBENGA OLAOLUWA**

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ABSTRACT

Biochar is a renewable value-added material that can be synthesized from agro-waste derived materials or waste materials. Recently attention has been channeled to utilization of Biochar-based materials (BBM) as a result of countless environmental benefits obtainable through them as sustainable and renewable biomaterials that adequately position them for green application in accordance with principle of Green Chemistry #7. They are porous in nature and suitable to be employed as environmental benign adsorbent/heterogenous catalytic materials for environmental remediation and potentials green credentials that make them preferred candidate over carbon adsorbent synthesized petroleum-derived sources. The origin of renewable resources has been investigated by numerous researchers and found to be remarkable as a perfect replacement for conventional nonrenewable materials. Moreover, the rapid increase in the world population has been the primary reason for promoting novel green-driven technology and processes, whose products can subsequently mitigate environmental pollution and its detrimental effect on our climate. Therefore, this work presents efficient strategies for remediation of heavy metals and pharmaceutical contaminants in order to prevent further environmental degradation that tend to pose a great threat to human health and ecosystem. Owing to the positive impact of biochar derived materials on environment we present their catalytic applications toward removal of emerging contaminants to adequately achieve SDG #6 (clean water and sanitation for all).

Keywords: Biomass; Biochar; Catalysis; Remediation; Pollutants; Sustainability.



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**BIOCHEMICAL AND TECHNOLOGICAL CHARACTERISTICS OF LACTIC ACID
BACTERIA GENUS *LACTOCOCCUS LACTIS* ISOLATED FROM RAW COW'S
MILK**

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ABSTRACT

The cheese industry often uses lactic acid bacteria, mostly made up of *lactococci*. The roles of this flora are, first of all, milk acidification following the hydrolysis of lactose. This flora also contributes to the development of flavor and helps limit the development of unwanted germs. In this work, we isolated, purified and selected 27 strains of *lactococcus* from a collection of 108 strains isolated from the raw milk of local brown cows from the Atlas and Tidili zones of Tafoughalt in the eastern region of Morocco. The objective of this work is to determine the technological characteristics of the 27 *lactococcus* strains, and particularly the proteolytic, lipolytic, thickening, flavoring, texturizing, coagulating and acidifying properties, in order to select more efficient lactic ferments in the manufacture of cheese by performing the Pearce test. The acidification power results showed that *Lactococcus lactis subs lactis* strains have a high acidification rate which varies between 60 ° D to 88 ° D, followed by *Lc. lactis ssp. cremoris* (from 55 ° D to 76 ° D) and *Lc. lactis ssp. lactis biovar. diacetylactis* (from 37 ° D to 43 ° D) during 24h at 35 ° C. The results showed that *Lc. lactis ssp. lactis biovar. diacetylactis* have a good flavoring power and all the subspecies of *lactococcus lactis* have good proteolytic and non-lipolytic activities. The Pearce test result showed that these strains have good functional properties (texturizing, flavoring, coagulating and thickening) which could be used in the dairy industry.

Keywords: Technological characteristics; Lactic acid bacteria; *lactococcus lactis*.



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**TRADITIONAL AGROFORESTRY SYSTEM OF GRAHWAL HIMALAYA AND
THEIR MANAGEMENT THROUGH THE STUDY OF INTERCROPPING**

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ABSTRACTS

Himalaya is a vast mountain covering partly / fully eight developing countries of south Asia including India, Afghanistan, Bangladesh, Bhutan, China, Myanmar, Nepal and Pakistan. In India, agroforestry land use covering 20.0 % of the total geographical area and distributed in patches of the Indian Himalaya. In the Uttarakhand agroforestry systems can be classified in different systems as agrisilvi, agrihorti, agrihortisilvi and silvipature. In these traditional agroforestry systems of Garhwal Himalaya different tree species have been grown or cultivated along the bund of agriculture field for the different purpose viz. Fuel, fodder, fibre, fruits fertilizers, timber, small timber, agricultural implements, medicinal uses. Along these trees, different fruits trees also grown and cultivated in home Gardens and agrihorti systems such as Apple, Citrus, Mango, Peach, Plum, Apricot, Banana, Guava, Papaya and Grapes. With the under stories of these trees different agriculture crops like small millets, rice, wheat, burly, pulse and oil crops, different vegetable crops and species has been cultivated successfully. But the increasing demand of food, fuel, fodder, medical plants, etc. the scientific input in cultivation of trees with agriculture crops in hilly region of Uttarakhand is negligible. The higher plants release some allelochemicals which inhibited or stimulate the germination, growth and over all yield of the agriculture crops. Trees with crops interaction study should be need for the increasing overall germination, growth and yield of the field crops. Subsequently farmers can grow tree and crops in intercropping in small land holdings in Garhwal Himalaya.

Keys words: Agriculture crops, Agroforestry, Allelopathy, Fruits trees, Garhwal Himalaya



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MOST IMPORTANT PARASITIC INSECTS OF BEES IN SERBIA

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ABSTRACT

In Serbia, the most widespread parasitic insect is the wasp *Vespula spp.* Wasps are usually present in beehives from August until autumn, when entering the hives and taking honey from bees can cause significant damage, especially to weak societies. In addition to stealing honey from the hive, wasps kill bees that feed to feed the young. From hornets, the most common is the European hornet (*Vespa crabro*). Hornets catch bees in flight and take them to their nests, and they often penetrate hives where they are filled with honey and bees. They pose the greatest threat to bees in August and September. Senotenirosis is a miasm that occurs in worker bees during the summer. Before they transform into a puppet, the larvae can turn into another dead bee and eat its tissues. The mature larva leaves the beetles, crawls on the surface of the soil, and then crawls into the ground, where after 7 to 14 days it transforms into an adult fly. During 2021 for the first time we observed *Meloidae sp.* (Insecta, Coleoptera), also known as blister beetles. Meloidae adults are phytophagous and often destructive pests of a wide variety of ornamental flowers and agricultural crops. The triangular stages of the larvae of these insects are extremely aggressive. In bee communities, these larvae first devour pollen and then move on to eggs and bee larvae. Monitoring for the presence of harmful insects and its control should become an indispensable part of preventive apitechnical measures.

Keywords: parasitic insects, honey bee, monitoring



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**TYPOLGY AND CHARACTERIZATION OF ISOLATED COLONIES OF HONEY
BEES (*APIS MELLIFERA INTERMISSA*), IN NORTH OF ALGERIA BY
MORPHOMETRIC, GEOMETRIC, AND PHYLOGENETIC APPROACHES**

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ABSTRACT

Eusocial hymenoptera insects, are a fundamental world resource. Their characterization is a salient step for better management and sustainability of beekeeping production systems hence, the present study , consists of determining the possible races and ecotypes of honeybees in north of Algeria through different approaches. To this end, in a representative way, initially, a typological characterization, a questionnaire is carried out among beekeepers, the survey concerns a number of parameters including the situation and the management of bee colonies. To continue, two morphometric methods (classical morphometry and geometric morphometry) are performed on a set of 445 worker bees sampled at 30hives in different locations. The first one, namely classical morphometry, for this purpose 15 morphometric parameters were measured to laboratory tools. At the same time, we carried out a geo-morphometric characterization using wing geometry, which highlights the geotechnical production potential of bee populations. The statistical analyses obtained revealed a biogeographic variation within the honey bee colonies targeted at the northern Algerian level. All the results obtained from statistical analysis made it possible to discriminate then among local populations and reveal a significant variation which may reflect a salient genetic diversity in groups. In parallel, we proceeds to the application of phylogenetic approach, comparing mtDNA sequences of 17 subspecies in order to build a phylogenetic tree which is at the origin of two clades comprising and seven groups. In short, this study targets the characterization action of the local race on a genetic standpoint so it can serve as harbingers in adopting the appropriate strategies for the conservation of Algeria's local race besides its diversity management.

Key words: *Apis mellifera intermissa*, morphometric characterization, geometry, statistical analysis, Bio-informatics, phylogeny, conservation, diversity



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**THE INFLUENCE OF THE SURFACTANT NATURE AND TYPE ON
PHYSICOCHEMICAL PROPERTIES AND STABILITY OF THE
NANOEMULSIONS PREPARED FROM PEPPERMINT ESSENTIAL OIL
STABILIZED WITH BASIL SEED MUCILAGE**

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ABSTRACT

The influence of three non-ionic emulsifying agents, including Tween 80, Tween 40, and Tween 20, in the formulation with a mass ratio of emulsifier to the essential oil of 3:1 was investigated on the formation and some properties of nanoemulsions prepared from peppermint essential oil. The nanoemulsions were prepared using the ultrasonic emulsification method, and the average particle size (Z-average), particle size dispersion index (PDI), zeta potential, viscosity, turbidity, pH, and physical stability of nanoemulsions were daily monitored at 4 °C for 35 days. The results showed that the nature and type of emulsifying agent had a significant effect ($P < 0.05$) on the properties mentioned above. As-prepared samples with Tween 20 exhibited the lowest value (Z-average). It demonstrated that these emulsifiers could be used in the structure and formation of stable nanoemulsions. The effect of storage time on the parameters of particle size (Z-average), particle size dispersion index (DPI), zeta potential, turbidity, and viscosity were statistically significant ($P < 0.05$).

Keywords: Nanoemulsion, non-ionic emulsifying agent, Physical properties, Peppermint essential oil, Basil seed mucilage.



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BIOTECHNOLOGY INDUSTRY IN INDIA

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ABSTRACT

India's biotechnology industry has been developing towards new statures related to the recent economic outburst. The nation can possibly reform bio drug and medical services areas. The Indian Biotechnology Industry is one of the fastest growing industries in India. Data has to be collected from multiple sources of evidence to understand the importance and overview of the biotechnology industry, in addition to books, journals, various websites, and newspapers. This article presents a brief overview of the current biotechnology industry in India, Global Biotechnology Market Size, and Regional Segment Analysis of the Biotechnology Market, Current Scenario in Biotechnology industry in India and marketing challenges.

Keywords: Biotechnology, BIRAC, Bio-Agri, Bio-industrial, Bioinformatics, Bio-pharma, Bio-services.



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**COMPARATIVE DATA ON THE PALYNOMORPHOLOGICAL FEATURES OF
POLLEN GRAINS OF TWO ALBANIA'S PLANTS OF *AUSTROADRIATICA* SPECIE
OF *CAMPANULA* GENUS**

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ABSTRACT

The two plants of the same specie of *Campanulaceae* family, collected in fresh conditions in different areas of Albania, such as in Shirokë and Shkalla e Tujanit, were analyzed based on comparative methodology for their palynomorphological features. Pollen grains of the two studied plants of *austroadriatica* specie resulted to be triporate with circular porus, isopolar, radiosymmetric with spheroidal shape in polar view and wide oval shape in equatorial one. The exine sculpture of pollen grains appeared echinate in both plants, but it was accompanied by microechini in pollen grains of *Campanula austroadriatica* collected in Shkalla e Tujanit and it was not accompanied by other elements in pollen grains of *Campanula austroadriatica* collected in Shirokë. The largest dimensions were identified to *Campanula austroadriatica* collected in Shkalla e Tujanit for length of polar and equatorial axis and width of porus, whereas the largest dimensions for length of porus and exine thickness were identified to *Campanula austroadriatica* collected in Shirokë. The smallest dimensions were found in *Campanula austroadriatica* collected in Shirokë for all palynological features except the exine thickness, which was equal to both plants.

Key words: Pollen grains, palynological features, exine.



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THE GENETIC DIVERSITY OF MITOCHONDRIAL 16s-rRNA GENE IN BLACK SPOTTED ROCK (*Staurois guttatus*) AND SABAH SPLASH (*Staurois latopalpmatus*) FROGS AT BORNEO ISLAND: A META-ANALYSIS STUDY

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ABSTRACT

Black-Spotted Rock / BSR (*Staurois guttatus*) and Sabah Splash / SS (*Staurois latopalpmatus*) frogs are two of *Ranidae* frogs species that can be found in Borneo (Kalimantan) Island. According to the IUCN (Red List) status, the BSR and SS frogs is under Least Concern (LC). This study aimed to observe the haplotype diversity in the BSR and SS frogs based on mitochondrial 16s-rRNA gene through a meta-analysis study. The primary data of 67 sequences of 16s-rRNA gene belonging to 29 sequences of BSR frog (519 bp) and 38 sequences of SS frog (527 bp) were collected from GeneBank for the data analysis. Thus, the sequence references used in this study originated from Kalimantan-Indonesia, Sabah-Malaysia and Sarawak-Malaysia. The bioinformatic analysis was performed in this study using three molecular package of BioEdit, ARLEQUINE, MEGA-X and DNAsp. Research revealed that the observed BSR and SS frogs has four (4) and six (6) haplotypes, respectively. The haplotype diversity (H_d) in BSR population was 0.36 and lower than SS population (0.76). The Fu's F_s statistic in both species were positive. In addition, about 53.17% of 16s-rRNA diversity in SS frogs was influenced by geographical factor based on AMOVA. In conclusion, mostly the BSR frogs at Borneo island were classified into Hap.1 (79%). Meanwhile, mostly the SS frogs at Borneo island consisted of three (3) maternal lineage of 29% Hap.1 (Kalimantan), 21% Hap.2 (Sabah) and 34% Hap.5 (Sarawak).

Keywords: *Staurois* frog, Borneo island, 16s-rRNA region, Haplotype, GenBank



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**GENETIC CHARACTERIZATION OF LOCAL BEE POPULATIONS *APIS
MELLIFERA INTERMISSA* IN NORTH-WEST ALGERIA**

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Summary

The disappearance of the bee would cause serious problems for nature and therefore for the human species. Therefore, the characterization of bees constitutes an important step for better management and for the sustainability of beekeeping production systems. However, in Algeria, raised honeybees are still poorly understood to this day. The objective of this study is therefore to identify, by classical morphometry and wing geometry, the possible races and ecotypes of honeybees (*Apis mellifera intermissa* and *Apis mellifera sahariensis*) in northwestern Algeria. A morphometric and geometric study was carried out on bees sampled in 7 cities in North-West Algeria. At each station, between 10 and 15 bees were randomly sampled, representing 530 bees. For each bee, 17 morphological characters and positioning of 20 reference points were measured using a magnifying glass, according to the protocol proposed by RUTTNER. F (1988), in order to highlight the differences and the commonalities between these bees, by the results obtained from statistical analyzes such as principal component analysis (PCA) of the values of the measurements of morphometric characters. This study having in general revealed a significant variation in the morphometric characters of the bee of *Apis mellifera intermissa* in the North-West of Algeria especially for individuals from the Chlef region, and gave us additional information about the biological diversity of our local race of bees it is therefore important to adopt appropriate strategies for the conservation of their diversity.

Key words: *Apis mellifera intermissa*, morphometric characterization, wing geometry, statistical analysis, conservation, diversity.



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**EFFECT OF BIOSTIMULATORS AND LIVING MULCH
ON THE HEALTHINESS OF CARROT (*DAUCUS CAROTA* L.)**

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ABSTRACT

The principles of good agricultural and horticultural practice, which considers both environmental protection and high yielding of plants, require modern methods of cultivation. The modern cultivation of horticultural plants uses, for example, cover crops, living mulches and biostimulators protecting the soil from degradation and the plants from plant pathogens and stress. The aim of the studies was to establish the effect of selected biostimulators (Asahi SL, Beta-Chikol, Timorex Gold 24EC) and living mulches from oats (*Avena sativa* L.) and buckwheat (*Fagopyrum esculentum* Mill.) on the healthiness of carrot (*Daucus carota* L.). A field experiment was conducted on Haplic Luvisol formed from silty medium loams. The experimental plant was carrot cv. Flakkese 2, grown on flat soil. In the experiment the following factors were investigated: two types of living mulch (oats, buckwheat), three biostimulators: Asahi SL (nitrophenols) - 0.1%, Beta-Chikol (a.s. chitosan) - 2.5%, Timorex Gold 24EC (the tea tree extract – *Melaleuca alternifolia* (Maiden & Betche) Cheel) - 0.5% and Zaprawa Nasienna T 75 DS/WS (a.s. tiuram) - 0,5g·100g⁻¹ of seeds. The seeds of oats and buckwheat were sown between the rows, after five weeks since seeding the carrot. In the objects with biostimulators made three spraying were performed, every ten days. The seeds that were not dressed and not sprayed constituted the control. The number and healthiness of carrot seedlings and roots after harvest were determined. Plants with the symptoms of necrosis on the roots were taken for a laboratory mycological analysis. This analysis made it possible to determine the quantitative and qualitative composition of fungi infecting the underground organs of carrot. Oats, buckwheat and biostimulators had a positive effect on the healthiness of carrot seedlings and roots. The smallest number of infected seedlings was observed in experimental treatment with oats, Asahi SL and Beta-Chokol. The highest proportion of infected seedlings of carrot was found out in the control. *Alternaria dauci*, *Alternaria radicina*, *Fusarium culmorum*, *Fusarium oxysporum*, *Phytophthora* sp., *Rhizoctonia solani* and *Sclerotinia sclerotiorum* proved to be the most harmful towards the studied underground parts of carrot. Oats and Asahi SL proved to be the most effective in inhibiting the occurrence of the pathogenic fungi for *Daucus carota*.

Keywords: *Daucus carota* L., Biocontrol, Healthiness, Biostimulators, Living Mulch

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**RESEARCH ON THE FINANCIAL EFFICIENCY OF THE CULTIVATED MAIZE
ON PADDY RICE LAND FARMING MODEL IN SOC TRANG PROVINCE,
VIETNAM**

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ABSTRACT

The research was conducted to analyze the current farming situation and financial efficiency of growing maize on paddy rice land farming model in Vietnamese Mekong delta under the case study in Chau Thanh district, Soc Trang province. Data of the study were collected from 45 households growing maize on rice land by convenient sampling method. The methods were used, including descriptive statistics, cost-benefit, and correlation regression analysis. Research results showed that the model farming of cultivated maize on rice land brought high production efficiency. The average corn yield per hectare/crop was an average of 21,273 corn fruits/ha. The total cost of corn cultivation per hectare/crop was an average of 24,749,000 VND/ha. The profit without family labor was an average of 36,370,000 VND/ha/growing season. The profit included family labor households ranging from -3,470,000 to 83,027,000 VND/ha/growing season. The corn productivity model depended on many factors in which hired labor and agrochemicals dose were positively correlated. The profit model depended on seed, hired labor, agrochemicals dose, and family labor costs. Besides these advantages, corn production in the district also faces many difficulties, including the price of inputs and output, the consumption of the market, and low technology production of the household scale.

Keywords: Cultivated maize on rice land, financial efficiency, Soc Trang province



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**METAL TOXICITY AND HEALTH PROBLEMS LINKED TO THE
CONSUMPTION OF ARK SHELLS (*ARCA NOAE* L.) FROM A TUNISIAN
COASTAL LAGOON**

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ABSTRACT

Trace elements (TEs) in coastal systems are a major problem as these elements contribute to the regular degradation of the environment because of their continuous inputs, persistence, toxicity and ability to concentrate in organisms through food webs. The levels of cadmium (Cd), Nickel (Ni), chromium (Cr) and lead (Pb) in the edible tissue of the edible bivalve *Arca noae* (L. 1758), sampled monthly from the Tunisian coastal lagoon (Bizerte lagoon) during 2013-2014, were determined by inductively coupled plasma mass spectrometry (ICP-MS). The impact of Cd, Ni, Cr and Pb on consumer health was considered and several parameters were used to assess the potential human risk (estimated weekly intake (EWI), target hazard quotient (THQ), total target hazard quotient (TTHQ) and target hazard risk (TR)). Results showed that Cd, Ni, Cr and Pb concentrations on a wet weight basis ($\text{mg kg}^{-1} \text{ ww}$) in *A. noae* flesh from the lagoon of Bizerte were well below international food safety standards. Regarding health risk assessment linked to *A. noae* consumption, all sanitary indicators (EWI, PTWI, THQ, TTHQ



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and TR) related to Cd, Ni, Cr and Pb levels bioaccumulated in its flesh were below values considered at risk for human health. It can be concluded that continued consumption over long periods of this shellfish may not represent a potential risk to the health of consumers regarding Cd, Ni, Cr and Pb. Consequently, this shellfish can be considered safe for human consumption and does not pose any sanitary problems. This preliminary study presents prospects for the valorization of this seafood product in Tunisia's food sector.

Keywords: Trace elements; Toxicity; Risk assessment.



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**PREDICTION OF APTAMER BINDING AFFINITY TO INFLUENZA VIRUSES
USING RADIAL BASIS FUNCTION NEURAL NETWORK**

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ABSTRACT

Influenza viruses are among the most concerning infections because of the potential risk of developing a pandemic with a fatal impact. Any expansion of the infections in secondary hosts such as bird species and livestock, could lead to outbreaks of human influenza infections. Therefore, it is vital to find an effective method to recognize the infection in the first days of exposure as well as to determine its variant. Developing accurate, user-friendly, sensitive detection strategies will provide a helpful method to control epidemics and their side effects. In this paper, we proposed a new molecular method based on aptamer oligonucleotides to recognize the influenza virus, both in humans and animals, due to aptamers' high potential in the diagnosis, control, and treatment of influenza infection. Taking advantage of artificial intelligence, now, it is simple to assess the effectiveness of aptamers in the diagnosis of influenza viruses. This study applied a Radial Basis Function (RBF) neural network to predict aptamers' binding affinity to the influenza viruses using nine aptamer structural features as the descriptors. The Radial basis function model predictions matched the experimental binding scores with $R=0.75$. This result indicates that RBF neural network can be a suitable model to predict aptamers' binding affinity to common influenza viruses between animals and human with an acceptable accuracy.

Keywords: aptamer, Influenza viruses, livestock, RBF, neural network, machine learning



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FUNGAL BIOREMEDIATION OF HEAVY METAL CONTAMINATED MEDIA

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ABSTRACT

Heavy metals in industrial and agricultural wastewater are one of the most important environmental pollutants. Removing heavy metals by conventional methods has several disadvantages such as production of toxic sludge, low sustainability and environmental pollution. Also, these methods are ineffective for low concentration contaminants. Based on the reports, fungi as a biological treatment are a suitable alternative for heavy metals remediation. In this study, the chromium absorption in the presence of different concentration of iron and also absorption of iron and chromium independently, was measured. Concentration of the remaining metal in solution was measured using atomic absorption spectrometry. In the single metal uptake test, effect of four effective parameters such as contact time, initial biomass dose, initial metal ion concentration and biomass pre-treatment with acid and alkali on the absorption of these two metals were studied. Effect of three parameters, biomass pre-treatment with acid and alkali contact time and different concentrations of iron ion, was investigated on final chromium ion uptake. Finally, the interaction of the factors on the absorption was analyzed using the Design Expert software. The absorption of iron was increased in following condition: increasing initial iron concentration, decreasing initial biomass dose, increasing contact time up to 180 minutes and pre-treatment of biomass with acid. Maximum absorption was resulted in contact time of 180 minutes. Moreover, best initial absorbent dose and best initial metal concentration by acid pretreated biomass was observed 0.5 g/l and 15 mg/l, respectively. In the case of chromium ion absorption test, increasing the initial concentration, decreasing the initial biomass dose, increasing the contact time up to 60 minutes and alkaline pre-treatment, leading to an enhanced absorption rate of chromium ion. The highest chromium uptake was observed in initial chromium concentration of 11.25 mg /l and contact time 60 minutes with alkaline pretreated biomass. Chromium uptake in the presence of different concentration of iron metal ions also increased with increasing contact time up to 180 minutes by alkali pre-treatment and the highest metal uptake was observed by alkaline pre-treated biomass during 180 minutes. According to the results it can be stated that even with low dose of dead biomass of *Sarocladium* sp. high concentration of metal ions could be eliminated. Therefore the dead biomass of *Sarocladium* sp. has the potential to remove chromium and iron ions from aqueous solutions.

Keywords: biosorption, biomass, metal ion, pre-treatment, *Sarocladium* sp.



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**BIOREMEDIATION OF LABORATORY WASTEWATER POLLUTANTS USING
SAROCLADIUM SP.**

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ABSTRACT

Discharging of laboratory wastewater into the environment specially water resources causes serious challenges and dangers for human being and environment. Bioremediation of wastewater is one of the most important biotechnology process in which microorganisms play an important role in the omission of contaminants. In biological treatments, microorganisms absorb organic materials existing in wastewater and use them for new cell generation, energy acquisition and various structural components. Fungi due to its structural features and also various enzymes have the ability to biodegrade a large number of contaminants. In this study, *Sarocladium* species (Halophile yeast) is used to biodegrade two contaminants (Phenol and Azo colors) existing in laboratory wastewater. In order to investigate phenol biodegradation, factors namely; initial concentration, contact time and yeast strains was studied. The elimination of phenol was measured via Folin–Ciocalteu method. In biodegradation the Azo dyes including methyl red and methyl orange, factors such as light intensity, contact time and initial concentration of dyes were surveyed. The study of all the parameters were performed through response surface methodology (RSM) using Design Expert software. In case of phenol biodegradation, strains 18 and 62 as alive and dead biomass, had the ability to eliminate complete phenol in concentration of 200 mg/L during 30 hours. Elimination of Azo dyes was performed using fungal strain 62; it eliminated 95% of initial concentration of 85 mg/L after 48 hours in light conditions of semi light (Lux=400). Moreover, 97% Methyl orange was eliminated from the culture of strain of 60 in the period of two days from initial concentration of 20 mg/L in complete light (Lux=800). Regarding to the results obtained, *Sarocladium* species has ability to biodegrade phenol and azo dyes contaminations existing in laboratory wastewater.

Key Words: *Sarocladium*, RSM, Phenol, Azo dye, Bioremediation.



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**DETERMINATION OF THE CAUSES OF THE SCALING PHENOMENON AND
INVESTIGATION OF THE EFFECT OF PHOSPHATE FERTILIZERS AS
INHIBITORS ON THE FORMATION OF SCALE IN MODERN IRRIGATION
SYSTEMS.**

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Abstract

Agriculture is a key part of the Moroccan economy. It contributes about 14% of the gross domestic product (GDP). In recent decades, modern irrigation technologies, known as "localized irrigation", have been developed to increase the profitability of agriculture and ensure sustainable management of water resources. Unfortunately, the chemical clogging of localized irrigation sprinklers, caused by the formation of inorganic precipitates on the internal walls of the irrigation systems, leads to technical problems and very significant economic costs.



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The goal of this study is to test the effectiveness of NPK phosphate fertilizer in controlling scaling in micro-irrigation systems using several techniques, including, conductivity test, LCGE, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), for a synthetic calco-carbonic solution with a hardness of 40 °F under the experimental conditions of T=25°C. The obtained data indicate that the inhibition of calcium carbonate precipitation took place completely after the addition of a low concentration of the inhibitor (0.8 ppm) to the calco-carbonic solution. There is also a significant change in the morphology and phase shape of the scale formed in the presence of the phosphate fertilizer. Therefore, the use of this fertilizer is suggested as an alternative scale inhibitor for micro-irrigation systems.



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**PLATE ACTIVITY IN GOLSHTIN'S CALFS DURING THE MILK FEEDING
PHASE**

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ABSTRACT

The ecological conditions of keeping animals can affect the level of platelet activity in their blood, which affects the course of metabolic processes, especially at the beginning of their ontogenesis. There is reason to believe that animals of different breeds, kept in different climatic and geographical conditions, have differences in the level of platelet activity. The work was carried out on 48 purebred Holstein calves kept in the conditions of Central Russia. All calves were examined and examined at 11, 15, 20, 25, 30 days of their life. During the study, biochemical, hematological and statistical research methods were used. During the milk feeding phase, the animals showed a weakening of platelet aggregation. The number of discocytes in the blood of the observed Holstein calves tended to increase. At the same time, the total number of active platelets in them decreased by 20.0%, and the level of small and large platelet aggregates circulating in their blood decreased during the observation period by 20.0% and 40.0%, respectively. Apparently, this was largely due to a weakening of thromboxane synthesis in platelets of the examined calves, a decrease in the amount of adenosine phosphate in them and inhibition of its secretion. In the second phase of early ontogenesis, the amount of actin and myosin in platelets of animals also decreased. In addition, the generation of actin and myosin in them decreased under conditions of induced platelet aggregation. It becomes clear that Holstein calves in the milk feeding phase are characterized by a high functional perfection of the hemostatic properties of platelets, which provides them with physiologically very favorable conditions for microcirculation in tissues. The low intravascular activity of platelets in Holstein calves during the milk feeding phase creates optimal conditions for perfusion and metabolism in all their tissues. This is extremely important for the implementation of their processes of rapid growth, development and creation of the foundations for the future high productivity of animals of this breed.

Key words: Central Russia, calves, resistance, Holstein breed, platelets.



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**PHYSIOLOGICAL PARAMETERS OF THE ORGANISM OF PIGLETS AT THE
END OF EARLY ONTOGENESIS**

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ABSTRACT

Environmental conditions have a great influence on metabolic processes in piglets, strongly determining their growth activity. Despite the significance of the influence of ecology on the organism of piglets of plant nutrition kept in the conditions of Central Russia, its features have been studied very poorly. In piglets reared in the climatic conditions of Central Russia, during the phase of plant feeding, the amount of total protein increases simultaneously with an increase in the concentration of albumin. During this age period, in piglets, the level of urea in the blood rises, confirming the activation of protein metabolism in them. It is common for piglets during the plant feeding phase to increase blood triglyceride and cholesterol levels with stable glucose concentrations. During the plant feeding phase, piglets are characterized by a stable alkaline phosphatase activity and a slight increase in gamma-glutamyltransferase activity. This is accompanied by an increase in the blood enzymatic properties of transaminases with the stability of the enzymatic capabilities of lactate dehydrogenase and creatine kinase. The levels of the considered metabolites and the activity of some enzymes found in the work can be considered normative for piglets of plant nutrition, reared in the climatic conditions of Central Russia.

Keywords: physiology, biomarkers, piglets, plant nutrition phase, blood.



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**PHYSIOLOGICAL CHANGES IN THE ORGANISM OF Dairy Calves UNDER THE
INFLUENCE OF A BIOSTIMULATOR**

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ABSTRACT

The increase in the productivity of all livestock production is very strongly determined by the increase in the level of vitality of the calves. This can be achieved by using various zootechnical measures, including the use of biological stimulants in them. The effectiveness of their use can be assessed by monitoring the main hematological parameters in calves. In the work, 4 courses of catosal, 10.0 ml each, were applied to calves of dairy and vegetable nutrition. As a result, physiologically very favorable changes in the parameters of the blood of animals were achieved. The onset of their dynamics against the background of the introduction of catosal is considered physiologically very beneficial in terms of stimulating the general viability of calves and increasing their productive potential. The revealed changes in blood parameters in the observed calves indicate the development in their body of a general anabolic orientation of metabolic processes, which leads to an increase in their growth and development. The results obtained give grounds to consider the use of catosal very effective in terms of biological stimulation of the body of calves during the third phase of their early ontogenesis.

Key words: calves, biostimulation, blood, phase of lacto-vegetable nutrition, blood, catosal.



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**APPLICATIONS OF INTEGRATED FARMING SYSTEM ON FARMER'S
AGRICULTURE INCOME**

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ABSTRACT

Integrated Farming System (IFS) is an advanced technology for farmers. It is a combination of related agro-economic activities where components interact in a particular agricultural setting. In India about 100 +million hectare's of land is cultivated in india,agriculture plays more valuable role in improvement in Indian economy for farmer. Integrated Farming System (IFS) is an eco-friendly for farmer. IFS are a mixture of more than crop farming system which includes at minimum two separate crops but logically both are inter related parts of a crop and livestock enterprises. IFS help to improvement of soil quality, control of weed and pest, incensement of water efficiency and water nature minimize the use of hazardous chemical fertilizers, weed killers and pesticides in integrated farming systems and protect the environment from adverse effects. Integrated Farming System grow the economic condition of farmer. It has increased Education, health and social atmosphere and improved the overall security of livelihoods. However IFS can minimized the use of chemicals like fertilizers and pesticides to provide chemical free healthy and nutritious food to our society.

Keywords: Integrated farming system, dual cropping, Agriculture economy



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**HOW HAS THE CONSTRUCTION, OPERATION AND POLITICS OF
MAINSTREAM DAMS ON THE MEKONG RIVER AFFECTED THE LOWER
MEKONG BASIN REGION?**

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ABSTRACT

The prosperity for human insecurity is greater in developing countries, where people are often highly dependent on their surrounding natural environment to conduct their economic activities, and where governments are less able to afford prevention of potential harm caused by environmental changes than in developed countries. The research aims at exploring the socio-economic impacts of the construction, operation and politics of mainstream Mekong dams to the Lower Mekong Basin region (consist of Cambodia, Laos, Thailand, Vietnam). The inquiry evaluates the importance of the Mekong River to the socio-development of the Lower Mekong Basin (LMB) region, explores Economic Consequences of The Construction and Operation of Mainstream Mekong Dams, presenting The Politics of Mainstream Mekong Dams' Current Method of Operation and Construction, and suggests possible solutions to the problem. The construction and operation of Mekong mainstream dams have affected a lot not only the livelihood of the countries that are near the end of the river but also global climate change. The conclusions drawn from the research are that the current methods of operation and construction of mainstream dams on the Mekong River have affected in numerous ways to the socio-economic development of the LMB region by disrupting marine life, causing severe water scarcity in "dry" seasons, and damaging land quality through landslides and salinity intrusions. In addition to the environmental damages, these mainstream dams' activities have degraded the livelihood, damaging economic activates such as fishery and agriculture along the river. In terms of politics, China views the water that flows through its country as a sovereign resource rather than a shared resource, thus highlighting the importance of promoting corporation among all countries in the region.

Keywords: Mekong mainstream dams; Lower Mekong Basin Region, socio-economic impacts



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**HEALTH PERFORMANCE OF LOCAL DOMESTIC BEE APIS MELLIFERA
INTERMISSA; CASE STUDY: SUSCEPTIBILITY TO NOSEMOSIS.**

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ABSTRACT:

Nosemosis *Nosema* sp. is a devastating disease of bee colonies. This study investigated the susceptibility of the tellian honey bee *Apis mellifera intermissa* to nosemosis. The experiment included individual inoculation of a dose of *Nosema* sp. Spores, 100,000 spores / bee, and a control group. The rates of corrected mortality after inoculation with a dose of 100,000 spores per bee and the rates of corrected deaths in control individuals are similar. For the comparison of the means (student test) between natural mortality (control) and mortality after spore inoculation, the GLM procedure (generalized linear model) of SAS.9, with the selection of the ANOVA model (ods select Model) ANOVA Means LSMeans), was used. We noted that there was no significant difference between natural mortality (controls) and mortality after inoculation with a dose of 100,000 spores per bee (DDL = 1; $p = 0.9468$). Likewise between repetitions (DDL = 2; Value of $F = 1.00$; $p = 0.3872$). In conclusion, the tellian bee *A. m. intermissa* is resistant against nosemosis.

Keywords: Inoculation; witness; *Nosema* sp. ; *Apis mellifera intermissa*; sensitivity.



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SOME TREATMENT METHODS FOR KOI HERPESVIRUS INFECTION

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ABSTRACT

Koi herpesvirus (KHV) is a highly contagious double-stranded DNA virus that causes high morbidity and mass mortality of common carp (*Cyprinus carpio* Linnaeus, 1758) and its ornamental varieties. The disease called koi herpesvirus disease (KHVD) has been listed as a notifiable disease by the World Organization for Animal Health in 2006. It is thought that the disease has been spread worldwide, although it is not reported everywhere yet. We discuss the opportunities of disinfectants and water temperatures to be adequate treatment methods against koi herpesvirus disease development. The usage of vaccines for aquatic animals and water environments is limited, associated to the risk of viral reactivation and reversion to virulence. In Europe, for example, no commercial vaccine for KHVD is available. Infection with KHV is horizontal, from fish to fish or by infected water and/or equipment. For that reason, some disinfectants have been shown effectiveness against KHV. However, the dosage and contact time should be carefully revised during the disinfection because different conditions such as water temperature affecting the result. It is thought that water temperature is one of the factors influencing the severity and disease speed. It is known that fish are most susceptible to KHV at temperatures 18–28°C, and no morbidities occur at 13°C and 30°C. That knowledge resumes the chance to control the disease development. If water temperature is not optimal for the living carps, and is too cold or is increased to 30°C, it could lead to decreased bacterial and parasitic resistance and additionally increased fish mortality.

Keywords: koi herpesvirus, viral diseases, common carp, water environment



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FULL TEXTS



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**SUNFLOWER (*Helianthus annuus* L.): GENETICS, ENVIRONMENT, PHYSIOLOGY
AND UTILISATION**

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ABSTRACT

Sunflower is a native crop in North America and a major oilseeds worldwide. Demand for high oleic sunflower oil is high due to its nutritional and industrial benefits. Climate change adaptation of sunflower is high due to stable yields across diversified environments. Due to hybridization with wild relatives, cultivated sunflower is genetically highly variable. Global declines in pollinators, including bees, is a treat for the crop. Downy mildew, rust, Phoma, Phomopsis, Sclerotinia and broomrape are major biotic stress factors for sunflower. Here in this article, informations related to genetics, environment, physiology and utilisation of sunflower is reviewed with the help of latest articles published in the last decade in international journals.

Keywords: Sunflower, *Helianthus annuus* L., genetics, environment, physiology, utilisation



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INTRODUCTION

Rapeseed and sunflower are major oilseeds worldwide (Lomascolo et al., 2012). Sunflower (*Helianthus annuus* L.) crop is primarily grown for its oil and fruits in subtropical and temperate climates in the world (Debaeke & Izquierdo, 2021). It is well known with its large composite flowers as an important source of oil and confectionary seeds (Renaut, 2017). Sunflower is native to North America. It was first domesticated by the Indians who used it as food and medicine as well as body painting in ceremonies (Kaya et al., 2012). Sunflower has a high level of climate change adaptation, produce stable yields across a wide spectrum of environments (Badouin et al., 2017).

Genetics and breeding

Domesticated plants frequently respond dramatically to selection. Instead of domestication and improvement bottlenecks, the cultivated sunflower remains highly variable genetically, possibly due to hybridization with wild relatives. The cultivated sunflower ($2n = 17$) pan-genome comprises 61,205 genes, of which 27% vary across genotypes. Approximately 10% of the cultivated sunflower pan-genome is derived through introgression from wild sunflower species, and 1,5% of genes originated through introgression. Gene ontology functional analyses indicate that genes associated with biotic resistance are over-represented among introgressed regions, an observation consistent with breeding records (Hübner et al., 2019).

The sunflower and its wild relatives have also been used as a model system to study fundamental questions in evolutionary biology, such as the appearance of new species (Renaut, 2017).

Helianthus (Asteraceae) genus contains 51 species (14 are annual and 37 are perennial). Interspecific hybridization has an important role in its breeding, especially for desirable genes of wild types. Historically, sunflower breeding efforts passed three phases: 1) mass selection, 2) individual selection for open pollinated cultivar development, 3) hybrid sunflower development. Variation development in breeding material is main task in breeding programs of sunflower. Molecular breeding methods are targeting the breeding process acceleration in sunflower. Many molecular markers were developed in last 30 years. Major targets in its breeding is high seed yield, high oil yield, better oil quality and resistance to stress factors (Kaya et al., 2012).

“Single Nucleotide Polymorphism” marker technology offers big potential in sunflower breeding programs to improve crop genetics and accelerate release of hybrids to market



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(Pegadaraju et al., 2013). Sunflower oil with high oleic acid content is in great demand due to its nutritional and industrial benefits. The trait is mainly controlled by dominant alleles at a major gene (Ol) with other modifiers (Premnath et al., 2016). Sunflower is native to the United States. USDA–ARS-NPGS wild sunflower collection is the largest collection in the world. It contains 2,519 accessions and 53 species (14 annual and 39 perennial) (Seiler et al., 2017). Crossing annual species is easier than perennial species because perennial species are more diverse and genomes have different ploidy levels. Difficulty of crossing wild perennial *Helianthus* species can be overcome by the novel molecular breeding techniques. The beneficial genes in wild species are valuable sources for many agronomic traits. Significant progress was made in transferring resistance to new races of downy mildew, rust, *Phoma*, *Phomopsis*, *Sclerotinia* and broomrape. Cytoplasmic male sterility and fertility restoration genes were also determined. However, only a small portion of the available genetic diversity of the wild *Helianthus* species has been utilized until now (Kaya, 2014).

Biotic and abiotic environmental factors

Mass-flowering crop monocultures of sunflower cannot harbour a permanent pollinator community. Their pollination is best secured if both “managed honey bees” and “wild pollinators” are present in the agricultural landscape. Semi-natural habitats are known to be the main foraging and nesting areas of wild pollinators, thus benefiting their populations, whereas crops flowering simultaneously may competitively dilute pollinator densities (Lajos et al., 2021). Global declines in pollinators, including bees, can have major consequences for ecosystem services. Bees are dominant pollinators, making it imperative to mitigate declines (Giacomini et al., 2018). The nutritional needs of bees are receiving renewed attention in the context of declining bee populations and changes in land use that threaten floral resources (Nicolson & Human, 2013).

Sunflower production is stressed by different biotic and abiotic stresses (Ma et al., 2019). Obligate parasitic plant broomrape (*Orobanche cumana*) infects sunflower roots and causes yield losses (Duriez et al., 2019). It is the most serious problem in sunflower production in Europe which may lead to yield losses up to 100% and may reduce seed quality. Although genetic resistance is the most effective and feasible control against broomrape, application of imidazolinone (IMI) herbicide as post emergence application offers an efficient control to broomrape (Kaya et al., 2012).



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Sclerotinia head rot is a devastating diseases of sunflower caused by necrotrophic fungus *Sclerotinia sclerotiorum*. Despite its worldwide occurrence, the genetic determinants of plant resistance are still largely unknown (Fass et al., 2020). Sclerotinia Head Rot is among major damaging diseases of sunflower in Europe, Argentina, and USA which cause 10-20% yield reductions. It may lead to total loss of yield under favorable environmental conditions for the pathogen (Fusari et al., 2012).

Sunflower downy mildew (*Plasmopara halstedii*) and sunflower rust (*Puccinia helianthi*) are two destructive foliar diseases of sunflower worldwide (Liu et al., 2019). Downy mildew (*Plasmopara halstedii*) is a severe biotic stress that is detrimental to cultivated sunflower yield and quality in many regions in the world. Resistance against its infestation in sunflower is commonly regulated by single dominant genes (Ma et al., 2019). Downy mildew dominant resistance locus *Pl ARG* originates from silverleaf sunflower (*H. argophyllus* Torrey and Gray) and confers resistance to all known races of *P. Halstedii* (Wieckhorst et al., 2010). A new downy mildew resistance gene (PI 19) was identified from a wild *Helianthus annuus* accession (PI 435414), introduced to confection sunflower (Zhang et al., 2017).

Sunflower Verticillium wilt and Leaf mottle (*Verticillium dahliae*) are soil-borne diseases affecting sunflowers globally. A single dominant locus (V1) was formerly effective in controlling North-American *Vd* races, whereas races from Argentina, Europe and an emerging race from USA overcome its resistance (Montecchia et al., 2021).

Rust is a serious fungal disease in the sunflower growing areas worldwide with increasing importance in North America in recent years. Several genes conferring resistance to rust have been identified in sunflower, but few of them have been genetically mapped and linked to molecular markers. The rust resistance gene *R₄* in the germplasm line HA-R3 was derived from an Argentinean open-pollinated variety and is still one of most effective genes (Qi et al., 2011). Drought is the most important crop production limiting factor in the changing climate scenario and its intensity is predicted to increase in future. Sunflower is an important oilseed crop having 8% share in the world oilseed production. Although, it is a moderately drought tolerant crop, severe drought causes reduction in the seed and oil production (Hussain et al., 2018).

Salinity is a major abiotic stress that affects plant growth and development and leads to crop yield loss. Many crop species are more sensitive to salinity stress at the seed germination stage than at other developmental stages. Some studies have shown that sunflower is tolerant to salinity to a certain degree. However, no systematic screening data for sunflower germplasms



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are available for salinity stress. In a study of Li et al., (2020), 552 sunflower germplasms were evaluated for salt tolerance. Among them, 30 and 53 sunflower germplasms were identified as highly salt-tolerant and salt-tolerant germplasms, respectively, while 80 and 23 were grouped as salt-sensitive and highly salt-sensitive materials, respectively. Of all the traits tested, the germination index and the germination vigor index were the two most reliable traits, showing the highest correlation with salt tolerance during the seed germination stage of sunflower.

Physiology and utilisation

Sunflower pollen was reported to contain respiratory allergens responsible for occupational allergy and pollinosis (Ghosh et al., 2020).

Solar tracking in the common sunflower, *Helianthus annuus*, is a dramatic example of a diurnal rhythm in plants. During the day, the shoot apex continuously reorients, following the sun's relative position so that the developing heads track from east to west. At night, the reverse happens, and the heads return and face east in anticipation of dawn. This daily cycle dampens and eventually stops at anthesis, after which the sunflower head maintains an easterly orientation. Although shoot apical heliotropism has long been the subject of physiological studies in sunflower, the underlying developmental, cellular, and molecular mechanisms that drive the directional growth and curvature of the stem in response to extrinsic and perhaps intrinsic cues are not known. Furthermore, the ecological functions of solar tracking and the easterly orientation of mature heads have been the subject of significant but unresolved speculation. Candidate regulatory mechanisms include light signaling and circadian rhythms (Vandenbrink et al., 2014).

The mature inflorescence of sunflowers (*Helianthus annuus*) orients eastward after its anthesis (the flowering period, especially the maturing of the stamens), from which point it no longer tracks the sun. Although several hypothetical explanations have been proposed for the ecological functions of this east facing, none have been tested. We suggest that the domesticated *Helianthus annuus* developed an easterly final orientation of its mature inflorescence, because it evolved in a region with cloudier afternoons (Horvath et al., 2020).

Oleic sunflower oil may be classified as 1) regular (14–39% oleic), 2) mid-oleic (43–72% oleic), 3) high-oleic (75–91% oleic). Regular sunflower oil finds many applications in the food market mainly as salad oil and cooking oil with good oxidative stability. Industrial applications of sunflower oil include its use as frying oil, as well as in the manufacture of mayonnaise and oil-based dressings. Hydrogenated sunflower oil may be used in the manufacture of margarines.



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High-oleic sunflower oil is the most appropriate type for use in industrial frying, in view of its low content in polyunsaturated fatty acids. Mid-oleic sunflower oil is of higher frying quality than other nonhydrogenated oils. Nonedible industrial uses of regular sunflower oil include the production of biodiesel, lubricants, vegetable oil-based printing inks, and so on. Meal, hulls, and sodium soapstock are obtained as byproducts of the extraction and refining processes. Other minor byproducts may also be obtained: lecithin, waxes, tocopherols, and so on (Grompone, 2011).

Non-oilseed sunflower seeds are used mostly for confectionery as snack but also for feeding birds and small pets. Other direction of non-oil sunflower breeding is creation of ornamental varieties (Kaya et al., 2012).

Sunflower seed cake is a by-product of the sunflower oil industry which is a valuable source of protein for animal feed. The presence of phenolic compounds significantly affects the sunflower proteins quality to animal feeding, decreasing its commercial value (Zardo et al., 2019).

Ruminant diet supplementation with sunflower oil and fish oil has been reported as a good strategy for enhancing some milk fat compounds such as conjugated linoleic acid and n-3 polyunsaturated fatty acids in dairy cows (Toral et al., 2010).

Sunflower stalks can be used for the production of methane, but their recalcitrant structure requires the use of thermo-chemical pretreatments (Monlau et al., 2012).

CONCLUSIONS

Climate change adaptation of sunflower is high due to stable yields across diversified environments. Due to hybridization with wild relatives cultivated sunflower is genetically highly variable. Global declines in pollinators, including bees, is a threat for the crop. Downy mildew, rust, Phoma, Phomopsis, Sclerotinia and broomrape are major biotic stress factors for sunflower whereas efforts are continuous and successful until now to transfer resistance to new races of the biotic stress factors. Drought and salinity are major abiotic stresses for sunflower. The presence of phenolic compounds significantly affects the sunflower proteins quality to animal feeding but ruminant diet supplementation with sunflower oil is a good strategy for enhancing some milk fat compounds.



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REFERENCES

- Badouin, H., Gouzy, J., Grassa, C. J., Murat, F., Staton, S. E., Cottret, L., ... & Langlade, N. B. (2017). The sunflower genome provides insights into oil metabolism, flowering and Asterid evolution. *Nature*, 546(7656), 148-152.
- Debaeke, P., & Izquierdo, N. G. (2021). Sunflower. In *Crop Physiology Case Histories for Major Crops* (pp. 482-517). Academic Press.
- Duriez, P., Vautrin, S., Auriac, M. C., Bazerque, J., Boniface, M. C., Callot, C., ... & Muños, S. (2019). A receptor-like kinase enhances sunflower resistance to *Orobanche cumana*. *Nature Plants*, 5(12), 1211-1215.
- Fass, M. I., Rivarola, M., Ehrenbolger, G. F., Maringolo, C. A., Montecchia, J. F., Quiroz, F., ... & Lia, V. V. (2020). Exploring sunflower responses to *Sclerotinia* head rot at early stages of infection using RNA-seq analysis. *Scientific reports*, 10(1), 1-14.
- Fusari, C. M., Di Rienzo, J. A., Troglia, C., Nishinakamasu, V., Moreno, M. V., Maringolo, C., ... & Paniego, N. B. (2012). Association mapping in sunflower for *sclerotinia* head rot resistance. *BMC plant biology*, 12(1), 1-13.
- Ghosh, N., Sircar, G., Asam, C., Wolf, M., Hauser, M., Saha, S., ... & Bhattacharya, S. G. (2020). Purification and biochemical characterization of Hel a 6, a cross-reactive pectate lyase allergen from Sunflower (*Helianthus annuus* L.) pollen. *Scientific reports*, 10(1), 1-15.
- Giacomini, J. J., Leslie, J., Tarpy, D. R., Palmer-Young, E. C., Irwin, R. E., & Adler, L. S. (2018). Medicinal value of sunflower pollen against bee pathogens. *Scientific reports*, 8(1), 1-10.
- Grompone, M. A. (2011). Sunflower oil. *Vegetable oils in food technology*. Oxford: Wiley-Blackwell, 137-67.
- Horvath, G., Slíz-Balogh, J., Horváth, Á., Egri, Á., Virág, B., Horváth, D., & János, I. M. (2020). Sunflower inflorescences absorb maximum light energy if they face east and afternoons are cloudier than mornings. *Scientific Reports*, 10(1), 1-15.
- Hussain, M., Farooq, S., Hasan, W., Ul-Allah, S., Tanveer, M., Farooq, M., & Nawaz, A. (2018). Drought stress in sunflower: Physiological effects and its management through breeding and agronomic alternatives. *Agricultural water management*, 201, 152-166.
- Hübner, S., Bercovich, N., Todesco, M., Mandel, J. R., Odenheimer, J., Ziegler, E., ... & Rieseberg, L. H. (2019). Sunflower pan-genome analysis shows that hybridization altered gene content and disease resistance. *Nature plants*, 5(1), 54-62.



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- Kaya, Y. (2014). Sunflower. In *Alien Gene Transfer in Crop Plants, Volume 2* (pp. 281-315). Springer, New York, NY.
- Kaya, Y., Jovic, S., & Miladinovic, D. (2012). Sunflower. In *Technological Innovations in Major World Oil Crops, Volume 1* (pp. 85-129). Springer, New York, NY.
- Lajos, K., Samu, F., Bihaly, Á. D., Fülöp, D., & Sárospataki, M. (2021). Landscape structure affects the sunflower visiting frequency of insect pollinators. *Scientific reports*, 11(1), 1-11.
- Li, W., Zhang, H., Zeng, Y., Xiang, L., Lei, Z., Huang, Q., ... & Cheng, Q. (2020). A salt tolerance evaluation method for sunflower (*Helianthus annuus* L.) at the seed germination stage. *Scientific Reports*, 10(1), 1-9.
- Liu, Z., Zhang, L., Ma, G. J., Seiler, G. J., Jan, C. C., & Qi, L. L. (2019). Molecular mapping of the downy mildew and rust resistance genes in a sunflower germplasm line TX16R. *Molecular Breeding*, 39(2), 1-11.
- Lomascolo, A., Uzan-Boukhris, E., Sigoillot, J. C., & Fine, F. (2012). Rapeseed and sunflower meal: a review on biotechnology status and challenges. *Applied microbiology and biotechnology*, 95(5), 1105-1114.
- Ma, G., Song, Q., Underwood, W. R., Zhang, Z., Fiedler, J. D., Li, X., & Qi, L. (2019). Molecular dissection of resistance gene cluster and candidate gene identification of Pl 17 and Pl 19 in sunflower by whole-genome resequencing. *Scientific reports*, 9(1), 1-10.
- Monlau, F., Barakat, A., Steyer, J. P., & Carrère, H. (2012). Comparison of seven types of thermo-chemical pretreatments on the structural features and anaerobic digestion of sunflower stalks. *Bioresource technology*, 120, 241-247.
- Montecchia, J. F., Fass, M. I., Cerrudo, I., Quiroz, F. J., Nicosia, S., Maringolo, C. A., ... & Paniego, N. B. (2021). On-field phenotypic evaluation of sunflower populations for broad-spectrum resistance to *Verticillium* leaf mottle and wilt. *Scientific reports*, 11(1), 1-14.
- Nicolson, S. W., & Human, H. (2013). Chemical composition of the 'low quality' pollen of sunflower (*Helianthus annuus*, Asteraceae). *Apidologie*, 44(2), 144-152.
- Pegadaraju, V., Nipper, R., Hulke, B., Qi, L., & Schultz, Q. (2013). De novo sequencing of sunflower genome for SNP discovery using RAD (Restriction site Associated DNA) approach. *BMC genomics*, 14(1), 1-9.



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and RURAL DEVELOPMENT
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Premnath, A., Narayana, M., Ramakrishnan, C., Kuppusamy, S., & Chockalingam, V. (2016). Mapping quantitative trait loci controlling oil content, oleic acid and linoleic acid content in sunflower (*Helianthus annuus* L.). *Molecular breeding*, 36(7), 1-7.

Qi, L. L., Hulke, B. S., Vick, B. A., & Gulya, T. J. (2011). Molecular mapping of the rust resistance gene R 4 to a large NBS-LRR cluster on linkage group 13 of sunflower. *Theoretical and applied genetics*, 123(2), 351-358.

Renaut, S. (2017). Genome sequencing: Illuminating the sunflower genome. *Nature plants*, 3(7), 1-2.

Seiler, G. J., Qi, L. L., & Marek, L. F. (2017). Utilization of sunflower crop wild relatives for cultivated sunflower improvement. *Crop Science*, 57(3), 1083-1101.

Toral, P. G., Frutos, P., Hervás, G., Gómez-Cortés, P., Juárez, M., & De la Fuente, M. A. (2010). Changes in milk fatty acid profile and animal performance in response to fish oil supplementation, alone or in combination with sunflower oil, in dairy ewes. *Journal of Dairy Science*, 93(4), 1604-1615.

Vandenbrink, J. P., Brown, E. A., Harmer, S. L., & Blackman, B. K. (2014). Turning heads: the biology of solar tracking in sunflower. *Plant Science*, 224, 20-26.

Wieckhorst, S., Bachlava, E., Dussle, C. M., Tang, S., Gao, W., Saski, C., ... & Bauer, E. (2010). Fine mapping of the sunflower resistance locus Pl ARG introduced from the wild species *Helianthus argophyllus*. *Theoretical and applied genetics*, 121(8), 1633-1644.

Zardo, I., de Espíndola Sobczyk, A., Marczak, L. D. F., & Sarkis, J. (2019). Optimization of ultrasound assisted extraction of phenolic compounds from sunflower seed cake using response surface methodology. *Waste and Biomass Valorization*, 10(1), 33-44.

Zhang, Z. W., Ma, G. J., Zhao, J., Markell, S. G., & Qi, L. L. (2017). Discovery and introgression of the wild sunflower-derived novel downy mildew resistance gene Pl 19 in confection sunflower (*Helianthus annuus* L.). *Theoretical and applied genetics*, 130(1), 29-39.



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**CHROMIUM ACCUMULATION CAPACITIES OF SOME TOBACCO VARIETIES
(*Nicotiana tabaccum* L.)**

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ABSTRACT

Plants show differing morpho-physiological responses to soil metal contamination. Most of them are sensitive to very low concentrations, others have developed tolerance, and a limited number has capability in hyperaccumulation. Two pot experiments were established with four oriental tobacco varieties, Akhisar, Basma, Dibek and Sarıbağlar, which were grown for 50 days in media containing 0, 10, 50, 100 and 150 mg/kg of Cr. Plants were departed as root, stem and leaf, and analyzed for their Cr amounts. In this regard, Cr distribution and uptake rates in different plant parts of the varieties were determined. Bioconcentration factor (BCF) values, which are considered to be important criteria for phytoremediation, were also calculated. Results revealed that Basma was the most efficient variety but Dibek was the most inefficient one in terms of biomass formation, Cr concentrations and uptake rates in the different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cr.

Keywords: Oriental tobacco, phytoremediation, hyperaccumulation, variability, chromium (Cr).



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INTRODUCTION

Plants show differing morpho-physiological responses to soil metal contamination. Most of them are sensitive to very low concentrations, others have developed tolerance, and a limited number has capability in hyperaccumulation [2-4]. Baker and Walker [5] classified plants in three groups (excluders, indicators, accumulators) with regard to the concentrations of pollutants in shoot biomass in compare to the soil as lower, similar, and higher respectively. Plants to be used in phytoremediation, their characteristics, and their potential to accumulate heavy metals as well as their accumulation mechanisms are investigated by many researchers [6-12]. Various mechanisms for detoxification of heavy metals are possible, such as reduced translocation [12], compartmentalization to vacuoles and cell walls [13], chelation with phytochelatins [14], and biotransformation [15]. Hyperaccumulators, such as the well-studied *Thlaspi* and *Alyssum* species [16], are able to uptake specifically one or more metals, generally producing a small shoot biomass with high metal concentrations [2, 17].

Desirable characteristics for a plant species to be used in phytoremediation are (I) fast growth and high biomass; (II) extended root system for exploring large soil volumes; (III) good tolerance to high concentrations of metals in plant tissues; (IV) high translocation factor; (V) adaptability to specific environments/sites; and (VI) easy agricultural management. The ideal phytoremediation crop may combine rapid growth and high biomass with high metal accumulation in the shoot tissues [18-20]. Small shoot and root growth of the hyperaccumulator plants and the absence of their commercially available seeds have stimulated the studies on biomass species including the herbaceous field crops [1]. Therefore, recently, such crops are preferred because they form more biomass and are easily found and cultivated. In this regard, tobacco received attention with its unique nicotine synthesis via roots.

The objective of this study was to examine Cr uptake, transport and accumulation characteristics of oriental tobacco with special emphasis on its different varieties. Possible potential effects of genetic differences between varieties will be discussed.

MATERIALS and METHODS

Two separate pot experiments were conducted to study the Cr uptake within Basma, Akhisar, Dibek and Sarıbağlar oriental tobacco varieties. A soil and perlite mixture was used as growing medium. For this purpose, 1.5 kg of soil and 75 g perlite was mixed and placed into plastic pots with 2 kg capacity (20 * 14 * 17 cm). The texture of soil was silty loam with 45% sand, 47%



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silt, and 8% clay. The pH, EC, and OM values of soil were 7.8, 0.2 dS m⁻¹, and 0.5%, respectively [25, 26]. For each experiment, the designated treatments were 1: control; 2: NPK; 3: NPK+10 mg/kg; 4: NPK+50 mg/kg; 5: NPK+ 100 mg/kg, and 6: NPK +150 mg/kg of Cr. Perlite was wetted with the nutrient and heavy metal solutions, further mixed well with 1.5 kg of soil, and placed in the pots. In the experiments, K₂Cr₂O₇ were used as Cr sources. 150 mg N/kg, 20 mg P/kg and 150 mg K/kg were used in all pots excluding the control. NH₄NO₃; KH₂PO₄ and K₂SO₄ were used as N, P and K sources, respectively. At the beginning of the experiments, four seedlings were planted in each pot. After ten days, thinning was made and only two seedlings were left. The irrigation was practiced at field capacity and the leaked water returned into the pots in order to prevent losses. After 50 days of growing, plants were harvested and separated as root, stem and leaf, and biomass values of plant parts were recorded.

Analysis

The dried (65–70°C) and finely ground plant samples were wet digested in a mixture of nitric acid (HNO₃)/perchloric acid (HClO₄) (4/1) [27]. Concentrations of Cr in the digest were measured using atomic absorption spectrophotometry (Varian 2200) [28].

Statistical Analysis

The data were subjected to analysis of variance (ANOVA) using factorial randomized complete block design with three replications. Each replication contained two pots with two plant (n:12), and least significant difference (LSD0.05) was used to determine significant differences between the treatment means. All graphs were created using SPSS version 15 for Windows (SPSS Inc., Chicago, IL).

RESULTS and DISCUSSION

In this study, biomass of different varieties, Cr concentrations of different plant parts (root, stem and leaf), the uptake amounts of Cr by these parts, and the bioconcentration factor (BCF) values related to the treatments were evaluated.

Biomass

Significant differences were found in the biomass of roots, stems and leaves of all varieties with respect to increasing concentrations of Cr. In all treatments, the highest biomass values (root, stem and leaf) were determined for the Basma and the lowest ones for the Dibek variety. The highest biomasses of the plant parts were obtained from NPK treatments. With the addition of Cr, the biomasses value decreased. Biomass values of Akhisar and Sarıbağlar varieties were



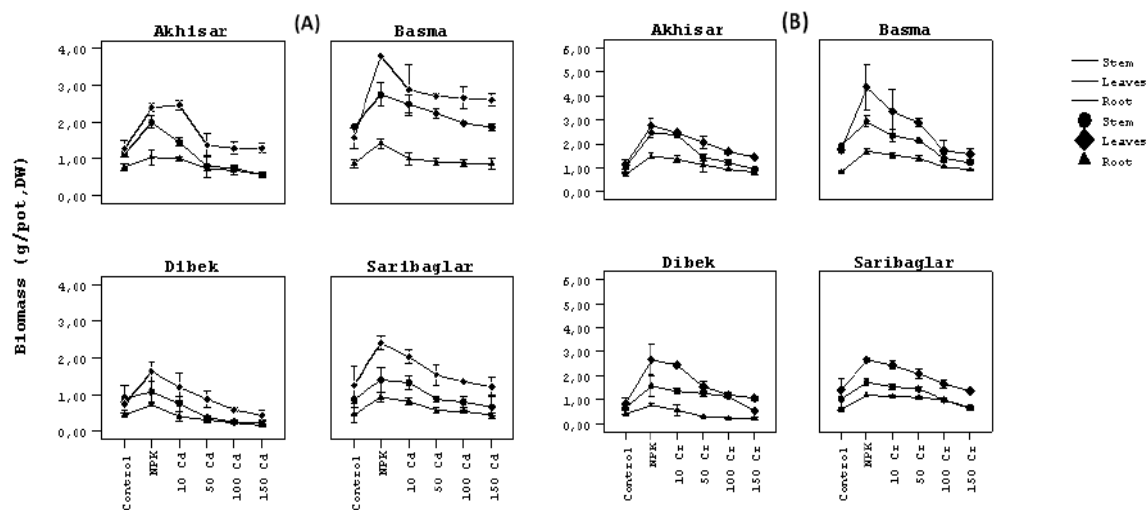
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found to be between the values observed for Basma and Dibek. Basma variety biomasses (root, stem and leaf) were higher than the values of all other varieties.

On the other hand, the biomass of Dibek variety was the lowest in all of the treatments (Fig. 1). The highest total biomass (root + stem + leaf) values were obtained from the NPK treatment, and total biomasses declined with increasing Cr concentrations at all varieties (Fig 2 and 3). The decline of Basma total biomass value was not very evident up to 100 mg/kg of Cr application. On the other hand, Dibek variety responded quite differently. The decrease in total biomass was evident in the Cr treatment, at doses over 10 mg/kg.

A high proportion of above-ground plant parts are desirable in terms of phytoremediation applicability. In this study, harvestable parts/root biomass ratios were calculated. Parallel with increasing concentrations of Cd, the specified ratio did not show any significant change in Basma variety; meanwhile, in other varieties tended to be decreased. In the Cr experiment, the harvestable/ root ratio of Dibek did not show any significant changes in any of the Cr dosage groups including the control and NPK (Table 1).



Distribution and Accumulation of Cr in Plant Parts

Depending on the application doses, Cr concentrations of different plant parts (roots, stems and leaves) of all varieties showed significant increases compared to the control and NPK treatments. All of the harvestable parts of Basma variety had higher Cr concentrations than the Dibek variety. In 150 mg/kg treatments, Cr concentrations in the leaves were measured to be 116.64 and 122.26 mg/kg, but 102.89 and 69.17 mg/kg in the roots, respectively (Table 2). It is



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stated that in the hyperaccumulator plants, the highest tissue metal levels are found in the shoots rather than the roots, possibly due to distinctive physiological characteristics associated with root-shoot partitioning [8, 29, 30].

In all varieties and treatments, Cr concentrations of the roots were found to be close to each other. This specific case might be related to the efficient translocation of Cr from roots to above-ground parts.

The ratio of harvestable/root concentrations of all varieties was found to be higher than 1 for the 10 mg/kg treatments. However, parallel to enhanced Cr concentrations, this ratio apparently declined in all varieties, except Basma variety, which showed no significant change. These findings once again confirm the hyperaccumulating nature of Basma.

Uptake of Cr

The total uptake of Cr changed according to varieties and treatments. Basma variety with its higher Cr tissue concentrations and higher biomass had higher uptake values for Cr, and significantly differed from the other varieties. In all of the varieties, the amount of Cr uptake was parallel with increasing Cr concentrations (Fig. 4).

In general, Cr uptake increased parallel with increasing application doses. However, total Cr uptake of Basma decreased after 50 mg/kg treatments (Fig. 4). In terms of the partitioning of total uptake according to different plant parts, Basma had higher values of Cr. For example, in the highest dose-treatments, this variety accumulated 5 to 6 fold Cr amounts compared to Dibek (Fig. 5). In addition to genetic variability, some researchers related translocation of heavy metals in plants with their transpiration rates. During the experimentation our observations about the relatively small leaf area and less irrigation requirement of Dibek variety might support the above specified role of transpiration rate in translocation of heavy metals.

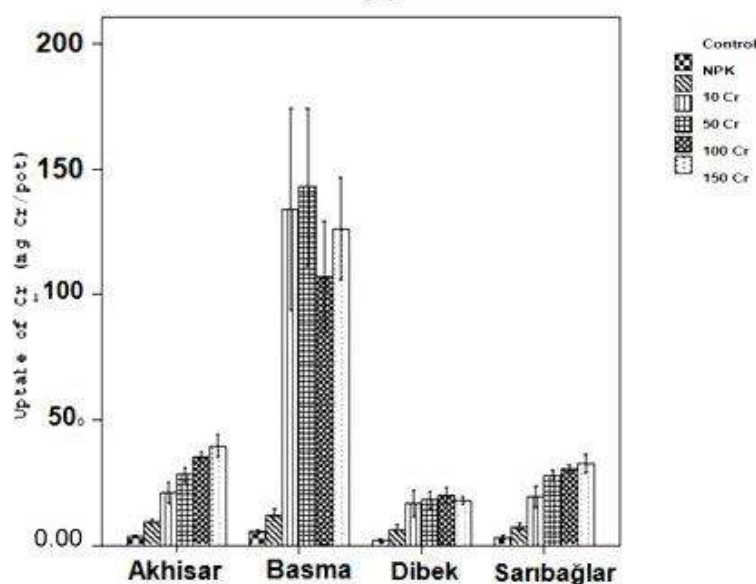


Figure 4 - Uptake of Cr by Akhisar, Basma, Dibek and Sarıbağlar varieties. Error bars represent the standard error for three replications

The Bioconcentration Factor

The bioconcentration factor (BCF) (above-ground/ soil concentration) can be used as an index for predicting the ability of plant species to accumulate trace elements or heavy metals with respect to the trace element concentration in the soil substrate. This factor is also defined as the ratio of metal concentration in the plant biomass to the initial concentration of metal ions in the growing media.

The higher the BCF, the higher is the plant uptake. Plants with a $BCF \geq 1$ will remove metals in soil or nutrient solution in each harvest [31]. At 50 mg/kg treatment, only Basma had BCF values >1 among the examined varieties (Table 3). A similar tendency was observed in the Cr experiment. Roots, the hidden parts of plants, have an important function in nutrient and heavy metal uptake. Root formation ability of plants in a soil environment with excess levels of heavy metals can be accepted as the first step in phytoremediation process. Differences in root biomass values could be good indicators for the selection of varieties.



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Table 3. Bioconcentration factor of Basma, Akhisar, Sarıbağlar, and Dibek at different concentrations of Cr.

	Cr (mg/kg)			
	10	50	100	150
Basma	5.44a	1.24a	0.67a	0.57a
Akhisar	0.89b	0.27b	0.17b	0.14b
Sarıbağlar	0.98b	0.27b	0.16b	0.13b
Dibek	1.11b	0.32b	0.20b	0.15b

Means with the same letter are not significantly different ($p < 0.05$)

Among the examined oriental tobaccos, Basma variety had higher biomass, even in excess doses. In addition, higher Cr concentrations in all the plant parts indicated the potential of this variety for phytoremediation of these specified metals. Higher BCF values of Basma might reflect the genetic differences due to root secretion and adaptation of the variety to the growing environment. Basma had naturally developed an adaptation mechanism to grow under acidic conditions where heavy metal solubility is high. On the other hand, Akhisar and Sarıbağlar grow in alkaline soils.

Root secretions may affect the heavy metal uptake and translocations. Rhizosphere acidification and release of root exudates contribute to the absorption of several heavy metals [19], as reported in Graminae, specifically for iron [32] and zinc [33]. Exudates may also be involved in the mechanisms of plant tolerance to heavy metals [34, 35]. Some root morphological traits, such as pattern of root density, maximum depth and specific root length, are considered to be crucial for adaptation to stress conditions

[36]. Higher root proliferation is usually observed in favorable (e.g. fertilized) micro-sites, but root response also depends on the mobility of nutrients [37]. Different responses of Dibek and Basma varieties to increasing Cr levels might be related to their different genetic properties like root excretions and nicotine which might have had happened as a result of their adaptation to different growing conditions like the climate and soil. In this regard, the high leaf nicotine content may be an indication of higher synthesis and secretion of nicotine from the roots. Basma variety had higher nicotine content in the leaves (1.0-1.4%) compared to the rest of the varieties (1.0%) [38], which may support the claims about the role of root secretion in the heavy metal uptake. Moreover, Basma variety might have had gained these specified properties by the adaptation to acidic soil conditions prevailing in the Black Sea region.

The genetic basis of metal tolerance is relatively well understood [24, 39] compared with the genetics of hyperaccumulation. It is reported that comparisons between genetic variation in tolerance and genetic variation in hyperaccumulation ability may shed light on this relationship



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[23]. The results of intra-species studies have an important contribution in this subject. In the present study, significant intra-specific variation was found between the tested tobacco varieties in their accumulation of Cr. The relationship between heavy metal tolerance and accumulation by plants is complicated and depends on the plant genotype [40]. Basma can be suggested as a hyperaccumulator plant for Cd, and it is worthwhile to examine in terms of the relationship between metal tolerance and hyperaccumulation.

CONCLUSION

As a result of this study, significant differences were found in the biomass of root, stem and leaves of all varieties with respect to increasing concentrations of Cr. In all treatments, Basma was the most efficient variety but Dibek the most inefficient one, in terms of biomass formation, Cr concentrations as well as uptake rates in different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cr.



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REFERENCES

- [1] Vamerali, T., Bandiera, M. and Mosca, G. (2010) Field crops for phytoremediation of metal-contaminated land, A review. *Environ Chem, Lett*, 8, 1–17.
- [2] Baker, A.J.M. and Brooks, R.R. (1989) Terrestrial higher plants which hyperaccumulate metallic elements—a review of their distribution, ecology and phytochemistry. *Biorecovery*, 1, 81–126.
- [3] Barcelo, J., Vazquez, M.D., Ma'dico, J. and Poschenrieder, C. (1994) Hyperaccumulation of zinc and cadmium in *Thlaspi caerulescens*. In: Varnavas SP (ed) *Environmental contamination*. CEP Consultants Ltd., Edinburgh, pp 132–134.
- [4] Brooks, R.R. (1998) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford.
- [5] Baker, A.J.M. and Walker, P.L. (1989) Ecophysiology of metal uptake by tolerant plants. In: Shaw A (ed) *Heavy metal tolerance in plants—Evolutionary aspects*. CRC Press, Boca Raton, Florida.
- [6] Cataldo, D.A., Garland, T.R. and Wildung, R.E. (1978) Nickel in plants: II. Distribution and chemical form in soybean plants. *Plant Physiol*, 62, 566–570.
- [7] Wagner, G.J. and Yeagan, R. (1986) Variation in Cadmium Accumulation Potential and Tissue Distribution of Cadmium in Tobacco. *Plant Physiol*, 82, 274–279.
- [8] Baker, A.J.M., Reeves. R.D. and Hajar, A.S.M. (1994) Heavy metal accumulation and tolerance in British populations of the metallophyte *Thlaspi caerulescens* J. and C. Presl (Brassicaceae), *New Phytol*, 127, 61–68.
- [9] Bert, V., Macnair, M.R., DeLaguerie, P., Saumitou-Laprade, P. and Petit, D. (2000) Zinc tolerance and accumulation in metallicolous and nonmetallicolous populations of *Arabidopsis halleri* (Brassicaceae). *New Phytol*, 146, 225–233.
- [10] Assunção, A.G.L., Martins, P.D.C., De Folter, S., Vooijs, R., Schat, H. and Aarts, M.G.M. (2001) Elevated expression of metal transporter genes in three accessions of the metal hyperaccumulator *Thlaspi caerulescens*. *Plant Cell Environ*, 24, 217–226.
- [11] Angelova, V., Ivanov, K. and Ivanova, R. (2004) Effect of Chemical Forms of Lead, Cadmium, and Zinc in Polluted Soils on Their uptake by Tobacco. *Journal of Plant Nutrition*, 27(5), 757- 773.
- [12] Angelova, V. and Ivanov, K. (2009) Bio-accumulation and distribution of heavy metals in black mustard (*Brassica nigra* Koch). *Environ Monit Assess*, 153, 449–459.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- [13] Lasat, M.M., Baker, A.J.M. and Kochian, L.V. (1998) Altered Zn compartmentation in the root symplasm and stimulated Zn absorption into the leaf as mechanisms involved in Zn hyperaccumulation in *Thlaspi caerulescens*. *Plant Physiol*, 118, 875–883.
- [14] Cobbett, C.S. (2000) Phytochelatin and their roles in heavy metal detoxification. *Plant Physiol*, 123, 825–832.
- [15] Tomsett, A.B., Sewell, A.K., Jones, S.J., Miranda, J.R. and De Thurman, D.A. (1992) Metal-binding proteins and metalregulated gene expression in higher plants. In: Wray JL (ed) *Inducible plant proteins: their biochemistry and molecular biology*, Cambridge University Press, Cambridge, pp 1–24.
- [16] McGrath, S.P. (1998) Phytoextraction for soil remediation. In: Brooks RR (ed) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford, pp 261–287.
- [17] Reeves, R.D. and Baker, A.J.M. (2000) Metal-accumulating plants. In: Raskin I, Ensley BD (eds) *Phytoremediation of toxic metals: using plants to clean up the environment*. Wiley, New York, pp 193–230.
- [18] Chaney, R.L., Li, Y.M., Brown, S.L., Homer, F.A., Malik, M., Angle, J.S., Baker, A.J.M., Reeves, R.D. and Chin, M. (2000) Improving metal hyperaccumulator wild plants to develop commercial phytoextraction systems: approaches and progress. In: *Phytoremediation of Contaminated Soil and Water*. Terry, N. And Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 129–158.
- [19] Lasat, M.M. (2002) Phytoremediation of toxic metals: a review of biological mechanisms. *J Environ Qual*, 31, 109–120.
- [20] McGrath, S.P., Zhao, F.J. and Lombi, E. (2002) Phytoremediation of metals, metalloids, and radionuclides. *Advances in Agronomy*, 75, 1–56.
- [21] Stephan, U.W. and Grün, M. (1989) Physiological disorders of the nicotianamine-auxotroph tomato mutant *chloronerva* at different level of iron nutrition. II Iron deficiency response and heavy metal metabolism. *Biochim Physiol, Pflanzen*, 185, 189–200.
- [22] Stephan, U.W. and Scholz, G. (1993) Nicotianamine: mediator of transport of iron and heavy metals in the phloem? *Physiol Plant*, 88, 522–529.
- [23] Pollard, A.J., Powell, K.D., Harper, F.A. and Smith, J.A.C. (2002) The genetic basis of metal hyperaccumulation in plants. *Critical Reviews in Plant Sciences*, 21(6), 539–566 pp 155–178.



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and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- [24] Macnair, M.R., Smith, S.E. and Cubes, Q.J. (1993) Heritability and distribution of variation in degree of copper tolerance in *Mimulus guttatus* at Copperopolis, California. *Heredity*, 71, 445–456.
- [25] Kacar, B. (2009) *Toprak Analizleri (Soil Analysis)*. Nobel Yayınları, No: 1387, Ankara.
- [26] Page, A.L., Miller, R.H. and Keeray, D.R. (1982) *Methods of soil analysis*. Amer. Soc. of Agronomy Inc, No: 9, Wisconsin, USA.
- [27] Kacar, B. (1972) Bitki ve Toprağın Kimyasal Analizleri: II. Bitki Analizleri [Chemical analysis of plant and soil, part II: Plant analysis], Ankara, Turkey: Faculty of Agriculture, Ankara University.
- [28] Isaac, R.A. and Kerber, J.D. (1971) “Atomic absorption and flame photometry: Techniques and uses in soil, plant and water analysis”. In *Instrumental Methods of Analysis of Soils and Plant Tissue* Madison, Wisc, Soil Science Society of America.
- [29] Baker, A.J.M. (1981) Accumulators and excluders – strategies in the response of plants to heavy metals. *J. Plant Nutr*, 3, 643–654.
- [30] Salt, D.E. and Krämer, U. (2000) Mechanisms of metal hyperaccumulation in plants. In: *Phytoremediation of Toxic Metals*. Raskin, I. and Ensley, B.D., Eds., John Wiley, New York. pp231–246.
- [31] Shahandeh, H. and Hossner, L.R. (2000) Plant screening for chromium phytoremediation. *Int. J. Phytorem*, 2, 31–51.
- [32] Kanazawa, K., Higuchi, K., Nishizawa, N.K., Fushiya, S., Chino, M. and Mori, S. (1994) Nicotianamine aminotransferase activities are correlated to the phytosiderophore secretion under Fedeficient conditions in Gramineae. *J Exp Bot*, 45, 1903–1906.
- [33] Cakmak, I., Sari, N., Marschner, H., Ekiz, H. and Kalayci, M. (1996) Phytosiderophore release in bread and durum wheat genotypes differing in zinc efficiency. *Plant Soil*, 180, 183–189.
- [34] Pellet, M.D., Grunes, D.L. and Kochian, L.V. (1995) Organic acid exudation as an aluminium tolerance mechanism in maize (*Zea mays* L.). *Planta*, 196, 788–795.
- [35] Larsen, P.B., Degenhardt, J., Tai, C.H.I., Stenzler, L.M., Howell, S.H. and Kochian, L.V. (1998) Aluminum-resistant *Arabidopsis* mutants that exhibit altered patterns of aluminum accumulation and organic acid release from roots. *Plant Physiol*, 117, 19–27.



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[36] Fitter, A.H. and Strickland, T.R. (1991) Architectural analysis of plant root systems. 2. Influence of nutrient supply on architecture in contrasting plant species. *New Phytol*, 118, 383–389.

[37] Campbell, B.D. and Grime, J.P (1989) A new method of exposing developing root systems to controlled patchiness in mineral nutrient supply. *Ann Bot*, 63, 395–400.

[38] Yilmaz, G. (1998) *Keyf Bitkileri*. Gaziosmanpaşa University, Tokat, Turkey, Zir. Fak. Yayın, Ders Notları Serisi, No: 5. [39] Macnair, M.R., Tilstone, G.H. and Smith, S.E. (2000) The genetics of metal tolerance and accumulation in higher plants. In: *Phytoremediation of Contaminated Soil and Water*, Terry, N. and Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 235–250.

[40] Belimov, A.A., Safronova, V.I., Tsyganov, V.E., Borisov, A.Y., Kozhemyakin, A.P., Stepanok, V.V., Martenson, A.M., Gianinazzi- Pearson, V. and Tikhonovich, I.A. (2003) Genetic variability in tolerance to cadmium and accumulation of heavy metals in pea (*Pisum sativum* L.). *Euphytica*, 131, 25–35.



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CADMIUM ACCUMULATION IN SOME TOBACCO VARIETIES (*Nicotiana tabacum* L.) PLANTS PARTS

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ABSTRACT

In this study, cadmium (Cd) phytoremediation responses of different tobacco varieties were compared and genetic differences between these varieties were analyzed. Two pot experiments were established with four oriental tobacco varieties, Akhisar, Basma, Dibek and Sarıbağlar, which were grown for 50 days in media containing 0, 10, 50, 100 and 150 mg/kg of Cd. Plants were departed as root, stem and leaf, and analyzed for their Cd amounts. In this regard, Cd distribution and uptake rates in different plant parts of the varieties were determined. Bioconcentration factor (BCF) values, which are considered to be important criteria for phytoremediation, were also calculated. Results revealed that Basma was the most efficient variety but Dibek was the most inefficient one in terms of biomass formation, Cd concentrations and uptake rates in the different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cd. Research results show that this variety can be classified as hyperaccumulator in terms of Cd.

Keywords: Oriental tobacco, phytoremediation, hyperaccumulation, variability, cadmium (Cd).



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INTRODUCTION

Environmental pollution in relation to heavy metals is a worldwide issue. A large number of methods and techniques are utilized to overcome this problem. One of the most widely used techniques is phytoremediation which is considered as a green technology. This technique involves the capability of some specific plants to absorb and accumulate heavy metal ions. Phytoremediation has received increasing attention starting from the discovery of hyperaccumulator plants, which are able to concentrate high levels of specific metals in their above-ground harvestable biomass [1]. Such a green technology addressed to metal pollution is preferred because of its cost-effectiveness, aesthetic advantages and long-term applicability. Moreover, it is a safe alternative to conventional soil cleanup methods.

Plants show differing morpho-physiological responses to soil metal contamination. Most of them are sensitive to very low concentrations, others have developed tolerance, and a limited number has capability in hyperaccumulation [2-4]. Baker and Walker [5] classified plants in three groups (excluders, indicators, accumulators) with regard to the concentrations of pollutants in shoot biomass in compare to the soil as lower, similar, and higher respectively. Plants to be used in phytoremediation, their characteristics, and their potential to accumulate heavy metals as well as their accumulation mechanisms are investigated by many researchers [6-12]. Various mechanisms for detoxification of heavy metals are possible, such as reduced translocation [12], compartmentalization to vacuoles and cell walls [13], chelation with phytochelatins [14], and biotransformation [15]. Hyperaccumulators, such as the well-studied *Thlaspi* and *Alyssum* species [16], are able to uptake specifically one or more metals, generally producing a small shoot biomass with high metal concentrations [2, 17].

Desirable characteristics for a plant species to be used in phytoremediation are (I) fast growth and high biomass; (II) extended root system for exploring large soil volumes; (III) good tolerance to high concentrations of metals in plant tissues; (IV) high translocation factor; (V) adaptability to specific environments/sites; and (VI) easy agricultural management. The ideal phytoremediation crop may combine rapid growth and high biomass with high metal accumulation in the shoot tissues [18-20]. Small shoot and root growth of the hyperaccumulator plants and the absence of their commercially available seeds have stimulated the studies on biomass species including the herbaceous field crops [1]. Therefore, recently, such crops are preferred because they form more biomass and are easily found and cultivated. In this regard, tobacco received attention with its unique nicotine synthesis via roots.



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The objective of this study was to examine Cd uptake, transport and accumulation characteristics of oriental tobacco with special emphasis on its different varieties. Possible potential effects of genetic differences between varieties will be discussed.

MATERIALS and METHODS

Two separate pot experiments were conducted to study the Cd uptake within Basma, Akhisar, Dibek and Sarıbağlar oriental tobacco varieties. A soil and perlite mixture was used as growing medium. For this purpose, 1.5 kg of soil and 75 g perlite was mixed and placed into plastic pots with 2 kg capacity (20 * 14 * 17 cm). The texture of soil was silty loam with 45% sand, 47% silt, and 8% clay. The pH, EC, and OM values of soil were 7.8, 0.2 dS m⁻¹, and 0.5%, respectively [25, 26]. For each experiment, the designated treatments were 1: control; 2: NPK; 3: NPK+10 mg/kg; 4: NPK+50 mg/kg; 5: NPK+ 100 mg/kg, and 6: NPK +150 mg/kg of Cd or Cr. Perlite was wetted with the nutrient and heavy metal solutions, further mixed well with 1.5 kg of soil, and placed in the pots. In the experiments, Cd(NO₃)₂ 4H₂O were used as Cd sources. 150 mg N/kg, 20 mg P/kg and 150 mg K/kg were used in all pots excluding the control. NH₄NO₃; KH₂PO₄ and K₂SO₄ were used as N, P and K sources, respectively. At the beginning of the experiments, four seedlings were planted in each pot. After ten days, thinning was made and only two seedlings were left. The irrigation was practiced at field capacity and the leaked water returned into the pots in order to prevent losses. After 50 days of growing, plants were harvested and separated as root, stem and leaf, and biomass values of plant parts were recorded.

Analysis

The dried (65–70o C) and finely ground plant samples were wet digested in a mixture of nitric acid (HNO₃)/perchloric acid (HClO₄) (4/1) [27]. Concentrations of Cd in the digest were measured using atomic absorption spectrophotometry (Varian 2200) [28].

Statistical Analysis

The data were subjected to analysis of variance (ANOVA) using factorial randomized complete block design with three replications. Each replication contained two pots with two plant (n:12), and least significant difference (LSD0.05) was used to determine significant differences between the treatment means. All graphs were created using SPSS version 15 for Windows (SPSS Inc., Chicago,IL).



RESULTS and DISCUSSION

In this study, biomass of different varieties, Cd concentrations of different plant parts (root, stem and leaf), the uptake amounts of Cd by these parts, and the bioconcentration factor (BCF) values related to the treatments were evaluated.

Biomass

Significant differences were found in the biomass of roots, stems and leaves of all varieties with respect to increasing concentrations of Cd. In all treatments, the highest biomass values (root, stem and leaf) were determined for the Basma and the lowest ones for the Dibek variety. The highest biomasses of the plant parts were obtained from NPK treatments. With the addition of Cd, the biomasses value decreased. Parallel to the increasing concentrations of Cd, the biomass values of root, stem and leaf of Dibek variety decreased starting from the lowest dose of Cd application, and showed significant declines with the enhancements in Cd. Basma variety root, stem and leaf biomass decreased with Cd applications as well. However, decreases were not evident in the lowest dose of Cd, but in the higher doses is more evident (Fig. 1). Biomass values of Akhisar and Sarıbağlar varieties were found to be between the values observed for Basma and Dibek. Basma variety biomasses (root, stem and leaf) were higher than the values of all other varieties.

On the other hand, the biomass of Dibek variety was the lowest in all of the treatments (Fig. 1). The highest total biomass (root + stem + leaf) values were obtained from the NPK treatment, and total biomasses declined with increasing Cd concentrations at all varieties (Fig 2 and 3). On the other hand, Dibek variety responded quite differently. In the Cd treatment, the decrease in total biomass was evident at the lowest dose.

A high proportion of above-ground plant parts are desirable in terms of phytoremediation applicability. In this study, harvestable parts/root biomass ratios were calculated. Parallel with increasing concentrations of Cd, the specified ratio did not show any significant change in Basma variety; meanwhile, in other varieties tended to be decreased.

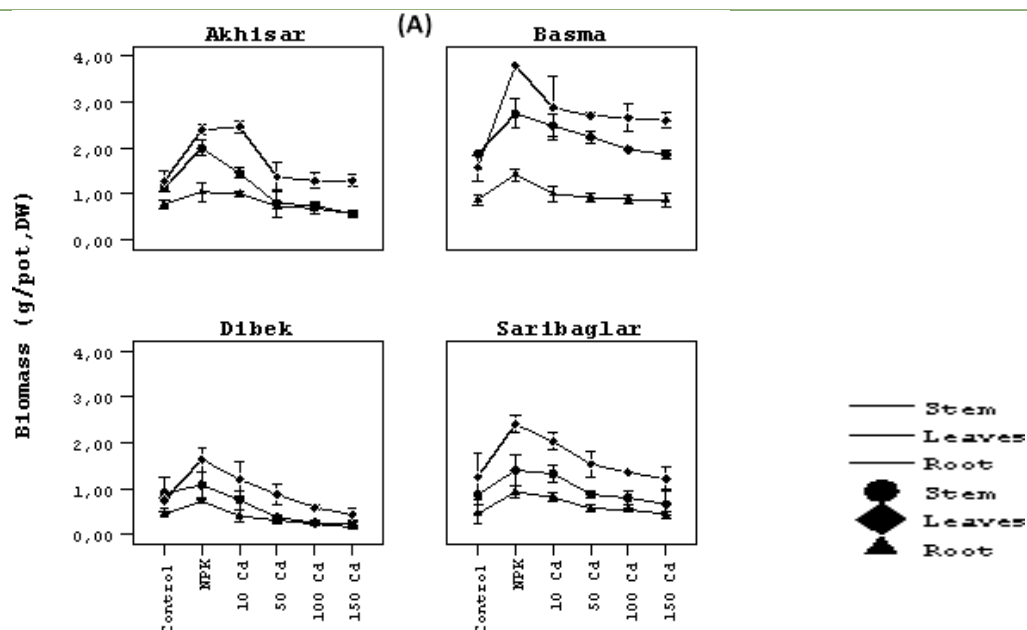


Figure 1. Effect of Cd (A) concentrations on biomass of plant parts. Error bars represent the standard error for three replications

Distribution and Accumulation of Cd in Plant Parts

Depending on the application doses, Cd concentrations of different plant parts (roots, stems and leaves) of all varieties showed significant increases compared to the control and NPK treatments. All of the harvestable parts of Basma variety had higher Cd concentrations than the Dibek variety. In 150 mg/kg treatments, Cd concentrations in the leaves were measured to be 116.64 and 122.26 mg/kg, but 102.89 and 69.17 mg/kg in the roots, respectively (Table 2). It is stated that in the hyperaccumulator plants, the highest tissue metal levels are found in the shoots rather than the roots, possibly due to distinctive physiological characteristics associated with root-shoot partitioning [8, 29, 30].

Plants containing more than 100 mg/kg Cd in their above-ground parts are classified as Cd hyperaccumulators [2]. According to our results, Basma variety can be classified as a Cd hyperaccumulator plant.

In all varieties and treatments, Cd concentrations of the roots were found to be close to each other. In contrast to roots, Cd concentrations of the above-ground parts changed according to the varieties and treatments.

This specific case might be related to the efficient translocation of Cd from roots to above-ground parts.



The ratio of harvestable/root concentrations of all varieties was found to be higher than 1 for the 10 mg/kg treatments. However, parallel to enhanced Cd concentrations, this ratio apparently declined in all varieties, except Basma variety, which showed no significant change. These findings once again confirm the hyperaccumulating nature of Basma.

Uptake of Cd

The total uptake of Cd changed according to varieties and treatments. Basma variety with its higher Cd tissue concentrations and higher biomass had higher uptake values for Cd, and significantly differed from the other varieties. In all of the varieties, the amount of Cd uptake was parallel with increasing Cd concentrations (Fig. 4).

In terms of the partitioning of total uptake according to different plant parts, Basma had higher values of Cd. For example, in the highest dose-treatments, this variety accumulated 5 to 6 fold Cd amounts compared to Dibek (Fig. 5). In addition to genetic variability, some researchers related translocation of heavy metals in plants with their transpiration rates. During the experimentation our observations about the relatively small leaf area and less irrigation requirement of Dibek variety might support the above specified role of transpiration rate in translocation of heavy metals.

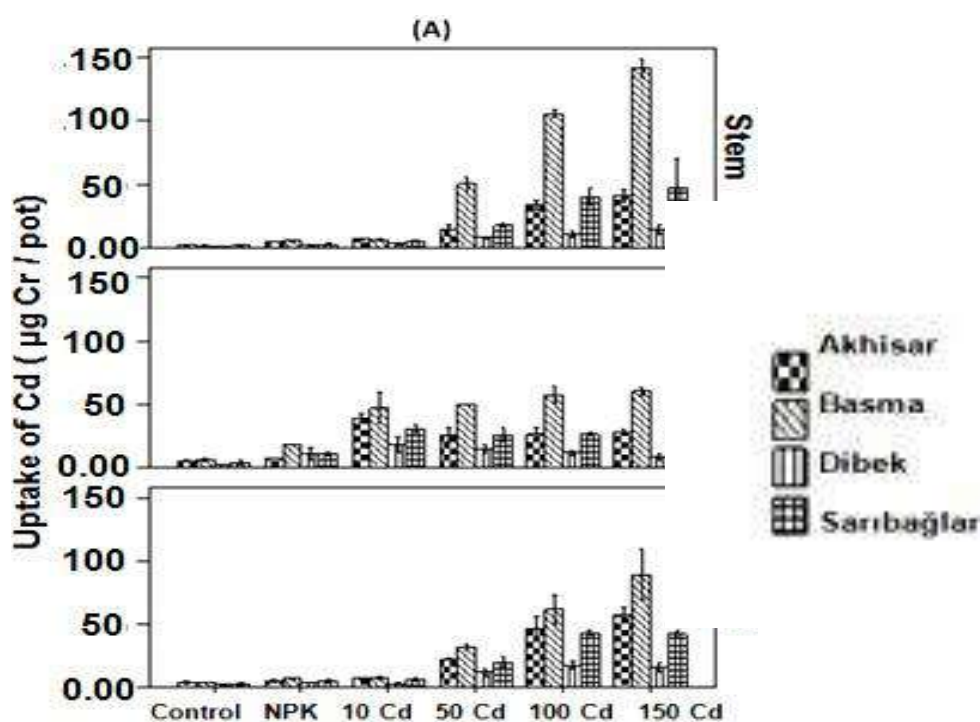


Figure 2. Uptake of Cd (A) by different plant parts of Akhisar, Basma, Dibek and Sarıbağlar. Error bars represent the standard error for three replications



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CONCLUSION

As a result of this study, significant differences were found in the biomass of root, stem and leaves of all varieties with respect to increasing concentrations of Cd and Cr. In all treatments, Basma was the most efficient variety but Dibek the most inefficient one, in terms of biomass formation, Cd concentrations as well as uptake rates in different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cd and Cr. Research results show that this variety can be classified as hyperaccumulator in terms of Cd.



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REFERENCES

- [1] Vamerali, T., Bandiera, M. and Mosca, G. (2010) Field crops for phytoremediation of metal-contaminated land, A review. *Environ Chem, Lett*, 8, 1–17.
- [2] Baker, A.J.M. and Brooks, R.R. (1989) Terrestrial higher plants which hyperaccumulate metallic elements—a review of their distribution, ecology and phytochemistry. *Biorecovery*, 1, 81–126.
- [3] Barcelo, J., Vazquez, M.D., Ma'dico, J. and Poschenrieder, C. (1994) Hyperaccumulation of zinc and cadmium in *Thlaspi caerulescens*. In: Varnavas SP (ed) *Environmental contamination*. CEP Consultants Ltd., Edinburgh, pp 132–134.
- [4] Brooks, R.R. (1998) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford.
- [5] Baker, A.J.M. and Walker, P.L. (1989) Ecophysiology of metal uptake by tolerant plants. In: Shaw A (ed) *Heavy metal tolerance in plants—Evolutionary aspects*. CRC Press, Boca Raton, Florida.
- [6] Cataldo, D.A., Garland, T.R. and Wildung, R.E. (1978) Nickel in plants: II. Distribution and chemical form in soybean plants. *Plant Physiol*, 62, 566–570.
- [7] Wagner, G.J. and Yeagan, R. (1986) Variation in Cadmium Accumulation Potential and Tissue Distribution of Cadmium in Tobacco. *Plant Physiol*, 82, 274–279.
- [8] Baker, A.J.M., Reeves. R.D. and Hajar, A.S.M. (1994) Heavy metal accumulation and tolerance in British populations of the metallophyte *Thlaspi caerulescens* J. and C. Presl (Brassicaceae), *New Phytol*, 127, 61–68.
- [9] Bert, V., Macnair, M.R., DeLaguerie, P., Saumitou-Laprade, P. and Petit, D. (2000) Zinc tolerance and accumulation in metallicolous and nonmetallicolous populations of *Arabidopsis halleri* (Brassicaceae). *New Phytol*, 146, 225–233.
- [10] Assunção, A.G.L., Martins, P.D.C., De Folter, S., Vooijs, R., Schat, H. and Aarts, M.G.M. (2001) Elevated expression of metal transporter genes in three accessions of the metal hyperaccumulator *Thlaspi caerulescens*. *Plant Cell Environ*, 24, 217–226.
- [11] Angelova, V., Ivanov, K. and Ivanova, R. (2004) Effect of Chemical Forms of Lead, Cadmium, and Zinc in Polluted Soils on Their uptake by Tobacco. *Journal of Plant Nutrition*, 27(5), 757- 773.
- [12] Angelova, V. and Ivanov, K. (2009) Bio-accumulation and distribution of heavy metals in black mustard (*Brassica nigra* Koch). *Environ Monit Assess*, 153, 449–459.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- [13] Lasat, M.M., Baker, A.J.M. and Kochian, L.V. (1998) Altered Zn compartmentation in the root symplasm and stimulated Zn absorption into the leaf as mechanisms involved in Zn hyperaccumulation in *Thlaspi caerulescens*. *Plant Physiol*, 118, 875–883.
- [14] Cobbett, C.S. (2000) Phytochelatins and their roles in heavy metal detoxification. *Plant Physiol*, 123, 825–832.
- [15] Tomsett, A.B., Sewell, A.K., Jones, S.J., Miranda, J.R. and De Thurman, D.A. (1992) Metal-binding proteins and metalregulated gene expression in higher plants. In: Wray JL (ed) *Inducible plant proteins: their biochemistry and molecular biology*, Cambridge University Press, Cambridge, pp 1–24.
- [16] McGrath, S.P. (1998) Phytoextraction for soil remediation. In: Brooks RR (ed) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford, pp 261–287.
- [17] Reeves, R.D. and Baker, A.J.M. (2000) Metal-accumulating plants. In: Raskin I, Ensley BD (eds) *Phytoremediation of toxic metals: using plants to clean up the environment*. Wiley, New York, pp 193–230.
- [18] Chaney, R.L., Li, Y.M., Brown, S.L., Homer, F.A., Malik, M., Angle, J.S., Baker, A.J.M., Reeves, R.D. and Chin, M. (2000) Improving metal hyperaccumulator wild plants to develop commercial phytoextraction systems: approaches and progress. In: *Phytoremediation of Contaminated Soil and Water*. Terry, N. And Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 129–158.
- [19] Lasat, M.M. (2002) Phytoremediation of toxic metals: a review of biological mechanisms. *J Environ Qual*, 31, 109–120.
- [20] McGrath, S.P., Zhao, F.J. and Lombi, E. (2002) Phytoremediation of metals, metalloids, and radionuclides. *Advances in Agronomy*, 75, 1–56.
- [21] Stephan, U.W. and Grün, M. (1989) Physiological disorders of the nicotianamine-auxotroph tomato mutant *chloronerva* at different level of iron nutrition. II Iron deficiency response and heavy metal metabolism. *Biochim Physiol, Pflanzen*, 185, 189–200.
- [22] Stephan, U.W. and Scholz, G. (1993) Nicotianamine: mediator of transport of iron and heavy metals in the phloem? *Physiol Plant*, 88, 522–529.
- [23] Pollard, A.J., Powell, K.D., Harper, F.A. and Smith, J.A.C. (2002) The genetic basis of metal hyperaccumulation in plants. *Critical Reviews in Plant Sciences*, 21(6), 539–566 pp 155–178.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- [24] Macnair, M.R., Smith, S.E. and Cubes, Q.J. (1993) Heritability and distribution of variation in degree of copper tolerance in *Mimulus guttatus* at Copperopolis, California. *Heredity*, 71, 445–456.
- [25] Kacar, B. (2009) *Toprak Analizleri (Soil Analysis)*. Nobel Yayınları, No: 1387, Ankara.
- [26] Page, A.L., Miller, R.H. and Keeray, D.R. (1982) *Methods of soil analysis*. Amer. Soc. of Agronomy Inc, No: 9, Wisconsin, USA.
- [27] Kacar, B. (1972) Bitki ve Toprağın Kimyasal Analizleri: II. Bitki Analizleri [Chemical analysis of plant and soil, part II: Plant analysis], Ankara, Turkey: Faculty of Agriculture, Ankara University.
- [28] Isaac, R.A. and Kerber, J.D. (1971) “Atomic absorption and flame photometry: Techniques and uses in soil, plant and water analysis”. In *Instrumental Methods of Analysis of Soils and Plant Tissue* Madison, Wisc, Soil Science Society of America.
- [29] Baker, A.J.M. (1981) Accumulators and excluders – strategies in the response of plants to heavy metals. *J. Plant Nutr*, 3, 643–654.
- [30] Salt, D.E. and Krämer, U. (2000) Mechanisms of metal hyperaccumulation in plants. In: *Phytoremediation of Toxic Metals*. Raskin, I. and Ensley, B.D., Eds., John Wiley, New York. pp231–246.
- [31] Shahandeh, H. and Hossner, L.R. (2000) Plant screening for chromium phytoremediation. *Int. J. Phytorem*, 2, 31–51.
- [32] Kanazawa, K., Higuchi, K., Nishizawa, N.K., Fushiya, S., Chino, M. and Mori, S. (1994) Nicotianamine aminotransferase activities are correlated to the phytosiderophore secretion under Fedeficient conditions in Gramineae. *J Exp Bot*, 45, 1903–1906.
- [33] Cakmak, I., Sari, N., Marschner, H., Ekiz, H. and Kalayci, M. (1996) Phytosiderophore release in bread and durum wheat genotypes differing in zinc efficiency. *Plant Soil*, 180, 183–189.
- [34] Pellet, M.D., Grunes, D.L. and Kochian, L.V. (1995) Organic acid exudation as an aluminium tolerance mechanism in maize (*Zea mays* L.). *Planta*, 196, 788–795.
- [35] Larsen, P.B., Degenhardt, J., Tai, C.H.I., Stenzler, L.M., Howell, S.H. and Kochian, L.V. (1998) Aluminum-resistant *Arabidopsis* mutants that exhibit altered patterns of aluminum accumulation and organic acid release from roots. *Plant Physiol*, 117, 19–27.



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[36] Fitter, A.H. and Strickland, T.R. (1991) Architectural analysis of plant root systems. 2. Influence of nutrient supply on architecture in contrasting plant species. *New Phytol*, 118, 383–389.

[37] Campbell, B.D. and Grime, J.P (1989) A new method of exposing developing root systems to controlled patchiness in mineral nutrient supply. *Ann Bot*, 63, 395–400.

[38] Yilmaz, G. (1998) *Keyf Bitkileri*. Gaziosmanpaşa University, Tokat, Turkey, Zir. Fak. Yayın, Ders Notları Serisi, No: 5. [39] Macnair, M.R., Tilstone, G.H. and Smith, S.E. (2000) The genetics of metal tolerance and accumulation in higher plants. In: *Phytoremediation of Contaminated Soil and Water*, Terry, N. and Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 235–250.

[40] Belimov, A.A., Safronova, V.I., Tsyganov, V.E., Borisov, A.Y., Kozhemyakin, A.P., Stepanok, V.V., Martenson, A.M., Gianinazzi- Pearson, V. and Tikhonovich, I.A. (2003) Genetic variability in tolerance to cadmium and accumulation of heavy metals in pea (*Pisum sativum* L.). *Euphytica*, 131, 25–35.



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**CONCENTRATIONS OF CHROMIUM IN SOME ORIENTAL TOBACCO
VARIETIES (*Nicotiana tabaccum* L.)**

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ABSTRACT

Chromium is a potentially toxic metal occurring in water and groundwater. In this study, chromium (Cr) phytoremediation responses of different tobacco varieties were compared and genetic differences between these varieties were analyzed. Two pot experiments were established with four oriental tobacco varieties, Akhisar, Basma, Dibek and Sarıbağlar, which were grown for 50 days in media containing 0, 10, 50, 100 and 150 mg/kg of Cr. Bioconcentration factor (BCF) values, which are considered to be important criteria for phytoremediation, were also calculated. Results revealed that Basma was the most efficient variety but Dibek was the most inefficient one in terms of biomass formation, Cr concentrations and uptake rates in the different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cr.

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INTRODUCTION

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MATERIALS and METHODS

Two separate pot experiments were conducted to study the Cr uptake within Basma, Akhisar, Dibek and Sarıbağlar oriental tobacco varieties. A soil and perlite mixture was used as growing medium. For this purpose, 1.5 kg of soil and 75 g perlite was mixed and placed into plastic pots with 2 kg capacity (20 * 14 * 17 cm). The texture of soil was silty loam with 45% sand, 47% silt, and 8% clay. The pH, EC, and OM values of soil were 7.8, 0.2 dS m⁻¹, and 0.5%, respectively [25, 26]. For each experiment, the designated treatments were 1: control; 2: NPK; 3: NPK+10 mg/kg; 4: NPK+50 mg/kg; 5: NPK+ 100 mg/kg, and 6: NPK +150 mg/kg of Cr. Perlite was wetted with the nutrient and heavy metal solutions, further mixed well with 1.5 kg of soil, and placed in the pots. In the experiments, K₂Cr₂O₇ were used as Cr sources. 150 mg N/kg, 20 mg P/kg and 150 mg K/kg were used in all pots excluding the control. NH₄NO₃; KH₂PO₄ and K₂SO₄ were used as N, P and K sources, respectively. At the beginning of the experiments, four seedlings were planted in each pot. After ten days, thinning was made and only two seedlings were left. The irrigation was practiced at field capacity and the leaked water returned into the pots in order to prevent losses. After 50 days of growing, plants were harvested and separated as root, stem and leaf, and biomass values of plant parts were recorded.

Analysis

The dried (65–70o C) and finely ground plant samples were wet digested in a mixture of nitric acid (HNO₃)/perchloric acid (HClO₄) (4/1) [27]. Concentrations of Cr in the digest were measured using atomic absorption spectrophotometry (Varian 2200) [28].

Statistical Analysis

The data were subjected to analysis of variance (ANOVA) using factorial randomized complete block design with three replications. Each replication contained two pots with two plant (n:12), and least significant difference (LSD0.05) was used to determine significant differences between the treatment means. All graphs were created using SPSS version 15 for Windows (SPSS Inc., Chicago,IL).

RESULTS and DISCUSSION

Significant differences were found in the biomass of roots, stems and leaves of all varieties with respect to increasing concentrations of Cr. In all treatments, the highest biomass values (root, stem and leaf) were determined for the Basma and the lowest ones for the Dibek variety. The highest biomasses of the plant parts were obtained from NPK treatments. With the addition of



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Cr, the biomasses value decreased. Parallel to the increasing concentrations of Cr, the biomass values of root, stem and leaf of Dibek variety decreased starting from the lowest dose of Cr application, and showed significant declines with the enhancements in Cr. Basma variety root, stem and leaf biomass decreased with Cr applications as well. However, decreases were not evident in the lowest dose of Cr, but in the higher doses is more evident (Fig. 1). Biomass values of Akhisar and Sarıbağlar varieties were found to be between the values observed for Basma and Dibek. Basma variety biomasses (root, stem and leaf) were higher than the values of all other varieties.

On the other hand, the biomass of Dibek variety was the lowest in all of the treatments (Fig. 1). The highest total biomass (root + stem + leaf) values were obtained from the NPK treatment, and total biomasses declined with increasing Cr concentrations at all varieties (Fig 2 and 3). The decline of Basma total biomass value was not very evident up to 100 mg/kg of Cr application. On the other hand, Dibek variety responded quite differently. In the Cr treatment, at doses over 10 mg/kg.

A high proportion of above-ground plant parts are desirable in terms of phytoremediation applicability. In this study, harvestable parts/root biomass ratios were calculated. In the Cr experiment, the harvestable/ root ratio of Dibek did not show any significant changes in any of the Cr dosage groups including the control and NPK (Table 1).

Table 1. Effect of Cr (mg/kg) concentrations on harvestable biomass of Akhisar, Basma, Dibek, and Sarıbağlar (B) concentrations of Cr (mg/kg) in oriental tobacco varieties

(Cr)		Control	NPK	10 Cr	50 Cr	100 Cr	150 Cr
Harvestable	Basma	3.69a	7.31a	5.69a	5.02a	3.12a	2.78a
	Akhisar	2.16b	5.23b	4.83ab	3.49b	2.89a	2.39a
	Sarıbağlar	2.43ab	4.40b	3.97b	3.53b	2.66a	2.05a
	Dibek	1.50b	4.25b	3.80b	2.80b	2.33a	1.60a
Harvestable/ root	Basma	4.42a	4.31a	3.71b	3.62b	3.00b	3.03b
	Akhisar	3.00a	3.50a	3.56b	3.10b	3.11b	2.89b
	Sarıbağlar	4.17a	3.70a	3.53b	3.21b	2.70b	3.23b
	Dibek	3.75a	5.47a	6.75a	9.33a	10.00a	8.00a

Means with same letters are not significantly different ($p < 0.05$).



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(B)		Control	NPK	10Cr	50Cr	100Cr	150Cr
Root	Basma	4.34a	4.52a	6.05a	21.59a	42.93a	69.17a
	Akhisar	4.87a	5.14a	5.60a	19.25a	43.54a	60.18b
	Sarıbağlar	5.31a	5.36a	7.13a	19.16a	33.58b	69.83a
	Dibek	3.33a	3.50a	4.05a	18.42a	37.12b	69.43a
Stem	Basma	2.62a	2.65a	63.83a	71.62a	81.04a	101.13a
	Akhisar	2.33a	2.46a	7.69b	20.35b	29.54b	41.46b
	Sarıbağlar	1.67a	2.09a	8.92b	19.39b	29.23b	40.28b
	Dibek	2.53a	2.38a	8.31b	18.94b	26.41b	37.71b
Leaves	Basma	4.29a	4.81a	72.83a	85.00a	93.92a	122.26a
	Akhisar	4.40a	4.82a	15.05b	16.27b	17.30b	20.15b
	Sarıbağlar	3.63a	4.56a	14.94b	16.24b	17.04b	18.96b
	Dibek	4.14a	4.58a	15.18b	16.42b	17.83b	18.25b
Harvestable/ root	Basma	0.64a	0.71a	8.99a	2.88a	1.55a	1.23a
	Akhisar	0.53a	0.56a	1.59c	0.70b	0.39b	0.35b
	Sarıbağlar	0.41a	0.53a	1.36c	0.70b	0.47b	0.28b
	Dibek	0.82a	0.93a	2.74b	0.86b	0.54b	0.32b

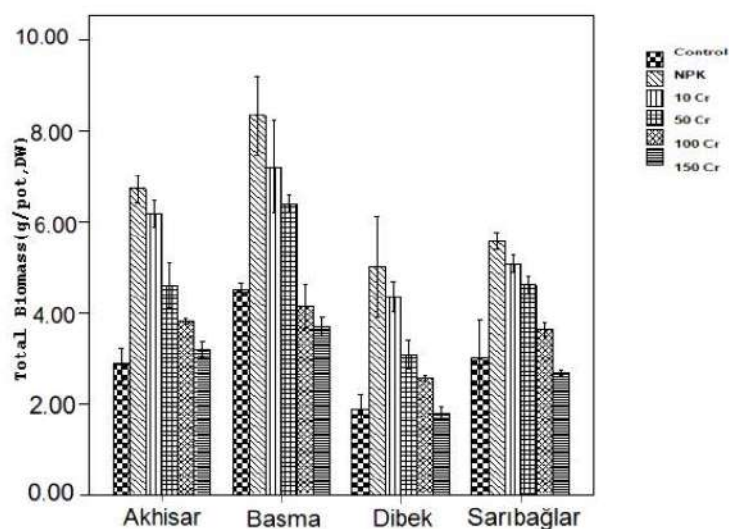


FIGURE 3 - Effect of Cr concentrations on total biomass of Akhisar, Basma, Dibek and Sarıbağlar. Error bars represent the standard error for three replications.

CONCLUSION

As a result of this study, significant differences were found in the biomass of root, stem and leaves of all varieties with respect to increasing concentrations of Cr. In all treatments, Basma was the most efficient variety but Dibek the most inefficient one, in terms of biomass formation, Cr concentrations as well as uptake rates in different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cr.



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REFERENCES

- [1] Vamerali, T., Bandiera, M. and Mosca, G. (2010) Field crops for phytoremediation of metal-contaminated land, A review. *Environ Chem, Lett*, 8, 1–17.
- [2] Baker, A.J.M. and Brooks, R.R. (1989) Terrestrial higher plants which hyperaccumulate metallic elements—a review of their distribution, ecology and phytochemistry. *Biorecovery*, 1, 81–126.
- [3] Barcelo, J., Vazquez, M.D., Ma'dico, J. and Poschenrieder, C. (1994) Hyperaccumulation of zinc and cadmium in *Thlaspi caerulescens*. In: Varnavas SP (ed) *Environmental contamination*. CEP Consultants Ltd., Edinburgh, pp 132–134.
- [4] Brooks, R.R. (1998) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford.
- [5] Baker, A.J.M. and Walker, P.L. (1989) Ecophysiology of metal uptake by tolerant plants. In: Shaw A (ed) *Heavy metal tolerance in plants—Evolutionary aspects*. CRC Press, Boca Raton, Florida.
- [6] Cataldo, D.A., Garland, T.R. and Wildung, R.E. (1978) Nickel in plants: II. Distribution and chemical form in soybean plants. *Plant Physiol*, 62, 566–570.
- [7] Wagner, G.J. and Yeagan, R. (1986) Variation in Cadmium Accumulation Potential and Tissue Distribution of Cadmium in Tobacco. *Plant Physiol*, 82, 274–279.
- [8] Baker, A.J.M., Reeves. R.D. and Hajar, A.S.M. (1994) Heavy metal accumulation and tolerance in British populations of the metallophyte *Thlaspi caerulescens* J. and C. Presl (Brassicaceae), *New Phytol*, 127, 61–68.
- [9] Bert, V., Macnair, M.R., DeLaguerie, P., Saumitou-Laprade, P. and Petit, D. (2000) Zinc tolerance and accumulation in metallicolous and nonmetallicolous populations of *Arabidopsis halleri* (Brassicaceae). *New Phytol*, 146, 225–233.
- [10] Assunção, A.G.L., Martins, P.D.C., De Folter, S., Vooijs, R., Schat, H. and Aarts, M.G.M. (2001) Elevated expression of metal transporter genes in three accessions of the metal hyperaccumulator *Thlaspi caerulescens*. *Plant Cell Environ*, 24, 217–226.
- [11] Angelova, V., Ivanov, K. and Ivanova, R. (2004) Effect of Chemical Forms of Lead, Cadmium, and Zinc in Polluted Soils on Their uptake by Tobacco. *Journal of Plant Nutrition*, 27(5), 757- 773.
- [12] Angelova, V. and Ivanov, K. (2009) Bio-accumulation and distribution of heavy metals in black mustard (*Brassica nigra* Koch). *Environ Monit Assess*, 153, 449–459.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- [13] Lasat, M.M., Baker, A.J.M. and Kochian, L.V. (1998) Altered Zn compartmentation in the root symplasm and stimulated Zn absorption into the leaf as mechanisms involved in Zn hyperaccumulation in *Thlaspi caerulescens*. *Plant Physiol*, 118, 875–883.
- [14] Cobbett, C.S. (2000) Phytochelatins and their roles in heavy metal detoxification. *Plant Physiol*, 123, 825–832.
- [15] Tomsett, A.B., Sewell, A.K., Jones, S.J., Miranda, J.R. and De Thurman, D.A. (1992) Metal-binding proteins and metalregulated gene expression in higher plants. In: Wray JL (ed) *Inducible plant proteins: their biochemistry and molecular biology*, Cambridge University Press, Cambridge, pp 1–24.
- [16] McGrath, S.P. (1998) Phytoextraction for soil remediation. In: Brooks RR (ed) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford, pp 261–287.
- [17] Reeves, R.D. and Baker, A.J.M. (2000) Metal-accumulating plants. In: Raskin I, Ensley BD (eds) *Phytoremediation of toxic metals: using plants to clean up the environment*. Wiley, New York, pp 193–230.
- [18] Chaney, R.L., Li, Y.M., Brown, S.L., Homer, F.A., Malik, M., Angle, J.S., Baker, A.J.M., Reeves, R.D. and Chin, M. (2000) Improving metal hyperaccumulator wild plants to develop commercial phytoextraction systems: approaches and progress. In: *Phytoremediation of Contaminated Soil and Water*. Terry, N. And Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 129–158.
- [19] Lasat, M.M. (2002) Phytoremediation of toxic metals: a review of biological mechanisms. *J Environ Qual*, 31, 109–120.
- [20] McGrath, S.P., Zhao, F.J. and Lombi, E. (2002) Phytoremediation of metals, metalloids, and radionuclides. *Advances in Agronomy*, 75, 1–56.
- [21] Stephan, U.W. and Grün, M. (1989) Physiological disorders of the nicotianamine-auxotroph tomato mutant *chloronerva* at different level of iron nutrition. II Iron deficiency response and havy metal metabolism. *Biochm Physiol, Pflanzen*, 185, 189-200.
- [22] Stephan, U.W. and Scholz, G. (1993) Nicotiamine: mediator of transport of iron and heavy metals in the phloem? *Physiol Plant*, 88, 522-529.
- [23] Pollard, A.J., Powell, K.D., Harper, F.A. and Smith, J.A.C. (2002) The genetic basis of metal hyperaccumulation in plants. *Critical Reviews in Plant Sciences*, 21(6), 539–566 pp 155–178.



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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BINGOL, TURKEY**



- [24] Macnair, M.R., Smith, S.E. and Cubes, Q.J. (1993) Heritability and distribution of variation in degree of copper tolerance in *Mimulus guttatus* at Copperopolis, California. *Heredity*, 71, 445–456.
- [25] Kacar, B. (2009) *Toprak Analizleri (Soil Analysis)*. Nobel Yayınları, No: 1387, Ankara.
- [26] Page, A.L., Miller, R.H. and Keeray, D.R. (1982) *Methods of soil analysis*. Amer. Soc. of Agronomy Inc, No: 9, Wisconsin, USA.
- [27] Kacar, B. (1972) Bitki ve Toprağın Kimyasal Analizleri: II. Bitki Analizleri [Chemical analysis of plant and soil, part II: Plant analysis], Ankara, Turkey: Faculty of Agriculture, Ankara University.
- [28] Isaac, R.A. and Kerber, J.D. (1971) “Atomic absorption and flame photometry: Techniques and uses in soil, plant and water analysis”. In *Instrumental Methods of Analysis of Soils and Plant Tissue* Madison, Wisc, Soil Science Society of America.
- [29] Baker, A.J.M. (1981) Accumulators and excluders – strategies in the response of plants to heavy metals. *J. Plant Nutr*, 3, 643–654.
- [30] Salt, D.E. and Krämer, U. (2000) Mechanisms of metal hyperaccumulation in plants. In: *Phytoremediation of Toxic Metals*. Raskin, I. and Ensley, B.D., Eds., John Wiley, New York. pp231–246.
- [31] Shahandeh, H. and Hossner, L.R. (2000) Plant screening for chromium phytoremediation. *Int. J. Phytorem*, 2, 31–51.
- [32] Kanazawa, K., Higuchi, K., Nishizawa, N.K., Fushiya, S., Chino, M. and Mori, S. (1994) Nicotianamine aminotransferase activities are correlated to the phytosiderophore secretion under Fedeficient conditions in Gramineae. *J Exp Bot*, 45, 1903–1906.
- [33] Cakmak, I., Sari, N., Marschner, H., Ekiz, H. and Kalayci, M. (1996) Phytosiderophore release in bread and durum wheat genotypes differing in zinc efficiency. *Plant Soil*, 180, 183–189.
- [34] Pellet, M.D., Grunes, D.L. and Kochian, L.V. (1995) Organic acid exudation as an aluminium tolerance mechanism in maize (*Zea mays* L.). *Planta*, 196, 788–795.
- [35] Larsen, P.B., Degenhardt, J., Tai, C.H.I., Stenzler, L.M., Howell, S.H. and Kochian, L.V. (1998) Aluminum-resistant *Arabidopsis* mutants that exhibit altered patterns of aluminum accumulation and organic acid release from roots. *Plant Physiol*, 117, 19–27.



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and RURAL DEVELOPMENT
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[36] Fitter, A.H. and Strickland, T.R. (1991) Architectural analysis of plant root systems. 2. Influence of nutrient supply on architecture in contrasting plant species. *New Phytol*, 118, 383–389.

[37] Campbell, B.D. and Grime, J.P (1989) A new method of exposing developing root systems to controlled patchiness in mineral nutrient supply. *Ann Bot*, 63, 395–400.

[38] Yilmaz, G. (1998) *Keyf Bitkileri*. Gaziosmanpaşa University, Tokat, Turkey, Zir. Fak. Yayın, Ders Notları Serisi, No: 5. [39] Macnair, M.R., Tilstone, G.H. and Smith, S.E. (2000) The genetics of metal tolerance and accumulation in higher plants. In: *Phytoremediation of Contaminated Soil and Water*, Terry, N. and Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 235–250.

[40] Belimov, A.A., Safronova, V.I., Tsyganov, V.E., Borisov, A.Y., Kozhemyakin, A.P., Stepanok, V.V., Martenson, A.M., Gianinazzi- Pearson, V. and Tikhonovich, I.A. (2003) Genetic variability in tolerance to cadmium and accumulation of heavy metals in pea (*Pisum sativum* L.). *Euphytica*, 131, 25–35.



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**PHYTOREMEDIATION CAPACITIES OF SOME TOBACCO VARIETIES
(*Nicotiana tabaccum* L.) OF CADMIUM IN SOIL**

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ABSTRACT

In this study, cadmium (Cd) phytoremediation responses of different tobacco varieties were compared and genetic differences between these varieties were analyzed. Two pot experiments were established with four oriental tobacco varieties, Akhisar, Basma, Dibek and Sarıbağlar, which were grown for 50 days in media containing 0, 10, 50, 100 and 150 mg/kg of Cd. Plants were departed as root, stem and leaf, and analyzed for their Cd amounts. In this regard, Cd distribution and uptake rates in different plant parts of the varieties were determined. Results revealed that Basma was the most efficient variety but Dibek was the most inefficient one in terms of biomass formation, Cd concentrations and uptake rates in the different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cd. Research results show that this variety can be classified as hyperaccumulator in terms of Cd.

Keywords: Oriental tobacco, phytoremediation, hyperaccumulation, cadmium (Cd).



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INTRODUCTION

Environmental pollution in relation to heavy metals is a worldwide issue. A large number of methods and techniques are utilized to overcome this problem. One of the most widely used techniques is phytoremediation which is considered as a green technology. This technique involves the capability of some specific plants to absorb and accumulate heavy metal ions. Phytoremediation has received increasing attention starting from the discovery of hyperaccumulator plants, which are able to concentrate high levels of specific metals in their above-ground harvestable biomass [1]. Such a green technology addressed to metal pollution is preferred because of its cost-effectiveness, aesthetic advantages and long-term applicability. Moreover, it is a safe alternative to conventional soil cleanup methods.

Plants show differing morpho-physiological responses to soil metal contamination. Most of them are sensitive to very low concentrations, others have developed tolerance, and a limited number has capability in hyperaccumulation [2-4]. Baker and Walker [5] classified plants in three groups (excluders, indicators, accumulators) with regard to the concentrations of pollutants in shoot biomass in compare to the soil as lower, similar, and higher respectively. Plants to be used in phytoremediation, their characteristics, and their potential to accumulate heavy metals as well as their accumulation mechanisms are investigated by many researchers [6-12]. Various mechanisms for detoxification of heavy metals are possible, such as reduced translocation [12], compartmentalization to vacuoles and cell walls [13], chelation with phytochelatins [14], and biotransformation [15]. Hyperaccumulators, such as the well-studied *Thlaspi* and *Alyssum* species [16], are able to uptake specifically one or more metals, generally producing a small shoot biomass with high metal concentrations [2, 17].

Desirable characteristics for a plant species to be used in phytoremediation are (I) fast growth and high biomass; (II) extended root system for exploring large soil volumes; (III) good tolerance to high concentrations of metals in plant tissues; (IV) high translocation factor; (V) adaptability to specific environments/sites; and (VI) easy agricultural management. The ideal phytoremediation crop may combine rapid growth and high biomass with high metal accumulation in the shoot tissues [18-20]. Small shoot and root growth of the hyperaccumulator plants and the absence of their commercially available seeds have stimulated the studies on biomass species including the herbaceous field crops [1]. Therefore, recently, such crops are preferred because they form more biomass and are easily found and cultivated. In this regard, tobacco received attention with its unique nicotine synthesis via roots.



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The objective of this study was to examine Cd uptake, transport and accumulation characteristics of oriental tobacco with special emphasis on its different varieties. Possible potential effects of genetic differences between varieties will be discussed.

MATERIALS AND METHODS

Two separate pot experiments were conducted to study the Cd uptake within Basma, Akhisar, Dibek and Sarıbağlar oriental tobacco varieties. A soil and perlite mixture was used as growing medium. For this purpose, 1.5 kg of soil and 75 g perlite was mixed and placed into plastic pots with 2 kg capacity (20 * 14 * 17 cm). The texture of soil was silty loam with 45% sand, 47% silt, and 8% clay. The pH, EC, and OM values of soil were 7.8, 0.2 dS m⁻¹, and 0.5%, respectively [25, 26]. For each experiment, the designated treatments were 1: control; 2: NPK; 3: NPK+10 mg/kg; 4: NPK+50 mg/kg; 5: NPK+ 100 mg/kg, and 6: NPK +150 mg/kg of Cd or Cr. Perlite was wetted with the nutrient and heavy metal solutions, further mixed well with 1.5 kg of soil, and placed in the pots. In the experiments, Cd(NO₃)₂ 4H₂O were used as Cd sources, respectively. 150 mg N/kg, 20 mg P/kg and 150 mg K/kg were used in all pots excluding the control. NH₄NO₃; KH₂PO₄ and K₂SO₄ were used as N, P and K sources, respectively. At the beginning of the experiments, four seedlings were planted in each pot. After ten days, thinning was made and only two seedlings were left. The irrigation was practiced at field capacity and the leaked water returned into the pots in order to prevent losses. After 50 days of growing, plants were harvested and separated as root, stem and leaf, and biomass values of plant parts were recorded.

Analysis

The dried (65–70o C) and finely ground plant samples were wet digested in a mixture of nitric acid (HNO₃)/perchloric acid (HClO₄) (4/1) [27]. Concentrations of Cd in the digest were measured using atomic absorption spectrophotometry (Varian 2200) [28].

Statistical Analysis

The data were subjected to analysis of variance (ANOVA) using factorial randomized complete block design with three replications. Each replication contained two pots with two plant (n:12), and least significant difference (LSD0.05) was used to determine significant differences between the treatment means. All graphs were created using SPSS version 15 for Windows (SPSS Inc., Chicago,IL).



RESULTS and DISCUSSION

In this study, biomass of different varieties, Cd concentrations of different plant parts (root, stem and leaf), the uptake amounts of Cd by these parts.

Biomass

Significant differences were found in the biomass of roots, stems and leaves of all varieties with respect to increasing concentrations of Cd. In all treatments, the highest biomass values (root, stem and leaf) were determined for the Basma and the lowest ones for the Dibek variety. The highest biomasses of the plant parts were obtained from NPK treatments. With the addition of Cd, the biomasses value decreased. Parallel to the increasing concentrations of Cd, the biomass values of root, stem and leaf of Dibek variety decreased starting from the lowest dose of Cd application, and showed significant declines with the enhancements in Cd. Basma variety root, stem and leaf biomass decreased with Cd applications as well. However, decreases were not evident in the lowest dose of Cd, but in the higher doses is more evident (Fig. 1). Biomass values of Akhisar and Sarıbağlar varieties were found to be between the values observed for Basma and Dibek. Basma variety biomasses (root, stem and leaf) were higher than the values of all other varieties.

On the other hand, the biomass of Dibek variety was the lowest in all of the treatments (Fig. 1). The highest total biomass (root + stem + leaf) values were obtained from the NPK treatment, and total biomasses declined with increasing Cd concentrations at all varieties (Fig 2).

A high proportion of above-ground plant parts are desirable in terms of phytoremediation applicability. In this study, harvestable parts/root biomass ratios were calculated. Parallel with increasing concentrations of Cd, the specified ratio did not show any significant change in Basma variety; meanwhile, in other varieties tended to be decreased.

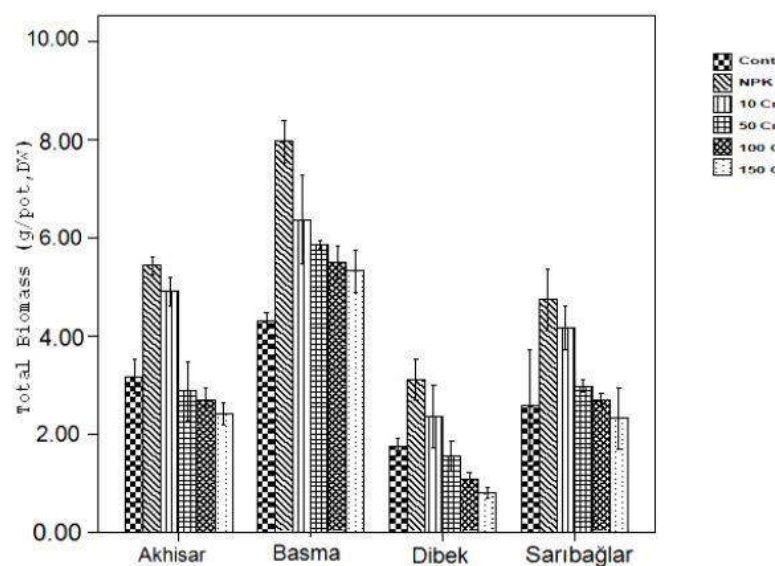


FIGURE 2 - Effect of Cd concentrations on total biomass of Akhisar, Basma, Dibek and Sarıbağlar. Error bars represent three replications.

Uptake of Cd

The total uptake of Cd changed according to varieties and treatments. Basma variety with its higher Cd tissue concentrations and higher biomass had higher uptake values for Cd, and significantly differed from the other varieties. In all of the varieties, the amount of Cd uptake was parallel with increasing Cd concentrations (Fig. 4).

In terms of the partitioning of total uptake according to different plant parts, Basma had higher values of Cd. For example, in the highest dose-treatments, this variety accumulated 5 to 6 fold Cd amounts compared to Dibek. In addition to genetic variability, some researchers related translocation of heavy metals in plants with their transpiration rates. During the experimentation our observations about the relatively small leaf area and less irrigation requirement of Dibek variety might support the above specified role of transpiration rate in translocation of heavy metals.



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Table 1. Effect of Cd (A) (mg/kg) concentrations on harvestable biomass of Akhisar, Basma, Dibek, and Sarıbağlar

(A)		Control Cd	NPK	10 Cd	50 Cd	100 Cd	150
Harvestable	Basma	3.44a	6.55a	5.37a	4.94a	4.62a	4.46a
	Akhisar	2.40ab	4.39b	3.91b	2.15b	2.02b	1.84b
	Sarıbağlar	2.12ab	3.81b	3.36b	2.41b	2.15b	1.87b
	Dibek	1.30b	3.72b	1.95c	1.24b	0.84b	0.64b
Harvestable/ root	Basma	3.97a	4.62a	5.38a	5.39a	5.29a	5.20a
	Akhisar	3.13a	4.23a	3.93a	2.97b	2.99b	3.27b
	Sarıbağlar	4.71a	4.11a	4.16a	4.27ab	4.00ab	4.22ab
	Dibek	3.00a	5.11a	4.88a	4.04ab	3.71ab	3.98ab

Means with same letters are not significantly different ($p < 0.05$).

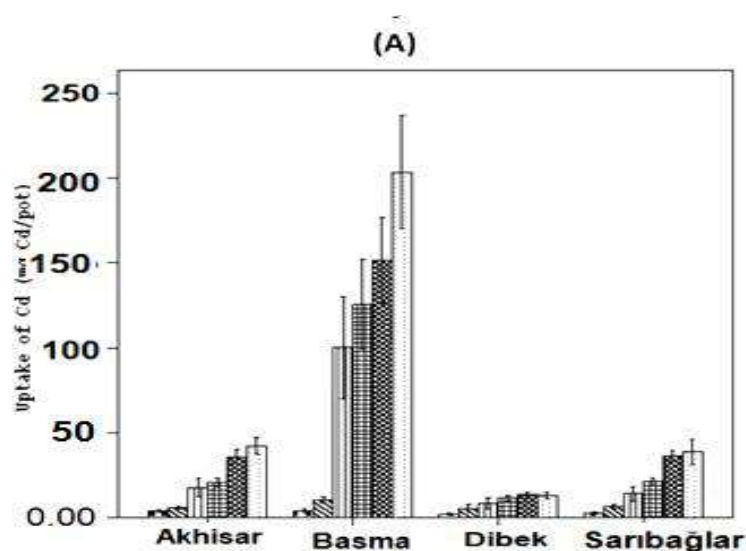


Figure 4 - Uptake of Cd (A) by Akhisar, Basma, Dibek and Sarıbağlar varieties. Error bars represent the standard error for three replications

CONCLUSION

As a result of this study, significant differences were found in the biomass of root, stem and leaves of all varieties with respect to increasing concentrations of Cd. In all treatments, Basma was the most efficient variety but Dibek the most inefficient one, in terms of biomass formation, Cd concentrations as well as uptake rates in different plant parts. Basma variety with higher BCF values was also found to be more effective than the other varieties for phytoremediation of Cd. Research results show that this variety can be classified as hyperaccumulator in terms of Cd.



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REFERENCES

- [1] Vamerali, T., Bandiera, M. and Mosca, G. (2010) Field crops for phytoremediation of metal-contaminated land, A review. *Environ Chem, Lett*, 8, 1–17.
- [2] Baker, A.J.M. and Brooks, R.R. (1989) Terrestrial higher plants which hyperaccumulate metallic elements—a review of their distribution, ecology and phytochemistry. *Biorecovery*, 1, 81–126.
- [3] Barcelo, J., Vazquez, M.D., Ma'dico, J. and Poschenrieder, C. (1994) Hyperaccumulation of zinc and cadmium in *Thlaspi caerulescens*. In: Varnavas SP (ed) *Environmental contamination*. CEP Consultants Ltd., Edinburgh, pp 132–134.
- [4] Brooks, R.R. (1998) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford.
- [5] Baker, A.J.M. and Walker, P.L. (1989) Ecophysiology of metal uptake by tolerant plants. In: Shaw A (ed) *Heavy metal tolerance in plants—Evolutionary aspects*. CRC Press, Boca Raton, Florida.
- [6] Cataldo, D.A., Garland, T.R. and Wildung, R.E. (1978) Nickel in plants: II. Distribution and chemical form in soybean plants. *Plant Physiol*, 62, 566–570.
- [7] Wagner, G.J. and Yeagan, R. (1986) Variation in Cadmium Accumulation Potential and Tissue Distribution of Cadmium in Tobacco. *Plant Physiol*, 82, 274–279.
- [8] Baker, A.J.M., Reeves. R.D. and Hajar, A.S.M. (1994) Heavy metal accumulation and tolerance in British populations of the metallophyte *Thlaspi caerulescens* J. and C. Presl (Brassicaceae), *New Phytol*, 127, 61–68.
- [9] Bert, V., Macnair, M.R., DeLaguerie, P., Saumitou-Laprade, P. and Petit, D. (2000) Zinc tolerance and accumulation in metallicolous and nonmetallicolous populations of *Arabidopsis halleri* (Brassicaceae). *New Phytol*, 146, 225–233.
- [10] Assunção, A.G.L., Martins, P.D.C., De Folter, S., Vooijs, R., Schat, H. and Aarts, M.G.M. (2001) Elevated expression of metal transporter genes in three accessions of the metal hyperaccumulator *Thlaspi caerulescens*. *Plant Cell Environ*, 24, 217–226.
- [11] Angelova, V., Ivanov, K. and Ivanova, R. (2004) Effect of Chemical Forms of Lead, Cadmium, and Zinc in Polluted Soils on Their uptake by Tobacco. *Journal of Plant Nutrition*, 27(5), 757- 773.
- [12] Angelova, V. and Ivanov, K. (2009) Bio-accumulation and distribution of heavy metals in black mustard (*Brassica nigra* Koch). *Environ Monit Assess*, 153, 449–459.



**ISPEC 8th INTERNATIONAL CONFERENCE
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and RURAL DEVELOPMENT
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- [13] Lasat, M.M., Baker, A.J.M. and Kochian, L.V. (1998) Altered Zn compartmentation in the root symplasm and stimulated Zn absorption into the leaf as mechanisms involved in Zn hyperaccumulation in *Thlaspi caerulescens*. *Plant Physiol*, 118, 875–883.
- [14] Cobbett, C.S. (2000) Phytochelatins and their roles in heavy metal detoxification. *Plant Physiol*, 123, 825–832.
- [15] Tomsett, A.B., Sewell, A.K., Jones, S.J., Miranda, J.R. and De Thurman, D.A. (1992) Metal-binding proteins and metalregulated gene expression in higher plants. In: Wray JL (ed) *Inducible plant proteins: their biochemistry and molecular biology*, Cambridge University Press, Cambridge, pp 1–24.
- [16] McGrath, S.P. (1998) Phytoextraction for soil remediation. In: Brooks RR (ed) *Plants that hyperaccumulate heavy metals*. CAB International, Wallingford, pp 261–287.
- [17] Reeves, R.D. and Baker, A.J.M. (2000) Metal-accumulating plants. In: Raskin I, Ensley BD (eds) *Phytoremediation of toxic metals: using plants to clean up the environment*. Wiley, New York, pp 193–230.
- [18] Chaney, R.L., Li, Y.M., Brown, S.L., Homer, F.A., Malik, M., Angle, J.S., Baker, A.J.M., Reeves, R.D. and Chin, M. (2000) Improving metal hyperaccumulator wild plants to develop commercial phytoextraction systems: approaches and progress. In: *Phytoremediation of Contaminated Soil and Water*. Terry, N. And Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 129–158.
- [19] Lasat, M.M. (2002) Phytoremediation of toxic metals: a review of biological mechanisms. *J Environ Qual*, 31, 109–120.
- [20] McGrath, S.P., Zhao, F.J. and Lombi, E. (2002) Phytoremediation of metals, metalloids, and radionuclides. *Advances in Agronomy*, 75, 1–56.
- [21] Stephan, U.W. and Grün, M. (1989) Physiological disorders of the nicotianamine-auxotroph tomato mutant *chloronerva* at different level of iron nutrition. II Iron deficiency response and havy metal metabolism. *Biochm Physiol, Pflanzen*, 185, 189-200.
- [22] Stephan, U.W. and Scholz, G. (1993) Nicotiamine: mediator of transport of iron and heavy metals in the phloem? *Physiol Plant*, 88, 522-529.
- [23] Pollard, A.J., Powell, K.D., Harper, F.A. and Smith, J.A.C. (2002) The genetic basis of metal hyperaccumulation in plants. *Critical Reviews in Plant Sciences*, 21(6), 539–566 pp 155–178.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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- [24] Macnair, M.R., Smith, S.E. and Cubes, Q.J. (1993) Heritability and distribution of variation in degree of copper tolerance in *Mimulus guttatus* at Copperopolis, California. *Heredity*, 71, 445–456.
- [25] Kacar, B. (2009) *Toprak Analizleri (Soil Analysis)*. Nobel Yayınları, No: 1387, Ankara.
- [26] Page, A.L., Miller, R.H. and Keeray, D.R. (1982) *Methods of soil analysis*. Amer. Soc. of Agronomy Inc, No: 9, Wisconsin, USA.
- [27] Kacar, B. (1972) Bitki ve Toprağın Kimyasal Analizleri: II. Bitki Analizleri [Chemical analysis of plant and soil, part II: Plant analysis], Ankara, Turkey: Faculty of Agriculture, Ankara University.
- [28] Isaac, R.A. and Kerber, J.D. (1971) “Atomic absorption and flame photometry: Techniques and uses in soil, plant and water analysis”. In *Instrumental Methods of Analysis of Soils and Plant Tissue* Madison, Wisc, Soil Science Society of America.
- [29] Baker, A.J.M. (1981) Accumulators and excluders – strategies in the response of plants to heavy metals. *J. Plant Nutr*, 3, 643–654.
- [30] Salt, D.E. and Krämer, U. (2000) Mechanisms of metal hyperaccumulation in plants. In: *Phytoremediation of Toxic Metals*. Raskin, I. and Ensley, B.D., Eds., John Wiley, New York. pp231–246.
- [31] Shahandeh, H. and Hossner, L.R. (2000) Plant screening for chromium phytoremediation. *Int. J. Phytorem*, 2, 31–51.
- [32] Kanazawa, K., Higuchi, K., Nishizawa, N.K., Fushiya, S., Chino, M. and Mori, S. (1994) Nicotianamine aminotransferase activities are correlated to the phytosiderophore secretion under Fedeficient conditions in Gramineae. *J Exp Bot*, 45, 1903–1906.
- [33] Cakmak, I., Sari, N., Marschner, H., Ekiz, H. and Kalayci, M. (1996) Phytosiderophore release in bread and durum wheat genotypes differing in zinc efficiency. *Plant Soil*, 180, 183–189.
- [34] Pellet, M.D., Grunes, D.L. and Kochian, L.V. (1995) Organic acid exudation as an aluminium tolerance mechanism in maize (*Zea mays* L.). *Planta*, 196, 788–795.
- [35] Larsen, P.B., Degenhardt, J., Tai, C.H.I., Stenzler, L.M., Howell, S.H. and Kochian, L.V. (1998) Aluminum-resistant *Arabidopsis* mutants that exhibit altered patterns of aluminum accumulation and organic acid release from roots. *Plant Physiol*, 117, 19–27.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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[36] Fitter, A.H. and Strickland, T.R. (1991) Architectural analysis of plant root systems. 2. Influence of nutrient supply on architecture in contrasting plant species. *New Phytol*, 118, 383–389.

[37] Campbell, B.D. and Grime, J.P (1989) A new method of exposing developing root systems to controlled patchiness in mineral nutrient supply. *Ann Bot*, 63, 395–400.

[38] Yilmaz, G. (1998) *Keyf Bitkileri*. Gaziosmanpaşa University, Tokat, Turkey, Zir. Fak. Yayın, Ders Notları Serisi, No: 5. [39] Macnair, M.R., Tilstone, G.H. and Smith, S.E. (2000) The genetics of metal tolerance and accumulation in higher plants. In: *Phytoremediation of Contaminated Soil and Water*, Terry, N. and Bañuelos, G., Eds., Lewis Publishers, Boca Raton. pp 235–250.

[40] Belimov, A.A., Safronova, V.I., Tsyganov, V.E., Borisov, A.Y., Kozhemyakin, A.P., Stepanok, V.V., Martenson, A.M., Gianinazzi- Pearson, V. and Tikhonovich, I.A. (2003) Genetic variability in tolerance to cadmium and accumulation of heavy metals in pea (*Pisum sativum* L.). *Euphytica*, 131, 25–35.



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**SIĞIR ETİ VE TAVUK ETİ İLE HAZIRLANAN KARIŞIMLARIN ORANLARININ
YAKIN KIZILÖTESİ (NIR) SPEKTROSKOPİSİ İLE HIZLI SAPTANMASI**

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ÖZET

Elektromanyetik radyasyonun kızılötesi dalgaboyu aralığına denk gelen kısmı, moleküllerin titreşim enerjileri ile etkileşebilmektedir. Bu nedenle içinde karbon, hidrojen, oksijen ve azot içeren moleküllerin ayırımı kızılötesi spektroskopi (NIR) ile yapılabilmektedir. Çünkü her farklı moleküldeki karbon vb. atomların oranı farklı olduğundan kızılötesi radyasyon ile etkileşimlerinde farklı spektrumlar elde edilmektedir. Bu şekilde NIR ile metil alkol ve etil alkol ayırımı yapılabilir; ilaçların, prospektüslerinde belirtilen etken maddeleri içerip içermedikleri saptanabilir. Kızılötesi spektroskopisinin gıdalarda kullanımı ile ilgili ilk literatüre 1949 yılında Amerika Tarım Departmanı (USDA)'nın yürüttüğü bir çalışmada rastlanılmaktadır. Bu çalışmada yumurtanın kalite kriterleri ile kızılötesi spektrumları arasında bir korelasyon araştırılmıştır. 1974'te ise Kanada Tahıl Komisyonu (CGC) tarafından buğdaydaki proteinin tespitinde kjeldahl yöntemine alternatif olarak kullanılmaya başlanmıştır. Günümüze kadar kızılötesi spektroskopinin gıdalarda kullanımı giderek yaygınlaşmış ve 2007 yılında et ve et ürünlerinin protein, yağ ve rutubet analizlerinde standart yöntem olarak kullanılmaya başlanmıştır. Et, yüksek besin değerine sahip bir gıda olduğundan tüketiciler tarafından yüksek oranlarda talep edilen bir gıdadır. Bu nedenle gelişmiş ve gelişmekte olan ülkelerde et ve et ürünlerine çeşitli taşıyıcılar (örneğin farklı ekonomik değere sahip etleri karıştırarak) yapılabilmektedir. Ayrıca çeşitli hayvan türlerinin etlerinin arasındaki farklar nedeniyle (yağ, protein, rutubet oranları ve etin tadını veren diğer kimyasal maddeler) tüketiciler tarafından karışım etler de talep edilebilmektedir. Bu çalışmada tavuk ve sığır etlerinden, % 0, %20, %50, %70 ve %100 oranında tavuk eti içeren karışımlar hazırlanmış ve bu karışımlar et endüstrisinde rutinde protein, yağ, rutubet ve tuz analizlerinde kullanılan ve laboratuvar tipi kızılötesi spektroskopi cihazlarından ekonomik olarak daha avantajlı NIR cihazı (Perten DA7250) ile analiz edilmiştir. Elde edilen kızılötesi spektrumlar çeşitli ön işlemlerden geçirilmiş ve sonrasında kısmi en küçük kareler regresyon (PLSR) tekniği ile istatistiki olarak incelenmiştir. Sonuç olarak başarılı bir şekilde NIR ile sığır etine katılan tavuk eti oranları tespit edilebilmiştir.

Anahtar Kelimeler: NIR, Sığır Eti, Tavuk Eti, Karışım



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**RAPID DETERMINATION OF CHICKEN MEAT MIXTURE RATIOS IN BEEF
MIXTURES BY NEAR INFRARED (NIR) SPECTROSCOPY**

ABSTRACT

The section of electromagnetic radiation that corresponds to the infrared wavelength range can interact with the vibration energies of the molecules. Therefore molecules containing carbon, hydrogen, oxygen and nitrogen can be distinguished by using infrared spectroscopy (NIR). Because the number of the carbon, oxygen, hydrogen, nitrogen and other atoms are not the same in each molecule, different spectrums can be obtained in their interactions with infrared spectrum. By using NIR spectroscopy methyl alcohol and ethyl alcohol can be separated; also whether the drugs contain the active ingredients specified in their prospectus can be determined. The first literature on the use of infrared spectroscopy in food is found in a 1949 study conducted by the United States Department of Agriculture (USDA). In that study, a correlation between the quality criterias of the egg and the infrared spectrums were investigated. In 1974, it was introduced by the Canadian Grain Commission (CGC) as an alternative to the kjeldahl method for detecting protein in wheat. To date, the use of infrared spectroscopy in foods has become increasingly common and in 2007 infrared spectrometry was used as standard method for protein, fat and moisture analysis in meat and meat products. Meat is a food of high nutritional value and therefore is highly demanded by consumers. For this reason, meat and meat products might be subjected to various adulteration (by mixing meats of different economic value) in both developed and developing countries. In addition, due to the differences between the meats of various animal species (fat, protein, humidity ratios and other chemicals that give the taste of meat), mixed meats can also be demanded by consumers. In this study, mixtures containing 0%, 20%, 50%, 70% and 100% chicken meat were prepared with beef and analyzed by NIR device (Perten DA7250) which the meat industry routinely uses in protein, fat, moisture and salt analysis and which is economically more advantageous than laboratory-type infrared spectroscopy devices. The resulting infrared spectrums were pre-treated and then statistically examined with partial least squares regression (PLSR) technique. As a result, the rates of chicken meat in beef successfully determined with NIR spectroscopy

Keywords: NIR, Beef, Chicken Meat, Mixture



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GİRİŞ

Gıdaların belirli kalite kriterlerine uygun şekilde üretimi tüketicilerin sağlığı, haksız ekonomik kazançların ve gıda kaynaklı skandalların önüne geçilmesinde son derece önemlidir. Bu doğrultuda gıdaların üretim ve tüketim hızları arttıkça, sahip oldukları kalite kriterlerini ortaya çıkartmaya yönelik analizlerin sürelerinin de kısaltmalarına yönelik talepler artmıştır. Kızılötesi spektroskopi de gıdaların hızlı analiz yöntemlerinden biridir. Kızılötesi spektroskopi moleküllerin titreşim enerjileri ile elektromanyetik radyasyonun kızılötesi bandındaki enerjinin etkileşimine dayanır. Herbir moleküldeki atomların molekülün merkezi etrafındaki gerilme ve bükülme hareketleri o molekülün titreşim enerjisini oluşturur. Elektromanyetik radyasyonun kızılötesindeki bandı ise bu enerjiler ile etkileşime girebilir. Yani bir molekülün titreşim enerjisi ile içinde bulunduğu uzaydaki elektromanyetik radyasyonun enerjisi ile aynı ve molekülün dipol momentini değiştirecek şekilde olduğunda molekül bu enerjiyi soğurabilir (Adapa ve ark., 2009). Herbir molekülün içerdiği karbon, azot, oksijen ve hidrojen atomları farklı olduğundan kızılötesi spektroskopi ile moleküllerin ayırımı yapılabilir (Sun, 2009).

Kızılötesi spektroskopinin gıdalarda kullanımına literatürde ilk defa Amerika Devleti Tarım Departmanı (USDA)'nın yürüttüğü bir araştırma projesinde rastlanılmaktadır. Projede yumurtaların tazelik gibi çeşitli kalite kriterlerinin belirlenmesinin bir uzman kişi tarafından gerçekleştirilmesi yerine otomatize edilmesi amaçlanmış ve bu doğrultuda kızılötesi spektroskopi yönteminden yararlanılmıştır (Norris, 1996). 1980'lerde ise Amerika Federal Tahıl Denetim Servisince (FGIS) buğdayların proteinlerinin tespitinde kjeldahl yöntemine alternatif olarak resmi metot kabul edilmiştir (Ertugay ve Başlar, 2011). Et ve et ürünlerinde ise 2007 yılından itibaren yağ, protein ve nem tayininde standart metot olarak kullanılmaktadır (AOAC 2007.04).

Bunun yanında et ve ürünlerinde çeşitli çalışmalar da bulunmaktadır. Thyholt ve Isaksson (1997) donmuş ve çözündürülmüş etlerin tespitinde kızılötesi spektroskopiden yararlanmış ve başarılı olmuşlardır. Ding ve Xu (1999) sığır eti ve kanguru etini ayırmada kızılötesi spektroskopisini başarı ile kullanmışlardır. Berzaghi ve ark. (2006) çeşitli yasal olmayan verim arttırıcı hormonların tespitini kızılötesi spektroskopi yöntemi ile tespit edebildiklerini bildirmişlerdir. Mourot ve ark., (2015) sığır etlerinin yağ asit profilini ortaya çıkarmada kızılötesi spektroskopiden yararlanmış ve oldukça başarılı sonuçlar elde etmişlerdir. McDevitt ve ark., (2005) ise tavuk etlerinin içerdiği yağ, ham protein ve kül oranlarını kızılötesi



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spektroskopi ile tespit edip bu etlerin elde edildiği tavukların genotipleri (hızlı büyüyen broyler, yavaş büyüyen broyler ve yumurtacı) ile korelasyon kurabilmişlerdir.

Süt ve süt ürünlerinde ise kızılötesi spektroskopi ile protein, laktoz, kazein, kuru madde, tuz, yağ ve nem oranları kolaylıkla tespit edilebilmektedir. Bunun yanında süt ve ürünlerine yapılan çeşitli taşışlar da bulunabilmektedir (Cattaneo ve Holroyd, 2013). Durna ve ark., (2016) koyun, keçi ve inek sütlerini kızılötesi spektroskopi ile ayırabilmişlerdir. Gondim ve ark., (2017) süte çeşitli amaçlar için katılan hidrojen peroksit, bikarbonat, formaldehit, karbonat, klorid, sitrat, hidroksit, hipoklorid, nişasta, sukroz ve suyu kızılötesi spektroskopi yardımı ile tespit edebildiklerini bildirmişlerdir. Chen ve ark., (2017) süte, protein oranını yüksek gösterme amaçlı katılan melamini, 10ppm düzeyine kadar kızılötesi spektroskopisi yöntemi ile tespit edebilmişlerdir. Núñez-Sánchez ve ark., (2016) keçi sütünün yağ asidi profilini kızılötesi spektroskopisi ile ortaya koyabilmiştir.

Kızılötesi spektroskopisi bal, kahve, meyve-sebze ve tahıllar gibi gıdalarda da kullanılabilmektedir. Örneğin Ferreiro-González ve ark., (2018) bala katılan yüksek fruktozlu mısır şurubunu kızılötesi spektroskopisi ile tespit edebilmişlerdir. Balın yapımında belirli nektarların örneğin avokado nektarının kullanıp kullanılmadığı da kızılötesi spektroskopisi ile tespit edilebilmektedir (Dvash ve ark., 2002; Medina ve ark., 2019). Kahve çekirdeğinin türü (*arabica* veya *robusta*) kızılötesi spektroskopisi ile tespit edilebilmektedir (Bertone, 2016). Mısır ve arpada aflatoksin B1, 20 ppb hassasitle kızılötesi spektroskopi yöntemi ile tespit edilebilmiştir (Fernández-Ibañez ve ark., 2009). Kızılötesi spektroskopinin meyvelerdeki kullanımı ile ilgili olarak ise elmada sertlik, pH, asidite, kuru madde oranı, alkolde çözünmeyen katılar, şeker içeriği, en uygun hasat zamanı tahmini; avokadoda kuru madde içeriği; muzda şeker içeriği; havuçta şeker ve karotenoidlerin miktarı; üzümde renk ve pH tespitinde; kivi de sertlik ve kuru madde içeriği tespitinde; mangoda kuru madde içeriği, nişasta içeriği ve asidite tespitinde; mantarda nem içeriğinin belirlenmesinde; zeytinde yağ, nem, oleik asit ve linoleik asit içeriğinin tespitinde; soğanda kuru madde oranının tespitinde kimyon, kişniş, rezene ve dereotunda esansiyel yağ içeriği ve türleri; fasulyede hücre duvarı pektinlerinin saptanmasında kullanıldığı çalışmalar literatürde bulunmaktadır (Nicolai ve ark., 2007)

GEREÇ ve YÖNTEM

Bu çalışmada Et ve Süt Kurumu'nca Türk Gıda Kodeksi Et, Hazırlanmış Et karışımları ve Et Ürünleri Tebliği'ne (Anon, 2019) uygun olarak üretilmiş sığır kıyma (yağ oranı en fazla %20)



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ve derisiz tavuk göğüs eti kullanılmıştır. Karışımlar %100 sığır eti, %70 sığır eti - %30 tavuk eti, %50 sığır eti - %50 tavuk eti, %20 sığır eti - %80 tavuk eti ve %100 tavuk eti olacak şekilde 5 farklı oranda hazırlanmıştır. Karışımların homojenize edilmesinde doğrayıcı kullanılmıştır. Doğrayıcının kabı ve bıçakları her bir karışım sonrasında herhangi bir bulaş olmaması için yağ sökücü ile temizlenmiş ve kurulanmıştır. Kızılötesi spektrumların elde edilmesinde Perten DA 7250 kızılötesi spektroskopisi cihazı kullanılmıştır. Cihazın yaklaşık 500 ml ve 150 ml hacminde iki adet numune kabı bulunmaktadır. Ve analiz sırasında numune kabı kendi çevresinde 360° dönmektedir. Böylelikle numunenin tamamını analiz edebilmektedir. Her bir karışım oranı için büyük ve küçük kapta ikişer kere olmak üzere toplamda 20 analiz gerçekleştirilmiştir. Kaplar her bir analiz sonrasında özel kaplamalarına zarar vermemek için sıcak su ile temizlendikten sonra kağıt havlu ile kurulanmıştır.

Elde edilen kızılötesi spektrumların istatistiksel analizi The Unscrambler® X programı ile gerçekleştirilmiştir. Spektrumlar ön işlem uygulanmadan; Savitzky – Golay ve normalizasyon ön işlemleri uygulanarak Kısmi En Küçük Kareler Regresyonu (Partial Least Squares Regression, PLSR) işlemi ile karışımların içerdiği tavuk eti oranları arasında korelasyon kurulmaya çalışılmıştır. Regresyon modelleri kurulurken tam çapraz validasyon (full cross validation) ile doğrulanmıştır. Oluşturulan regresyon modellerinin performans kriterleri olan RMSEC (Root Mean Square Error of Calibration, Kalibrasyonun ortalama karekökü hatası), RMSEV (Root Mean Square of Validation, Validasyonun ortalama karekökü hatası), Eğim (kalibrasyon), Eğim (validasyon) ve R^2 (kalibrasyon) ile R^2 (validasyon) değerleri karşılaştırılmıştır.

BULGULAR

Oluşturulan regresyon modellerinin performanslarını gösteren değerler Çizelge.1’de sunulmuştur.

Çizelge 1. Oluşturulan regresyon modellerinin performanslarını gösteren çizelge

DEĞER	Ön İşlem		
	Ön İşlemsiz	Savitzky-Golay	Normalizasyon
RMSEC	1.6889474	2.8061309	1.8715708
RMSEV	2.1218348	3.6599088	2.7798302
Eğim (C)	0.9977289	0.9937316	0.9972116
Eğim (V)	0.9944972	0.9905797	0.9977048
R^2 (C)	0.9977289	0.9937306	0.9972112
R^2 (V)	0.996765	0.9903751	0.9944474

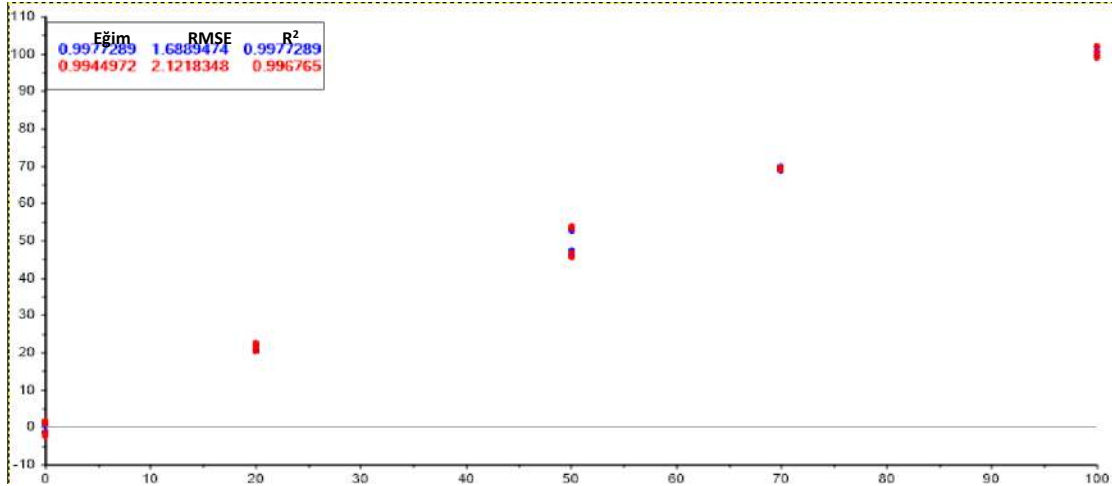


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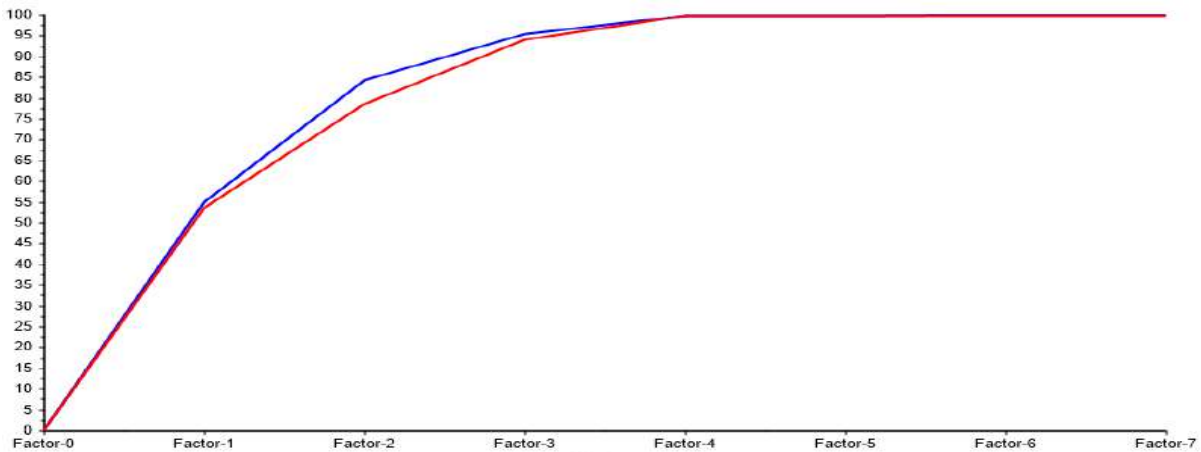


Çizelge.1'den de görüleceği üzere istatistiksel olarak en üstün değerler ön işlemsiz olarak kurulan modelde ortaya çıkmıştır. Sadece validasyon eğim değeri normalizasyon ön işlemi uygulanmış modelde daha iyidir. Savitzky-Golay ön işlemi ise en kötü istatistiksel değerlere sahiptir. Genel olarak modeldeki parazit (noise) veriyi ayıklamak için kullanılan ön işlemler bu modeller kurulurken daha kötü sonuç vermiştir. Bu durumda veri kümesinin az sayıda eleman içermesinin (20 adet) neden olduğu düşünülmüştür.

Ön işlemsiz modelin performans değerlerinin grafiksel gösterimi Şekil.1'de sunulmuştur. Şekil.1'den de görüleceği üzere kurulan regresyon modelinin eğimi bire çok yakındır. Buradan oluşturulan modelin başarılı olduğu sonucuna varılır. Şekilde mavi değerler kalibrasyon değerlerini kırmızı değerler ise validasyon değerlerini göstermektedir.



Şekil 1 Oluşturulan ön işlemsiz regresyon modelinin performansını gösteren grafik



Şekil 2. Oluşturulan regresyon modelinin 4 faktör ile kurulabildiğini gösteren grafik



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Oluşturulan regresyon modeline en çok katkı sağlayan kıvırlötesi radyasyonun dalgaboylarından ilk set 1005nm’den başlayıp 1065nm’de pik yapmakta ve 1122 nm’ye kadar sürmektedir. İkinci set ise 1178nm’den başlayıp 1214nm’de pik yapmakta ve 1236nm’ye kadar sürmektedir. Son set ise 1520nm’den başlamakta ve cihazın son çözünürlüğü olan 1650nm’ye kadar artarak devam etmektedir. Bu durumun grafiksel gösterimi Şekil.3’te sunulmuştur.



Şekil 3 Oluşturulan regresyon modeline en çok katkı sağlayan kıvırlötesi radyasyonun dalgaboylarını gösteren grafik

TARTIŞMA VE SONUÇ

Et ve et ürünleri insanlar tarafından oldukça talep edilen gıdalar olduklarından bu gıdalara çeşitli taşışşler yapılabilmekte, hatta et ve et ürünleri kaynaklı gıda skandalları ortaya çıkabilmektedir (“2013 Horse Meat Scandal,” 2021). Ülkemizde de 2013 yılından sonra kırmızı et ve et ürünlerine kanatlı et ve et ürünlerinin karıştırılması yasaklanmıştır (Anon, 2019). Bunun bir nedeninin de kırmızı et ürünlerine katılan kanatlı etlerinin oranının tespit edilemeyişi olduğu düşünülmektedir. Bu çalışma ile kırmızı et ürünü olan kıymaya katılan kanatlı etinin oranının kıvırlötesi spektroskopisi ile tespit edilebileceği ortaya konmuştur. Literatürde farklı hayvan türlerinin etlerinin kıvırlötesi spektroskopisi ile ayrımının gerçekleştirilebildiği yayınlar mevcuttur (Ding ve Xu 1999, Ding ve Xu, 2000; Mamani-Linares ve ark., 2012; McElhinney ve ark., 1999, Schmutzler ve ark., 2015, Boyacı ve ark., 2014, Rady ve Adedeji, 2018). Ancak bu çalışma numunenin miktarı, numune hazırlamanın oldukça kısa sürmesi, kullanılan cihazın laboratuvar tipi cihazlarından ekonomik olarak daha avantajlı olması, kullanılan kıvırlötesi radyasyonun dalgaboyları ve kullanılan kıvırlötesi spektroskopinin çeşidi (reflektans) bakımından literatürdeki diğer çalışmalardan ayrılmaktadır.



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Regresyon modeline en büyük katkısı sağlayan kızılötesi radyasyonun dalgaboylarına bakıldığında 1065 nm dalgaboyunun O-H arasında olan ve başlıca suda bulunan bağdan kaynaklandığı görülmüştür. Bu nedenle sığır ve tavuk eti arasındaki su oranının karışım oranlarını belirlemede önemli olduğu kanaatine varılmıştır. 1214 nm ve 1650 nm dalgaboylarına bakıldığında ise bu değerlerdeki kızılötesi radyasyonun C-H arası bağlarla etkileştiği görülmüştür. Bu aralıkta çeşitli hidrokarbonlar bulunmaktadır. Dolayısı ile karışımların oranının tespitinde çeşitli hidrokarbonların da rolü olduğu düşünülmektedir (Jr ve Weyer, 2012).

Teknoloji her geçen gün artan bir ivme ile gelişmektedir. P Reinig ve ark., (2017) ile Pügner ve ark., (2016) yaptıkları çalışmalar, yani kızılötesi spektroskopinin cep telefonlarına entegrasyonu gerçekleşir ve yaygınlaşırsa son tüketicinin de güvenli gıda ve ilaçlara ulaşımında yaşanan krizler ortadan kalkabilecektir.



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KAYNAKLAR

- 2013 horse meat scandal. (2021). In *Wikipedia*.
https://en.wikipedia.org/w/index.php?title=2013_horse_meat_scandal&oldid=1043586086
- Adapa, P., Karunakaran, C., Tabil, L., & Schoenau, G. (2009). *Potential Applications of Infrared and Raman Spectromicroscopy for Agricultural Biomass*. 25.
- Anon. (2019). Türk Gıda Kodeksi Et, Hazırlanmış Et Karışımları Ve Et Ürünleri Tebliği. <https://www.resmigazete.gov.tr/eskiler/2019/01/20190129-4.htm>
- AOAC 2007.04, Official Methods of Analysis of AOAC INTERNATIONAL (2019) 21st Ed., AOAC INTERNATIONAL, Gaithersburg, MD, USA, Official Method 2007.04.
- Bertone, E. (2016). Simultaneous determination by NIR spectroscopy of the roasting degree and Arabica/Robusta ratio in roasted and ground coffee. *Food Control*, 7.
- Berzaghi, P., Segato, S., Cozzi, G., & Andrighetto, I. (2006). Mid and Near Infrared Spectroscopy to Identify Illegal Treatments in Beef Cattle. *Veterinary Research Communications*, 30(S1), 109–112. <https://doi.org/10.1007/s11259-006-0022-z>
- Cattaneo, T. M. P., & Holroyd, S. E. (2013). The Use of near Infrared Spectroscopy for Determination of Adulteration and Contamination in Milk and Milk Powder: Updating Knowledge. *J. Near Infrared Spectrosc.*, 9.
- Chen, H., Tan, C., Lin, Z., & Wu, T. (2017). Detection of melamine adulteration in milk by near-infrared spectroscopy and one-class partial least squares. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 173, 832–836. <https://doi.org/10.1016/j.saa.2016.10.051>
- Ding, H. B., & Xu, R. J. (1999). Differentiation of Beef and Kangaroo Meat by Visible/Near-Infrared Reflectance Spectroscopy. *Journal of Food Science*, 64(5), 814–817. <https://doi.org/10.1111/j.1365-2621.1999.tb15918.x>
- Durna, Ş., Yetişemiyen, A., Geniş, H. E., & Boyacı, I. H. (2016). Yakın-Kızılötesi (NIR) Spektroskopisi Kullanılarak Koyun, Keçi ve İnek Sütlerinin Tanımlanması. *Academic Food Journal*, eki-ara2016; Volume 14(4), 382–387.
- Dvash, L., Afik, O., Shafir, S., Schaffer, A., Yeselson, Y., Dag, A., & Landau, S. (2002). Determination by Near-Infrared Spectroscopy of Perseitol Used as a Marker for the Botanical Origin of Avocado (*Persea americana* Mill.) Honey. *Journal of Agricultural and Food Chemistry*, 50(19), 5283–5287. <https://doi.org/10.1021/jf020329z>



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Ertugay, M. F., & Başlar, M. (2011). Gıdaların Kalite Özelliklerinin Belirlenmesinde Yakın Kızılötesi (Nir) Spektroskopisi. *The Journal of Food*, 36, 49–54.

Fernández-Ibañez, V., Soldado, A., Martínez-Fernández, A., & de la Roza-Delgado, B. (2009). Application of near infrared spectroscopy for rapid detection of aflatoxin B1 in maize and barley as analytical quality assessment. *Food Chemistry*, 113(2), 629–634. <https://doi.org/10.1016/j.foodchem.2008.07.049>

Ferreiro-González, M., Espada-Bellido, E., Guillén-Cueto, L., Palma, M., Barroso, C. G., & Barbero, G. F. (2018). Rapid quantification of honey adulteration by visible-near infrared spectroscopy combined with chemometrics. *Talanta*, 188, 288–292. <https://doi.org/10.1016/j.talanta.2018.05.095>

Gondim, C. de S., Junqueira, R. G., Souza, S. V. C. de, Ruisánchez, I., & Callao, M. P. (2017). Detection of several common adulterants in raw milk by MID-infrared spectroscopy and one-class and multi-class multivariate strategies. *Food Chemistry*, 230, 68–75. <https://doi.org/10.1016/j.foodchem.2017.03.022>

Jr, J. W., & Weyer, L. (2012). *Practical Guide and Spectral Atlas for Interpretive Near-Infrared Spectroscopy, Second Edition*. CRC Press.

McDevitt, R. M., Gavin, A. J., Andrés, S., & Murray, I. (2005). The Ability of Visible and near Infrared Reflectance Spectroscopy to Predict the Chemical Composition of Ground Chicken Carcasses and to Discriminate between Carcasses from Different Genotypes. *Journal of Near Infrared Spectroscopy*, 13(3), 109–117. <https://doi.org/10.1255/jnirs.463>

Medina, S., Pereira, J. A., Silva, P., Perestrelo, R., & Câmara, J. S. (2019). Food fingerprints – A valuable tool to monitor food authenticity and safety. *Food Chemistry*, 278, 144–162. <https://doi.org/10.1016/j.foodchem.2018.11.046>

Mourot, B. P., Gruffat, D., Durand, D., Chesneau, G., Mairesse, G., & Andueza, D. (2015). Breeds and muscle types modulate performance of near-infrared reflectance spectroscopy to predict the fatty acid composition of bovine meat. *Meat Science*, 99, 104–112. <https://doi.org/10.1016/j.meatsci.2014.08.014>

Nicolai, B. M., Beullens, K., Bobelyn, E., Peirs, A., Saeys, W., Theron, K. I., & Lammertyn, J. (2007). Nondestructive measurement of fruit and vegetable quality by means of NIR spectroscopy: A review. *Postharvest Biology and Technology*, 46(2), 99–118. <https://doi.org/10.1016/j.postharvbio.2007.06.024>



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Norris, K. H. (1996). History of NIR. *Journal of Near Infrared Spectroscopy*, 4(1), 31–37. <https://doi.org/10.1255/jnirs.941>

Núñez-Sánchez, N., Martínez-Marín, A. L., Polvillo, O., Fernández-Cabanás, V. M., Carrizosa, J., Urrutia, B., & Serradilla, J. M. (2016). Near Infrared Spectroscopy (NIRS) for the determination of the milk fat fatty acid profile of goats. *Food Chemistry*, 190, 244–252. <https://doi.org/10.1016/j.foodchem.2015.05.083>

Rady, A., & Adedeji, A. (2018). Assessing different processed meats for adulterants using visible-near-infrared spectroscopy. *Meat Science*, 136, 59–67. <https://doi.org/10.1016/j.meatsci.2017.10.014>

Schmutzler, M., Beganovic, A., Böhrer, G., & Huck, C. W. (2015). Methods for detection of pork adulteration in veal product based on FT-NIR spectroscopy for laboratory, industrial and on-site analysis. *Food Control*, 57, 258–267. <https://doi.org/10.1016/j.foodcont.2015.04.019>

Sun, D.-W. (2009). *Infrared Spectroscopy for Food Quality Analysis and Control*. Academic Press.

Thyholt, K., & Isaksson, T. (1997). *Differentiation of Frozen and Unfrozen Beef Using Near-Infrared Spectroscopy*. 8.



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**BAZI TEK YILLIK BAKLAGİL - TAHİL KARIŞIMLARINDA EKİM ZAMANININ
OT KALİTESİNE ETKİLERİ**

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ÖZET

İklim, ürün desenini ve yetiştiriciliği etkileyen önemli bir faktördür. İklim değişimi seneryolarına yetiştiriciliği yapılan bitki türlerinin ekim zamanı ve ekim şekli belirlenerek uyum sağlaması sürdürülebilir üretim için önemli bir uygulamadır. Bu amaçla yürütülen çalışmada ekim zamanı ve şekli kuru madde oranı, ham protein oranı, NDF ve ADF içeriklerini önemli olarak etkilemiştir. Sıcak dönemde yapılan ekimde kuru madde oranı artarken, ham protein oranı azalmıştır. Araştırma sonuçlarına göre yem bezelyesi ve fiğ bitkisi yetiştiriciliğinde kalite açısından yem bezelyesinin tercih edilmesi ve yulaf ile karışık olarak Mart ayında ekiminin yapılması gerektiği tespit edilmiştir.

Anahtar Kelimeler: Yem bezelyesi, Fiğ, Yalnız ve karışık ekim, Ekim zamanı, Kalite



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**THE EFFECTS OF SOWING TIME ON QUALITY IN SOME ANNUAL LEGUMES -
CEREALS MIXTURES**

ABSTRACT

Climate is an important factor affecting crop pattern and cultivation. It is an important practice for sustainable production to adapt to climate change scenarios by determining the sowing time and sowing method of the plant species grown. In the study carried out for this purpose, the sowing time and sowing method significantly affected the dry matter ratio, crude protein ratio, NDF and ADF contents. While the dry matter ratio increased in the high temperature period sowing, the crude protein ratio decreased. According to the results of the research, it has been determined that forage peas and vetch plant cultivation should be preferred in terms of quality and sowing in March mixed with oats.

Keywords: Forage pea, Common vetch, Sole and mono cropping, Sowing date, Quality



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GİRİŞ

İklimdeki dalgalanmaya karşın ekim zamanının ayarlanması sıcaklık stresinden kurtulmanın önemli bir yoludur. Özellikle serin iklim bitkilerinin ekim zamanının belirlenerek sıcaklık stresine maruz kalmadan yetiştirme periyodunu tamamlaması veya uygun bitkiler ile karışık yetiştiriciliği yaygın yapılan bir uygulamadır. İklim özellikleri dikkate alınarak serin dönemde yetiştiricilik için serin iklim bitkisi, sıcak dönemde yetiştiricilik için ise sıcak iklim bitkilerinin olması yetiştiricilik açısından istenmektedir (Açıkgöz 2001; Chen vd. 2004; Gülümser vd. 2017).

Küresel iklim değişiminin yaşandığı çağımızda artan sıcaklığın, bitki türlerinin yetiştiriciliğine etkileri tam olarak bilinmemektedir. Serin iklim bitkileri karbondioksit oranının artmasına olumlu tepki gösterirken, artan sıcaklık büyüme, gelişme ve kaliteyi etkilemektedir (Alexander vd. 2015). Çünkü serin iklim bitkileri CO₂ doyma noktasına henüz ulaşmamışken, sıcak iklim bitkileri doyma noktasına yakındır. Bu nedenle iklim değişimi veya sıcaklık artışının serin iklim türlerinin verimini artıracak kaçınılmazdır. Sıcaklıktaki artış ayrıca bitki büyümesini hızlandırarak yapısal karbonhidrat oranının artmasına ve düşük protein oranı nedeniyle yüksek karbon azot oranı (C:N) oluşmaktadır (Robinson vd. 2012; Stiling ve Cornelissen, 2007). Bunun bir sonucu olarak azalan protein oranı nedeniyle bitki türünün hayvansal üretimde kullanımı kısıtlanır ve zamanla kullanımı terkedilebilir. Ülkemizde en fazla yetiştiriciliği yapılan fiğ bitkisi ve son yıllarda öne çıkan yem bezelyesi serin iklim türleri olup sıcak şartlarda büyümesi azalmakta verimde çok ciddi oranlarda kayıplar yaşanmaktadır. Değişen iklim senaryolarına bağlı olarak ekim zamanlarının veya yetiştirme döneminin değiştirilerek verim kaybı yaşamadan üretimin sürdürülebilirliği kaçınılmazdır. Yem bezelyesi ve fiğ tek yıllık baklagil olup gövdeleri ince, sukkulent, yatmaya hassas bitkilerdir. Ancak karışık olarak dik gelişen bir bitkiyle yetiştirildiğinde sarılcı özellikleri nedeniyle dik gelişebilmektedirler. Ülkemizde karışımlarla ilgili yapılan çok sayıda çalışmada baklagilleri küçük taneli tahıllarla birlikte %25 tahıl oranıyla ekilmesi verimi ve kaliteyi artırmaktadır. Eskişehir ve benzer ekolojilerde küresel iklim değişikliği senaryolarına uygun olarak serin iklim bitkilerinin potansiyelini dikkate alarak yem bezelyesi ve fiğin sürdürülebilir kullanımı ve kalite kaybı yaşamadan yetiştiriciliği kaliteli kaba yem üretimi için öne çıkmaktadır. Bu amaçla yem bezelyesi ve fiğ yetiştiriciliğinde sıcaklığın olumsuz etkisini azaltmak için ne zaman ekim yapılmalı, karışık yetiştiricilik yapılacaksa tercih edilmesi gereken tahılın hangisi olması, kuru madde oranı ve kaliteye etkilerini belirlemek amacıyla yürütülmüştür.



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MATERYAL ve METOT

Eskişehir Osmangazi Üniversitesi Ziraat Fakültesi Araştırma alanlarında 2019 yılında yürütülen çalışmada yem bezelyesinin (*Pisum arvense* L.) Töre ve fiğin (*Vicia sativa* L.) Orakefe çeşidi, arpanın (*Hordeum vulgare* L.) Bilgi-91 ve yulafın (*Avena sativa* L.) Çekota çeşidi kullanılmıştır. Denemede gübre olarak 2 kg/da azot ve 5 kg/da fosfor uygulanmıştır. Yem bezelyesi ve fiğin sırasıyla 14 ve 12 kg/da ekim normu, %25 oranında yulaf ve arpa ile aynı sıraya İlkbaharda I: geleneksel ekim zamanı (26 Mart 2019), II: sıcaklığın yüksek olduğu büyüme mevsiminde (14 Haziran 2019) ve III: sıcaklığın yüksek ancak büyüme mevsiminde sıcaklığın azalmaya başladığı (19 Temmuz 2019) dönemde ekim yapılmıştır. Deneme Şansa Bağlı Tam Bloklar Deneme Desenine göre 3 tekrarlamalı olarak 30 cm sıra aralığında, her parselde 5 sıra olacak şekilde 5 m uzunluğunda sıralara elle yapılmıştır. Eskişehir ili karasal iklimin hüküm sürdüğü bir ilimiz olup, 2019 yılı ve uzun yıllar ortalamasına ait sıcaklık, yağış ve nispi nem değerleri Tablo 1’de verilmiştir. Araştırma sahası toprakları killi-tınlı bünyeye sahip olup, kireçli (%14.61), tuzsuz (0.07), hafif alkali (pH 7.68), fosfor içeriği zayıf (6.16 P₂O₅ kg/da), organik madde miktarı az (% 1.65), potasyum içeriği yeterli (168.8 K₂O kg/da) olduğu belirlenmiştir.

Tablo 1. Eskişehir ili uzun yıllar ve denemenin yürütüldüğü yıllara ait bazı iklim verileri*

Aylar	2019 Yılı			Uzun Yıllar Ortalaması		
	Sıcaklık (°C)	Yağış (mm)	Nispi Nem (%)	Sıcaklık (°C)	Yağış (mm)	Nispi Nem (%)
Ocak	2.2	32.2	83.2	-0.2	40.0	75.2
Şubat	6.6	23.0	77.7	1.4	32.8	71.0
Mart	10.1	46.4	67.1	5.0	35.3	65.0
Nisan	15.6	7.9	53.4	10.2	38.4	62.4
Mayıs	17.6	51.9	68.7	15.0	44.9	59.9
Haziran	20.6	78.6	64.9	18.9	33.6	55.0
Temmuz	23.0	27.8	61.7	21.5	13.2	51.8
Ağustos	23.5	10.9	57.1	21.4	8.7	52.9
Eylül	21.0	1.4	53.5	17.4	15.9	58.4
Ekim	12.9	29.8	69.8	12.9	28.9	65.2
Kasım	7.0	8.0	80.9	6.9	30.9	70.9
Aralık	4.7	34.8	82.4	2.2	46.0	76.0
Top./Ort.	23.5	350.9	68.2	11.05	366.6	52.9

*T.C. Tarım ve Orman Bakanlığı Meteoroloji Genel Müdürlüğü

Hasat baklagillerin alt baklalarının dolduğu devrede gerçekleştirilmiştir. Geleneksel olarak yapılan ilkbahar ekimi Temmuz ayı başında (4 Temmuz 2019), sıcak dönemde ekimi yapılan



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parseller Eylül ayı başında (3 Eylül 2019) ve III. dönemde ekimi yapılan parseller Eylül ayı sonunda (27 Eylül 2019) yapılmıştır. Hasat parsel kenarlarından birer sıra ve parsel başlarından 50’şer cm atıldıktan sonra yapılmıştır. Hasat esnasında karışımlar baklagil ve buğdaygil olarak ayrıldıktan sonra ayrı ayrı hassas terazide tartılmış hasat edilen örneklerden 500 gram örnek alınarak etüvde 100 °C’da sabit ağırlığa gelene kadar kurutulup tartılıp oranlanarak kuru madde oranı belirlenmiştir. Kurutulan örnekler, 2 mm’lik elekten geçecek şekilde öğütülmüş ham protein oranları, NDF ve ADF içerikleri Near Infra-Red Spectroscopy (NIRS) kullanılarak belirlenmiştir.

Elde edilen veriler StatView paket programında varyans analizine tabi tutulmuştur (SAS Institute, 1998). Ortalamalar Bonferroni/Dunn çoklu karşılaştırma testi ile karşılaştırılmıştır.

SONUÇLAR ve TARTIŞMA

Ele alınan çalışmada yem bezelyesi ve fiğın kuru madde oranı oranı üzerine ekim zamanı, ekim şekli ve ekim zamanı x ekim şekli interaksyonu çok önemli bulunmuştur ($p<0.0001$) (Tablo 2). Ortalama kuru madde oranı %22.75 olup, II. ekim zamanında (%26.69) en yüksek olurken II. ekim zamanında (%18.67) en düşük olarak kaydedilmiştir (Tablo 2). Yem bezelyesi saf ve karışımlarında fiğın saf ve karışımlarına göre daha düşük kuru madde içeriği belirlenmiştir (Tablo 2). Kuru madde oranının ekim zamanı ve ekim şekline göre geniş bir varyasyon göstermesi ekim zamanı x ekim şekli interaksyonu önemli olmasının bir sebebi olabilir (Şekil 1).



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Tablo 2. Yem bezelyesi ve fiğın ekim zamanı ile karışık ekimlerinin kuru madde oranına, ham protein oranına, NDF ve ADF içeriklerine ait ortalama ve varyans analiz sonuçları

Uygulamalar	Kuru Madde Oranı (%)	Ham Protein Oranı (%)	NDF	ADF
Ekim Zamanı (EZ)				
I	22.88 B	27.42 a	33.74 B	31.18 A
II	26.69 A	16.70 b	34.82 B	28.82 C
III	18.67 C	14.22 b	36.72 A	30.56 B
Ekim Şekli (EŞ)				
Yem Bezelyesi	20.93 B	20.02 A	33.58 B	25.91 C
Yem Bezelyesi+Arpa	21.78 B	18.76C	34.46 B	28.47 B
Yem Bezelyesi+Yulaf	22.15 B	20.10 A	33.41 B	27.83 B
Fiğ	23.64 A	18.93C	35.96 A	33.04 A
Fiğ+Arpa	24.22 A	19.51 B	36.20 A	33.11 A
Fiğ+Yulaf	23.77 A	19.36 B	36.92 A	32.77 A
Ortalama	22.75	19.45	35.09	30.19
EZ	***	*	***	***
EŞ	***	***	***	***
EZ x EŞ	***	***	***	***

Ham protein oranı yem bezelyesi ile fiğın saf veya arpa ve yulaf ile karışık yetiştiriciliğinde ekim zamanı ($p<0.05$), ekim şekli ($p<0.0001$) ve ekim zamanı x ekim şekli etkisi ($p<0.0001$) istatistiki olarak önemli olmuştur (Tablo 2). Ham protein oranı I. ekim zamanında %27.42 olurken, II. ve III. ekim zamanlarında sırasıyla %16.70 ve 14.22 olarak tespit edilmiştir (Tablo 2). En yüksek ham protein oranı yem bezelyesinin saf ve yulaf ile olan karışımından elde edilmiştir (Tablo 2). Ekim zamanı ve ekim şekli ham protein oranı üzerine bitki türlerine ve ekim zamanına bağlı olarak farklı etki göstermiştir. Ham protein oranında ortaya çıkan bu farklılık ekim zamanı x ekim şekli etkisinin önemli olmasına sebep olmuş olabilir (Şekil 2).

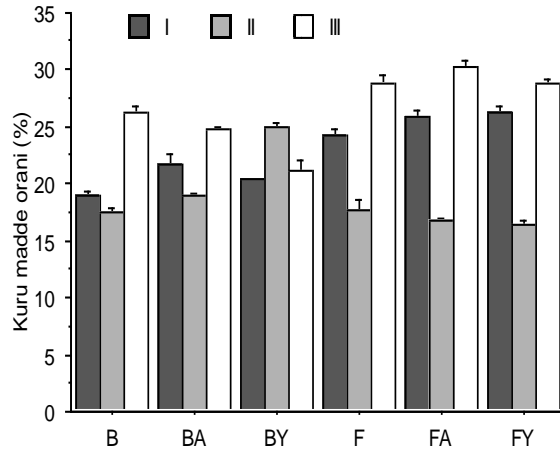
Yem bezelyesi ile fiğın saf veya arpa ve yulaf ile karışık olarak yetiştiriciliğinde NDF ve ADF içeriği üzerine ekim zamanı, ekim şekli ve ekim zamanı x ekim şekli etkisinin önemli etkisi tespit edilmiştir ($p<0.0001$) (Tablo 2). NDF içeriği en yüksek III. ekim zamanında (%36.72) tespit edilirken, ADF içeriği en yüksek I. ekim zamanında (%31.18) tespit edilmiştir (Tablo 2). Ortalama NDF ve ADF içeriği sırasıyla %35.09 ve 30.19 olarak kaydedilmiştir (Tablo 2). Fiğın saf ve karışık olarak yetiştiriciliğinde hem NDF hem de ADF içeriği yem bezelyesine göre daha yüksek bulunmuştur (Tablo 2). NDF içeriği yem bezelyesinin saf ve karışımlarında II. ekim zamanında yüksek olurken, fiğın saf ve karışımlarında III. ekim zamanında daha yüksek olmuştur. Oluşan bu farklılık ekim zamanı x ekim şekli



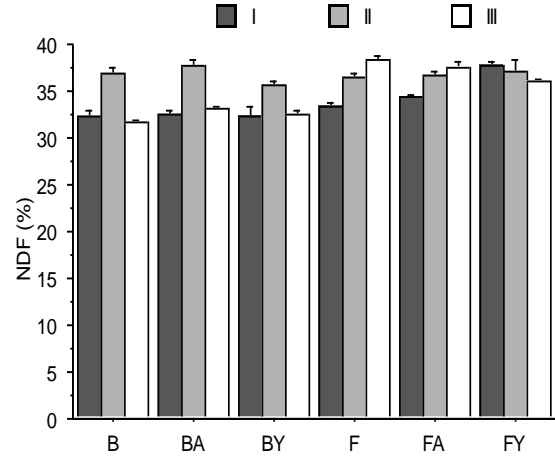
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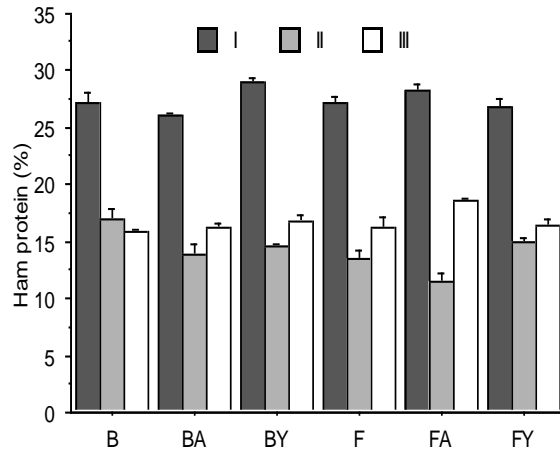
interaksiyonunun önemli bir kaynağı olmuş olabilir (Şekil 3). Yem bezelyesinde I. ekim zamanında yüksek olan ADF içeriği, fiğde II. ekim zamanında daha yüksek olarak tespit edilmiştir. Aynı uygulamalar arasındaki ortaya çıkan farklılık ekim zamanı x ekim şekli interaksiyonunun önemli olmasının bir sebebidir (Şekil 4).



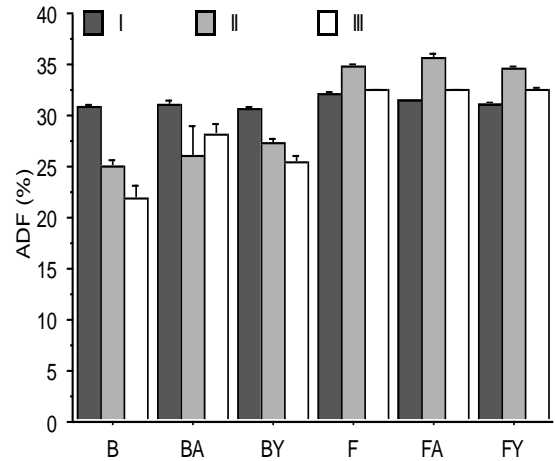
Şekil 1. Kuru madde oranlarına ait ekim zamanı x ekim şekli interaksiyonu



Şekil 3. NDF içeriğine ait ekim zamanı x ekim şekli interaksiyonu



Şekil 2. Ham protein oranlarına ait ekim zamanı x ekim şekli interaksiyonu



Şekil 4. ADF içeriğine ait ekim zamanı x ekim şekli interaksiyonu



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Bitki türleri arasındaki ilişki bitki özellikleri, iklim ve çevrenin etkisi altında şekillenmektedir. Çevre şartlarının da etkisi ile bitkilerin birbirlerini olumlu, olumsuz ve nötr olarak etkilediği bilinmektedir (Koç vd. 2013). Yürütülen çalışmada I. ve III. ekim zamanında sıcaklık serin iklim türlerinin yetiştiriciliği için uygundur. Ancak II. ekim zamanında yüksek sıcaklık serin iklim türlerinin büyümesi sınırlanmaktadır. Artan sıcaklık ve CO₂ konsantrasyonlarının bitki büyümesi ve kalitesi üzerindeki etkileri çevresel koşullara bağlı olarak değişmektedir. Fotosentez hızı hem atmosferik CO₂ konsantrasyonuna hem de ortam sıcaklığına bağlı olarak birincil ve ikincil metabolizmasını etkilemektedir (Robinson vd. 2012; Stiling ve Cornelissen, 2007). Bunun bir sonucu olarak sıcaklık bitkilerde hızlı gelişme ve kuru madde oranında artışa neden olmaktadır. Nitekim yürütülen çalışmada da sıcaklığın daha yüksek olduğu II. ekim zamanında kuru madde oranı daha yüksek olarak bulunmuştur. Yetiştiriciliği yapılan bitki türlerinin genetik ve morfolojik özelliklerinin farklı olması kuru madde oranlarının farklılığının en önemli kaynağıdır. Nitekim Bacchi vd. (2021) yaptıkları çalışmalarda yem bezelyesi ile fiğın kuru madde oranlarının farklılık gösterdiğini tespit etmişlerdir. Çevresel faktörlerin (sıcaklık, azot, su veya ışık) etkilerinin artması veya azalması bitkisel üretime etki eden temel faktörlerdir. Örneğin bir bitki için etkili olmayan çevresel faktörler diğer bitkinin az veya fazla etkilenmesine neden olabilir (Altman ve Bland, 2003). Yetiştiriciliği yapılan bitkilerin genetik özelliklerinin ve çevresel faktörlere göstermiş olduğu tepkinin farklı olması interaksyonun önemli olmasına neden olmuş olabilir.

Yürütülen çalışmada sıcak dönemde fotosentetik etkinliğin artması sonucu oluşan yapısal karbonhidrat içeriği bitki organlarındaki karbon oranını artırmaktadır. Morfoloji ve fizyolojideki farklılıklara ilave olarak artan fotosentez ve üretkenlik yoluyla kazanılan karbon, yaprak proteinlerinin konsantrasyonunu seyreltebilir (Lincoln vd. 1993). Kuru madde oranı ve yem kalitesi iklim, çevre, bitki türlerinin genetik ve morfolojisine bağlı olarak değişim gösterebilmektedir (Michlaet 2006). Yetiştirme periyodunun uzunluğu ile yetiştirme periyodu içerisindeki iklim ve çevre şartları ham protein oranını belirleyen önemli unsurlardır. Yapılan çalışmalarda erken ekimlerde veriminin ve ham protein oranının daha yüksek olduğu bildirilmiştir (Hanaa ve Ali, 2011; Hamid vd. 2015). Yürütülen çalışmada da benzer sonuçlar elde edilmiştir. Yem bezelyesi ve fiğın yalnız ve buğdaygillerle yetiştiriciliğinde ham protein oranı I. ekim zamanı olan Mart ayında yapılan ekimde diğer ekim zamanlarına göre daha yüksek olmuştur. Sıcak dönem olan II. ekim zamanında protein oranının düşük olmasına karşın kuru madde oranı daha yüksek olmuştur. Elde edilen sonuçlara benzer olarak ekim zamanı ve



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büyüme periyodu döneminde oluşan sıcaklıkların etkisi araştırmacılar tarafından ortaya konulmuştur (Çağan ve Kökten, 2017; El-Afifi vd. 2019). Bitki türlerinin genetik, morfolojik ve fizyolojik özelliklerindeki farklılıklara ilave olarak karışımdaki oranlarında farklılıklar bulunan tahıllar nedeniyle ham protein oranları farklılık göstermesi beklenen bir durumdur. Bitki türlerinde ve ekim zamanlarında oluşan bu farklılık interaksiyonun muhtemel kaynağıdır. Serin dönemlerde veya daha geç yapılan ekimlerde NDF ve ADF oranı düşük olabilmektedir. Fotosentetik etkinliğin artması sonucunda kazanılan karbon NDF ve ADF içeriklerini doğrudan etkilemektedir (Lincoln vd. 1993). Kuru madde oranı bağlı olarak NDF ve ADF içeriklerinde de değişimlerin olması beklenen bir durumdur. Fiğ bitkisinin kuru madde oranının yem bezelyesinden yüksek olması NDF ve ADF içeriklerinin yüksek olmasının önemli bir sebebidir. Nitekim yapılan çalışmalarda türlerin ve uygulamaların etkilerinin farklı olabileceği araştırmacılar tarafından belirtilmiştir (Dhima 2007; Javanmard vd. 2015). NDF ve ADF içerikleri ekim zamanı ile bitki türlerine göre farklılık sergilemesi ekim zamanı x ekim şekli interaksiyonunun muhtemel sebebidir.

Sonuç olarak; yüzyılımızın en önemli problemlerinden olan iklim değişimi ve iklimdeki dalgalanmalardan bitkisel üretimin en az şekilde etkilenmesini sağlamak amacıyla çok daha fazla araştırma yapılması gerekmektedir. Ekim zamanı iklim değişimi ve iklimdeki dalgalanmalar ile ilgili de çalışılması gereken konuların başında gelmektedir. Eskişehir ve benzer ekolojiler için yem bezelyesi ve fiğ bitkisi yetiştiriciliğinde ot kalitesi için yem bezelyesinin tercih edilmesi saf veya yulaf ile karışık olarak Mart ayında ekiminin yapılmasında fayda görülmektedir. Ancak tarımsal üretimde tek yıllık veriler gerçekçi olmadığı için daha fazla tekrarın yapılması gerekmektedir.



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KAYNAKLAR

- Açıkgöz E (2001) *Yem Bitkileri (3. Baskı)*, Uludağ Üniversitesi Güçlendirme Vakfı (182).
- Alexander J, Diez M, ve Levine J M (2015) Novel competitors shape species' responses to climate change, *Nature*, 525(7570), 515-518.
- Altman DG ve Bland JM (2003) Interaction revisited: the difference between two estimates. *British Medical Journal*, 326, 219.
- Bacchi M, Monti M, Calvi A, Presti E L, Pellicano A ve Preiti G (2021) Forage potential of cereal/legume intercrops: agronomic performances, yield, quality forage and ler in two harvesting times in a mediterranean environment. *Agronomy*, 11, 121.
- Chen C, Westcott M, Neill K, Wichman D ve Knox M (2004) Row configuration and nitrogen application for barley-pea intercropping in Montana, *Agronomy Journal*, 96(6), 1730-1738.
- Çaçan E ve Kökten K (2017) Bingöl koşullarında yaygın fiğ ve koca fiğ çeşitleri için uygun ekim zamanının belirlenmesi, *Türk Doğa ve Fen Dergisi*, 6(1), 19-23.
- Dhima K V, Lithourgidis A S, Vasilakoglou I B ve Dordas C A (2007) Competition indices of common vetch and cereal intercrops in two seeding ratio, *Field Crops Research*, 100(2-3), 249-256.
- EL-Afifi S T M, Farid S M ve Mansour R S (2019) Effect of some stimulants on productivity of pea (*Pisum sativum* L.) under high temperature stress conditions, *Journal of Plant Production*, 10(11), 891-901.
- Gülümser E, Mut H, Doğrusöz M Ç ve Başaran U (2017) Baklagil yem bitkisi tahıl karışımların ot kalitesi üzerinde tohum oranlarının etkisi, *Selcuk Journal of Agriculture and Food Sciences*, 31(3), 43-51.
- Hamid F S, Gul H, Mumtaz S, Aslam S ve Ahmed N (2015) Effect of sowing date in the performance of pea plant (*Pisum sativum*) under agro climatic condition of Mansehra, *Moroccan Journal of Chemistry*, 3(4), 3-4.
- Hanaa H ve Ali E (2011) Agronomic performance of seven pea (*Pisum sativum*) genotypes with five sowing dates in sandy soil, *Acta Agronomica Hungarica*, 59(4), 337-347.



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Javanmard A, Shekari F ve Dehghanian H (2015) Evaluation of forage yield and competition indices for intercropped barley and legumes, *International Journal of Agricultural and Biosystems Engineering*, 8(2), 193-196.

Koc A, Erkovan S, Erkovan H I, Oz U, Birben M M ve Tunc R (2013) Competitive effects of plant species under different sowing ratios in some annual cereal and legume mixtures, *J. of Animal and Vet. Adv*, 12(4), 509-520.

Lincoln PE, Fajer ED ve Johson RH (1993) Plant–insect herbivore interactions in elevated CO₂. *Trends in Ecology and Evolution*, 8, 64–68.

Michalet R (2006) Is facilitation in arid environments the result of direct or complex interactions, *New Phytologist*, 169, 3-6.

Robinson E A, Ryan G D, ve Newman J A (2012) A meta analytical review of the effects of elevated CO₂ on plant–arthropod interactions highlights the importance of interacting environmental and biological variables, *New Phytologist*, 194(2), 321-336.

SAS Institute (1988) SAS procedures Guide. Sas Inst.

Stiling P ve Cornelissen T (2007) How does elevated carbon dioxide (CO₂) affect plant–herbivore interactions? A field experiment and meta analysis of CO₂ mediated changes on plant chemistry and herbivore performance, *Global change biology*, 13(9), 823-1842.



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**TÜYLÜ FİĞİN (*Vicia villosa* Roth) TOHUM VERİMİ, KES VERİMİ VE KES
KALİTESİ AÇISINDAN DEĞERLENDİRİLMESİ**

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ÖZET

Bu çalışma, tüylü fiğın tohum verimi, kes verimi ve kes kalitesinin belirlenmesi amacıyla yürütülmüştür. Çalışmada, iki farklı tüylü fiğ çeşidi (Efes-79, Menemen-79) kullanılmış ve çalışma üç yıl süre ile tesadüf blokları deneme desenine göre üç tekrarlamalı olarak yürütülmüştür. Çalışmada tohum verimi, kes verimi, bin tane ağırlığı, ham kül oranı, ham protein oranı, ham protein verimi, NDF oranı, ADF oranı, sindirilebilir kuru madde oranı ve nispi yem değeri incelenmiştir. Çalışmada ortalama tohum verimi 82.2 kg/da, kes verimi 592 kg/da, bin tane ağırlığı 33.8 g, ham kül oranı %9.1, ham protein oranı %11.8, ham protein verimi 69.2 kg/da, NDF oranı %56.3, ADF oranı %42.0, sindirilebilir kuru madde oranı %56.2 ve nispi yem değeri 93.2 olarak tespit edilmiştir. Çalışmada; Efes-79 çeşidinin verim özellikleri açısından, Menemen-79 çeşidinin ise kalite özellikleri açısından üstün özellikler gösterdiği sonucuna varılmıştır.

Anahtar kelimeler: Tüylü fiğ, Tohum verimi, Kes verimi, Kes kalitesi



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**EVALUATION OF HAIRY VETCH (*Vicia villosa* Roth) IN TERMS OF SEED YIELD,
STRAW YIELD AND STRAW QUALITY**

ABSTRACT

In this study was carried out to determine the seed yield, straw yield and straw quality of hairy vetch. In the study, two different cultivars of hairy vetch (Efes-79, Menemen-79) were used and the study was carried out in three replications for three years according to the randomized blocks design. In the study, seed yield, straw yield, thousand grain weight, crude ash ratio, crude protein ratio, crude protein yield, NDF ratio, ADF ratio, digestible dry matter ratio and relative feed value were investigated. In the study, average seed yield 82.2 kg/da, straw yield 592 kg/da, thousand grain weight 33.8 g, crude ash rate 9.1%, crude protein rate 11.8%, crude protein yield 69.2 kg/da, NDF rate 56.3%, ADF rate 42.0%, digestible dry matter rate 56.2% and relative feed value was determined as 93.2. In the study; it was concluded that Efes-79 cultivar showed superior characteristics in terms of yield characteristics and Menemen-79 cultivar showed superior characteristics in terms of quality characteristics.

Keywords: Hairy vetch, Seed yield, Straw yield, Straw quality



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GİRİŞ

Türkiye’de 15.7 milyon hayvan birimine denk gelecek sayıda hayvan varlığı bulunmaktadır. Bu hayvanların ihtiyaç duyduğu kaba yem miktarı yıllık ortalama 70.7 milyon ton civarındadır. Bu miktarın 41.5 milyon tonu çayır meralardan ve silajlık mısır dâhil olmak üzere yem bitkilerinden karşılanmaktadır. Geriye 29.5 milyon tonluk bir açık bulunmakta ve bu açık büyük oranda bitkisel üretim artıklarından karşılanmaktadır (Çaçan & Yüksel, 2016). Bitkisel üretim artıklarından kastedilen büyük oranda tohumu alındıktan sonra geriye kalan başta buğday ve arpa olmak üzere sap ve saman artıklarıdır (Alçiçek et al., 2010). Genel olarak buğdaygillerin tohumu alındıktan sonra geriye kalan kısmına saman, baklagillerin tohumu alındıktan sonra geriye kalan kısmına kes adı verilmektedir.

Her ne kadar sap ve saman artıkları Türkiye’nin kaba yem ihtiyacını karşılamada önemli bir paya sahip olsa da tahıllardan elde edilen samanların kaliteleri (Çaçan & Kökten, 2019; Karabulut & Çaçan, 2018), baklagillerden elde edilen kes kalitelerine (Çaçan et al., 2018a, 2018b; Çaçan & Kökten, 2020) nazaran daha düşük olmaktadır. Baklagillerin kes kalitelerini belirlemeye yönelik birçok çalışma yürütülmüştür (Kaplan et al., 2012; Çaçan et al., 2018a, 2018b; Kökten et al., 2019; Keskin et al., 2021b). Bu çalışmalardan elde edilen sonuçlar, baklagillerin kes kalitelerinin yüksek olduğunu ortaya koymuştur.

Bu çalışma da bir baklagil yem bitkisi olan tüylü fiğın tohum verimi, bin tane ağırlığı ile tohumu alındıktan sonra geriye kalan kesinin verim ve kalitesini tespit etmek amacıyla yürütülmüştür.

MATERYAL VE METOT

Araştırma, 2014-2016 yılları arasında Bingöl Üniversitesi, Tarımsal Uygulama ve Araştırma Merkezi uygulama arazisinde yürütülmüştür. Araştırmada materyal olarak 2 adet tüylü fiğ çeşidi (Efes-79, Menemen-79) kullanılmıştır.

Çalışmanın yürütüldüğü Bingöl ilinin iklim verilerine göre; uzun yıllar (1990-2016) aylık sıcaklık ortalaması 12.3 °C, yağış toplamı 950.8 mm ve nispi nem ise %56.9 olduğu tespit edilmiştir. Araştırmanın yürütüldüğü 2014-2016 yılları genellikle uzun vadeli ortalamalara benzer sıcaklıklara ve nispi neme sahip değerler sergilemiştir, ancak yağışlar uzun dönem ortalamalarının altında kalmıştır (MGM, 2021). Araştırmanın yürütüldüğü arazinin 30 cm derinliğinden toprak numuneleri alınmış ve Bingöl Üniversitesi Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarında analiz yapılmıştır. Yapılan analiz sonuçlarına göre;



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toprak yapısı tınlı, tuzsuz ve pH'nın ise hafif asidik olduğu saptanmıştır. Organik madde, kireç ve fosfor, potasyum seviyesinin ise düşük olduğu saptanmıştır (Aydeniz & Brohi, 1991).

Araştırma, tesadüf blokları deneme deseninde üç tekrarlamalı olarak kurulmuştur. Ekim işlemleri, 2014-2016 yıllarında eylül ayının son haftasında 3 yıl süreyle her bir parselde 6 sıra olacak şekilde 5 m uzunluğunda, 20 cm sıra aralığında ve her sıraya 100 adet tohum olacak şekilde yapılmıştır. Denemede ekim yapılırken 3 kg/da saf azot ve 6 kg/da saf fosfor uygulanmıştır.

Denemedeki bitkilerin tamamen olgunlaştıktan sonra parsellerden kenar tesirleri çıkarılıp 2 sıra hasat edilmiştir. Hasat edilen bitki örneklerinin tohumları, el ile ayıklanmıştır. Ayıklanan tohumlar ve kesler tartılarak tohum verimi ve kes verimi elde edilmiştir. Her bir parselden dörder adet 100 adet tohum tartılıp, 10 ile çarpıldıktan sonra ortalaması alınarak, tohumların bin tane ağırlığı hesaplanmıştır. Kes örnekleri 1 mm elek çapına sahip değirmende öğütülmüştür. Öğütülen numunelerin ham kül içeriği 550 °C'de 8 saat kül fırınında yakılarak saptanmıştır. Kjeldahl yöntemine göre de toplam N içerikleri belirlenmiştir. Sonra azot içerikleri 6.25 katsayısıyla çarpılarak Kacar (1972) ve Akyıldız (1984)'ın belirttikleri yöntemle göre ham protein oranları hesaplanmıştır. Ham protein oranları ve kes verimleri yardımıyla ham protein verimleri hesaplanmıştır. Kes numunelerinin NDF ve ADF oranları Van Soest et al. (1991)'nın belirttikleri yöntem kullanılarak saptanmıştır Saptanan NDF ve ADF içerikleri yardımı ile numunelerin sindirilebilir kuru madde (SKM) oranı ve nispi yem değerleri (NYD) saptanmıştır [$SKM = 88.9 - (0.779 \times \%ADF)$, $KMT = 120 / (\%NDF)$; $NYD = (SKM \times KMT) / 1.29$ (Sheaffer et al., 1995)].

Araştırma sonuçları, JMP istatistik paket programı kullanılarak tesadüf blokları deneme desenine göre varyans analizine tabi tutulmuştur. İstatistiksel olarak önemli çıkan sonuçlar %5 önem seviyesinde LSD testi ile karşılaştırılmıştır (JMP, 2018).

BULGULAR ve TARTIŞMA

Tüylü fiğın tohum verimi, kes verimi, bin tane ağırlığı, ham kül oranı, ham protein oranı, ham protein verimi, NDF oranı, ADF oranı, sindirilebilir kuru madde oranı ve nispi yem değeri Tablo 1'de verilmiştir.

Kes veriminde çeşitler arasında, ham protein veriminde yıllar arasında, NDF oranında yıl x çeşit interaksijonunda, ADF ve SKM oranlarında çeşitler ve yıl x çeşit interaksijonunda ve nispi yem değeriinde yıl x çeşit interaksijonunda istatistiksel olarak herhangi bir farklılık



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görülmemiştir. Geriye kalan tüm parametrelerin çeşit, yıl ve yıl x çeşit interaksyonlarında istatistiksel olarak farklılıklar olduğu görülmektedir (Tablo 1).

Tablo 1. Tüylü fiğin tohum verimi (TV), kes verimi (KV), bin tane ağırlığı (BTA), ham kül (HK), ham protein oranı (HPO), ham protein verimi (HPV), nötral deterjanda çözünmeyen lif (NDF) oranı, asit deterjanda çözünmeyen lif (ADF) oranı, sindirilebilir kuru madde (SKM) oranı ve nispi yem değeri (NYD)

TV					KV			
Çeşit	2014	2015	2016	Ortalama	2014	2015	2016	Ortalama
Efes-79	87.6 b	111.7 a	119.5 a	106.3 A	519 e	624 b	667 a	603
Menemen-79	50.9 d	62.0 c	61.2 c	58.1 B	573 cd	611 bc	558 d	581
Ortalama	69.3 B	86.8 A	90.4 A	82.2	546 B	617 A	613 A	592
LSD (0.05)	Yıl:6.6**, Çeşit:5.4**, Yıl x Çeşit:9.3*				Yıl:28.0**, Çeşit:---, Yıl x Çeşit:39.6**			
BTA					HK			
Çeşit	2014	2015	2016	Ortalama	2014	2015	2016	Ortalama
Efes-79	34.9 b	39.9 a	35.5 b	36.8 A	10.5 b	9.8 c	9.8 c	10.0 A
Menemen-79	34.5 b	25.7 d	32.3 c	30.8 B	11.2 a	6.8 d	6.8 d	8.3 B
Ortalama	34.7 A	32.8 AB	33.9 B	33.8	10.8 A	8.3 B	8.3 B	9.1
LSD (0.05)	Yıl:1.3*, Çeşit:1.1**, Yıl x Çeşit:1.8**				Yıl:0.4**, Çeşit:0.3**, Yıl x Çeşit:0.6**			
HPO					HPV			
Çeşit	2014	2015	2016	Ortalama	2014	2015	2016	Ortalama
Efes-79	12.3 b	10.6 d	10.5 d	11.1 B	63.7 c	66.0 bc	69.8 b	66.5 B
Menemen-79	13.2 a	12.1 bc	12.0 c	12.4 A	75.5 a	73.7 a	66.8 bc	72.0 A
Ortalama	12.7 A	11.3 B	11.2 B	11.8	69.6	69.9	68.3	69.2
LSD (0.05)	Yıl:0.2**, Çeşit:0.1**, Yıl x Çeşit:0.3**				Yıl:---, Çeşit:2.3**, Yıl x Çeşit:3.9**			
NDF					ADF			
Çeşit	2014	2015	2016	Ortalama	2014	2015	2016	Ortalama
Efes-79	52.7	59.6	59.6	57.3 A	39.6	43.0	42.9	41.8
Menemen-79	52.1	56.8	57.0	55.3 B	39.0	43.7	43.8	42.2
Ortalama	52.4 B	58.2 A	58.3 A	56.3	39.3 B	43.3 A	43.4 A	42.0
LSD (0.05)	Yıl:1.6**, Çeşit:1.3**, Yıl x Çeşit:---				Yıl:1.6**, Çeşit:---, Yıl x Çeşit:---			
SKM					NYD			
Çeşit	2014	2015	2016	Ortalama	2014	2015	2016	Ortalama
Efes-79	58.1	55.4	55.4	56.3	102.5	86.4	86.5	91.8 B
Menemen-79	58.5	54.9	54.8	56.0	104.4	90.0	89.4	94.6 A
Ortalama	58.3 A	55.2 B	55.1 B	56.2	103.4 A	88.2 B	87.9 B	93.2
LSD (0.05)	Yıl:1.2**, Çeşit:---, Yıl x Çeşit:---				Yıl:3.4**, Çeşit:2.8*, Yıl x Çeşit:---			

**P≤0.01, *P≤0.05

Çeşitler açısından bir değerlendirme yapıldığında; Efes-79 çeşidinin tohum verimi, bin tane ağırlığı, ham kül oranı, NDF oranı açısından Menemen-79 çeşidine göre daha yüksek değerler verdiği görülmektedir. Menemen-79 çeşidi ise ham protein oranı, ham protein verimi ve nispi yem değeri açısından Efes-79 çeşidine göre daha yüksek değerler verdiği görülmektedir. Dolayısıyla verim özellikleri açısından Efes-79, kalite özellikleri açısından ise Menemen-79 çeşidinin üstün değerler verdiği açıkça görülmektedir (Tablo 1).



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Yıllar açısından bir değerlendirme yapıldığında; her iki çeşidin ortalaması olarak ilk yıl tohum verimi, kes verimi, NDF oranı ve ADF oranlarının daha düşük olduğu, ikinci ve üçüncü yıllarda bu parametrelerde artış olduğu görülmektedir. Bu durumun tersi olacak şekilde de ilk yıl bin tane ağırlığı, ham kül oranı, ham protein oranı, sindirilebilir kuru madde ve nispi yem değerinin yüksek, ikinci ve üçüncü yıllarda ise bu parametrelerde düşüş olduğu görülmektedir. Kısaca ikinci ve üçüncü yıllarda tohum ve kes verimi açısından daha yüksek değerler, ancak kalite açısından daha düşük değerler elde edilmiştir (Tablo 1).

Yıl x çeşit etkisi açısından bir değerlendirme yapıldığında; tohum verimi, kes verimi ve bin tane ağırlığı açısından Efes-79 çeşidinin ikinci ve üçüncü yıllarda daha yüksek değerler verdiği, ham kül oranı, ham protein oranı, ham protein verimi gibi kalite parametreleri açısından ise Menemen-79 çeşidinin ikinci ve üçüncü yıllarda daha yüksek değerler verdiği görülmektedir (Tablo 1).

Daha önce yapılan çalışmalara bakıldığında; Iğdır ekolojik koşullarında farklı ekim zamanlarında ve farklı çeşitlerde yürütülen iki yıllık çalışmada yem bezelyesinin kes verimi 264.7-284.0 kg/da (Keskin et al., 2021a), yem bezelyesinin kesinde ham protein oranı %6.97-7.29, NDF oranı %53.4-54.3, ADF oranı %35.7-35.9, kuru madde sindirimi oranı %60.8-61.0 ve nispi yem değeri 105.5-106.7 olarak tespit edilmiştir (Keskin et al., 2021b). Yine bazı yem bezelyesi hat ve çeşitlerinde kes verimi 160.3-887.0 kg/da, ham kül oranı %9.42-11.19, ham protein oranı %6.54-11.91, ham protein verimi 11.9-104.9 kg/da, NDF oranı %39.1-51.2, ADF oranı %29.5-39.8, SKM oranı %57.9-65.9 ve NYD 105.5-157.4 olarak tespit edilmiştir (Çaçan et al., 2018a). Bazı adi fiğ hat ve çeşitlerinde kes verimi 105.7-289.8 kg/da, bin tane ağırlığı 37.9-56.3 g, ham kül oranı %9.4-15.3, ham protein oranı %8.1-12.4, ham protein verimi 12.1-31.1 kg/da, NDF oranı %42.0-51.4, ADF oranı %29.5-37.3, SKM oranı %59.8-65.9 ve NYD 111.2-147.1 arasında değişmiştir (Çaçan et al., 2018b). Bazı yonca genotiplerinde kes veriminin 293-860 kg/da, ham protein oranının %8.7-13.9, NDF oranının %39.6-54.3, ADF oranının %21.2-41.8, SKM oranının %56.4-65.1 ve nispi yem değerinin 97-152 arasında değişim gösterdiği bildirilmiştir (Çaçan & Kökten, 2020).

Araştırmacılar tarafından daha önce elde edilen bu sonuçların, çalışmadan elde edilen sonuçlar ile benzerlik gösterdiği görülmektedir. Bu benzerliğin muhtemel nedeni üzerinde çalışılan bitkilerin aynı familyaya ait olmalarıdır. Yani hepsinin birer baklagil yem bitkisi olması nedeniyle, kes verimleri ve keslerin kalite değerlerinin birbirine yakın olduğunu söylemek mümkündür. Ancak bu sonuçlara rağmen baklagil yem bitkileri içerisinde, koca fiğin



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tanelerinin diğer türlere göre daha iri olmasından dolayı daha yüksek tohum verimine sahip olabileceğini söylemek mümkündür. Nitekim daha önce Diyarbakır ekolojik koşullarında yapılan bir çalışmada bunu destekleyen bir sonuç elde edilmiştir. Bazı koca fiğ hatlarında tohum verimi 131.3-346.6 kg/da ve kes verimi 238.4-625.1 kg/da olarak tespit edilmiştir (Sayar et al., 2017).

SONUÇ

Efes-79 ve Menemen-79 çeşitleri ile 3 yıl boyunca yürütülen bu çalışma sonucunda; tüylü fiğ çeşitlerinin tohumu alındıktan sonra geriye kalan kesinin kıymetli bir kaba yem olduğu ve üzerinde çalışılan çeşitlerden Efes-79 çeşidinin verim özellikleri açısından, Menemen-79 çeşidinin ise kalite özellikleri açısından üstün özellikler göstererek öne çıktığı belirlenmiştir.



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KAYNAKLAR

- Akyıldız, A. R. (1984). *Yemler Bilgisi ve Laboratuvar Kılavuzu*. Ankara Üniversitesi Ziraat Fakültesi, Yayın No: 895, Ankara.
- Alçiçek, A., Kılıç, A., Ayan, V., & Özdoğan, M. (2010). Türkiye’de Kaba Yem Üretimi ve Sorunları. *Türkiye Ziraat Mühendisliği VII. Teknik Kongresi, 11-15 Ocak 2010, Ankara*.
- Aydeniz, A., & Brohi, A. R. (1991). *Gübreler ve Gübreleme*. Ç.Ü. Tokat Ziraat Fakültesi Yayın No: 10, Ders Kitabı No: 3, Tokat.
- Çaçan, E., Kaplan, M., Kökten, K., & Tutar, H. (2018a). Bazı Yem Bezelyesi Hat ve Çeşitlerinin (*Pisum sativum* ssp. *arvense* L.) Tohum Verimi ve Kes Kalitesi Açısından Değerlendirilmesi. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 8(2), 275-284.
- Çaçan, E., Kaplan, M., Kökten, K., & Tutar, H. (2018b). Bingöl Koşullarında Bazı Adi Fiğ Hat ve Çeşitlerinin (*Vicia sativa* L.) Tohum Verimi, Kes Verimi ve Kes Kalitesi Açısından Değerlendirilmesi. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 8(1), 289-300. <https://doi.org/10.21597/jist.407888>
- Çaçan, E., & Kökten, K. (2019). Tahıl Türlerinin Kaba Yem Olarak Değerlendirilmesi Üzerine Bir Araştırma. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 56(2), 221-229. <https://doi.org/10.20289/zfdergi.459694>
- Çaçan, E., & Kökten, K. (2020). Bazı Yonca Genotiplerinin (*Medicago sativa* L.) Kes Verimi ve Kes Kalitesi Açısından Karşılaştırılması. *Euroasia Journal of Mathematics, Engineering, Natural & Medical Sciences*, 7(9), 266-272.
- Çaçan, E., & Yüksel, A. (2016). Çayır ve Meraların Bölgesel Kalkınma Üzerindeki Etkisi. *ÜNİDAP Uluslararası Bölgesel Kalkınma Konferansı*.
- JMP. (2018). *Statistical Discovery from SAS, USA*.
- Kacar, B. (1972). *Bitki ve Toprağın Kimyasal Analizleri*. Ankara Üniversitesi Ziraat Fakültesi Yayın No: 453, Ankara.
- Kaplan, M., Kökten, K., Yılmaz, H. Ş., Arslan, M., Kale, H., Bozkurt, S., & Temizgül, R. (2012). Kara Nohutta (*Cicer arietinum* L.) Ekim Zamanının Ot, Tane ve Kes Verimi ile Kalite Özelliklerine Etkisi. *11. Tarla Bitkileri Kongresi, 7-10 Eylül 2015, Çanakkale*, 322-325.
- Karabulut, D., & Çaçan, E. (2018). Farklı Zamanlarda Ekilen Bazı Tahıl Türlerinin Ot Verimi ve Kalitesi Bakımından Karşılaştırılması. *Alinteri Ziraat Bilimler Dergisi*, 33(2), 125-131. <https://doi.org/10.28955/alinterizbd.360031>



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Keskin, B., Temel, S., & Eren, B. (2021a). Bazı Yem Bezelyesi (*Pisum sativum* ssp. *arvense* L.) Çeşitlerinin Farklı Ekim Zamanlarındaki Tohum Verimi ve Bazı Verim Öğeleri. *Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi*, 44(6), 1315-1326. <https://doi.org/10.18016/ksutarimdogavi.870115>

Keskin, B., Temel, S., & Eren, B. (2021b). Farklı Zamanlarda Ekilen Bazı Yem Bezelyesi (*Pisum sativum* ssp. *arvense* L.) Çeşitlerinin Tohum ve Kesinin Besin Değerleri. *Uluslararası Tarım ve Yaban Hayatı Bilimleri Dergisi*, 7(1), 96-105. <https://doi.org/10.24180/ijaws.870687>

Kökten, K., Kaplan, M., Seydoşoğlu, S., Tutar, H., & Özdemir, S. (2019). Bingöl Koşullarında Bazı Burçak (*Vicia ervilia* (L.) Willd) Genotiplerinin Tohum Verimi ve Kalite Özelliklerinin Belirlenmesi. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 56(1), 27-33. <https://doi.org/10.20289/zfdergi.409921>

MGM. (2021). *Tarım ve Orman Bakanlığı Meteoroloji Genel Müdürlüğü*, <http://www.mgm.gov.tr>.

Sayar, M. S., Han, Y., & Başbağ, M. (2017). Bazı Ümitvar Koca Fiğ (*Vicia narbonensis* L.) Hatlarında Tohum Verimi ve İlgili Özelliklerin Belirlenmesi ve GGE Biplot Analiz Yöntemi ile Değerlendirilmesi. *KSÜ Doğa Bilimleri Dergisi*, 20, 38-45. <https://doi.org/10.18016/ksudobil.348897>

Sheaffer, C. C., Peterson, M. A., Mccalin, M., Volene, J. J., Cherney, J. H., Johnson, K. D., Woodward, W. T., & Viands, D. R. (1995). *Acid detergent fiber, neutral detergent fiber concentration and relative feed value*.

Van Soest, P. J., Robertson, J. B., & Lewis, B. A. (1991). Methods for Dietary Fiber, Neutral Detergent Fiber and Non-starch Polysaccharides in Relation to Animal Nutrition. *J. Dairy Sci*, 74, 3583-3597.



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**BİNGÖL EKOLOJİK KOŞULLARINDA BAZI TÜYLÜ FİĞ (*Vicia villosa* ROTH.)
ÇEŞİTLERİNİN OT VERİMİ VE KALİTESİ AÇISINDAN DEĞERLENDİRİLMESİ**

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ÖZET

Bu çalışma, Bingöl ekolojik koşullarında yetiştirilen bazı tüylü fiğ çeşitlerinin ot verimi ve kalitesinin belirlenmesi amacıyla 2014-2016 yılları arasında Bingöl Üniversitesi, Tarımsal Uygulama ve Araştırma Merkezi uygulama arazisinde üç yıl süreyle yürütülmüştür. Çalışmada materyal olarak 2 adet tüylü fiğ çeşidi (Efes-79, Menemen-79) kullanılmıştır. Araştırma tesadüf blokları deneme desenine göre üç tekerrürlü olarak kurulmuştur. Araştırmada; bitki boyu, yeşil ot verimi, kuru ot verimi, ham protein oranı, ham protein verimi, ham kül oranı, asit deterjanda çözünmeyen lif (ADF) oranı, nötral deterjanda çözünmeyen lif (NDF) oranı, sindirilebilir kuru madde (SKM) oranı, kuru madde tüketimi (KMT) oranı ve nispi yem değerlerine (NYD) ilişkin veriler ele alınmıştır. Araştırma sonucunda; bitki boyu 102.8-194.3 cm, yeşil ot verimi 1841-2591 kg/da, kuru ot verimi 280-559 kg/da, ham protein oranı %17.1-18.7, ham protein verimi 47.8-103.8 kg/da, ham kül oranı %8.9-9.9, ADF oranı %35.4-39.5, NDF oranı %47.5-49.8, SKM oranı %58.1-61.3, KMT oranı %2.41-2.53 ve nispi yem değeri 112-120 arasında değişmiştir. Üç yıl tekrarlanan bu çalışma sonucunda, çalışmada kullanılan her iki çeşitte Bingöl ekolojik koşullarına uyum sağlamış olup Efes-79 çeşidinin Menemen-79 çeşidine oranla daha yüksek ot verimi sağladığı tespit edilmiştir.

Anahtar Kelimeler: Tüylü fiğ, Ot verimi, Ot kalitesi, ADF, NDF



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**EVALUATION OF SOME HAIRY VETCH (*Vicia villosa* ROTH.) VARIETIES IN
TERMS OF HERBAGE YIELD AND QUALITY IN BINGÖL ECOLOGICAL
CONDITIONS**

ABSTRACT

This study was carried out in Bingöl University, Agricultural Application and Research Center application field for three years between 2014-2016 in order to determine the herbage yield and herbage quality of some hairy vetch varieties grown in Bingöl ecological conditions. In the study, 2 hairy vetch varieties (Efes-79, Menemen-79) were used as material. The research was set up in a randomized block design with three replications. In the research; plant height, green herbage yield, dry herbage yield, crude protein ratio, crude protein yield, crude ash ratio, acid detergent insoluble fiber (ADF) ratio, neutral detergent insoluble fiber (NDF) ratio, digestible dry matter (DDM) ratio, dry matter intake (DMI) ratio and relative feed values (RFV) are discussed. As a result of the research; plant height 102.8-194.3 cm, green herbage yield 1841-2591 kg/da, dry herbage yield 280-559 kg/da, crude protein rate 17.1-18.7%, crude protein yield 47.8-103.8 kg/da, crude ash rate 8.9-9.9%, ADF rate 35.4-39.5%, NDF rate 47.5-49.8%, DDM rate 58.1-61.3%, DMI rate 2.41% -2.53 and RFV varied between 112-120. As a result of this study, which was repeated for three years, it was determined that both cultivars used in the study adapted to the ecological conditions of Bingöl, and it was determined that Efes-79 variety provided higher forage yield than Menemen-79 variety.

Keywords: Hairy vetch, Herbage yield, Herbage quality, ADF, NDF



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GİRİŞ

Hayvansal üretimde ihtiyaç duyulan yem girdisinin, işletmenin kendi olanakları ile karşılanabilmesi hem maliyetlerin düşürülmesinde hem de sürekli ve güvenli kaba yem üretiminin devamlılığı açısından önemlidir (Akman ve ark., 2007). Ayrıca tarımsal faaliyetler içerisinde çok önemli bir yere sahip olan yem bitkileri tarımı hayvansal üretimin sigortası olarak kabul edilmektedir. Yem bitkileri sadece hayvanların beslenmesi için değil aynı zamanda toprağın verimini arttırılmasında özellikle baklagil yem bitkilerinin köklerinde simbiyotik olarak hayatını sürdüren bakteriler aracılığıyla toprağın azot bakımından zenginleşmesini sağlaması, erozyonun önlenmesi ve ekolojik dengeyi korumak için oldukça önemli fonksiyonları bulunmaktadır. Ülkemizde geçmişten günümüze, doğru olmayan işleme metotları ve tek yönlü ürün yetiştiriciliğinden kaynaklanan tuzluluk ve çevre kirliliği sorunları ortaya çıkmıştır. Bu sorunların ortadan kaldırılması için yem bitkilerinin ekim sistemi içinde oranının artırılması gerekmektedir. Ülkemizde gerek büyükbaş ve gerekse küçükbaş hayvancılıkta hayvanların beslenmesi genel olarak meraya dayanmaktadır. Fakat meraların yıllardan beri aşırı ve erken otlatılmalarından dolayı verimlilikleri oldukça azalmış ve hayvanlar yem değeri az otlarla beslenmek durumunda kalmışlardır. Hayvansal üretimi fazlalaştırmak için hayvan beslemede kaliteli yemlerin kullanılması gerekmektedir. Bunun için tarla tarımı içerisinde kaliteli yem bitkileri ekilişi ve üretiminin artırılması gerekmektedir (Gençkan, 1992).

Fiğ (*Vicia*) cinsinin Dünya üzerinde yaklaşık 140 ile 150 civarlarında türü olduğu belirtilmektedir. Özellikle Asya, Avrupa ve Akdeniz ülkelerinin yerli bir bitkisi olarak bilinir. Fiğ bitkisinin tarımı ilk defa eski Dünyada yapılmaya başlanmıştır. Kültüre alınan ve incelen ilk fiğ türü ise yaygın fiğ ve bakla olarak bilinmektedir (Avcıoğlu ve ark. 2009).

Fiğ türleri içerisinde tarımı oldukça yaygın olan, kışa ve kurağa dayanımı oldukça yüksek olan tüylü fiğ çeşidi ilk kez 1857'de Almanya'da kültüre alınmıştır. Tüylü fiğ tek ya da iki yıllık bir bitkidir. Tek yıllık tüylü fiğ sapsız ve yaprakları hafif tüylü ya da çıplaktır. İki yıllık tüylü fiğ çeşidinde ise sap ve yaprakları yoğun tüylüdür. Yaygın ve çok sayıda yan köklere sahiptir. Tırmanıcı özellikte olan sap; 30-60 cm bazen de 150 cm kadar boylanır. Genellikle yabancı döllendir. Mavi, menekşe veya erguvan-menekşe rengine olan çiçekler 15-20 mm uzunlukta ve 3-30 adedi tek taraflı olarak çiçek eksenine birleşerek salkım oluştururlar (Soya ve ark., 2004). İklim istekleri yönünden en belirgin özelliği kış soğuklarına ve gelişmiş kök sistemi sayesinde kuraklıklara karşı dayanıklı olmasıdır. Bu nedenle iç ve doğu bölgelerimizde sonbaharda erken ekilmek koşuluyla kışlık olarak yetiştirilebilmektedir. Bitki gölgeye belli ölçüde toleranslıdır.



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Toprak isteği yönünden fazla seçiciliği yoktur. Ancak, hafif ve kumlu topraklarda daha iyi gelişmektedir. Nemli, ağır ve su tutan topraklarda iyi gelişemez. Dekara kuru ot verimi 200-250 kg kadardır (Açıkgöz, 2001). Dekara tohum verimi ise ortalama 100-150 kg kadardır. Çok iyi koşullarda bu değer 300 kg'a kadar çıkabilmektedir (Manga ve ark., 2003).

Yem bitkilerinde üretimin arttırılması için birim alandan elde edilen verimin arttırılması gerekmektedir. Bu ise, yüksek verim potansiyeline sahip iyi bir çeşit ve uygun yetiştirme tekniklerinin geliştirilmesi ile mümkün olacaktır (Seydoşoğlu ve ark., 2015). Bu çalışmanın amacı, Bingöl ekolojik koşullarına iyi uyum sağlayabilen tüylü fiğ çeşitlerinin ot verimi ve kalitesini belirlemektir.

MATERYAL ve YÖNTEM

Bu çalışma, 2014-2016 yılları arasında Bingöl Üniversitesi, Tarımsal Uygulama ve Araştırma Merkezi uygulama arazisinde sonbahar aylarında ekim yapılarak yürütülmüştür. Araştırmada materyal olarak 2 adet tüylü fiğ çeşidi (Efes-79, Menemen-79) kullanılmıştır.

Çalışmanın yürütüldüğü Bingöl ilinin iklim verilerine göre; uzun yıllar (1990-2016) aylık sıcaklık ortalaması 12.3 °C, yağış toplamı 950.8 mm ve nispi nem ise %56.9 olduğu tespit edilmiştir. Araştırmanın yürütüldüğü 2014-2016 yılları genellikle uzun vadeli ortalamalara benzer sıcaklıklara ve nispi neme sahip değerler sergilemiştir, ancak yağışlar uzun dönem ortalamalarının altında kalmıştır (Anonim, 2016). Araştırmanın yürütüldüğü arazinin 30 cm derinliğinden toprak numuneleri alınmış ve Bingöl Üniversitesi Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarında analiz yapılmıştır. Yapılan analiz sonuçlarına göre; toprak yapısı tınlı, tuzsuz ve pH'nın ise hafif asidik olduğu saptanmıştır. Organik madde, kireç ve fosfor, potasyum seviyesinin ise düşük olduğu saptanmıştır (Aydeniz ve Brohi, 1991).

Araştırma, tesadüf blokları deneme deseninde üç tekrarlamalı olarak kurulmuştur. Ekim işlemleri, 2014-2016 yıllarında eylül ayının son haftasında 3 yıl süreyle her bir parselde 6 sıra olacak şekilde 5 m uzunluğunda, 20 cm sıra aralığında ve her sraya 100 adet tohum olacak şekilde ekim yapılmıştır. Denemede ekim yapılırken 3 kg/da saf azot ve 6 kg/da saf fosfor uygulanmıştır.

Denemedeki bitkilerin alt baklaları oluşmaya başladığı dönemde kenar tesirleri çıkarılıp 2 sıra hasat edilmiş, bitki boyu ve yeşil ot verimleri alınmış daha sonra alınan yeşil ot örnekleri 70 °C'de 48 saat süreyle etüvde kurutulmuş ve kuru ot verimi elde edilmiştir. Kuruyan örnekler 1 mm elek çapına sahip değirmende öğütülmüştür. Öğütülen numuneler Kjeldahl yöntemine göre



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toplam N içerikleri belirlenmiştir. Sonra azot içerikleri 6.25 katsayısıyla çarpılarak Kacar (1972) ve Akyıldız (1984)'ın belirttikleri yöntemle göre ham protein oranları hesaplanmıştır. Numunelerin NDF ve ADF oranları Van Soest ve ark. (1991)'nın belirttikleri yöntem kullanılarak saptanmıştır. Saptanan NDF ve ADF içerikleri yardımı ile numunelerin SKM = $88.9 - (0.779 \times \%ADF)$ (Oddy ve ark., 1983); KMT = $120 / (\%NDF)$ (Sheaffer ve ark., 1995); NYD = $(SKM \times KMT) / 1.29$ (Sheaffer ve ark., 1995) değerleri saptanmıştır.

Araştırma sonuçları, JMP istatistik paket programı kullanılarak tesadüf blokları deneme desenine göre varyans analizine tabi tutulmuştur. İstatistiksel olarak önemli çıkan sonuçlar %5 önem seviyesinde LSD testi ile karşılaştırılmıştır (JMP, 2018).

BULGULAR ve TARTIŞMA

3 yıllık araştırma sonuçlarına göre; tüylü fiğ çeşitlerine ait yeşil ot verimi, kuru ot verimi, ham protein verimi, bitki boyu, nötral deterjanda çözünmeyen lif oranı, kuru madde tüketimi oranı ve nispi yem değerlerinin yıl, çeşit ve yıl×çeşit etkisi açısından istatistiksel olarak %1 seviyesinde önemli iken, ham protein oranlarının çeşit ve yıllar açısından istatistiksel olarak %1 seviyesinde önemli olduğu, ham kül oranı, asit deterjanda çözünmeyen lif oranı ve sindirilebilir kuru madde oranları ise yıllar açısından istatistiksel olarak önemli olmadığı sadece çeşit açısından istatistiksel olarak %1 seviyesinde önemli olduğu görülmektedir.

Yeşil Ot Ve Kuru Ot Verimleri

Tüylü fiğ çeşitlerinin yeşil ot ve kuru ot verimlerine ait değerler ve ortalamalar Tablo 1'de verilmiştir. Tablo 1'de görüldüğü üzere yeşil ot ve kuru ot verimleri arasındaki farklılığın yıl, çeşit ve yıl×çeşit etkisi açısından önemli olduğu tespit edilmiştir ($P \leq 0.01$).

Yeşil ot ve kuru ot verimleri açısından Efes-79 çeşidinin Menemen-79 çeşidine göre daha yüksek değerler verdiği görülmektedir. 2014 yılı ile 2016 yıllarında elde edilen ortalama yeşil ot ve kuru ot verimlerinin daha yüksek olduğu görülmektedir. Tüylü fiğin yetiştirildiği 2015 yılında daha az miktarda yağış düşmesinden dolayı yeşil ot ve kuru ot verimleri daha düşük elde edilmiştir. Yıl×çeşit etkisi açısından bakıldığında en yüksek yeşil ot ve kuru ot verimlerinin Efes-79 çeşidinden 2014 ve 2016 yıllarında alındığı görülmüştür.

Çalışma sonucunda tüylü fiğ ile ilgili elde edilen yeşil ot verimleri; Erzurum ekolojik koşullarında 772.3-1123 kg/da (Andiç vd., 1996), Diyarbakır koşullarında 1152.08 kg/da (Saruhan ve Başbağ, 1997), İç Anadolu koşullarında 1530 kg/da (Altınok ve Hakyemez, 2000), Diyarbakır ekolojik koşullarında 1712.78 kg/da (Saruhan vd., 2001), Tekirdağ ekolojik



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koşullarında 1828 kg/da (Zeybek, 2010) ve Ankara koşullarında 1529.3 kg/da (Doğan, 2014) olarak elde edilen bulgulardan daha yüksek olmuştur. İklim koşulları ve toprak özelliklerinin farklılığının yanı sıra, tercih edilen çeşitlerin ve ekim ile hasat zamanlarının farklılığından dolayı bu çalışmada elde edilen bulgular; Antalya ova koşullarında 3427.41 kg/da (Özyiğit ve Bilgen, 2003) ve Akdeniz sahil koşullarında 6114 kg/da (Çeçen vd., 2005) olarak elde edilen bulgulardan daha düşük tespit edilmiştir. Diğer taraftan, Tokat koşullarında 2442.9 kg/da (Büyükburç vd., 1994) olarak elde edilen bulgular ile çalışma bulguları benzerlik göstermiştir.

Tablo 1. Tüylü fiğ çeşitlerinin yeşil ot ve kuru ot verimlerine ait ortalama değerler ve oluşan gruplar

Çeşit	Yeşil Ot Verimi (kg/da)				Kuru Ot Verimi (kg/da)			
	2014	2015	2016	Ort.	2014	2015	2016	Ort.
Efes-79	2578 a	2169 b	2591 a	2446 A	537 a	349 b	559 a	482 A
Menemen-79	1841 c	1849 c	1951 c	1880 B	280 c	273 c	391 b	315 B
Ort.	2210 A	2009 B	2271 A	2163	408 A	311 C	475 A	398
LSD (0.05)	Yıl:113.3 **, Çeşit:92.5 **, Yıl x Çeşit: 160.2 **				Yıl:35.5 **, Çeşit:29.0 **, Yıl x Çeşit: 50.2 **			

**P≤0.01

Tüylü fiğ ile ilgili elde edilen kuru ot verimleri; Erzurum ekolojik koşullarında 229.2- 329.7 kg/da (Andiç vd., 1996), Diyarbakır koşullarında 295.15 kg/da (Saruhan ve Başbağ, 1997), İç Anadolu koşullarında 339 kg/da (Altınok ve Hakyemez, 2000), Diyarbakır ekolojik koşullarında 363 kg/da (Saruhan vd., 2001) ve Ankara koşullarında 269.00 kg/da (Doğan, 2014) olarak verilen bulgulardan daha yüksek iken; Akdeniz sahil koşullarında 992 kg/da (Çeçen vd., 2005) ve Çukurova koşullarında 908 kg/da (Yaktubay ve Anlarsal, 1997) olarak elde edilen bulgulardan daha düşük tespit edilmiştir. Diğer taraftan, Antalya ova koşullarında 554.25 kg/da (Özyiğit ve Bilgen, 2003) ve Tokat koşullarında 564.4 kg/da (Büyükburç vd., 1994) olarak elde edilen bulgularla çalışma bulguları benzerlik göstermiştir. Kuru ot verimi elde edilen yeşil ot verimi ile doğrudan ilişkilidir. Yeşil ot veriminin yüksek olarak elde edildiği çalışmalarda kuru ot verimi de yüksek olarak elde edilmektedir.

Ham Protein Oranı, Ham Protein Verimi

Tüylü fiğ çeşitlerinin ham protein oranı ve ham protein verimlerine ait değerler ve ortalamalar Tablo 2’de verilmiştir. Tablo 2’de görüldüğü üzere ham protein oranı verimleri arasındaki farklılığın yıl ve çeşit açısından önemli olduğu, ancak yıl x çeşit intraksiyonu bakımından önemsiz olduğu tespit edilmiştir ($P \leq 0.01$). Ham protein verimleri arasındaki farklılığın yıl, çeşit ve yıl x çeşit interaksiyonu açısından önemli olduğu saptanmıştır ($P \leq 0.01$). Ham protein oranı ve ham protein verimleri açısından Efes-79 çeşidinin Menemen-79 çeşidine göre daha yüksek değerler verdiği görülmüştür.



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Tüylü fiğ çeşitlerinden elde edilen üç yıllık ortalama verilere bakıldığında ham protein oranları %17.7-18.1 arasında değişim göstermiş ve yılların ortalaması %17.9 olarak elde edilmiştir. Yıl x çeşit interaksiyonuna baktığımızda; en yüksek ham protein oranı 2015 yılında Efes-79 çeşidinden elde edilirken, en düşük ham protein oranı 2014 yılında Menemen-79 çeşidinden elde edilmiştir (Tablo 2).

Çalışmadan elde edilen ham protein oranları; Ankara ekolojik şartlarında %14.7 (Altınok, 2001), Doğu Anadolu Bölgesi ekolojik koşullarında %16.0 (Turgut vd., 2006) ve Karabük ekolojik koşullarında %15.46 (Pınar, 2007) olarak elde edilen bulgulardan yüksek tespit edilirken; Erzurum ekolojik koşullarında %19.79 (Gürsoy ve Macit, 2015) ve Isparta ekolojik koşullarında %21.35 (Güzeloğulları ve Albayrak, 2016) olarak elde edilen bulgulardan düşük olmuştur. Diğer taraftan, Tokat-Yozgat ekolojik koşullarında kuru otta ham protein oranı %17.48 (Büyükburç ve Karadağ 2001) olarak elde edilen bulgularla çalışma bulguları benzerlik göstermiştir. Ham protein oranları arasında ortaya çıkan farklılık büyük oranda hasat zamanları ile ilgilidir. Erken yapılan hasatlarda protein oranı yüksek, geç yapılan hasatlarda ise düşük çıkmaktadır.

Tablo 2. Tüylü fiğ çeşitlerinin ham protein oranı ve verimlerine ait ortalama değerler ve oluşan gruplar

Çeşit	Ham Protein Oranı (%)				Ham Protein Verimi (kg/da)			
	2014	2015	2016	Ort.	2014	2015	2016	Ort.
Efes-79	18.2	18.7	18.6	18.5 A	97.9 a	65.2 b	103.8 a	88.9 A
Menemen-79	17.1	17.5	17.4	17.3 B	47.9 c	47.8 c	68.2 b	54.6 B
Ort.	17.7 B	18.1 A	18.0 A	17.9	72.9 B	56.5 C	86.0 A	71.8
LSD (0.05)	Yıl:0.1**, Çeşit:0.1**, Yıl x Çeşit:---				Yıl:6.2**, Çeşit:5.1**, Yıl x Çeşit:8.8**			

**P≤0.01

Tüylü fiğ çeşitlerinden elde edilen üç yıllık ortalama verilere bakıldığında ham protein verimi 56.5-86.0 kg/da arasında değişim göstermiş ve yılların ortalaması 71.8 kg/da olarak elde edilmiştir. Yıl x çeşit interaksiyonuna baktığımızda; en yüksek ham protein verimi 2016 yılında Efes-79 çeşidinden elde edilirken, en düşük ham protein verimi ise 2015 yılında Menemen-79 çeşidinden elde edilmiştir (Tablo 2).

Tüylü fiğ ile ilgili elde edilen ham protein verimleri; Ankara ekolojik koşullarında 52.83 kg/da (Altınok ve Hakyemez, 2000), Karabük ekolojik koşullarında 79.6 kg/da (Pınar, 2007) ve Isparta ekolojik koşullarında 90.60 kg/da (Güzeloğulları ve Albayrak, 2016) olarak elde edilen bulgular ile benzerlik gösterirken; Çukurova ekolojik şartlarında 119.2 kg/da (Yaktubay ve Anlarsal, 1997) ve İzmir ekolojik koşullarında 141 kg/da (Kavut ve Geren, 2018) olarak elde edilen bulgulardan farklı olmuştur. Ham protein verimi, kuru ot verimi ile ham protein oranının



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çarpılması sonucu elde edilen bir değer olduğundan, kuru ot veriminin yüksek olarak elde edildiği çalışmalarda ham protein verimi de yüksek olarak elde edilmektedir.

Bitki Boyu, Ham Kül Oranı

Tüylü fiğ çeşitlerinin bitki boyu ve ham kül verimlerine ait değerler ve ortalamalar Tablo 3’de verilmiştir. Tablo 3’de görüldüğü üzere bitki boyu değerleri arasındaki farkın yıl, çeşit ve yıl×çeşit etkisiyi açısından önemli olduğu saptanmıştır ($P \leq 0.01$). Ham kül oranları bakımından çeşitler arasındaki farkın önemli olduğu ($P \leq 0.05$), yıl ve yıl×çeşit etkisiyi bakımından ise önemsiz olduğu tespit edilmiştir. Bitki boyu değerleri açısından Menemen-79 çeşidinin Efes-79 çeşidine göre daha yüksek değerler verdiği görülmektedir. Yıl x çeşit etkisiyi baktığımızda; en yüksek bitki boyu 194.3 cm ile 2015 yılında Menemen-79 çeşidinden elde edilirken, en düşük bitki boyu 102.8 cm ile 2014 yılında Efes-79 çeşidinden elde edilmiştir. Yıllar arasındaki farklılığın düşen yağış miktarından kaynaklandığı söylenebilir.

Tablo 3. Tüylü fiğ çeşitlerinin bitki boyu ve ham kül oranına ait ortalama değerler ve oluşan gruplar

Çeşit	Bitki Boyu (cm)				Ham Kül Oranı (%)			
	2014	2015	2016	Ort.	2014	2015	2016	Ort.
Efes-79	102.8 d	172.9 b	104.9 d	126.9 B	9.0	9.0	8.9	8.9 B
Menemen-79	129.3 c	194.3 a	185.0 ab	169.5 A	9.9	9.7	9.7	9.7 A
Ort.	116.0 C	183.6 A	144.9 B	148.2	9.5	9.3	9.3	9.3
LSD (0.05)	Yıl:9.3**, Çeşit:7.6**, Yıl x Çeşit:13.2**				Yıl:--- , Çeşit:0.6*, Yıl x Çeşit:---			

** $P \leq 0.01$, * $P \leq 0.05$

Tüylü fiğ çeşitlerinin ham kül oranlarına bakıldığında Menemen-79 çeşidinin Efes-79 çeşidinden daha yüksek değerler verdiği görülmektedir. Tüylü fiğ çeşitlerinden elde edilen üç yıllık verilere bakıldığında bitki boyunun 116.0-183.6 cm arasında, ham kül oranının ise %9.3-9.5 arasında değişim gösterdiği tespit edilmiştir (Tablo 3).

Ülkemizin farklı bölgelerinde yapılan çalışmalarda; Tüylü fiğ bitki boyuna ait elde ettiğimiz değerler Yaktubay ve Anlarsal (1997) tarafından 106 cm, Saruhan ve Başbağ (1997) tarafından 99.30 cm, Dok ve ark. (2016) tarafından 110 cm, Pınar (2007) tarafından 87.0 cm olarak elde ettikleri değerlerden daha yüksek bitki boyu elde edilmiştir. Elde ettiğimiz değerler ile diğer araştırmacıların elde ettiği değerler arasındaki farklılıkların nedeni, araştırmalarda kullanılan çeşitlerin farklı olması, araştırmaların kurulduğu bölgelerin toprak ve iklim faktörlerinin farklı olmasından kaynaklanmaktadır.

Çalışmada ham kül oranı ile ilgili elde edilen değerler; Karabük ekolojik koşullarında %10.13 (Pınar, 2007) olarak elde edilen değerden daha düşük tespit edilmiştir.



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ADF, NDF Oranları

Tüylü fiğ çeşitlerinin asit deterjanda çözünmen lif ve nötral deterjanda çözünmeyen lif oranlarına ait değerler ve ortalamalar Tablo 4’de verilmiştir. Tablo 4’de görüldüğü üzere NDF oranları arasındaki farklılığın yıl, çeşit ve yıl x çeşit etkisi açısından, ADF oranlarının ise çeşit açısından istatistiki olarak önemli olduğu saptanmıştır ($P \leq 0.01$). ADF oranları arasındaki farklılığın yıl ve yıl x çeşit etkisi açısından önemsiz olduğu tespit edilmiştir. Çalışmadan elde edilen değerlere bakıldığında Menemen-79 çeşidinin Efes-79 çeşidine nazaran daha yüksek ADF oranına sahip olduğu, NDF oranı bakımından ise tam tersi olarak Efes-79 çeşidinde Menemen-79 çeşidine göre daha yüksek olduğu görülmektedir.

Tablo 4. Tüylü fiğ çeşitlerinin ADF ve NDF oranlarına ait ortalama değerler ve oluşan gruplar

Çeşit	ADF Oranı (%)				NDF Oranı (%)			
	2014	2015	2016	Ort.	2014	2015	2016	Ort.
Efes-79	37.2	35.4	35.6	36.1 B	49.8 a	47.7 b	47.7 b	48.4 A
Menemen-79	39.2	39.4	39.5	39.3 A	47.8 b	47.5 b	47.5 b	47.6 B
Ort.	38.2	37.4	37.5	37.7	48.8 A	47.6 B	47.6 B	48.0
LSD (0.05) Yıl:---, Çeşit:0.8**, Yıl x Çeşit:--- Yıl:0.6**, Çeşit:0.5**, Yıl x Çeşit:0.8**								

** $P \leq 0.01$

Tüylü fiğ çeşitlerinden elde edilen üç yıllık ortalama verilere bakıldığında ADF oranları %37.4-38.2 arasında değişim göstermiş olup, yılların ortalaması %37.7 olarak tespit edilmiştir. NDF oranları ise %47.6-48.8 arasında değişim göstermiş ve ortalaması %48.0 olarak saptanmıştır (Tablo 4).

ADF oranları ile ilgili olarak elde edilen sonuçlar; Erzurum ekolojik koşullarında %33.60 (Gürsoy ve Macit, 2015) ve Isparta ekolojik koşullarında %34.33 (Güzeloğulları ve Albayrak, 2016) olarak elde edilen bulgularla benzerlik gösterirken; İzmir-Bornova ekolojik şartlarında %29.10 (Kavut ve Geren, 2018) olarak elde edilen sonuçtan daha yüksek tespit edilmiştir.

NDF ile ilgili olarak elde edilen sonuçlar; Erzurum ekolojik koşullarında %51.32 (Gürsoy ve Macit, 2015) ve İzmir-Bornova ekolojik şartlarında %42.15 (Kavut ve Geren, 2018) olarak elde edilen bulgular ile benzerlik göstermiştir. Isparta ekolojik koşullarında %38.32 (Güzeloğulları ve Albayrak, 2016) olarak elde edilen sonuçtan ise bir miktar farklılık göstermiştir.

SKM VE KMT Oranları (%)

Tüylü fiğ çeşitlerinin sindirilebilir kuru madde ve kuru madde tüketimi oranlarına ait değerler ve ortalamalar Tablo 5’de verilmiştir. Tablo 5’de görüldüğü üzere KMT oranları arasındaki farklılığın yıl, çeşit ve yıl x çeşit etkisi açısından, SKM oranları arasındaki farklılığın ise



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çeşitler açısından istatistiki olarak önemli olduğu saptanmıştır ($P \leq 0.01$). SKM oranları arasındaki farklılığın yıllar ve yıl x çeşit interaksionu açısından önemsiz olduğu tespit edilmiştir. Elde edilen değerlere bakıldığında Efes-79 çeşidinin Menemen-79 çeşidine göre daha yüksek SKM oranına sahip olduğu, KMT oranının ise tam tersi olarak Menemen-79 çeşidinde Efes-79 çeşidine göre daha yüksek olduğu görülmektedir. Tüylü fiğ çeşitlerinin üç yıllık SKM oranı ortalaması %59.5 iken, KMT oranı ortalaması %2.50 olarak tespit edilmiştir. Tüylü fiğ çeşitlerinden elde edilen üç yıllık ortalama verilere bakıldığında sindirilebilir kuru madde oranları %59.1-59.8 arasında değişim göstermiş olup, ortalaması %59.5 olarak tespit edilmiştir. Kuru madde tüketimi oranları ise %2.46-2.52 arasında değişim göstermiş ve ortalaması %2.50 olarak elde edilmiştir (Tablo 5).

Bazı tek yıllık baklagil yem bitkileri ile yapılan çalışmalarda SKM ile ilgili elde edilen sonuçlar; Haymana-İkizce ekolojik koşullarında %56.57 (Mutlu, 2012), Isparta ekolojik koşullarında %62.15 (Güzeloğulları ve Albayrak, 2016), Bornova İzmir ekolojik koşullarında %66.23 (Kavut ve Geren, 2018), Erzurum ekolojik koşullarında %62.72 (Gürsoy ve Macit, 2015), Bingöl ekolojik koşullarında %69.05 (Kökten ve ark., 2018) ve %53.5-73.8 (Çaçan ve ark., 2015) arasında değiştiği rapor edilmiştir. Bu değerlerin elde edilen sonuçlarla benzer olduğu görülmektedir.

Tablo 5. Tüylü fiğ çeşitlerinin SKM ve KMT oranlarına ait ortalama değerler ve oluşan gruplar

Çeşit	SKM Oranı (%)				KMT Oranı (%)			
	2014	2015	2016	Ort.	2014	2015	2016	Ort.
Efes-79	59.9	61.3	61.2	60.8 A	2.41 b	2.51 a	2.52 a	2.48 B
Menemen-79	58.4	58.2	58.1	58.3 B	2.51 a	2.53 a	2.53 a	2.52 A
Ort.	59.1	59.8	59.7	59.5	2.46 B	2.52 A	2.52 A	2.50
LSD (0.05)	Yıl:---, Çeşit:0.6**, Yıl x Çeşit:---				Yıl:0.03**, Çeşit:0.02**, Yıl x Çeşit:0.04**			

** $P \leq 0.01$

KMT ile ilgili elde edilen sonuçlar; Isparta ekolojik koşullarında %3.13 (Güzeloğulları ve Albayrak, 2016) olarak elde edilen sonuçtan düşük, Haymana-İkizce ekolojik koşullarında %1.90 (Mutlu, 2012) olarak elde edilen sonuçtan yüksek, Bornova-İzmir ekolojik koşullarında %2.84 (Kavut ve Geren, 2018) ve Erzurum ekolojik koşullarında %2.33 (Gürsoy ve Macit, 2015) olarak elde edilen sonular ile benzerlik göstermiştir.

Nispi Yem Değeri

Tüylü fiğ çeşitlerinde yıllara göre tespit edilen nispi yem değerine ait veriler ve ortalamalar Tablo 6'da verilmiştir. Tablo 6'da görüldüğü üzere nispi yem değerleri arasındaki farkın yıl, çeşit ve yıl x çeşit interaksionu açısından önemli olduğu görülmüştür. ($P \leq 0.01$) Nispi yem



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değeri açısından Efes-79 çeşidinin Menemen-79 çeşidine göre daha yüksek değerler verdiği görülmüştür.

Tablo 6. Tüylü fiğ çeşitlerinin NYD'lerine ait ortalama değerler ve oluşan gruplar

Çeşit	NYD			Ort.
	2014	2015	2016	
Efes-79	112 b	120 a	119 a	117 A
Menemen-79	114 b	114 b	114 b	114 B
Ort.	113 B	117 A	117 A	115
LSD (0.05) Yıl:1.8**, Çeşit:1.5**, Yıl x Çeşit:2.6**				
**P≤0.01				

Tüylü fiğ çeşitlerinden elde edilen üç yıllık ortalama verilere bakıldığında nispi yem değerlerinin 113-117 arasında değişim göstermiş olup, ortalaması 115 olarak tespit edilmiştir. Yıl x çeşit interaksiyonuna baktığımızda; en yüksek nispi yem değeri 2015 yılında Efes-79 çeşidinden elde edilirken, en düşük nispi yem değeri 2014 yılında yine Efes-79 çeşidinden elde edilmiştir (Tablo 6). Nispi yem değeri ile ilgili elde edilen sonuçlar; Haymana-İkizce ekolojik koşullarında 83.32 (Mutlu, 2012) olarak elde edilen sonuçtan yüksek, Erzurum ekolojik koşullarında 113.28 (Gürsoy ve Macit, 2015) olarak elde edilen sonuç ile benzer, Isparta ekolojik koşullarında 150.5 (Güzeloğulları ve Albayrak, 2016) ve Bornova-İzmir ekolojik koşullarında 145 (Kavut ve Geren, 2018) olarak elde edilen sonuçlardan ise daha düşük olarak elde edilmiştir.

SONUÇ

Bingöl ekolojik şartlarına uygun tüylü fiğ çeşitlerinin belirlenmesi amacıyla yürütülen bu çalışmada; üç yıllık verilere göre, hem yeşil ve hem de kuru ot verimleri birlikte dikkate alındığında Efes-79 çeşidinin Menemen-79 çeşidine göre daha yüksek verime sahip olduğu saptanmıştır. Bunun yanı sıra Efes-79 çeşidi ham protein oranı, ham protein verimi, sindirilebilir kuru madde oranı ve nispi yem değeri bakımından Menemen-79 çeşidine oranla daha yüksek değerler verdiği tespit edilmiştir. Bitki boyu, ham kül oranı ve kuru madde tüketimi oranı bakımından ise Menemen-79 çeşidi öne çıkmıştır. En düşük ADF oranı Efes-79 çeşidinde tespit edilirken, en düşük NDF oranı Menemen-79 çeşidinde saptanmıştır. Elde edilen tüm bu sonuçlar birlikte değerlendirildiğinde verim ve kalite parametreleri açısından Bingöl ekolojik şartlarında Efes-79 çeşidinin yetiştirilebileceği önerilmektedir.



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KAYNAKLAR

- Akyıldız, A. R. (1984). Yemler bilgisi ve laboratuvar kılavuzu. Ankara Üniversitesi Ziraat Fakültesi, Yayın No: 895, Ankara.
- Akman, N., Aksoy, F., Şahin, O., Kaya, Ç. Y., Erdoğan, G. (2007). Cumhuriyetimizin 100. yılında Türkiye'nin hayvansal üretimi. Türkiye Damızlık Sığır Yetiştiriciliği Birliği Yayınları No: 4, 116.
- Altınok, S., Hakyemez, B. (2000). İç Anadolu koşullarında bazı yalancı tüylü fiğ (*Vicia villosa* ssp. *dasycarpa* (Ten) Cav.) hatlarında yem verimi ve kalitesi. Tarım Bilimleri Dergisi, 6(3): 122-125.
- Andiç, C., Andiç, N., Terzioğlu, Ö., Keskin, B., Yılmaz, L., Deveci, M., Akdeniz, H., Akdemir, H. (1996). Tüylü fiğ (*Vicia villosa* Roth.) hat ve çeşitlerinin ot verimleri üzerinde bir araştırma. Türkiye 3.Çayır-Mer'a ve Yembitkileri Kongresi, Erzurum.
- Anonim. (2016). Bingöl İli Meteoroloji Verileri, Bingöl Meteoroloji İl Müdürlüğü.
- Avcıoğlu R, Hatipoğlu R, Karadağ Y (2009) Tarım ve Köyişleri Bakanlığı Tarımsal Üretim ve Geliştirme Genel Müdürlüğü Yembitkileri, Baklagil Yembitkileri, Cilt 2
- Aydeniz, A., Brohi, A. R. (1991). Gübreler ve gübreleme. Ç.Ü. Tokat Ziraat Fakültesi Yayın No: 10, Ders Kitabı No: 3, Tokat.
- Büyükburç, U., İptaş, S., Yılmaz, M. (1994). Tokat ve yöresinde bazı tek yıllık baklagil yem bitkilerinin yazlık adaptasyonuna yönelik araştırma. Gazi Osmanpaşa Üniversitesi Ziraat Fakültesi Dergisi, 11: 145-156.
- Büyükburç, U., Karadağ, Y. (2001). Farklı lokasyonlarda kışlık olarak yetiştirilen fiğ türlerinin biyolojik ve saman verimleri ile kalite özelliklerinin belirlenmesi. GOÜ. Ziraat Fakültesi Dergisi, 18(1): 75-80.
- Çaçan, E., Aydın, A., Başbağ, M., (2015). Bingöl Üniversitesi yerleşkesinde yer alan bazı baklagil yem bitkilerine ait kalite özelliklerinin belirlenmesi. Türk Tarım ve Doğa Bilimleri Dergisi, 2(1): 105-111.
- Çeçen, S., Öten, M., Erdurmuş, M. (2005). Batı Akdeniz sahil kuşağında bazı tek yıllık baklagil yem bitkilerinin ikinci ürün olarak değerlendirilmesi. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 18(3): 331-336.
- Doğan, H. (2014). Ankara koşullarında yalancı tüylü fiğ (*Vicia dasycarpa* Ten.) ve arpa (*Hordeum vulgare* L.) karışım oranlarının ve ekim yöntemlerinin yem verimine etkisi. Ankara Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, Ankara.



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Dok, M., Şahin, M., Sürmen, M., Sezer, İ. (2016). Çeltik tarlalarında değişik baklagil yem bitkilerinin kışlık ara ürün olarak yetiştirme imkânlarının araştırılması. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi, 25 (Özel sayı-1):105-109.

Gençkan, M. S. (1992). Yem bitkileri tarımı. Ege Üniversitesi Ziraat Fakültesi Yayınları No: 467, 249-254, Bornova-İzmir.

Gürsoy, E., Macit, M. (2015). Erzurum ili meralarında doğal olarak yetişen bazı baklagil yem bitkilerinin in vitro gaz üretim değerlerinin belirlenmesi. Anadolu Derg. /Anadolu j Agr Sci., 30: 292-299.

Güzeloğulları, E., Albayrak, S. (2016). Isparta ekolojik koşullarında farklı ekim ve hasat zamanlarının bazı fiğ (*Vicia* spp.) türlerinin ot verim ve kalitesi üzerine etkileri. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi, 25(2):158-165.

JMP. (2018). Statistical Discovery from SAS, USA.

Kacar, B. (1972). Bitki ve toprağın kimyasal analizleri. Ankara Üniversitesi Ziraat Fakültesi Yayın No: 453, Ankara.

Kavut, Y., Geren, H. (2018). İtalyan çimi (*Lolium multiflorum* L.) + Tüylü fiğ (*Vicia villosa* L.) karışımlarında farklı hasat zamanları ve karışım oranlarının verim ve kalite özelliklerine etkisi, Mediterranean Agricultural Sciences, 31(3): 283-287.

Kökten, K., Kaplan, M., Seydoşoğlu, S., Yılmaz, H.Ş., Uçar, R. (2018). Bingöl koşullarında bazı burçak [*Vicia ervilia* (L.) Willd] genotiplerinin ot verimi ve kalite özelliklerinin belirlenmesi. Turk J Agric Res, 5(3): 236-245.

Manga, İ., Acar, Z., Ayan, İ. (2003). Baklagil yembitkileri, Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Ders Kitabı No:7, Samsun.

Mutlu, Z. (2012). Bazı kışlık fiğ türlerinde biçim zamanının ot verimine etkisi. Ankara Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı, Yüksek Lisans Tezi, Ankara.

Oddy, V. H., Robards, G. E., Low, S. G. (1983). Prediction of in vivo dry matter digestibility from the fiber nitrogen content of a feed. In: Robards, G.E., Packham, R.G. (Eds.), Feed Information and Animal Production. Common wealth Agricultural Bureau, pp. 395-398, Farnham Royal, UK.

Özyiğit, Y., Bilgen, M. (2003). Arı bitkisi olarak değerlendirilebilecek bazı baklagil yem bitkilerinde farklı biçim dönemlerinin verim ve tarımsal özellikler üzerine etkisi. Türkiye 5. Tarla Bitkileri Kongresi, 13-17 Ekim, Diyarbakır.



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Pınar, İ. (2007). Değişik karışım oranlarının tüylü fiğ (*Vicia villosa* Roth) + arpa (*Hordeum vulgare* L.) ve Macar fiği (*Vicia pannonica* Crantz) + arpa (*Hordeum vulgare* L.) karışımlarının verim ve verim özelliklerine etkisi. Ege Üniversitesi Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi.

Saruhan, V., Başbağ, M. (1997). Diyarbakır koşullarında kışlık ara ürün olarak yetiştirilen arpa+tüylü fiğ karışımında karışım oranlarının verim ve verim unsurları üzerine yapılan bir araştırma. Dicle Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü, Diyarbakır.

Saruhan, V., Başbağ, M., Gül, İ. (2001). Diyarbakır koşullarında bazı tek yıllık baklagil yem bitkilerinin adaptasyon üzerine yapılan bir araştırma. Türkiye 4. Tarla Bitkileri Kongresi, 169-173, 17-21 Eylül, Tekirdağ.

Seydoşoğlu, S., Saruhan, V., Kökten, K. (2015) Diyarbakır ekolojik koşullarında bazı burçak (*Vicia ervilia* L. Willd) genotiplerinin verim ve verim unsurlarının belirlenmesi. JAFAG, 32 (2), 107-115.

Sheaffer, C. C., Peterson, M. A., Mccalin, M., Volene, J. J., Cherney, J. H., Johnson, K. D., Woodward, W. T., Viands, D. R. (1995). Acid detergent fiber, neutral detergent fiber concentration and relative feed value. North American Alfalfa Improvement Conference, Minneapolis.

Soya, H., Avcıoğlu, R., Geren, H. (2004). Yem bitkileri. Hasat Yayıncılık, İstanbul.

Turgut, L., Yanar, M., Kaya, A., Tan, M. (2006). Farklı olgunluk dönemlerinde hasat edilen bazı fiğ türlerinin ham besin maddeleri içeriği ve bunların in situ rumen parçalanabilirlikleri. Atatürk Üniv. Ziraat Fak. Dergi., 37(2): 181-186.

Van Soest, P. J., Robertson, J. B., Lewis, B. A. (1991). Methods for dietary fiber, neutral detergent fiber and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science, 74, 3583-3597.

Yaktubay, Ş., Anlarsal, E. (1997). Çukurova koşullarında farklı ekim ve biçim zamanlarının bazı adi fiğ (*V. sativa* L.) ve tüylü fiğ (*V. villosa* Roth) çeşitlerinin arpa (*Hordeum vulgare* L.) ile karışımlarında verim ve verimle ilgili özelliklere etkisi üzerinde bir araştırma. Çukurova Üniversitesi Fen Bilimleri Enstitüsü Ziraat Fakültesi Tarla Bitkileri Anabilim Dalı, Yüksek Lisans Tezi.

Zeybek, A. (2010). Bazı fiğ türlerine ait çeşitlerin Tekirdağ şartlarında verim ve tarımsal özelliklerinin belirlenmesi. Selçuk Üniversitesi Fen Bilimleri Enstitüsü Tarla Bitkileri Anabilim Dalı, Yüksek Lisans Tezi, Konya.



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**FARKLI KURAKLIK SEVİYELERİNİN BAZI KARABUĞDAY (*Fagopyrum
esculentum* Moench) ÇEŞİTLERİNİN ÇİMLENME ÖZELLİKLERİ ÜZERİNE
ETKİLERİNİN BELİRLENMESİ**

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ÖZET

Bu çalışma, karabuğdayın 2 farklı çeşidinin kuraklık stresine toleransının belirlenmesi amacıyla Bursa Uludağ Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Bitki Fizyolojisi Laboratuvarında yürütülmüştür. Deneme tesadüf parselleri deneme deseninde 4 tekerrürlü olarak planlanmıştır. Denemede bitki materyali olarak Güneş ve Aktaş çeşitleri kullanılmıştır. Çeşitlerin kuraklık stresine tepkilerini belirlemek için 6 farklı kuraklık seviyesi (Kontrol, % 5 PEG, % 10 PEG, % 15 PEG, % 20 PEG ve % 25 PEG) ele alınmış ve polietilen glikol 6000 (PEG-6000) solüsyonları kullanılarak kuraklık seviyeleri oluşturulmuştur. Araştırmada karabuğday çeşitlerinin çimlenme yüzdesi, ortalama çimlenme süresi, sapçık ve kökçük uzunluğu, sapçık yaş ve kuru ağırlığı, kökçük yaş ve kuru ağırlığı gibi özellikler incelenmiştir. Araştırma sonucunda, karabuğday çeşitlerinde kuraklık stresinin incelenen parametreler üzerindeki etkilerinin değişken olduğu tespit edilmiştir. Kuraklık stresinin % 10 ve %15 PEG seviyeleri, çimlenme yüzdesini artırmış ve ortalama çimlenme süresini nispeten kısaltmıştır. Ancak bu seviyelerden sonra her iki özellik de olumsuz etkilenmiştir. Çeşitlerin kuraklık stresine etkileri incelendiğinde; en yüksek kuraklık seviyesinde kontrole oranla çimlenme yüzdesi Güneş çeşidinde yaklaşık % 20.62 azalırken, Aktaş çeşidinde % 47.37 oranında azalmıştır. Buna karşılık Aktaş çeşidinde artan kuraklık seviyeleri sapçık ve kökçük uzunluğu ile sapçık ve kökçük kuru ağırlıklarında daha az azalışa neden olmuştur.

Anahtar kelimeler: Kuraklık, karabuğday, polietilen glikol, çimlenme



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**DETERMINATION OF THE EFFECTS OF DIFFERENT DROUGHT LEVELS ON
GERMINATION TRAITS OF SOME BUCKWHEAT (*Fagopyrum esculentum* Moench)
VARIETIES**

ABSTRACT

This study was carried out in order to determine the drought stress tolerance of 2 different varieties of buckwheat in Bursa Uludag University Faculty of Agriculture Field Crops Department Plant Physiology Laboratory. The experiment was planned in a randomized plot design with four replications. Güneş and Aktaş cultivars were used as a plant material in the experiment. In order to determine the response of the varieties to drought stress, 6 different drought levels (control, 5% PEG, 10% PEG, 15% PEG, 20% PEG and 25% PEG) were used and drought levels were established using polyethylene glycol 6000 (PEG-6000) solutions. In the research, features such as germination percentage, mean germination time, shoot and root length, shoot fresh and dry weight, root fresh and dry weight of buckwheat varieties examined. As a result of the research, it was determined that the effects of drought stress on the investigated parameters in buckwheat varieties were variable. 10% and 15% PEG levels of drought stress increased the germination percentage and shortened the mean germination time. However, after these levels, both features were negatively affected. When the effects of cultivars on drought stress were examined, the germination percentage decreased by approximately 20.62 % in Güneş variety compared to the control at the highest drought level, while a decrease by 47.37 % in Aktaş variety. On the other hand, increasing drought levels in Aktaş cultivar caused less decrease in shoot and root length and dry weight of shoot and root.

Keywords: Drought, buckwheat, polyethylene glycol, germination



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GİRİŞ

Karabuğday kuzukulağıgiller (Polygonaceae) familyasından *Fagopyrum* cinsine dahil, vejetasyon dönemi kısa, geniş yapraklı ve tek yıllık otsu bir bitki türüdür (Kara ve Telli, 2016). Geçmiş çok eskilere dayanan bu bitki Orta Asya kökenlidir (Alkay ve Kökten, 2020). İlk olarak Çin’de ve Japonya’da yetiştirilmeye başlanmış ve daha sonra Rusya’ya ve Avrupa’ya yayılmış ve oradan da 17. yüzyıl başlarında Amerika’ya ulaşmıştır (Dizlek ve ark., 2009). Dünyada karabuğday üretimi yaklaşık 3,8 milyon ton olup bu üretimin büyük çoğunluğunu Asya kıtası oluşturmaktadır (Biçer, 2019). Karabuğday bitkisinin en çok yetiştirildiği ülkeler arasında Çin, Rusya, Ukrayna ve Kazakistan yer almaktadır (Er, 2018).

Tarımsal üretimi sınırlandıran abiyotik stres faktörlerinden biri olan kuraklığın şiddeti, yağışlarla alınan suyun miktarı, yetiştirilen bitki türü ve çeşidi, toprağın su tutma kapasitesi, sıcaklık ve bulutluluk gibi bir çok faktöre bağlıdır. Bitkilerin gelişme dönemleri boyunca etkili olan kuraklık, genellikle çimlenme sürecinin gecikmesine neden olmakta ve çimlenme yüzdesini, çimlenme hızını ve büyüme oranını önemli ölçüde azaltmaktadır (Özkurt ve ark., 2019). Tohumların çimlenebilmesi için ağırlıklarının %50’si kadar suyu topraktan alması gerekmektedir. Bu dönemde oluşacak su eksikliği veya aşırı nem gelişmeyi geciktirmektedir (Çırak ve Esenal, 2006). Karabuğday (*Fagopyrum esculentum* Moench) kuraklığa karşı oldukça hassastır. Bitki gelişimi sırasında uygulanan su stresinin tohum üretimi üzerine etkisine yönelik birçok araştırma yapılmasına karşın, bitki yaşamının erken dönemlerinde meydana gelen streslerin etkilerine ilişkin çok fazla çalışma bulunmamaktadır. Çiçeklenme ve tohum olgunlaşması sırasında yaşanan kuraklık, bitkide çiçek ve tohum kayıplarına neden olmakta ve verimde önemli düşüşler meydana getirmektedir (Coway ve ark., 2006).

PEG, belirli bir moleküler ağırlığa sahip, nötr, iyonik olmayan, hücre zarlarına karşı neredeyse geçirimsiz olan ve doğrudan fizyolojik hasara neden olmadan üniform su stresini indükleyebilen bir nötr ozmotik olarak aktif polimerlerden oluşan bir gruptur. Bitkilerin çimlenme aşamasında kuraklık stresine tepkisini incelemek amacıyla yaygın olarak kullanılmaktadır (Wang ve ark., 2018). Jamwal ve ark. (2015), karabuğdayda farklı PEG-6000 (% 15, % 20, % 25, % 30, % 35 ve % 40 PEG) konsantrasyonlarını kullanarak yaptıkları çalışmada kuraklık stresinin tohum çimlenmesi ve fide büyümesi üzerindeki etkilerini incelemişlerdir. Araştırmacılar, kuraklık stresinin çimlenme yüzdesini ve fide büyüme parametrelerini önemli ölçüde etkilediğini, sürgün uzunluğu, yaş ve kuru ağırlık değerlerinin % 15 PEG seviyesinden sonra azalma eğilimi gösterdiğini belirlemişlerdir. Kontrol grubunda



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çimlenme yüzdesi % 67.23 iken, % 15 PEG, %20 PEG, % 25 PEG, % 30 PEG, %35 PEG ve % 40 PEG seviyelerinde sırasıyla % 81.25, % 52.45, % 40.83, % 23.33, % 13.75 ve % 8.33 olmuştur.

Bu çalışma; karabuğday çeşitlerinde farklı kuraklık seviyelerinin çimlenme özellikleri üzerine etkilerini incelemek amacıyla yürütülmüştür.

MATERYAL ve YÖNTEM

Bu çalışma, Bursa Uludağ Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Bitki Fizyolojisi Laboratuvarı'nda tesadüf parselleri deneme deseninde 4 tekerrürlü olarak planlanmıştır. Denemede bitki materyali olarak Güneş ve Aktaş karabuğday çeşitleri kullanılmıştır. Denemede 6 farklı kuraklık seviyesi (kontrol, % 5 PEG, % 10 PEG, % 15 PEG, % 20 PEG ve % 25 PEG) ele alınmıştır. Araştırmada kullanılan kuraklık seviyelerine ait Mpa ve bar karşılıkları Çizelge 1'de verilmiştir. Devamlı solma noktasında toprağın su potansiyeli çoğu yerlerde -1 MPa ile -2 MPa arasında değişmekte olup ortalama olarak da -1,5 MPa'dır. Bitkinin kuraklık stresine girmesindeki en önemli unsur topraktaki su potansiyelinin azalmasıdır. Toprakta yeterli su bulunamaz ve bitki transpirasyonla su kaybetmeye devam ederken tolerans mekanizmalarını çalıştıramazsa su stresi başlar. Topraktaki su potansiyeli daimi solma noktasına geldiğinde (-1.5 MPa) yaprakların su potansiyeli kökün ve toprağın su potansiyelinin aşağısındadır. Yani bir su potansiyeli farkı olmasına rağmen bitki su alamaz ve solmaya baslar (Kocaçalışkan, 2003).

Çizelge 1. Denemede kuraklık seviyelerinin (% PEG) MPa ve bar cinsinden karşılıkları (Mexal ve ark.,1975, Li ve ark.,2013)

PEG	MPa	bar
%5	-0.3	-0.3
%10	-0.6	-1.9
%15	-0.9	-4.1
%20	-1.2	-6.7
%25	-1.5	-9.9

Çimlendirme öncesinde tohumlar 5 dk. % 0.1 'lik HgCl₂ içerisinde çalkalanmış ve ardından saf su ile iyice yıkanarak yüzey sterilizasyonu yapılmıştır (Jamwal ve ark., 2015). Tohumlar, önceki nem içeriklerine ulaşınca kadar oda koşullarında 48 saat kurutma kağıtları üzerine

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sıcaklığa ayarlı çimlendirme kabineye konulmuş ve 10 gün boyunca her gün petrilere çimlenen tohum sayıları belirlenmiştir. Denemede çimlenme yüzdesi (ÇY-%), ortalama çimlenme süresi (OÇS-gün), sapçık uzunluğu (SU-cm), kökçük uzunluğu (KU-cm), sapçık yaş ağırlığı (SYA-mg), kökçük yaş ağırlığı (KYA-mg), sapçık kuru ağırlığı (SKA-mg) ve kökçük kuru ağırlığı (

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Araştırmadan elde edilen veriler, tesadüf parselleri deneme desenine uygun olarak varyans analizine tabi tutulmuştur (Turan, 1995). Bütün hesaplamalar bilgisayarda Jump programından faydalanılarak yapılmıştır. Önemlilik testlerinde % 1 ve % 5, farklı grupların belirlenmesinde ise % 5 olasılık düzeyi kullanılmıştır. Farklı grupların belirlenmesinde LSD testinden yararlanılmıştır.

ARAŞTIRMA SONUÇLARI ve TARTIŞMA

Farklı kuraklık seviyelerinin karabuğday çeşitlerinin çimlenme özellikleri üzerine etkisine ilişkin varyans analiz sonuçları Çizelge 2’de verilmiştir. Çizelge 2’den de görüldüğü gibi kuraklık seviyelerinin karababuğday çeşitlerinin çimlenme döneminde incelenen tüm özellikler üzerindeki etkisi % 1 olasılık düzeyinde çok önemli çıkmıştır. Çeşitler arasında ortalama çimlenme süresi, kökçük uzunluğu ve sapçık yaş ağırlığı özellikleri hariç incelenen diğer özellikler bakımından farklılıklar belirlenmiştir. Çeşit x kuraklık interakasyonunun etkisi ise ortalama çimlenme süresi ve kökçük uzunluğu hariç incelenen tüm özelliklerde % 1 olasılık düzeyinde çok önemli olmuştur.

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Çizelge 2. Farklı kuraklık seviyelerinin karabuğday çeşitlerinde çimlenme özellikleri üzerine etkisine ilişkin varyans analiz sonuçları

Varyasyon Kanağı	SD	ÇY	OÇS	KU	SU	KYA	SYA	KKA	SKA
Ç	1	öd	**	öd	**	**	öd	*	**
K	5	**	**	**	**	**	**	**	**
Ç x K	5	**	öd	öd	**	**	**	**	**

SD: Serbestlik derecesi, öd: önemsizdir, ÇY: Çimlenme yüzdesi, OÇS: Ortalama çimlenme süresi, KU: Kökçük uzunluğu, SU: Sapçık uzunluğu, KYA: Kökçük yaş ağırlığı, SYA: Sapçık yaş ağırlığı, KKA: Kökçük kuru ağırlığı, SKA: Sapçık kuru ağırlığı, Ç: Çeşit, K: Kuraklık

Kuraklık seviyelerinin karabuğdayda çimlenme yüzdesi üzerine etkisi % 1 olasılık düzeyinde önemli çıkmış ve en yüksek çimlenme yüzdesi % 50.00 ile % 15 PEG seviyesinden elde edilmiştir. İkili interakasyonun çimlenme yüzdesi üzerine etkisi % 1 olasılık düzeyinde önemli

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olmuş ve en yüksek çimlenme yüzdesi (% 55.00) Güneş çeşidinin % 15 PEG uygulanmasında belirlenmiştir (Çizelge 2 ve Çizelge 3). % 5 PEG uygulaması her iki çeşitte de çimlenmeyi olumsuz etkilerken, % 10 ve % 15 PEG uygulamalarında çimlenme kontrole göre artış göstermiştir. Ancak bu seviyelerden sonra artan kuraklık stresi karabuğday çeşitlerinde çimlenme yüzdesinin azalmasına neden olmuştur. Ayrıca, çimlenme yüzdesi bakımından artan kuraklık seviyelerinin etkisi çeşitler arasında farklılık göstermiştir. Güneş çeşidinde çimlenme yüzdesi kontrole oranla % 25 PEG seviyesinde % 20.62 azalırken bu oran Aktaş çeşidinde % 47.37 olmuştur (Çizelge 3). Janwal ve ark. (2015), kontrol grubunda çimlenme yüzdesinin % 67.23 iken, %15 PEG uygulamasında artarak % 81.25 olduğunu ancak artan kuraklık seviyelerinin çimlenmeyi olumsuz etkilediğini bildirmişlerdir.

Ortalama çimlenme süresi üzerine kuraklık seviyelerinin etkisi önemli olmuş ve başlangıçta % 5 ve % 10 PEG uygulamalarında çimlenme süresi kontrole göre kısalmış ancak artan stres seviyeleri ortalama çimlenme süresini artırmıştır. En düşük ortalama çimlenme süresi 6.89 gün ile % 5 PEG uygulamasından elde edilmiş ve % 10 PEG uygulamasından elde edilen çimlenme süresi % 5 PEG uygulaması ile aynı istatistiki grupta yer almıştır. Çeşitler arasında da çimlenme süresi bakımından farklılıklar ortaya çıkmış ve en kısa çimlenme süresi 7.00 ile Aktaş çeşidinde belirlenmiştir. İkili interaksiyonun ortalama çimlenme süresi üzerine etkisi ise istatistiki anlamda önemsiz olmuştur (Çizelge 2 ve Çizelge 3).

Çizelge 3. Farklı kuraklık seviyelerinin karabuğday çeşitlerinin çimlenme yüzdesi ve ortalama çimlenme süresi üzerine etkileri

Kuraklık seviyesi	Çimlenme Yüzdesi (%)			Ortalama Çimlenme Süresi (gün)		
	Çeşit		Ortalama	Çeşit		Ortalama
	Aktaş	Güneş		Aktaş	Güneş	
% 0	47.50 ab	44.09 a-d	45.79 ab	7.35	7.45	7.40 a
% 5	16.67 f	37.50 b-d	27.08 d	6.48	7.30	6.89 c
% 10	49.17 ab	47.50 ab	48.33 a	6.78	7.03	6.90 c
% 15	45.00 a-c	55.00 a	50.00 a	7.03	7.05	7.04 bc
% 20	43.33 a-d	32.50 de	37.92 bc	7.25	7.33	7.29 ab
% 25	25.00 ef	35.00 c-e	30.00 cd	7.10	7.45	7.28 ab
Ortalama	37.78	41.93		7.00 b	7.27 a	

Kuraklık seviyelerinin kökçük uzunluğu üzerine etkileri incelendiğinde; en uzun kökçük uzunluğunun 13.57 cm ile kontrol grubundan elde edildiği ve artan kuraklık seviyelerinin kökçük uzunluğunu olumsuz etkilediği görülmektedir. Çeşitler arasında kökçük uzunluğu bakımından önemli bir farklılık ortaya çıkmamıştır. İkili interaksiyonda ise en uzun kökçük uzunluğu Güneş çeşidinin kontrol uygulamasında tespit edilmiştir. Çeşitlerin kuraklığa karşı tepkileri karşılaştırıldığında; en yüksek kuraklık seviyesinde kontrole oranla Aktaş çeşidinde



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kökçük uzunluğunun % 74 azalırken, bu oranın Güneş çeşidinde % 85 olduğu görülmüştür (Çizelge 4). Janwal ve ark. (2015), % 15 PEG uygulamasının kökçük uzunluğunu artırdığını ancak artan kuraklık seviyelerinde kökçük uzunluğunun kısaldığını bildirmişlerdir.

Sapçık uzunluğu üzerine kuraklık seviyelerindeki artışın etkisi olumsuz yönde olmuş ve bunun sonucunda en düşük sapçık uzunluğu 0.50 cm ile % 25 PEG uygulamasından elde edilmiştir. Çeşitler arasında sapçık uzunluğu bakımından önemli bir fark ortaya çıkmış ve en yüksek sapçık uzunluğu Aktaş çeşidinden elde edilmiştir. İkili interaksyonda ise en yüksek sapçık uzunluğu 12.45 cm ile Aktaş çeşidinin % 5 PEG uygulamasında ortaya çıkmıştır. Artan kuraklıkla birlikte çeşitlerin sapçık uzunluğu olumsuz etkilenmiş ve bunun sonucunda da kontrole oranla % 25 PEG uygulamasında Aktaş çeşidinde % 91, Güneş çeşidinde % 95 azalma meydana gelmiştir (Çizelge 4). Janwal ve ark. (2015), sapçık uzunluğunun kuraklık seviyelerindeki artışa bağlı olarak azaldığını ve azalma oranının kontrole göre % 15, % 20, % 25, % 30, % 35 ve % 40 PEG uygulamalarında sırasıyla % 6.5, % 23.7, % 47.8, % 62.4, % 67.7 ve % 73 olduğunu bildirmişlerdir.

Çizelge 4. Farklı kuraklık seviyelerinin karabuğday çeşitlerinin kökçük ve sapçık uzunluğu üzerine etkileri

Kuraklık seviyesi	Kökçük Uzunluğu (cm)			Sapçık Uzunluğu (cm)		
	Aktaş	Güneş		Aktaş	Güneş	
% 0	10.33 c	16.81 a	13.57 a	5.40 cd	8.98 b	7.19 b
% 5	13.38 b	7.98 d	10.68 b	12.45 a	5.13 d	8.79 a
% 10	8.08 d	5.87 e	6.97 c	5.99 c	4.19 e	5.09 c
% 15	2.54 f	6.34 e	4.44 d	1.38 g	2.76 f	2.07 d
% 20	2.67 f	3.65 f	3.16 e	0.88 gh	0.69 gh	0.78 e
% 25	2.64 f	2.51 f	2.58 e	0.51 h	0.48 h	0.50 e
Ortalama	6.61	7.19		4.43 a	3.70 b	

Kuraklık uygulamasına bağlı olarak kökçük yaş ağırlıkları azalma eğilimi göstermiştir. Bunun sonucunda da en yüksek kökçük yaş ağırlığı kontrol grubundan, en düşük ise % 25 PEG uygulamasından elde edilmiştir. Çeşitler bakımından en yüksek kökçük yaş ağırlığı Aktaş çeşidinde tespit edilmiştir. İkili interaksiyon bakımından ise en yüksek kökçük ağırlığı 20.38 mg ile Aktaş çeşidinin % 5 PEG uygulamasından elde edilmiş ve her iki çeşidinde kontrol grubunda tespit edilen kökçük yaş ağırlıkları en yüksek değerlerle aynı istatistiki grupta yer almıştır (Çizelge 5). Sapçık yaş ağırlığı kuraklık seviyelerinde artışa bağlı olarak azalmış ve en düşük değer 3.42 mg ile % 25 PEG uygulamasından elde edilmiştir. İkili interaksiyonun sapçık yaş ağırlığı üzerine etkisi önemli olmuş ve en yüksek sapçık yaş ağırlığı Güneş çeşidinin kontrol grubunda, en düşük değer ise Aktaş çeşidinin % 25 PEG uygulamasında ortaya çıkmıştır (Çizelge 5).



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Kökçük kuru ağırlığı üzerine kuraklık uygulamasının başlangıç dozu olan % 5 PEG uygulaması önemli etki yaparken, artan dozlarda kökçük kuru ağırlığının azalış gösterdiği tespit edilmiştir. Çeşitler bakımından en yüksek kökçük kuru ağırlığı kökçük yaş ağırlığında da olduğu gibi Aktaş çeşidinde tespit edilmiştir. İkili interaksyonda en yüksek kökçük kuru ağırlığı 2.28 mg ile Aktaş çeşidinde % 5 PEG uygulamasında belirlenmiştir. Genel olarak çeşitlerin en yüksek kuraklık seviyesi karşısında tepkileri farklı olmuştur. Kökçük kuru ağırlığı bakımında kontrole oranla en yüksek kuraklık seviyesinde kökçük kuru ağırlığında Aktaş çeşidinde % 36, Güneş çeşidinde ise % 70 azalma ortaya çıkmıştır (Çizelge 6). Sapçık kuru ağırlığı kuraklık seviyesinin artmasına karşılık başlangıçta sayısal bir artış göstermekle birlikte artan seviyelerde azalma eğilim göstermiş ve en düşük sapçık kuru ağırlığı 0.72 mg ile % 25 PEG uygulamasından elde edilmiştir. Çeşitler arasında sapçık yaş ağırlığı bakımından belirgin bir farklılık ortaya çıkmamasına karşılık en yüksek sapçık kuru ağırlığı Güneş çeşidinden elde edilmiştir. İkili interaksyonda ise en yüksek sapçık yaş ağırlığı Güneş çeşidinin kontrol grubunda ortaya çıkmıştır. Aktaş çeşidinin % 5 PEG uygulamasından elde edilen sapçık kuru ağırlığı değeri de en yüksek değerle aynı istatistiki grupta yer almıştır. En yüksek kuraklık seviyesinde kontrole oranla Aktaş çeşidinde % 78, Güneş çeşidinde ise 83 azalma meydana gelmiştir (Çizelge 6). Janwal ve ark. (2015), karabuğdayda artan kuraklık seviyelerinin, 15 günlük çimlenme dönemi sonunda fide yaş ve kuru ağırlığında önemli ölçüde düşüslere neden olduğunu bildirmişlerdir. Araştırmacılar, fide yaş ve kuru ağırlığındaki azalma oranlarının en az % 15 PEG, en fazla ise % 40 PEG uygulamasında olduğunu rapor etmişlerdir.

Çizelge 5. Farklı kuraklık seviyelerinin karabuğday çeşitlerinin kökçük ve sapçık yaş ağırlığı üzerine etkileri

Kuraklık seviyesi	Kökçük Yaş Ağırlığı (mg)			Sapçık Yaş Ağırlığı (mg)		
	Aktaş	Güneş		Aktaş	Güneş	
% 0	19.04 a	20.25 a	19.65 a	59.45 c	125.17 a	92.31 a
% 5	20.38 a	8.88 bc	14.63 b	107.67 b	56.90 cd	82.28 b
% 10	10.03 b	6.34 cd	8.18 c	45.85 d	49.29 cd	47.57 c
% 15	4.98 de	7.58 b-d	6.28 c	14.62 ef	24.77 e	19.69 d
% 20	3.17 e	2.33 e	2.75 d	9.33 f	6.36 f	7.84 e
% 25	1.96 e	2.33 e	2.15 d	3.08 f	3.75 f	3.42e
Ortalama	9.92 a	7.95 b		40.00	44.37	

Çizelge 6. Farklı kuraklık seviyelerinin karabuğday çeşitlerinin kökçük ve sapçık kuru ağırlığı üzerine etkileri



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Kuraklık seviyesi	Kökçük Kuru Ağırlığı (mg)			Sapçık Kuru Ağırlığı (mg)		
	Aktaş	Güneş		Aktaş	Güneş	
% 0	1.32 c	1.79 b	1.56 ab	2.89 c	4.69 a	3.79 a
% 5	2.28 a	1.17 cd	1.72 a	4.49 a	3.46 b	3.98 a
% 10	1.35 bc	1.17 cd	1.26 b	2.71 c	3.37 b	3.04 b
% 15	1.36 bc	1.31 c	1.34 b	1.50 d	2.63 c	2.06 c
% 20	0.64 e	0.69 e	0.66 c	1.12 de	1.33d	1.22 d
% 25	0.84 de	0.53 e	0.69 c	0.65 e	0.78 e	0.72 e
Ortalama	1.30 a	1.11 b		2.23 b	2.71 a	

Sonuç olarak; kuraklık stresinin % 10 ve %15 PEG seviyeleri çimlenme yüzdesini artırmış ve ortalama çimlenme süresini nispeten kısaltmıştır. Ancak bu seviyelerden sonra her iki özellik de olumsuz etkilenmiştir. Çeşitlerin kuraklık stresine tepkileri incelendiğinde; en yüksek kuraklık seviyesinde kontrole oranla çimlenme yüzdesi Güneş çeşidinde yaklaşık % 20.62 azalırken, Aktaş çeşidinde % 47.37 azalma göstermiştir. Buna karşılık Aktaş çeşidinde artan kuraklık seviyeleri sapçık ve kökçük uzunluğu ile sapçık ve kökçük kuru ağırlıklarında daha az azalışa neden olmuştur. Çimlenme döneminde yapılan bu çalışmanın ilerleyen gelişme dönemlerinde de yapılması kurağa dayanıklı çeşidin seçiminde son derece önemlidir.



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KAYNAKLAR

- Alkay R., Kökten, K., 2020. Karabuğday'ın (*Fagopyrum esculentum* Moench) önemi ve kullanım alanları. Gıda ve Yem Bilimi - Teknolojisi Dergisi, 24: 16-21.
- Biçer, A. 2019. İkinci ürün olarak yetiştirilen karabuğday'da (*Fagopyrum esculentum* Moench.) organik gübre dozlarının verim ve bazı kalite özelliklerine etkisi. Yüksek Lisans Tezi, Siirt Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı, Siirt.
- Cawoy, V., Lutts, S. & Kinet, J.M. (2006) Osmotic stress at seedling stage impairs reproductive development in buckwheat (*Fagopyrum esculentum*). *Physiologia Plantarum*, 128, 689–700.
- Çırak, C., Esendal, E. (2006). Soyada kuraklık stresi. Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Dergisi, 21(2): 231-237.
- Dizlek, H., Özer, M.S., İnanç, E., Gül, H., 2009. Karabuğday'ın (*Fagopyrum esculentum* Moench) bileşimi ve gıda sanayinde kullanım olanakları. Gıda, 34(5), 317-324.
- Er, M. 2018. Karabuğday bitkisinin kuru otu ya da silajının besin değeri ile süt keçilerinde süt verimine etkilerinin belirlenmesi. *Yüksek Lisans Tezi*, Adnan Menderes Üniversitesi Fen Bilimleri Enstitüsü, Zootekni Anabilim Dalı, Aydın.
- Jamwal, A., Puri, S., Sharma, S., Bhattacharya, S., 2015. Polyethylene glycol induced morphological changes in *Fagopyrum esculentum* Moench of Indian Himalayan Region. *Asian Journal of Advanced Basic Sciences*, 3(2):142-6.
- Kara, B., Telli, M., 2016. Karabuğdayın (*Fagopyrum esculentum* Moench) fosfor kullanım etkinliği. *Derim*, 33(2), 327-336.
- Karagüzel, O., Cakmakçı, S., Ortacesme, V., Aydınoglu B. 2004. Influence of seed coat treatments on germination and early seedling growth of *Lupinus varius* (L.). *Pakistan Journal of Botany*, 36(1): 65-74.
- Kocaçalışkan, İ., 2003. Bitki fizyolojisi. DPÜ Fen-Edebiyat Fakültesi Yayını, 420.
- Li, H., Li, X., Zhang, D., Liu, H. And Guan, K. 2013. Effects of drought stress on the seed germination and early seedling growth of the endemic desert plant *Eremosparton songoricum* (Fabaceae). *EXCLI J.* 2013; 12: 89–101.
- Mexal, J., Fisher, J.T., Osteryoung, J. And Reid, C.P. 1975. Oxygen availability in polyethylene glycol solutions and its implications in plant-water relations. *Plant Physiology*, 55 20-24.



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Özkurt, M., Saygili, İ., Özdemir Dirik, K., 2019. Bazı Yonca Çeşitlerinin Erken Gelişme Dönemindeki Kuraklık Toleransının Belirlenmesi. KSÜ Tarım ve Doğa Derg 22(4): 557-562.

Turan, Z.M., 1995. Araştırma ve Deneme Metotları. Uludağ Üniversitesi Ziraat Fakültesi Ders Notları. No:62, Bursa. 121 s.

Wang, C., Zhou, L., Zhang, G., Xu, Y., Gao, X., Jiang, N., Zhang, L., Shao, M., 2018. Effects of drought stress simulated by polyethylene glycol on seed germination, root and seedling growth, and seedling antioxidant characteristics in Job's Tears. Agricultural Sciences, 2018, 9, 991-1006



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**SEROPREVALENCE AND RISK FACTORS OF THE BLUETONGUE VIRUS
INFECTION IN CATTLE**

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ABSTRACT

Bluetongue virus (BTV) is an arbovirus, which can cause serious economic losses in ruminants. Twenty-eight serotypes of BTV are recognized globally, four (BTV-4, BTV-8, BTV-9 and BTV-16) of which have been identified in Turkey. BTV infected cattle generally asymptomatic, but clinical signs such as haemorrhage and ulceration of the mucous membranes can be seen in infected sheep. Although there are several serological studies confirming that BTV infection is endemic in the Turkey, there is still knowledge gap about its risk factors in cattle in Turkey. Therefore, aim of the study was to investigate the seroprevalence and risk factors on BTV infection in cattle. Blood samples were collected from randomly selected unvaccinated cattle (n= 140) from epidemiologically independent herds (n=33) in the Afyonkarahisar Province in the Aegean region of Turkey. Commercial competitive ELISA kit was used for the detection of BTV anti-VP7 antibodies in sera samples. The following variables were tested for statistical association with BTV seropositivity: sex (female and male), age (≤ 3 years and >3 years), breed (European and local), number of cattle per farm (≤ 50 cattle and >50 cattle), number of cattle per village (≤ 500 cattle and >500 cattle). Fisher's exact test, chi-square test and multivariable logistic regression were used to determine risk factors for BTV seropositivity. Antibodies against BTV were detected in 14 (10%) cattle. Among the 33 herds, 7 (21.2%) had one or more BTV seropositive animals. Seropositivity rate of BTV was higher in local breeds than European breeds ($P<0.05$). The higher BTV seroprevalence rate was found among cattle older than 36 months ($P<0.05$). Statistical analyses indicated that there was no significant association between seroprevalence of BTV infection and other risk factors including sex, number of cattle per farm and number of cattle per village. The results of this study indicate that BTV infection is prevalent in cattle in the Afyonkarahisar Province. Further epidemiological studies are needed to determine risk factors associated with BTV infection in cattle.

Keywords: Cattle, Bluetongue virus, Seroprevalence, Risk factors



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INTRODUCTION

Bluetongue (BT) is a viral and non-contagious disease of domestic and wild ruminants, notably sheep and cattle (Mecham and Johnson, 2005). The disease is characterized by fever, oral lesion, nasal discharge, facial oedema, anorexia and abortion. However, cattle and goats may be asymptomatic (Verwoerd and Erasmus, 2004; Arun et al., 2014). Cattle can serve as a virus reservoir for *Culicoides* species that biologically transmit bluetongue virus (BTV) to sheep and other ruminants (Gong et al., 2021). *Culicoides spp.* are biological vectors that transmit BTV from infected to susceptible ruminants (Sick et al., 2019). Morbidity rates in sheep may reach 100% whereas mortality rate can reach 70% in more susceptible breeds (OIE, 2021).

The causative agent, BTV, is classified within the genus Orbivirus in the subfamily *Sedoreovirinae* of family *Reoviridae* (ICTV, 2021). BTV has double-stranded and segmented (10 segmented) RNA genome. It also contains three-layer capsid formed of structural proteins; inner (VP3), middle (VP7) and outer (VP2 and VP5) (Maclachlan and Osburn, 2017; Roy, 2017). There are 28 recognised BTV serotypes and several strains which are yet unclassified (OIE, 2021).

The disease occurs almost between latitudes 35°S and 40°N (Walton, 2004). The first BT outbreak was reported in 1944 in Turkey. Later, four serotypes (BTV-4, BTV-8, BTV-9 and BTV-16) have been identified to date in Turkey (Taylor and Mellor, 1994; Ertürk et al., 2004; Saegerman et al., 2008; OIE, 2018; Rajko-Nenow et al., 2020). There is limited knowledge available about the prevalence of BTV infection in cattle in Turkey (Ertürk et al., 2004; Gür, 2008; Yıldırım and Yılmaz, 2010; Yılmaz et al., 2012). Furthermore, the possible risk factors for BTV infection in cattle have not been studied in Turkey. Therefore, aims of this study were to determine the seroprevalence and risk factors of BTV infection in cattle in Turkey.

MATERIALS AND METHODS

Study Area And Sample Collection

The study was carried out in the Afyonkarahisar Province, located between 38°39' N latitudes and 30°40' E longitudes, in the Aegean region of Turkey. The elevation of the Afyonkarahisar Province is 1021m. The study area is one of the major livestock centers in the Aegean region with approximately 420,000 cattle (Afyonkarahisar Chamber of Commerce and Industry, 2019). Afyonkarahisar has hot dry-summer and cold and snowy winter (GDM, 2020).



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A cross-sectional study was conducted from June to September 2018. Blood samples were collected from randomly selected unvaccinated cattle ($n=140$; 90% confidence interval and with a 7 percent margin of error) from epidemiologically independent herds ($n=33$) with a history of reproductive problems from 14 villages in Afyonkarahisar Province (Table 1). Blood samples were collected into vacutainer tubes and serum was separated by centrifugation at $2000\times g$ at 4°C for 10 min., and then stored at -20°C until serological analysis.

The breed of sampled cattle were European breeds ($n=136$) and local breeds ($n=4$). The number of the small ($n=1-10$), medium ($n=10-50$) and large herds ($n=50-100$) were 7, 21 and 5, respectively. Sampled four villages had ≤ 500 cattle whereas 10 villages had >500 cattle.

Table 1. Details of the sampled cattle.

Sex	Age		
	0-12 months	12-36 months	>36 months
Female	25	48	38
Male	20	8	1
Total	45	56	39

Serological Analysis

The BTV anti-VP7 antibodies in the sera samples were detected using a commercial competitive enzyme-linked immunosorbent assay (ELISA) kit as recommended by the manufacturer (IDvet Innovative Diagnostics, Montpellier, France). The reported sensitivity and specificity of this test are 87.8% and 98.2%, respectively (Vandenbussche et al., 2008). Results of the ELISA analyses were evaluated according to the manufacturer's instructions.

Statistical Analyses

To assess risk factors associated with BTV seropositivity, epidemiological data were collected using a questionnaire from farmers during blood sampling. In this study, an infected herd was defined at least one of the samples was seropositive within herd. The following variables were tested for statistical association with BTV seropositivity: sex (female and male), age (≤ 3 years and >3 years), breed (European and local), number of cattle per farm (≤ 50 cattle and >50 cattle), number of cattle per village (≤ 500 cattle and >500 cattle).

First, association between response variables and the BTV seropositivity was evaluated in a univariable analysis using Fisher's exact and chi-square tests. Those significant factors ($p \leq 0.20$) were analysed by multivariable logistic regression analysis. Final model was fitted by using Hosmer and Lemeshow test. Variables which had a p -value ≤ 0.05 were defined as risk factors



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for BTV seropositivity. All statistical analyses were performed using GraphPad Prism (GraphPad Software, CA, US).

RESULTS

Antibodies against BTV were detected in 14 (10%) cattle. The true seroprevalence was 9.3% (95% CI: 3.52 - 15.08). Among the 33 herds, 7 herds had one or more BTV seropositive animals which means that herd seroprevalence was 21.2% (95% CI: 7.26 - 35.16). Seropositivity rate of BTV was higher in local breeds (75%, 3/4) than European breeds (8%, 11/136) ($P < 0.05$). BTV-specific antibodies were detected in 11 (9.9%) of 111 female cattle and 3 (10.3%) of 29 male cattle.

Seroprevalence rate among cattle younger than 36 months was 5.9% (6/101). The higher BTV seroprevalence rate was found among cattle older than 36 months (20.5%, 8/39) ($P < 0.05$). Statistical analyses indicated that there was no significant association between seroprevalence of BTV infection and other risk factors including sex, number of cattle per farm and number of cattle per village (Table 2 and Table 3).

Table 2. Risk factors associated with BTV seropositivity

Variable	Categories	OR	CI 95 % OR	P-value
Sex	Male			
	Female	0.7974	0.0741 - 8.5850	0.8519
Age	< 36 months			
	> 36 months	0.1092	0.0245 - 0.4863	0.0037
Breed	European			
	Local	0.0030	0.0001 - 0.0849	0.0007
Number of cattle per farm	≤ 50 cattle			
	>50 cattle	1.6432	0.3040 - 8.8808	0.5640
Number of cattle per village	≤ 500 cattle			
	>500 cattle	0.1700	0.0189 - 1.5272	0.1137

OR = odds ratio, CI = confidence interval.

Table 3. Results of the multivariable logistic model of BTV seropositivity

Variable	Categories	OR	CI 95 % OR	P-value
Age	< 36 months			
	> 36 months	0.1313	0.0307 - 0.5609	0.0061
Breed	European			
	Local	0.0091	0.0005 - 0.1580	0.0012



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DISCUSSION

The global distribution of BTV has changed because of climate change. Climate change is affecting the distribution of vector-borne disease (Zuliani et al., 2015). The presence of BTV infection has been reported in Turkey (Ertürk et al., 2004; Gür, 2008; Yıldırım and Yılmaz, 2010; Yılmaz et al., 2012). In this study, the true BTV seroprevalence in the study area was 9.3%. This rate is lower than that reported in different regions of Turkey, where 73.54% in Marmara region (Karaoğlu et al., 2007), 48.02% in Northeast Anatolia region (Yıldırım and Burgu, 2005) and 31.76% in Southeastern Anatolia (Özgünlük, 2009). However, a previous study in Middle Blacksea region has shown similar levels of seropositivity to BTV in cattle (11%) (Albayrak and Ozan, 2010). These differences in seroprevalence rates in different regions may be related to the age of the sampled animals, number of sampled animals and herds, and management conditions. Furthermore, seroprevalence rate can change depending on locations and seasons.

When BTV seroprevalence rate was evaluated based on the age, there was a significant association between the BTV seropositivity rate and the age of the animal. Age-specific seropositivity was higher in cattle > 3 years of age compared with groups < 3 years of ages ($P < 0.05$). This finding is in agreement with previous studies that reported higher seropositivity rate in the older age categories (Khair et al., 2014; Gaire et al., 2016). The observed higher seropositivity rate in older animals can be explained by high risk for exposure to the BTV with age.

In this study, breed-specific seropositivity was higher in local breeds compared with European breeds ($P < 0.05$). However, Elhassan et al. (2014) have reported that breed was not significant associated with BTV seropositivity in cattle. One reason may be that farmers raising local breeds are more likely to keep outside, which may lead to higher culicoidal activity.

Although BTV seroprevalence was high (10.3%) in male cattle in our study, it was not statistically significant. This finding is in agreement with previous studies that reported sex has no association with BTV infection (Adam et al., 2014; Khair et al., 2014). However, Elmahi et al. (2021) have reported that there is a significant association between BTV seropositivity and sex. This variation may be due to the difference in the sample size of female and male or due to differences in management conditions.

In this study, there were no significant differences between number of cattle per farm and number of cattle per village and BTV seropositivity. This finding is in agreement with previous



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reports (Adam et al., 2014; Khair et al., 2014). This situation can be explained by the transmission route of BTV infection and differences in management conditions. *Culicoides spp.* are primer vectors that transmit BTV. Most of the sampled herds were used insecticides for nuisance fly and ectoparasites.

In conclusion, results of this study indicate that BTV infection is prevalent in cattle in the Afyonkarahisar Province. Future epidemiological studies for BTV should be extended to include other susceptible animals such as sheep and goats. Furthermore, the distribution of *Culicoides* vectors in Turkey should also be considered to better understanding of the movement of infected vectors.



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REFERENCES

Adam IA, Abdalla MA, Mohamed ME, Aradaib IE. Prevalence of bluetongue virus infection and associated risk factors among cattle in North Kordufan State, Western Sudan. BMC Vet Res. 2014;10:94. doi: 10.1186/1746-6148-10-94.

Afyonkarahisar Chamber of Commerce and Industry, 2019. Afyonkarahisar Hayvancılık Raporu. http://www.afyonkarahisartso.org.tr/atsodisticaretulkerapor/hayvancilik_raporu_birlesik.pdf (accessed 04 Dec 2021)

Albayrak H, Ozan E. Orta Karadeniz Bölgesinde Ruminant ve Tek Tırnaklılarda Kan Emici Sineklerle Nakledilen Bazı Arboviral Enfeksiyonların Seroprevalansı. Kafkas Univ Vet Fak Derg. 2010;16(1):33-36.

Arun S, John K, Ravishankar C, Mini M, Ravindran R, Prejit N. Seroprevalence of bluetongue among domestic ruminants in Northern Kerala, India. Trop Biomed. 2014;31(1):26-30.

Elhassan AM, Fadol MA, El Hussein AR. Seroprevalence of bluetongue virus in dairy herds with reproductive problems in Sudan. ISRN Vet Sci. 2014;2014:595724. doi: 10.1155/2014/595724.

Elmahi MM, Hussien MO, Karrar ARE, Elhassan AM, El Hussein ARM. Sero-epidemiological survey of bluetongue disease in one-humped camel (*Camelus dromedarius*) in Kassala State, Eastern Sudan. Ir Vet J. 2021;74(1):9. doi: 10.1186/s13620-021-00186-2.

Ertürk A, Tatar N, Kabaklı O, Incoglu S, Cizmeci SG, Barut FM. The current situation of bluetongue in Turkey. Vet Ital. 2004;40:137-140.

Gaire TN, Karki S, Dhakal IP, Khanal DR, Bowen RA. Serosurveillance and factors associated with the presence of antibodies against bluetongue virus in dairy cattle in two eco-zones of Nepal. Rev Sci Tech. 2016;35(3):779-785. doi: 10.20506/rst.35.3.2568.

General Directorate of Meteorology (GDM), 2020. Climate classification, <https://www.mgm.gov.tr/iklim/iklim-siniflandirmalari.aspx?m> (accessed 04 Dec 2021)

Gong QL, Wang Q, Yang XY, Li DL, Zhao B, Ge GY, Zong Y, Li JM, Leng X, Shi K, Liu F, Du R. Seroprevalence and Risk Factors of the Bluetongue Virus in Cattle in China From 1988 to 2019: A Comprehensive Literature Review and Meta-Analysis. Front Vet Sci. 2021;7:550381. doi: 10.3389/fvets.2020.550381.



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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BINGOL, TURKEY**



Gür S. A serologic investigation of blue tongue virus (BTV) in cattle, sheep and gazella subgutturosa subgutturosa in southeastern Turkey. Trop Anim Health Prod. 2008;40(3):217-21. doi: 10.1007/s11250-007-9083-4.

ICTV, 2021. Taxonomic Information. <https://talk.ictvonline.org/taxonomy/> (accessed 04 Dec 2021)

Karaoğlu T, Özgünlük İ, Demir B, Özkul A, Burgu İ. Seroprevalence of culicoides-borne disease in cattle in European Turkey. Ankara Üniv Vet Fak Derg. 2007;54:121-125.

Khair HO, Adam IA, Bushara SB, Eltom KH, Musa NO, Aradaib IE. Prevalence of bluetongue virus antibodies and associated risk factors among cattle in East Darfur State, Western Sudan. Ir Vet J. 2014;67(1):4. doi: 10.1186/2046-0481-67-4.

Maclachlan NJ, Osburn BI. Teratogenic bluetongue and related orbivirus infections in pregnant ruminant livestock: timing and pathogen genetics are critical. Curr Opin Virol. 2017;27:31-35. doi: 10.1016/j.coviro.2017.10.002.

Mecham JO, Johnson DJ. Persistence of bluetongue virus serotype 2 (BTV-2) in the southeast United States. Virus Res. 2005;113(2):116-22. doi: 10.1016/j.virusres.2005.04.022.

OIE, 2021. Bluetongue (Infection with bluetongue virus), Chapter 3.1.3. https://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/3.01.03_BLUETONGUE.pdf (accessed 04 Dec 2021)

OIE, 2018. Immediate Notification—New Strain of a Listed Disease in the Country; OIE: Paris, France, 2018.

Özgünlük İ. A Serologic Investigation of Blue Tongue Virus Serotypes (BTV-9, BTV-16) in Cattle in the Southeastern Anatolia Project Area in Turkey. J Anim Vet Adv. 2009;8(12):2612-2616.

Rajko-Nenow P, Christodoulou V, Thurston W, Ropiak HM, Savva S, Brown H, Qureshi M, Alvanitopoulos K, Gubbins S, Flannery J, Batten C. Origin of Bluetongue Virus Serotype 8 Outbreak in Cyprus, September 2016. Viruses. 2020;12(1):96. doi: 10.3390/v12010096.

Roy P. Bluetongue virus structure and assembly. Curr Opin Virol. 2017;24:115-123. doi: 10.1016/j.coviro.2017.05.003.

Saegerman C, Berkvens D, Mellor PS. Bluetongue epidemiology in the European Union. Emerg Infect Dis. 2008;14:539-544.



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Sick F, Beer M, Kampen H, Wernike K. Culicoides Biting Midges-Underestimated Vectors for Arboviruses of Public Health and Veterinary Importance. *Viruses*. 2019;11(4):376. doi: 10.3390/v11040376.

Taylor WP, Mellor PS. Distribution of bluetongue virus in Turkey, 1978-81. *Epidemiol Infect*. 1994;112(3):623-33. doi: 10.1017/s0950268800051323.

Vandenbussche F, Vanbinst T, Verheyden B, Van Dessel W, Demeestere L, Houdart P, Bertels G, Praet N, Berkvens D, Mintiens K, Goris N, De Clercq K. Evaluation of antibody-ELISA and real-time RT-PCR for the diagnosis and profiling of bluetongue virus serotype 8 during the epidemic in Belgium in 2006. *Vet Microbiol*. 2008;129(1-2):15-27. doi: 10.1016/j.vetmic.2007.10.029.

Verwoerd DW, Erasmus BJ: Bluetongue. In, Coetzer JAW, Tustin RC (Eds): *Infectious Diseases of Livestock*. 2nd ed. 1201-1220, Oxford University Press, Cape Town, 2004.

Walton TE. The history of bluetongue and a current global overview. *Vet Ital*. 2004;40(3):31-8.

Yıldırım Y, Burgu İ. Kuzeydoğu Anadolu bölgesindeki sığırlarda mavidil (BT), IBR, PI-3, EBL ve BVD enfeksiyonlarının seroprevalansı. *Ankara Üniv Vet Fak Derg*. 2005;52:113-117.

Yıldırım Y, Yılmaz V. Seroprevalence of bluetongue virus 4, 9 and 16 serotypes in cattle in various North-eastern provinces of Turkey. *Revue Méd. Vét.*, 2010;161:372-375.

Yılmaz V, Yıldırım Y, Otlı S. The Seroprevalance of Bluetongue Virus Infection in Cattle in the Kars District of Turkey. *Isr. J. Vet. Med*. 2012;67(4):232-236.

Zuliani A, Massolo A, Lysyk T, Johnson G, Marshall S, Berger K, Cork SC. Modelling the Northward Expansion of *Culicoides sonorensis* (Diptera: Ceratopogonidae) under Future Climate Scenarios. *PLoS One*. 2015;10(8):e0130294. doi: 10.1371/journal.pone.0130294.



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**YAYGIN DAĞILIŞ GÖSTEREN BAZI *Crataegus* sp. TÜRLERİNİN SİSTEMATİK
ÖZELLİKLERİ VE FENOLİK BİLEŞENLERİ ÜZERİNE BİR DEĞERLENDİRME**

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ÖZET

Dünya üzerinde kabul edilmiş 400 aşkın *Crataegus* taksonu vardır. *Crataegus* cinsi Türkiye’de 24 tür, 3 alttür, 6 varyete ve 6 melez tür olmak üzere toplam 28 taksonla temsil edilir. 24 türün 10’u endemiktir. Genellikle kuzey yarımkürenin ılıman bölgelerinde ve orta Amerika’da yayılış gösterir. Rosaceae familyasına ait bu cins yaprak dökken, dikenli, 5-15 m boylanabilen ağaç veya çalı şeklindedirler. Yaprakla, basit, loblu ve kenarları testere dişli uzun sürgünlerde sarmal dizilişlidir. Çiçekler yalancı şemsiye şeklinde beyaz ve pembe renklidir. Meyveleri, açık sarı, kırmızı, mor veya siyah renkli, hafif buruşuk tatlıdır. Alıç türleri, farklı geleneksel tıp sistemlerinde aritmi, hipertansiyon, anjina, konjestif kalp yetmezliği için bir çare olarak yaygın olarak kullanılmaktadır. Özellikle geleneksel Çin Tıbbında alıç meyveleri dolaşımı iyileştirmek, hazımsızlık, ishal, kan durgunluğunu gidermek karın ağrısı, hiperlipidemi ve hipertansiyonu tedavi etmek için kullanılır. Fenolik bileşikler, kalp-damar hastalıkları, bazı kanser türleri ve tip 2 diyabet gibi çeşitli hastalıklarla mücadelede önemli bir yere sahiptir. Fenolik bileşikler gibi antioksidan maddeler açısından doğal olarak zengin gıdaların alımı oldukça yaygındır. *Crataegus* türleri sindirim ve endokrin sistem rahatsızlıklarında da kullanılmaktadır. Bu türler ayrıca, antiinflamatuvar, serbest radikal süpürücü, antimikrobiyal, gastroprotektif, antiiskemik ve antifungal etkiler göstermiştir. *Crataegus* türlerinin meyveleri, çiçekleri ve yaprakları güçlü antioksidan özellik gösteren flavonoid bileşikler bakımından oldukça zengindir. Flavonoid bileşikleri içerdiğinden ötürü alıç yüksek derecede antioksidan aktiviteye sahiptir. Alıcın meyvelerinde, yapraklarında ve çiçeklerinde; flavonoidler, oligomerik proantosyanidinler, triterpen asitler, organik asitler, steroller ve iz miktarlarda kardiyolojik aktif aminler gibi kimyasal bileşenler bulunur. Ayrıca, meyveler karbonhidrat, şeker ve vitamin C bakımından oldukça zengindir. Çalışmamızın amacı yaygın dağılışı gösteren bazı *Crataegus* türlerinin sistematik özelliklerinin ve fenolik bileşenler yönünden detaylı bir incelemesini yaparak, yapılacak olan çalışmalara yol gösterici nitelikte olmasını sağlamaktır.

Anahtar Kelimeler: *Crataegus*, Sistematik, Fenolik Bileşenler, Antioksidan, Meyve



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**SOME WIDELY DISTRIBUTED *Crataegus* sp. AN EVALUATION ON THE
SYSTEMATIC PROPERTIES AND PHENOLIC COMPONENTS OF THE SPECIES**

ABSTRACT

There are over 400 accepted *Crataegus* taxa in the world. The genus *Crataegus* is represented in Turkey by a total of 28 taxa, including 24 species, 3 subspecies, 6 varieties and 6 hybrid species. 10 of the 24 species are endemic. It generally occurs in temperate regions of the northern hemisphere and central America. This genus, which belongs to the Rosaceae family, is deciduous, spiny, 5-15 m tall, in the form of a tree or shrub. The leaves are simple, lobed and spirally arranged on long shoots with saw-toothed edges. The flowers are in the form of false umbrellas, white and pink in color. The fruits are light yellow, red, purple or black in color, slightly wrinkled, sweet. Hawthorn species are widely used in different systems of traditional medicine as a remedy for arrhythmia, hypertension, angina, congestive heart failure. Especially in Traditional Chinese Medicine, hawthorn berries are used to improve circulation, treat indigestion, diarrhea, blood stagnation, abdominal pain, hyperlipidemia and hypertension. Phenolic compounds have an important place in the fight against various diseases such as cardiovascular diseases, some types of cancer and type 2 diabetes. The intake of foods naturally rich in antioxidant substances such as phenolic compounds is quite common. *Crataegus* species are also used in digestive and endocrine system disorders. These strains also showed anti-inflammatory, free radical scavenging, antimicrobial, gastroprotective, antiischemic and antifungal effects. The fruits, flowers and leaves of *Crataegus* species are very rich in flavonoid compounds with strong antioxidant properties. Hawthorn has a high level of antioxidant activity because it contains flavonoid compounds. In the fruits, leaves and flowers of the buyer; chemical components such as flavonoids, oligomeric proanthocyanidins, triterpene acids, organic acids, sterols and trace amounts of cardioactive amines. In addition, fruits are very rich in carbohydrates, sugars and vitamin C. The aim of our study is to make a detailed examination of some *Crataegus* species, which are widely distributed, in terms of systematic properties and phenolic components, and to provide guidance for future studies.

Keywords: *Crataegus*, Systematic, Phenolic Components, Antioxidant, Fruit



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GİRİŞ

Alıç ülkemizde bol miktarda yabani olarak yetişen halk arasında yemişen adıyla da bilinen, meyveleri yüksek flavonoid içeriği ile antioksidan özellik gösteren bir bitkidir. Güçlü bir antioksidan aktiviteye sahip olduğundan dolayı dokuları serbest radikal hasarlarından korur, yaşlanmayı geciktirici etki gösterir ve bağışıklık sistemini de güçlendirir. Antioksidan özelliği ile vücuda zararlı olan serbest radikalleri, vücuttan uzaklaştırır ve bu sayede kalp sağlığını korur. Alıç çiçekleri, meyveleri ve yaprakları güçlü antioksidan özellik gösteren flavonoid bileşikler bakımından oldukça zengindir. Flavonoidler ve oligomerik proantosiyonidinler kardiyovasküler olarak birincil derecede koruyucu bileşenlerdir (Vatansever, 2016; Çelik ve Ayran, 2020).

Çalışmamızın amacı; Bingöl ve çevresinde de yaygın olarak bulunan alıç türlerinin sistematik yönden değerlendirmesini yaparak dünyada da yaygın bir şekilde kullanılan alıç türlerinin fenolik bileşenlerce zengin olduğunu gösteren bir çalışma yapmaktır. İleride yapılacak olan çalışmalara yön gösterici nitelikte olmasını amaçlayarak, literatüre de katkı sağlanması hedeflenmektedir.

SİSTEMATİK ÖZELLİKLERİ

Rosaceae diğer ismiyle Gülgiller; 85-90 cins ve 2500-3000 tür içeren, ağaç, çalı veya otsu ve bazen tırmanıcı familya üyelerinin genellikle Ilıman Kuzey Bölgeler olmak üzere dünyanın hemen hemen her yerinde yayılım gösterdiği bir familyadır. Familya üyeleri, kültüre alınmış birçok meyvenin, Uçucu yağı elde edilen cinslerin veya kültürü yapılan çok sayıda süs bitkisinin kaynağı olduğu için ekonomik olarak önem arz etmektedir (Simpson, 2012). Ülkemizde 36 cins ve 250 tür ile temsil edilir (Seçmen ve diğ., 2011).

Crataegus cinsi üyeleri, yaprak döken, genellikle 5-15 m boylanabilen dikenli ağaç veya çalıdır. Yapraklar basit veya loblu, uzun sürgünlerde sarmal dizilişlidir. Çiçekler, yalancı şemsiye şeklinde, kaliks ve korolla 5 loblu, hipantiyum karpellerle birleşmiştir. Stamen 5-25, karpeller 1-5, meyve sarı, kırmızı, mor veya siyah drubadır (Yıldız ve Artoklu, 2010; Seçmen ve diğ., 2011; Simpson, 2012). Genellikle kuzey yarımkürenin ılıman bölgelerinde ve orta Amerika'da yayılım gösterir (Akkemik, 2014). *Crataegus* cinsi Türkiye'de 24 tür, 3 alttür, 6 varyete ve 6 melez tür olmak üzere toplam 28 taksonla temsil edilir. 24 türün 10'u endemiktir (Güner, 2012). Dünya üzerinde kabul edilmiş 400 aşkın *Crataegus* taksonu vardır Ülkemizde *Crataegus monogyna* Jacq. oldukça yaygındır (The Plantlist).



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Türkiye'deki *Crataegus* cinsine ait taksonların, yöresel isimleri, yayılış alanları, endemik durumları, etnobotanik olarak kullanılan taksonlar Tablo 1'de verilmiştir. Buna göre Türkiye'de bulunan 24 *Crataegus* türünün 10' u endemiktir. *Crataegus* taksonlarının 18'i Bingöl ve çevresinde (5a) yayılış göstermektedir. Tabloda belirtilen 14 takson, çeşitli etnobotanik kaynaklarda geçmektedir (Ekim, 2014). Alış olarak bildiğimiz bazı *Crataegus* türleri yemiş olarak tüketilir. Kasaba pazarlarında ipe dizilerek satılmaktadır. Meyve olarak tüketildiği gibi tedavi amaçlı da kullanılmaktadır. Yirminci yüzyılın başlarından beri çiçeklerinden hazırlanan hûlasalar tansiyon düşürücü, yatıştırıcı olarak kullanılmaktadır. Ayrıca Avrupa'da yapılan birçok ilacın terkinde, sinir sistemi yatıştırıcı, spazmları azaltıcı, kalp atışlarının hızını azaltıcı, tansiyon düşürücü, idrar söktürücü ve kabız önleyici etkileri sebebiyle, kullanılır (Baytop, 1999).

Tablo 1: Türkiye'deki *Crataegus* cinsine ait taksonlar, Türkçe isimleri ve yayılış alanları (Güner, 2012; <https://www.bizimbitkiler.org.tr/list.html>).

Takson	Türkçe İsim	End-Etno	Yayılış Alanları
<i>Crataegus ambigua</i> A.K.Becker*	kuşyemişi		(5a) Yukarı Fırat Bölümü, (5ç) Hakkari Bölümü
<i>Crataegus azarolus</i> L.*	müzmüldek		(2c) Doğu Karadeniz Bölümü, (3a) Asıl Ege Bölümü, (4b) Orta Kızılırmak Bölümü, (5a) Yukarı Fırat Bölümü, (6a) Antalya Bölümü, (6b) Adana Bölümü, (7a) Orta Fırat Bölümü, (7b) Dicle Bölümü
<i>Crataegus azarolus</i> var. <i>azarolus</i> *	müzmüldek	Etno	(3a) Asıl Ege Bölümü, (4b) Orta Kızılırmak Bölümü, (5a) Yukarı Fırat Bölümü, (6a) Antalya Bölümü, (6b) Adana Bölümü, (7a) Orta Fırat Bölümü, (7b) Dicle Bölümü
<i>Crataegus azarolus</i> var. <i>pontica</i> (K.Koch) K.I.Chr.		Etno	(2c) Doğu Karadeniz Bölümü, (4b) Orta Kızılırmak Bölümü
<i>Crataegus caucasica</i> K.Koch, Verh	sülsülük		(2c) Doğu Karadeniz Bölümü, (5b) Erzurum-Kars Bölümü
<i>Crataegus christensenii</i> Dönmez	peksülsülük	End	(5ç) Hakkari Bölümü
<i>Crataegus heterophylloides</i> Pojark. ex K.I.Chr. *	yaryemişeni	End	(5a) Yukarı Fırat Bölümü
<i>Crataegus laevigata</i> (Poir.) DC.	bahçalıcı		Türkiye'de gösterişli çiçeklerinden dolayı park ve bahçelerde süs ağacı olarak yetiştirilmektedir.
<i>Crataegus longipes</i> Pojark.*	sülünymişen		(5a) Yukarı Fırat Bölümü
<i>Crataegus meyeri</i> Pojark.*	roğuk	Etno	(2a) Batı Karadeniz Bölümü, (4a) Yukarı Sakarya Bölümü, (4b) Orta Kızılırmak Bölümü, (4c) Yukarı Kızılırmak Bölümü, (5a) Yukarı Fırat Bölümü, (5c) Yukarı Murat-Van Bölümü, (5ç) Hakkari Bölümü, (6b) Adana Bölümü
<i>Crataegus microphylla</i> K.Koch*	kocakarıarmudu	Etno	(1b) Çatalca-Kocaeli Bölümü, (1ç) Güney Marmara Bölümü, (3b) İç Batı Anadolu Bölümü, (5a) Yukarı Fırat Bölümü



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<i>Crataegus microphylla</i> subsp. <i>microphylla</i> *	kocakarıarmudu		(1b) Çatalca-Kocaeli Bölümü, (1c) Güney Marmara Bölümü, (3b) İç Batı Anadolu Bölümü, (5a) Yukarı Fırat Bölümü
<i>Crataegus monogyna</i> Jacq.*	yemişen	Etno	Türkiye'nin her bölgesinde doğal yayılışı vardır.
<i>Crataegus monogyna</i> var. <i>lasiocarpa</i> (Lange) K.I.Chr.		Etno	(1a) Istanca Bölümü, (1c) Ergene Bölümü, (3a) Asıl Ege Bölümü, (4a) Yukarı Sakarya Bölümü, (6a) Antalya Bölümü
<i>Crataegus monogyna</i> var. <i>monogyna</i> *	yemişen		Türkiye'nin her bölgesinde doğal yayılışı vardır.
<i>Crataegus orientalis</i> Pall. ex M.Bieb.*	alıç	Etno	(1c) Ergene Bölümü, (1c) Güney Marmara Bölümü, (2a) Batı Karadeniz Bölümü, (2b) Orta Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü, (4b) Orta Kızılırmak Bölümü, (4c) Konya Bölümü, (5a) Yukarı Fırat Bölümü, (5c) Yukarı Murat-Van Bölümü, (6a) Antalya Bölümü, (6b) Adana Bölümü, (7a) Orta Fırat Bölümü
<i>Crataegus orientalis</i> subsp. <i>orientalis</i> *	alıç		(1c) Güney Marmara Bölümü, (2a) Batı Karadeniz Bölümü, (2b) Orta Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü, (4b) Orta Kızılırmak Bölümü, (4c) Konya Bölümü, (5a) Yukarı Fırat Bölümü, (5c) Yukarı Murat-Van Bölümü, (6a) Antalya Bölümü, (6b) Adana Bölümü, (7a) Orta Fırat Bölümü
<i>Crataegus orientalis</i> subsp. <i>szovitsii</i> (Pojark.) K.I.Chr.*	koyunalıcı	Etno	(1c) Ergene Bölümü, (2a) Batı Karadeniz Bölümü, (3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü, (4b) Orta Kızılırmak Bölümü, (5a) Yukarı Fırat Bölümü
<i>Crataegus pentagyna</i> Waldst. & Kit. ex Willd.	kömüşdiken	Etno	Avrupa-Sibirya elementi; (1a) Istanca Bölümü, (1b) Çatalca-Kocaeli Bölümü, (1c) Ergene Bölümü, (2a) Batı Karadeniz Bölümü, (2b) Orta Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (3a) Asıl Ege Bölümü, (5c) Hakkari Bölümü
<i>Crataegus peshmenii</i> Dönmez	peşmenalıcı	End	(5c) Hakkari Bölümü
<i>Crataegus pseudoheterophylla</i> Pojark.*	öküzgötü	Etno	(4a) Yukarı Sakarya Bölümü, (5a) Yukarı Fırat Bölümü
<i>Crataegus pseudoheterophylla</i> subsp. <i>turcomanica</i>			
<i>Crataegus rhipidophylla</i> Gand.*	kızılcırık		(1b) Çatalca-Kocaeli Bölümü, (2a) Batı Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü, (5a) Yukarı Fırat Bölümü, (5c) Yukarı Murat-Van Bölümü, (5c) Hakkari Bölümü, (6b) Adana Bölümü
<i>Crataegus rhipidophylla</i> var. <i>kutahyaensis</i> Dönmez		End	(3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü
<i>Crataegus rhipidophylla</i> var. <i>rhipidophylla</i> *	kızılcırık	Etno	(1b) Çatalca-Kocaeli Bölümü, (2a) Batı Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (4a) Yukarı Sakarya Bölümü, (5a) Yukarı Fırat Bölümü, (5c) Yukarı Murat-Van



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			Bölümü, (5ç) Hakkari Bölümü, (6b) Adana Bölümü
<i>Crataegus tanacetifolia</i> (Poir.) Pers. *	kotanalıcı	End, Etno	(2a) Batı Karadeniz Bölümü, (2b) Orta Karadeniz Bölümü, (2c) Doğu Karadeniz Bölümü, (4a) Yukarı Sakarya Bölümü, (4c) Yukarı Kızılırmak Bölümü, (5a) Yukarı Fırat Bölümü
<i>Crataegus turcicus</i> Dönmez	türkalıcı	End	(2c) Doğu Karadeniz Bölümü
<i>Crataegus x bornmuelleri</i> Zabel ex K.I.Chr. & Ziel.	kızlaryemişi	End, Etno	(2a) Batı Karadeniz Bölümü, (4a) Yukarı Sakarya Bölümü
<i>Crataegus x browicziana</i> K.I.Chr.	haziranağacı	End	(3b) İç Batı Anadolu Bölümü, (4a) Yukarı Sakarya Bölümü
<i>Crataegus x rubrinervis</i> Lange	kızıldamar		(1b) Çatalca-Kocaeli Bölümü
<i>Crataegus x sinaica</i> Boiss. *	çölalıcı	Etno	(5a) Yukarı Fırat Bölümü, (6a) Antalya Bölümü
<i>Crataegus x subsphaerica</i> Gand.	topuzalıcı		(2a) Batı Karadeniz Bölümü
<i>Crataegus x yosgatica</i> K.I.Chr.	yozgatalıcı	End	(4b) Orta Kızılırmak Bölümü
<i>Crataegus yaltirikii</i> Dönmez	efealıcı	End	(5ç) Hakkâri Bölümü

(*: Bingöl’de yayılış gösteren taksonlar, **Etno**: Etnobotanik kaynaklarda geçen taksonlar, **End**: Endemik)

FENOLİK BİLEŞENLERİN GENEL ÖZELLİKLERİ

a) Sekonder Metabolitlerin İşlevleri

Bitki kimyasalları genellikle primer ve sekonder metabolitler olarak ikiye ayrılır. Primer metabolitler doğada yaygın olup, yüksek bitkilerin tohum ile vejetatif dokularında oldukça fazladır. Bunlar hücre metabolizmasındaki temel görevlerinden dolayı, bitkinin fizyolojik gelişimi için gereklidirler. (Mammadov, 2014) Sekonder metabolitler, düşük moleküler ağırlıklı bileşiklerdir. Ancak bu bileşiklerin organdan organa, bazen de bitki ve türleri arasında farklılık gösterdiği bilinmektedir. Bitkileri hem biyotik hem de abiyotik streslere karşı korumaktadırlar (Verpoorte ve Alfermann, 2013) Sekonder metabolitler bu özelliklerinin yanı sıra endüstriyel alanlarda boya, elyaf, tutkal, yağ, aroma, parfüm ve ilaçlar içerisinde kullanılmaktadır. (Zinkel ve Russell, 1989; Dawson, 1994). Özellikle son dönemlerde sekonder metabolitlerin tüm dünyada pandemi ilan edilen yeni koronavirüs proteaz enzimini inhibe etmek için enzimin yapısındaki önemli amino asitlerle etkileşime girebileceği sonucuna varılması bu bileşiklerin önemini daha da arttırmıştır (Mohammadi ve Shaghghi, 2020). Sekonder metabolitler, fenolik bileşenlerin büyük bir kısmını oluşturur. Fenolik bileşenler yapısında, aromatik halkanın karbon atomları ile birleşmiş olan bir veya birkaç adet hidroksil grubu bulunduran, doğal bileşenlerdir. Metabolizmada hayati fonksiyonlar üstlenen fenolik bileşenlerin bitki hücresinde toplanması bitki hayatında önemli bir hadisedir (Mammadov,



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2014) Ayrıca fenolik bileşikler, insan sağlığında antidiyabetik, antienflamatuar, antiviral antialerjik, antimikrobiyal, antipatojenik ve antitrombotik etki gösterir (Manach ve diğ.,2004).

b) Fenolik Bileşiklerin Sınıflandırılması

b.1. Flavonoidler: Polifenollerin en büyük grubunu oluştururlar. Bitkilerin sekonder metabolitleri olan flavonoidler aminoasitler, karbonhidratlar gibi birincil metabolitlerden türerler. Düşük molekül ağırlığına sahip bu polifenoller bitkilerde kırmızı, yeşil, turuncu pigmentlerden sorumlu yapılardır. İnsanlar üzerindeki etkileri de kanıtlanan flavonoidlerin en etkin özelliği kardiyovasküler hastalıklarda koruyucu görev almasıdır (Birman, 2012).

Antosiyoninler: Birden fazla bitkiye pembeden mora kadar değişik tonlarda renk veren maddedir. Bitkilerde tozlaşma, üreme, savunma, antioksidan etki ve UV ışınlarından korunma gibi olaylarda görev alır.

Flavanonollar: Antienflamatuar ve antioksidan etkisine sahiptir.

İzoflavon: İzoflavonlar fitoöstrojenik olarak bilinirler. Bu özelliğinden dolayı meme kanseri ve endometriozis riskini arttırdığını düşünülse de yapılan araştırmalar durumun tam tersi yönünde olduğunu bildiriyor.

Flavanoller (Kateşinler): Gıdalarda en yaygın olarak bulunan gruptur. Renksizdirler ve flavonoid oluşumunda ara ürün olarak görev alırlar.

Flavanonlar: Turuncgil meyvelerinde yaygın olarak bulunan bu flavanoidler, bitter ve nötral tatındaki bazı flavanonların glikozitlerinden bir halkanın açılmasıyla oluşurlar.

Flavonlar: Her bitkide bulunan sarı renge sahip bileşiklerdir. Sakinleştirici, kas gevşetici ve anksiyolitik etkiye sahiptir (Kolaç ve diğ.,2017).

b.2. Fenolik Asitler: Hem bağlı hem de serbest şekilde bulunan fenolik asitler sıklıkla bağlı haldedirler. Bitki formlarına bağlı olanları ise ester bağı, eter bağı ve asetat bağları ile bağlanabilirler. İçinde barındırdıkları -OH ve -OCH₃ gruplarına göre, hidroksisinamik asitler ve hidroksibenzoik asitler olarak iki alt gruptan oluşurlar (Ignat ve diğ.,2011).

b.2.1. Hidroksisinamik Asitler: Hidroksil grubunun sayısına ve konumuna göre farklılık gösteren alt grupları vardır. Genellikle bağlı olarak bulunan hidroksisinamik asitler çoğunlukla asit ve türevleri halindedirler. Hidroksisinamik asitlerin, antimikrobiyal, anti kanserojen, antidiyabetik ve antimikrobiyal etkisinin olduğu kanıtlanmıştır (Kolaç ve diğ.,2017).

b.2.2. Hidroksibenzoik Asitler: Bitkilerde çok iz miktarda bulunan hidroksibenzoik asitler fenilmetan yapısındadır (Nizamlioğlu ve Nas, 2010). Bu grup, hidroksisinamik asitlerin oksidasyonu ile meydana gelir (Kolaç ve diğ., 2017)



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b.3. Tanenler: Suda çözünebilir tanenler yüksek yapılı bitkilerin genelinde bulunur. Protein ve diğer makro moleküllerle çapraz bağ oluşturma yeteneğine sahiptirler. Protein, mineral gibi moleküllerle kompleks oluşturarak gıdaların besin değerinde azalmaya neden olurlar. Tanen miktarının fazlalığıyla beraber yoğun bir şekilde tanen içeren besinlerin tüketilmesi kanser türlerinin tetiklenmesinde rol oynadığı görülmüştür (Ergezer ve diğ., 2008)

b.4. Stilbenler: En yaygını resveratrol'dür. Üzüm, yer fıstığı, dut gibi 70'den fazla bitkinin yoğun stres altında salgıladığı resveratrolün insan sağlığına birçok olumlu etkisi vardır (Ignat ve diğ., 2011). Antioksidan, antiviral, yaşlanmayı geciktirici, kardiyoprotektif, enfeksiyondan muhafaza, obeziteyi azaltma gibi birçok yararı bulunan resveratrol tıp ve eczacılık alanında sıkça kullanılır (Karabulut, 2008).

b.5. Lignanlar: 2 fenil-propanların oksidatif dimerizasyonu ile üretilen lignanlar, stilbenlerle hemen hemen aynı etkiye sahiptirler. Keten tohumu, yağlı tahıllarda ve tahıl tanelerinde bol miktarda bulunurlar (Cong ve diğ., 2017).

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Çin organik alıç meyvesi *Crataegus pinnatifida*'da değişik ekstraksiyon yöntemleri kullanılarak serbest fenolik bileşikler, çözünür esterlenmiş bağlı fenolik bileşikler ve esterle çözünmeyen fenolik bileşiklerin antioksidan kapasite yöntemleri ve HPLC-ESI-MS/MS ile incelenmiştir. Çözünür esterlenmiş bağlı fenolik bileşiklerin aksine, esterle çözünmeyen fenolik bileşikler selüloz, arabinoksilan, kitin ve hemiselüloz gibi hücre duvarı matrisi ile etkileşim nedeniyle ince bağırsakta emilmez. Bu nedenle, esterle çözünmeyen fenolik bileşikler, pH'ı düşürmek, fermentatif mikroflora geliştirmek ve patojenik ve kanserojen bakterilerin büyümesini önlemek gibi bir dizi sağlık yararını teşvik edebilecek çeşitli mikroorganizmalar tarafından kolonida salınabilir (Acosta Estrada, Gutiérrez Uribe ve Serna Saldívar, 2014; Tomas ve diğ., 2020). HPLC-ESI-MS/MS ile toplam 22 fenolik madde tespit edilmiş, en bol bulunan fenolik maddeler epikateşin, prosiyanidin, kateşin, klorojenik asittir. Genel olarak serbest fenolik bileşikler, çözünür esterlenmiş bağlı fenolik bileşikler ve esterle çözünmeyen fenolik bileşiklerin baskın fenolik alt sınıflarını flavonoidler oluşturur, oysa esterle çözünmeyen fenolik bileşiklerin çoğunlukla fenolik asitler olduğu tespit edilmiştir. Antioksidan aktivitenin %35.3-37.8'i alıçta serbest fenolik bileşiklerde, ardından esterle çözünmeyen fenolik bileşiklerde %25-27, çözünür esterlenmiş bağlı fenolik bileşikler ise %25,7-23,4 olduğu tespit edilmiş ve fenolik



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maddeler ile antioksidan aktivite arasında önemli pozitif korelasyonlar gözlemlenmiştir (Lou ve diğ., 2020).

Türkiye florasında yabani olarak yetişen beş *Crataegus* taksonunun (*C. monogyna*, *C. orientalis*, *C. pontica*, *C. rhipidophylla* ve *C. turcicus*) meyve ekstraktlarının antioksidan aktiviteleri DPPH radikal süpürme, FRAP, CUPRAC ve toplam antioksidan kapasite testlerinin kullanıldığı, toplam fenolik içerik, fenolik asit, flavonoid ve proantosiyanidin içerikleri spektrofotometrik olarak ölçüldüğü ve bazı fenolik maddelerin varlığının LC-MS/MS ile tespit edildiği çalışmada; *C. Turcicus* 398.48 ± 0.98 GAE/g ekstraktı ile en yüksek toplam fenolik bileşik ve 23.87 ± 2.74 QE/g ekstraktı ile toplam flavonoid içeriğine sahip olduğu gözlemlendi, *C. monogyna* 175.65 ± 10.59 EGCG-E/g ekstraktı ile büyük farkla en yüksek toplam proantosiyanidin içeriğine, %0.42 ile hiperosid ve %0.90 ile klorojenik asit içeriğine sahiptir. *Crataegus monogyna*, FRAP, CUPRAC ve TOAC testlerinde en yüksek antioksidan aktiviteyi göstermiştir (Bardakçı ve diğ., 2019).

Antalya, Burdur ve Isparta illerinde yayılış gösteren *Crataegus* taksonlarında yapılan bir çalışmada bazı tıbbi özelliklerinin belirlenmesi amaçlanmış ve antioksidan, toplam fenolik/ flavonoit madde miktarları, fenolik bileşen (viteksin, hiperosit, rutin, kuersetin, kamferol, kumuronin klorit ve antimikrobiyal) aktivite içerikleri belirlenmiştir. Toplam flavonoit miktarı, toplam fenolik madde ve antioksidan aktivite için en yüksek değerler, *C. x sinaica* bahar döneminde saptanmıştır. Fenolik içerik bakımından çiçeklerde; *C. orientalis* (Alıç) ve *C. monogyna* (Yemişen), yaprak ve meyvelerde ise *C. monogyna* (Yemişen) ve *C. x sinaica* (Çöl Alıcı) öne çıkmış. Kuersetin miktarı çiçeklerde, rutin miktarı yapraklarda daha yüksek bulunurken hiperosit tüm örneklerde baskın bileşen olduğu belirlenmiştir (Çınar ve diğ., 2020). *Crataegus pentagyna* ekstraktlarının araştırıldığı çalışmada tamamen veya kısmen tanımlanan toplam 39 bileşik sayısı tespit edilmiştir. Bunların arasında önemli miktarda ya organik asitler (sitrik asit, protokateşik asitler, kinik asit, hidroksibenzoik asit ve protokateşik asitler) ya da hidroksisanimik asitler (klorojenik, kafeoilteonik, kafeik, kafeoilşikimik, kumaroilmalik, kumaroilkinik ve dikaffeoilkinik asitler) olduğu belirlenmiştir. Bununla birlikte, kuersetin O-glikozitleri ve apigenin veya luteolin C-glikozitlerinin yüksek miktarda olmasıyla beraber 15 flavonoid tespit edilmiştir (Bujor ve diğ., 2020).

Cezayir’de yetişen *Crataegus azarolus* yaprak ve çiçek kısımları ile yapılan bir çalışmada su distilasyonu ve mikrodalga ısıtması teknikleri kullanılarak uçucu bileşenler ve fenolik bileşen içeriği araştırılmıştır. Buna göre; saptanan uçucuların ana aileleri asitler ve esterler (12 bileşen)



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mikrodalga için %27.59'a karşılık su distilasyonu için %50.71'dir; alkanlar ve alkenler (17 bileşen) mikrodalga için %40.77'yi ve su distilasyonu için %29.59'u oluşturur; seskiterpen hidrokarbonlar (5 bileşen) mikrodalga için %17,85'e karşılık su distilasyonu için %8,26'yı oluşturur; diğer aileler (dört bileşen) mikrodalga için %5,30'a karşılık su distilasyonu için %4,65'tir; oksijenli seskiterpenler (sekiz bileşen) mikrodalga için %3,05'e karşılık su distilasyonu için %2,46'yı oluşturur; aldehitler (dokuz bileşen) mikrodalga için %1,65'e karşılık su distilasyonu için %2,70'i oluşturur; diterpenler (üç bileşen) mikrodalga için %3.51'i ve su distilasyonu için %0.96'yı oluşturur; ve monoterpenler (üç bileşen)) mikrodalga için %0,18'e karşı su distilasyonu için %0.41'dir. *C. azarolus* türünün polifenoller açısından oldukça zengin olduğunu belirtilmektedir. Antioksidan aktivite ve toplam fenolik içerik seviyeleri de pozitif ve anlamlı şekilde ilişkilendirilmiştir (Lakache, 2014).

Makedonya'da *Crataegus orientalis* yaprak ve meyve kısımlarından elde edilen ekstraksiyonlarda antioksidan kapasite yöntemlerinden DPPH ile yapılan analizlerde ($IC_{50} = 29.7 \mu\text{g/g}$) yaprak ekstraksiyonlarında meyvelerinden daha fazla antioksidan içeriğe sahip olduğu görülmüştür. Yaprak ve meyvelerin etanolik ekstraktlarında 7 fenolik varlığı ve içeriği, en baskın bileşiklerin ise hiperosid, izokersitrin ve klorojenik asit olduğu HPLC-DAD kullanılarak tespit edilmiştir (Savikin ve diğ., 2017).

Crataegus monogyna Jacq alıç türünün meyve ve yapraklarının etil asetat, etanol ve kloroform ekstraktlarındaki toplam fenolik ve flavonoid içeriğinin belirlenmesi ve antioksidan aktivitenin değerlendirildiği bir çalışmada flavonoidlerin içeriği, alüminyum klorür kullanılarak, toplam fenolik bileşiklerin içeriği, Folin-Ciocalteu reaktifi kullanılarak spektrofotometrik yöntemle belirlenmiştir. Test edilen ekstraktların antioksidan aktivitesinin *in vitro* değerlendirmesi DPPH yöntemiyle tespit edilmiştir. Toplam fenolik madde miktarı meyve ve yaprak ekstraktlarında 38.05 ± 0.18 ile $365.11 \pm 0.32 \text{ mg GAE/g dw}$ arasında olduğu gözlemlenmiştir. Alıç yapraklarının etil asetat ekstraktı $365.11 \pm 0.32 \text{ mg GAE/g dw}$ ile en yüksek fenolik bileşik içeriğini göstermiştir. Alıç meyvelerinde ve yapraklarında flavonoid içeriği farklı olduğu gözlemlenmiştir ve 21.11 ± 0.11 ila $122.98 \pm 0.21 \text{ mg RU/g dw}$ arasında değişmektedir. Buna göre en yüksek flavonoid içeriği $122.98 \pm 0.21 \text{ mg RU/g}$ ile yaprakların etil asetat ekstraktındadır. Alıç yapraklarının etil asetat ekstraktı, $IC_{50} = 5,53 \pm 0,08 \mu\text{g/ml}$ ile önemli ölçüde antioksidan potansiyel göstermiştir (Dekić ve diğ., 2020).

Kuzeydoğu İtalya'da bulunan alıç türlerinden *C. monogyna* Jacq., *C. laevigata* Poir. toplanan tomurcuk ve filizlerden oluşturulan ekstraktlara $AlCl_3$ bazlı yöntem, Folin-Ciocalteu yöntemi



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ve HPLC-DAD ile belirlenen fenolik içerik, tomurcuklarda sırasıyla 1kg kuru maddede 23,534-27,728, 75,284-100,616 ve 57.317-58,639 mg aralığında olduğu belirlenmiştir. Filizlerde 1kg kuru maddede sırasıyla 17.280-19.330, 27.653-38.590 ve 30.635-32.185 mg. Antioksidan aktivite sırasıyla tomurcuk ve filizlerde Trolox eşdeğeri 1kg kuru maddede 119.864-174.640 ve 31.484-52.584 mg olduğu tespit edilmiştir. Antioksidan aktivite, favan-3-ol ve hidroksisinamik asit miktarı ve fenolik olmayan maddeler ile ilişkilidir. HPLC-DAD, alıç fenoliklerinin belirlenmesinde daha etkili olduğunu kanıtlanmıştır (Ferioli ve diğ., 2020).

4.SONUÇ

Yapılan çalışmalara bakıldığında zaman dünya genelinde yaygın dağılışı gösteren *Crataegus* türlerinin fenolik madde, antioksidan kapasitesi ve flavonoid madde bakımından zengin bir içeriğe sahip olduğu görülmüştür. Yaptığımız bu çalışmanın Bingöl ve çevresinde de yaygın dağılışı gösteren alıç türlerinin araştırılması bakımından bir öncü çalışma olacağı düşünülmektedir.



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KAYNAKÇA

- Acosta Estrada, B.A., Gutiérrez Uribe, J.A. ve Serna Saldivar, S.O., 2014, Bound phenolics in foods, a review. *Food Chemistry*, 152,46–55.
- Akkemik, Ü., 2014, *Türkiye'nin Doğal-Egzotik Ağaç ve Çalıları I. Crataegus (Alıçlar)*, Orman Genel Müdürlüğü Yayınları, Ankara.
- Bardakçı, H., Celep, E., Gözet, T., Kan, Y. ve Kırmızıbekmez, H., 2019, Phytochemical characterization and antioxidant activities of the fruit extracts of several *Crataegus* taxa. *South African Journal of Botany*, 124, 5-13.
- Baytop, T., 1999, *Türkiye'de Bitkiler ile Tedavi, Geçmişte ve Bugün*. Nobel Tıp Kitapevleri, s.147.
- Birman, H., 2012, Bioactivities of plant flavonoids and the possible action mechanisms. *Journal of İstanbul Faculty of Medicine*, 75, 46-49.
- Bujor, A., Miron, A., Luca, S. V., Skalicka-Wozniak, K., Sillion, M., Trifan, A. ve Totoson, P., 2020, Vasorelaxant effects of *Crataegus pentagyna*: Links with arginase inhibition and phenolic profile. *Journal of ethnopharmacology*, 252, 112559.
- Cong-Cong, X. U., Bing, W. A. N. G., Yi-Qiong, P. U., Jian-Sheng, T. A. O. ve ZHANG, T., 2017, Advances in extraction and analysis of phenolic compounds from plant materials. *Chinese journal of natural medicines*, 15 (10).
- Çelik, S. A. ve Ayran, İ., 2020, Antioksidan Kaynağı Olarak Bazı Tıbbi ve Aromatik Bitkiler. *Türk Bilimsel Derlemeler Dergisi*, 13(2), 115-125.
- Çınar, N., Yeğin, A. B., Fırat, A. ve BAYER, F. U., 2020, Batı Akdeniz Bölgesi *Crataegus* spp. Taksonlarında Fenolik/Flavonoit Madde Miktarları, Antioksidan ve Antimikrobiyal Aktivite Değerleri. *Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 24(2), 464-473.
- Dawson, F.A., 1994, The amazing terpenes. *Naval Stores Rev.* March/April, 6-12.
- Dekić, V., Ristić, N., Dekić, B. ve Ristić, M., 2020, Phenolic and flavonoid content and antioxidant evaluation of hawthorn (*Crataegus monogyna* Jacq.) fruits and leaves extracts. *The University Thought-Publication in Natural Sciences*, 10 (1), 20-25.
- Ekim, T., 2014, *Resimli Türkiye Florası*. Cilt 1, Cilt Ed., İş bankası yayınları, Yeniden Bitkiler, s. 377.
- Ergezer, H. ve Çam, M., 2008, Tanenler: sınıflandırma, yapıları ve sağlık üzerine etkileri, Türkiye 10. Gıda Kongresi Kitabı, Ankara: Gıda Teknolojisi Derneği, Yayın No, 37.



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Ferioli, F., Giambanelli, E. ve D'Antuono, L. F., 2020, Application of different analytical methods for the determination of phenolics and antioxidant activity in hawthorn (*Crataegus* spp.) bud and sprout herbal extracts.

Güner, A., 2012, *Türkiye Bitkileri Listesi Damarlı Bitkiler*, Nezahat Gökyiğit Botanik Bahçesi Yayınları, Flora Dizisi 1, İstanbul.

Karabulut, A. B., 2008, Resveratrol ve Etkileri. *Türkiye Klinikleri Journal of Medical Sciences*, 28(6).

Kolaç, T., Gürbüz, P. ve Yetiş, G., 2017, Doğal Ürünlerin Fenolik İçeriği Ve Antioksidan Özellikleri, İnönü Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu Dergisi, 5(2).

Lakache, Z., Tigrine-Kordjani, N., Tigrine, C., Kameli, A. ve diğ. Meklati, B. Y., 2014, Volatile constituents, phenolic compounds, and antioxidant activity of *Crataegus azarolus* leaves and flowers growing in Algeria. *Chemistry of natural compounds*, 50(6), 1132-1135.

Lou, X., Xu, H., Hanna, M. ve Yuan, L., 2020, Identification and quantification of free, esterified, glycosylated and insoluble-bound phenolic compounds in hawthorn berry fruit (*Crataegus pinnatifida*) and antioxidant activity evaluation. *LWT*, 130, 109643.

Mammadov, R., 2014, *Tohumlu bitkilerde sekonder metabolitler*. Nobel Akademik Yayıncılık. 15 s., 187s. Ankara.

Manach, C., Scalbert, A., Morand, C., Rémésy, C. ve Jiménez, L., 2004, Polyphenols: food sources and bioavailability. *The American journal of clinical nutrition*, 79(5), 727-747.

Mohammadi, N. ve Shaghaghi, N., 2020, Inhibitory effect of eight Secondary Metabolites from conventional Medicinal Plants on COVID_19 Virus Protease by Molecular Docking Analysis.

Nizamlioğlu, N. M. ve Nas, S., 2010, Meyve ve sebzelerde bulunan fenolik bileşikler; yapıları ve önemleri. *Gıda Teknolojileri Elektronik Dergisi*, 5(1), 20-35.

Savikin, K. P., Krstić-Milošević, D. B., Menković, N. R., Beara, I. N., Mrkonjić, Z. O. ve Pljevljakušić, D. S., 2017, *Crataegus orientalis* leaves and berries: Phenolic profiles, antioxidant and anti-inflammatory activity. *Natural product communications*, 12(2), 1934578X1701200204.

Seçmen, Ö., Gemici, Y., Görk, G., Bekat, L. ve Leblebici, E., 2011, *Tohumlu Bitkiler Sistematiği*. Ege Üniversitesi Basımevi, İzmir, syf: 222.



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Simpson, M. G., 2012, *Bitki Sistematigi*. (Çeviri editörü: Zeki Aytaç), Nobel yayınları, syf: 334.

Tomas, M., Rocchetti, G., Ghisoni, S., Giuberti, G., Capanoglu, E. ve Lucini, L., 2020, Effect of different soluble dietary fibres on the phenolic profile of blackberry puree subjected to in vitro gastro intestinal digestion and large intestine fermentation. *Food Research International*, 130, 108954.

Vatansever, H., 2016, Alıç (*Crataegus Tanacetifolia*, *Crataegus Monogyna*) Meyvesi Çeşitlerinden Üretilen Marmelat ve Reçellerin Bazı Özelliklerinin Belirlenmesi. Yüksek Lisans Tezi, Afyon Kocatepe Üniversitesi, Fen Bilimleri Enstitüsü, Afyonkarahisar.

Verpoorte, R. ve Alfermann, A.W., 2013, Metabolic engineering of plant secondary metabolism. Springer Science and Business Media

Yıldız, B. ve Aktoklu, E., 2010, *Bitki Sistematigi, İlk Karasal Bitkilerden bir Çeneklilere*. syf. 267, Palme Yayıncılık, 2010.

Zinkel, D.F. ve Russell, J., 1989, Naval Stores: Production, Chemistry, Utilization. (New York: Pulp Chemicals Association).

<http://www.theplantlist.org/tpl1.1/search?q=crataegus>

<https://www.bizimbitkiler.org.tr/list.html>



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ARONYA YETİŞTİRİCİLİĞİNİN ÖNEMİ VE ÜRETİM OLANAKLARI

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ÖZET

Günümüzde insanların doğal ürünlere yönelmesi ile tıbbi ve aromatik bitkilerin pazarı ve önemi artış göstermektedir. Son zamanlarda bu bitkilerden biri olan Aronya (*Aronia melanocarpa* (Michx.) Elliot), nutrasötik bir ürün olarak dikkatleri üzerine çekmiştir. Aronya meyveleri, flavanol, flavonoid, antosiyanin, fenolik asitler ve proantosiyanidinleri bünyesinde en çok barındıran meyvelerdendir. Çeşitli antioksidanları oldukça yüksek miktarlarda içermesi sayesinde aronya bitkisi oksidatif stres, kardiyovasküler hastalıklar, diyabet ve kansere bağlı kronik problemlerin tedavisinde kullanılan en etkili bitkiler içerisinde yer almaktadır. Yaşlanmayı geciktiren aronya meyvesi yaşlılık ile meydana gelen geçici hafıza sorunlarının da önüne geçebilmektedir. Adaptasyon kabiliyetinin yüksek olması, hastalık ve zararlılara dayanıklı olması, makinalı hasada uygun olması ve düşük üretim maliyeti gibi pek çok olumlu neden ile aronya yetiştiriciliği üreticiler için cazip hale gelmiştir. Tarım bakanlığının 2021 yılında oluşturduğu fizibilite raporunda, aronya bitkisinin ülkemiz iklim ve arazi koşullarına oldukça uygun olduğu belirtilmiştir. Ayrıca raporda, üzüksü meyvelerin pazarında öncülük eden Türkiye için bu bitkinin yaygınlaştırma olasılığının yüksek olduğu bildirilmiştir. Bu derlemede, aronya yetiştiriciliğinin önemi ve üretim imkanları, bitkinin yetiştiricilik avantajları, kullanım alanları, insan sağlığına katkısı ve botanik özellikleri ile birlikte değerlendirilmiştir.

Anahtar Kelimeler: *Aronia melanocarpa*, Aronya, antosiyanin, antioksidan



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**IMPORTANCE OF ARONIA CULTIVATION AND PRODUCTION
OPPORTUNITIES**

ABSTRACT

The market and importance of medicinal and aromatic plants are increasing with people turning to natural products today. Recently, one of these plants, Aronia (*Aronia melanocarpa* (Michx.) Elliot), has attracted attention as a nutraceutical product. Aronia berries are among the fruits that contain the most flavonols, flavonoids, anthocyanins, phenolic acids, and proanthocyanidins. Thanks to its high content of various antioxidants, the Aronia plant is among the most effective plants used in the treatment of chronic problems related to oxidative stress, cardiovascular diseases, diabetes, and cancer. Aronia fruit, which delays aging, can also prevent temporary memory problems that occur with old age. Aronia cultivation has become attractive for producers due to many positive reasons such as its high adaptability, resistance to diseases and pests, being suitable for machine harvesting, and low production cost. In the feasibility report prepared by the Ministry of Agriculture in 2021, it was stated that the Aronia plant has a very suitable climate and land demands for our country. Also, in the report, it was stated that the possibility of popularization of this plant is high for Turkey, which is a leader in the market of grapy fruits. In this review, the importance of growing the Aronia and its production possibilities were evaluated together with its cultivation advantages, usage areas, contribution to human health, and botanical characteristics.

Keywords: *Aronia melanocarpa*, Aronia, anthocyanin, antioxidant

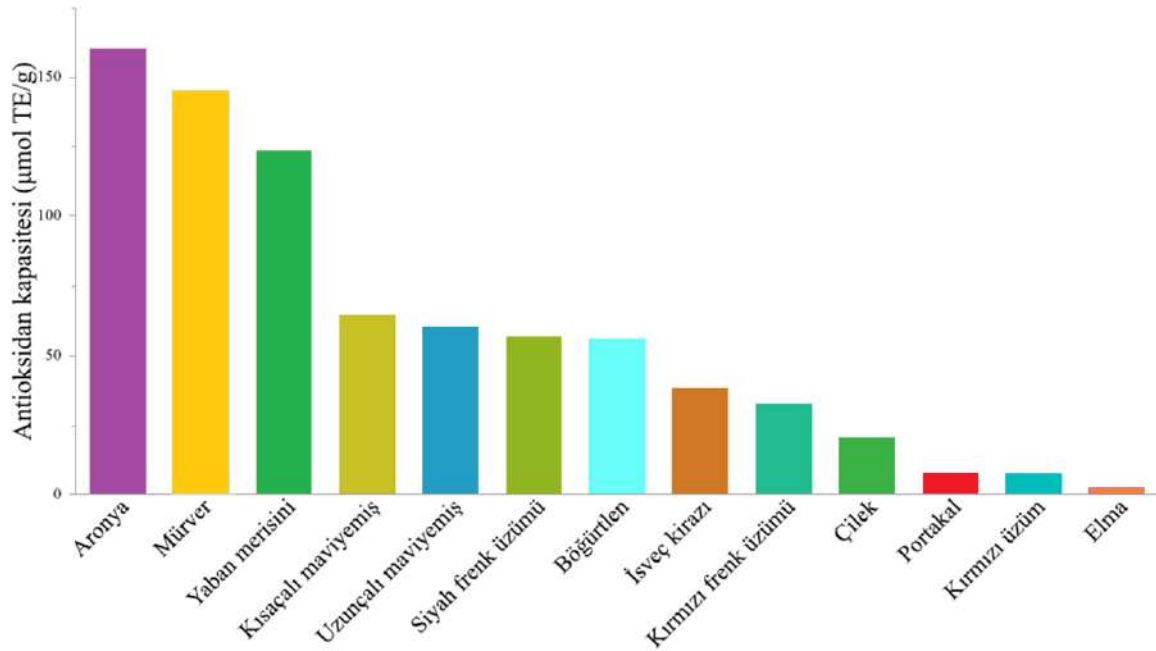


GİRİŞ

Aronya, zengin polifenol içeriğe ve yüksek antioksidan aktiviteye sahip olarak son zamanlarda popülerliği artan ve daha çok tercih edilen meyveler arasında yer almıştır (Denev ve ark. 2019; Yılmaz ve ark 2021). Meyveleri yüksek antosiyanin içermesi nedeniyle çayların ve fonksiyonel meyve sularının yapımında değerlendirilmektedir (Balcerek ve Szopa 2005; Gonzalez-Molina ve ark., 2008). Diğer meyve sularının antosiyanin ve flavonoid seviyelerini artırmak için aronya meyve suyu, çok iyi bir seçenek olarak sunulmaktadır (Kokotkiewicz ve ark., 2010).

Aronya bitkisi fenolik asitler, flavanoller ve prosiyanidinler gibi biyoaktif fenolik maddelerin en iyi bitkisel kaynaklarından biri olarak raporlanmıştır (Simic et al., 2016). Aronya meyvesi, yüksek fenolik bileşik seviyesi ile antioksidan, antidiyabetik ve immünomodülatör etkiler gibi birçok faydalı sağlık özelliğine sahiptir (Meng ve ark, 2019).

Antosiyaninler, aronya meyvelerinde kuru ağırlık itibariyle %0,60 ve %2,00 arasında değişmekte olup bitkide ikinci en büyük fenolik bileşik grubunu oluşturmaktadır (Kokotkiewicz ve ark., 2010). Antosiyanin varlığı aronya bitkisinin antioksidan kapasitesini belirleyen en önemli etmenlerdendir (Yılmaz ve ark., 2021). Aronya bitkisi, yüksek antosiyanin içeriği ile antioksidan kapasitesi bakımından çoğu meyve türünden üstün özellik göstermektedir (Şekil 1).



Şekil 1. Bazı meyvelerde antioksidan kapasitesi (Kulling ve Rawel, 2008).

İlaç endüstrisinde aronya ekstraktı diyet takviyeleri ve şurup olarak değerlendirilmektedir (Wolski ve ark., 2007). Doğu Avrupa ülkeleri ve Rusya'da anti-aterosklerotik ve hipertansif



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ilaç olarak kullanılan aronya meyveleri, bitkisel ilaç ihtiyacını gidermek için bu coğrafyalarda popülerlik kazanmış olan en önemli ürünler içerisinde yer almaktadır (Kokotkiewicz ve ark., 2010). Aronya meyveleri, pektin içeriklerinin yüksek olması sayesinde düşük pektinli meyveler ile karışık olarak reçel yapımında kullanılmaktadır (Scott ve Skirvin 2007). Diğer taraftan, reçellerin renklerinin, tatlarının ve antioksidan özelliklerinin iyileştirilmesi için de aronya meyveleri kullanılabilir (Wojdyło ve ark., 2008).

ARONYA ÜRETİMİ

Gıda ve tarım sektörü için aronya bitkisi büyük önem arz etmektedir. Birim alandan elde edilen geliri ve sağlık açısından oldukça yararlı özelliklere sahip olmasından dolayı dünya çapında en çok aranan bitkilerden birisi olan aronya, son yıllarda ülkemizde iç taleplerin artmasıyla birlikte popülerliği ve ürün değerini artırmıştır. Türkiye’de aronya üretimi için yapılacak yatırımlar arz talep dengesi itibarıyla değerlendirilecek olursa arz tarafındaki gerekliliğin yüksek düzeylerde olduğu görülmektedir. Yatırımların artması ile birlikte, ülkenin aronya ihtiyacı yerli üretim ile karşılanacaktır. Daha önemlisi ihtiyaç fazlası olan aronya ürünleri için ihracat fırsatı oluşacak ve ülkemize döviz girdisi sağlanacaktır (Tarım ve Orman Bakanlığı Bitkisel Üretim Genel Müdürlüğü, 2021).

2019 yılı verilerine göre Türkiye’de toplam 78 hektar alanda aronya yetiştiriciliği yapılmıştır. En çok yetiştiricilik yapan iller sırasıyla Kırklareli, Bursa, Manisa, Kırşehir ve Yalova’dır (Yılmaz ve ark., 2021). Ülkemizde aronya yetiştiriciliği henüz istenilen seviyelerde yaygınlaşmamıştır. Bakanlık aronya yetiştiriciliği için teşvik olarak gerekli adımları atmaktadır. Aronya bahçeleri için Tarım ve Orman Bakanlığı tarafından hem yatırım yılında sertifikalı fidan kullanımı desteği hem de bahçe tesisi kurması için destek taahhüdü verilmektedir. Sertifikalı fidanların %15’lik bedeli ve bahçe tesisi için %95’lere varan faiz indirimli krediler bakanlıkça sağlanmaktadır (Tarım ve Orman Bakanlığı Bitkisel Üretim Genel Müdürlüğü, 2021).

Aronya, Kuzey Amerika menşeli çok yıllık bir bitkidir. Çalı formunda olan ve kış mevsiminde yapraklarını döken bitkinin genişliği 60-180 cm, yüksekliği ise 90-240 cm arasındadır (Yılmaz ve ark., 2021). Aronya’nın bazı bitkisel özellikleri ve vejetasyon döngüsü Şekil 1’de gösterilmiştir. Yaklaşık olarak 6 mm çapa sahip olan aronya meyveleri mor-siyah renklidir. Aronya yaprakları 3-7 cm uzunlukta olup tüysüz ve parlaktır. Dikim işleminde popülerliği daha fazla olan Nero ve Viking çeşitleri için 3,5 m sıra arası ve 1,5 m sıra üzeri mesafeleri tavsiye edilmektedir. Gölgelemeye nispeten dayanıklı olduğundan dolayı aronyanın sıra üzeri



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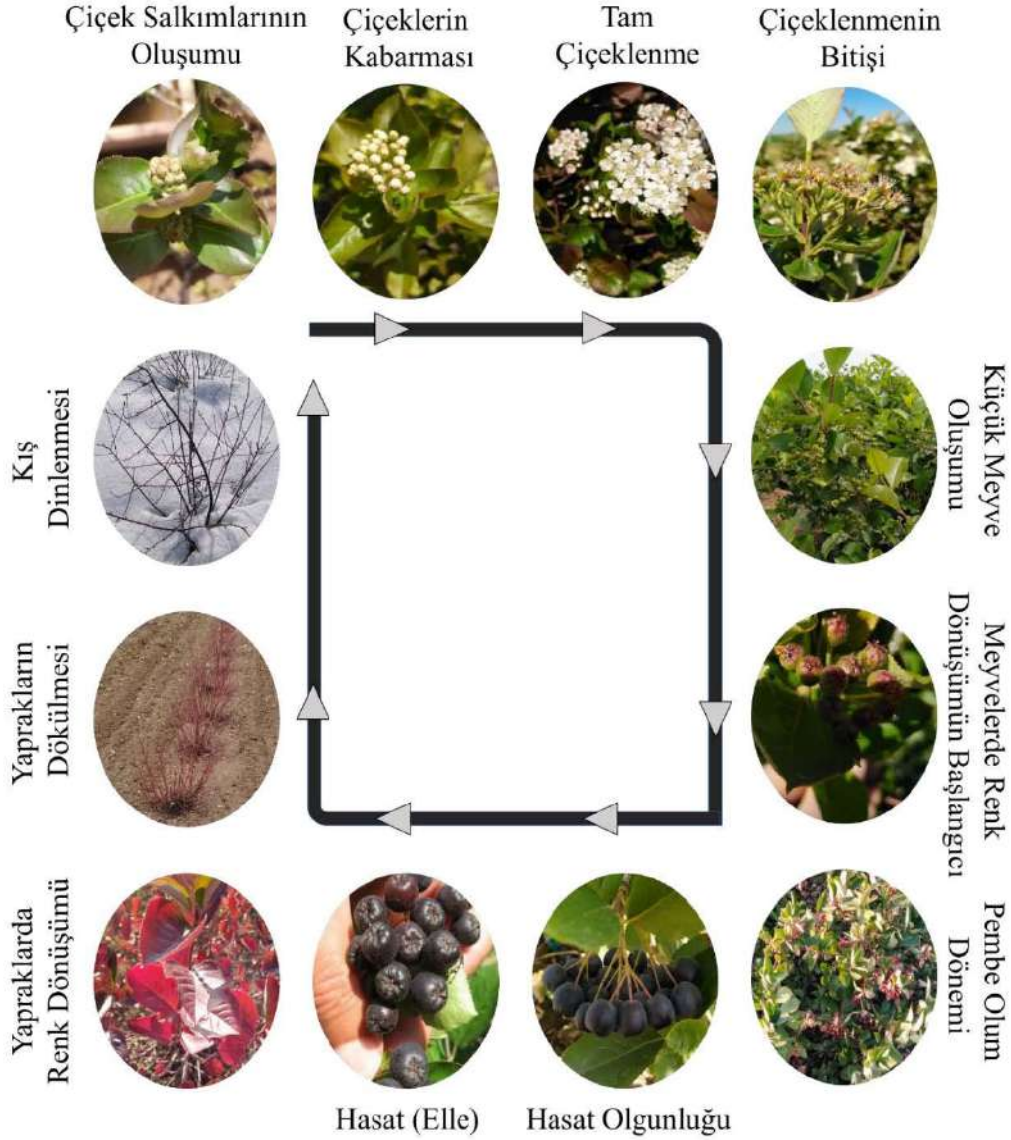
mesafeleri azaltılabilmektedir. Diğer taraftan açık ve güneşli yörelerde daha iyi verim sağladığı da ifade edilmektedir (Hardin 1973, Scott ve Skirvin 2007. Brand, 2010).

Soğuğa karşı oldukça dirençli bir bitki olması nedeniyle aronya, sadece ılıman iklim koşullarında değil, -35 °C'nin altındaki sıcaklıklarda da yetişebilmektedir (Jurendić ve Šćetar, 2021). Kuru ve kumlu topraklardan nemli ve bataklık topraklara kadar çoğu toprak koşulunda yetişebilmektedir. Toprağın desteklenmesinin yapılması ile daha verimli ve sağlıklı bitkiler oluşmaktadır. Bitkinin istediği optimum toprak pH'sı 6.0-6.5 arasındadır. Ancak 5.0-8.5 pH aralığına kadar bitki kendisini tolere edebilmektedir (Everhart, 2013).

Uygun iklim ve arazi şartlarının değerlendirilmesi sonucunda Türkiye'nin aronya üretimi için oldukça uygun koşullara sahip olduğu saptanmıştır. Diğer taraftan üzüksü meyvelerin ihracat ve üretim potansiyelleri dikkate alındığında, uygun pazarlama stratejileri ile ülkemizin aronya pazarı adına küresel üstünlüğe sahip olabileceği düşünülmektedir. Aronya ürünlerinin farklı kullanım alanları ve sağlık açısından faydaları göz önünde bulundurulduğunda, Türkiye'de aronya bahçelerin tesis edilmesi daha çok önem arz etmektedir (Tarım ve Orman Bakanlığı Bitkisel Üretim Genel Müdürlüğü, 2021).



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Şekil 2. Aronya bitkisinin vejetasyon döngüsü (Yılmaz ve ark 2021).

Tarım ve Orman bakanlığının fizibilite raporuna göre 100 dekarlık aronya bahçesinden en az 20 yıllık proje süresince bugünkü değeri ile net 67 milyon TL gibi yüksek bir gelir edilebileceği öngörülmüştür (Tarım ve Orman Bakanlığı Bitkisel Üretim Genel Müdürlüğü, 2021).

SONUÇ

İklim ve toprak koşullarına olan adaptasyon kabiliyeti ile aronyanın farklı bölgelerde kolay bir şekilde yetiştirme imkânı bulunmaktadır. Bitkinin ekonomik zarara neden olduğu bilinen herhangi bir zararlı ve hastalığının bulunmaması yetiştiricilikte olası verim risklerini azaltmaktadır. Uzun süreli hasat dönemi sayesinde aronya üreticilerinin işgücünü zamana yayarak işçi maliyeti az olmaktadır. Makinalı hasada uygunluğu ile geniş arazilerde



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yetiřtiricilięine imkân tanıyan bir bitki olarak öne çıkmaktadır. Zengin antioksidan içerięe sahip olan meyveleri pek çok hastalık için çare olabilmektedir. İnsanların doęal kaynaklar ve Alternatif Tıp'a olan ilgisinin artması ile aronyanın popölerlięi her geen gün daha da artmış ve “mucize” / “süper” bitki olarak anılmasını saęlamıştır. Geniş kullanım alanları sayesinde pazarlama sorununun olmayacağı öngörölen aronya bitkisinin ölkemizdeki yetiřtiricilięinin hızlı bir řekilde artacağı düşünölmektedir.



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KAYNAKLAR

Balcerek, M., Szopa, J.S. (2005). Optimization of the technology of aronia-spirit production-Part 2. Influence of the fermentation conditions on the aroma compounds. *Deutsche Lebensmittel-Rundschau*, 101(1): 16-19.

Brand, M. 2010. Aronia: Native shrubs with untapped potential. *Arnoldia*, 67(3): 14-25.

Denev, P., Číž, M., Kratchanova, M., Blazheva, D. (2019). Black chokeberry (*Aronia melanocarpa*) polyphenols reveal different antioxidant, antimicrobial and neutrophil-modulating activities. *Food Chemistry*, 284: 108-117.

Everhart, E. 2013. Aronia—A New Crop for Iowa. Retrieved May 24.

Gonzalez-Molina, E., Moreno, D.A., Garcia-Viguera, C. (2008). Aronia-enriched lemon juice: a new highly antioxidant beverage. *Journal of agricultural and food chemistry*, 56(23): 11327-11333.

Hardin, J.W. (1973). The enigmatic chokeberries (*Aronia*, Rosaceae). *Bulletin of the Torrey Botanical Club*, 178-184.

Jurendić, T., & Ščetar, M. (2021). *Aronia melanocarpa* Products and By-Products for Health and Nutrition: A Review. *Antioxidants*, 10(7), 1052.

Kokotkiewicz, A., Jaremicz, Z., Luczkiewicz, M. (2010). Aronia plants: a review of traditional use, biological activities, and perspectives for modern medicine. *Journal of medicinal food*, 13(2): 255-269.

Meng, L., Zhu, J., Ma, Y., Sun, X., Li, D., Li, L., ... & Meng, X. (2019). Composition and antioxidant activity of anthocyanins from *Aronia melanocarpa* cultivated in Haicheng, Liaoning, China. *Food Bioscience*, 30, 100413.

Scott, R.W., Skirvin, R.M. (2007). Black chokeberry (*Aronia melanocarpa* Michx.): A semi-edible fruit with no pests. *Journal of the American Pomological Society*, 61(3): 135.

Simić, V. M., Rajković, K. M., Stojičević, S. S., Veličković, D. T., Nikolić, N. Č., Lazić, M. L., & Karabegović, I. T. (2016). Optimization of microwave-assisted extraction of total polyphenolic compounds from chokeberries by response surface methodology and artificial neural network. *Separation and Purification Technology*, 160, 89-97.

Tarım ve Orman Bakanlığı Bitkisel Üretim Genel Müdürlüğü (2021). Aronya Fizibilite Raporu ve Yatırım Rehberi, Editörler; Engin Toprak ve Ercan Türktemel, T.C. Tarım ve Orman Bakanlığı Eğitim ve Yayın Dairesi Başkanlığı.



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Wojdyło, A., Oszmiański, J., Bober, I. (2008). The effect of addition of chokeberry, flowering quince fruits and rhubarb juice to strawberry jams on their polyphenol content, antioxidant activity and colour. *European Food Research and Technology*, 227(4): 1043-1051.

Wolski, T., Kalisz, O., Prasał, M., Rolski, A. (2007). Black chokeberry- *Aronia melanocarpa* (Michx.) Elliot- the rich source of antioxidants. *Post. Fitoter.* 3:145-154.

Yılmaz, A., Güler, E., Soydemir, H.E., Demirel, S., Mollahaliloğlu, S., Karadeniz, T., Çiftçi, V. (2021). Mucize Bitki: Aronya (*Aronia melanocarpa*). *MAS Journal of Applied Sciences* 6(1): 83–94.



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**KİTOSAN VE PROPOLİS KULLANILARAK GÜMÜŞ NANOPARTİKÜLLERİN
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ÖZET

Bilim ve teknolojik uygulamalarının pek çok alanında kullanılan nanoteknoloji, günümüzde sitotoksik çalışmalarda da etkili olarak kullanılmaktadır. Gümüş nanopartiküllerin antikanser çalışmalarda sıklıkla kullanıldığı literatürde görülmektedir. Gümüş atomlarının hücre içi proteinlerin fonksiyonel grupları ve nitrojen bazları ile aktif fizikokimyasal etkileşimi ile gümüşün sitotoksik etkisinin ortaya çıktığı bilinmektedir. Gümüş nanopartiküllerin fiziksel ve kimyasal sentezlere alternatif olarak, çevre dostu ve ekonomik olmasıyla yeşil sentez yöntemi günümüzde daha çok tercih edilmektedir. Yeşil sentez yönteminde ise biyoaktif bileşenlerce zengin olan doğal maddeler kullanılmaktadır. Çalışma kapsamında kullanılan; düşük toksisiteye sahip ve biyouyumlu bir polimer olan kitosanın, nanopartiküler sistemlerin zorluklarının üstesinden gelebileceği düşünülmektedir. Ayrıca içerdiği birçok aktif bileşikler sayesinde antibakteriyel, antifungal, antiviral, antiprotozoa, antitümör, antiülser ve antiinflamatuvar gibi çok farklı biyolojik ve farmakolojik özellikler gösteren propolisin, nanoteknolojinin yenilikçi kazanımları bu çalışmayı yapmaya teşvik etmiştir. Çalışmada biyoaktif maddelerce zengin olduğu bilinen propolis ve kitosan, gümüş nanopartikül biyosentezinde kullanılmıştır. Sentezlenen kitosan ve propolis bazlı gümüş nanopartiküllerin (KP@AgNP) karakterizasyonu X-ışını kırınımı (XRD) cihazı, taramalı elektron mikroskobu (SEM) ve fourier dönüşümlü kızıl ötesi (FT-IR) spektroskopisi ile gerçekleştirilmiştir. KP@AgNP'lerin prostat kanseri (PC-3) hücre hattındaki sitotoksik etkilerinin belirlenmesi amacıyla öncelikle hücre kültürü çalışmaları gerçekleştirilmiştir. Hücre kültürü yöntemiyle çoğaltılan PC-3 hücre hattının hücre canlılığı XTT testiyle belirlenmiştir. Kitosan ve propolis ile biyosentezlenen gümüş nanopartiküllerin, prostat kanseri (PC-3) hücrelerinin canlılığını, doza bağlı bir şekilde azaltabildiği çalışma sonucunda görülmüştür. Sonuç olarak çalışmada sitotoksik etki gösteren KP@AgNP'lerin geliştirilerek antikanser çalışmalarında kullanılabilir hale getirilmesi hedeflenmiştir. Yani mevcut sentezlenmiş nanopartikül boyutlarının ve şekillerinin değiştirilmesi ya da içerisine etken maddelerin enkapsüle edilmesi ile kanser hücrelerinde uygulanması gelecek çalışmalar için ışık tutacaktır.

Anahtar Kelimeler: Kitosan, propolis, nanopartikül, sitotoksitite, PC-3



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**DETERMINATION OF THE BIOSYNTHESIS AND CYTOTOXICITY OF SILVER
NANOPARTICLES USING CHITOSAN AND PROPOLIS**

ABSTRACT

Nanotechnology, which is used in many fields of science and technological applications, is also used effectively in cytotoxic studies today. It is seen in the literature that silver nanoparticles are frequently used in anticancer studies. It is known that the cytotoxic effect of silver occurs with the active physicochemical interaction of silver atoms with the functional groups of intracellular proteins and nitrogen bases. As an alternative to the physical and chemical synthesis of silver nanoparticles, the green synthesis method is more preferred today, as it is environmentally friendly and economical. In the green synthesis method, natural substances rich in bioactive components are used. Used within the scope of the study; It is thought that chitosan, a biocompatible polymer with low toxicity, can overcome the difficulties of nanoparticle systems. In addition, thanks to the many active compounds it contains, the innovative achievements of propolis and nanotechnology, which show very different biological and pharmacological properties such as antibacterial, antifungal, antiviral, antiprotozoal, antitumor, antiulcer, and anti-inflammatory, have encouraged this study. In the study, propolis and chitosan, which are known to be rich in bioactive substances, were used in the biosynthesis of silver nanoparticles. Characterization of synthesized chitosan and propolis-based silver nanoparticles (KP@AgNP) was performed with an X-ray diffraction (XRD) device, scanning electron microscope (SEM), and Fourier transform infrared (FT-IR) spectroscopy. Cell culture studies were carried out first to determine the cytotoxic effects of KP@AgNPs in prostate cancer (PC-3) cell line. Cell viability of PC-3 cell line propagated by cell culture method was determined by XTT test. As a result of the study, it has been seen that silver nanoparticles biosynthesized with chitosan and propolis can reduce the viability of prostate cancer (PC-3) cells in a dose-dependent manner. As a result, it was aimed to develop KP@AgNPs with cytotoxic effects and make them usable in anticancer studies. In other words, changing the sizes and shapes of the existing synthesized nanoparticles or encapsulating the active substances and applying them in cancer cells will shed light on future studies.

Keywords: Keywords: Chitosan, propolis, nanoparticle, cytotoxicity, PC-3



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GİRİŞ

Nanoteknoloji fizik, kimya, biyoloji, tıp, elektronik ve enerji üretimi gibi kapsamlı uygulama alanları bulunan bir bilim dalıdır. Boyutları 100 nm ve altında olan nanopartiküller ise nanoboyutlu malzemelerin dolayısıyla nanoteknolojinin temelini oluşturmaktadır (Rao et al. 2005; Miller et al. 2004). Çözeltinin sıcaklığı, metal tuzlarının konsantrasyonu, indirgeyici ajan ve reaksiyon süresi nanopartiküllerin boyutunu ve şeklini etkilemektedir. Nanopartiküller boyut ve şekillerinin farklılıkları sayesinde kataliz, optik, mikro elektronik ve benzeri gibi birçok alanda farklı özellikler gösterirler (Sileikaite et al. 2006). Nanopartiküllerin çevre dostu üretiminde bitkilerin kullanımı, kimyasal ve fiziksel yöntemlerle üretilen nanopartiküllere göre büyük ölçeklerde daha uygun maliyete üretilmektedir. Ayrıca bu çevre dostu üretim yönteminde yüksek basınç, enerjiye, sıcaklığa ve toksik kimyasal kullanımına gerek yoktur (Sileikaite et al. 2006; Porte et al. 2002).

Gümüş iyonlarının proteinlerin tiol (SH) grupları ile reaksiyona girdiği ve onları etkisiz hale getirerek zar geçirgenliğini düşürdüğü ve böylece bakteri hücrelerinin ölümüne neden olduğu yapılan çalışmalarla ortaya konmuştur (Duran vd. 2010). Gümüş nanopartikülleri bakteri membranını bozmakta, hücre içi potasyum kaybını artırmakta ve ATP'yi azaltarak hücre canlılığının kaybolmasına neden olmaktadır (Navarro et al. 2008). PC-3 hücre hatları, prostat kanseri araştırmasında kullanılan hücre hatlarından biridir. Bu hücreler ileri prostat kanseri hücrelerindeki biyokimyasal değişiklikleri araştırmada ve kemoterapötik ajanlara verdikleri yanıtı değerlendirmede kullanılan hücre hattıdır (Papatsoris et al. 2001). Bu çalışmada kitosan ve propolis ile sentezlenen nanopartiküllerin PC-3 hücre hattı üzerinde verdiği yanıtlar değerlendirilmiştir.

Kitin doğada yaygın olarak bulunan bir aminopolisakkarittir. Kitosan ise kitinin deasetilasyonu ile elde edilen doğal, pozitif yüklü bir polisakkarittir (Akkurt 2012). Kitosan, düşük toksisiteye sahip biyoyoumlu bir polimerdir. Nanopartiküler formda moleküler ağırlığı, iletim aracının boyutu, nanopartiküllerin boyutu ve yükü gibi farklı faktörlere bağlı olarak iyi biyobozunurluğa ve biyolojik dağılıma sahiptir. Tüm bu özelliklerinden dolayı nanopartiküler sistemlerin zorluklarının üstesinden gelebilmektedir (Patrula et al 2015; Pereira et al. 2015).

Bal arıları (*Apis mellifera*) propolisi kovan girişini davetsiz misafirlerden korumak ve kovanda istenmeyen mikroorganizmaların gelişmesini önlemek amacıyla kullanır. Propolis içerdiği birçok aktif bileşik (fenolik asitler, esterler ve flavonoidler gibi) sayesinde antibakteriyel, antifungal, antiviral, antiprotozoa, antitümör, antiülser ve antiinflamatuvar gibi çok farklı



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biyolojik ve farmakolojik özellikler göstermektedir (Güney ve Yılmaz 2013). Doğal biyoaktif bileşik olarak propolisin, nanoteknolojinin yenilikçi kazanımları bu çalışmayı yapmaya teşvik etmiştir.

MATERYAL VE METOD

Kp@Ag Nanopartiküllerinin Sentezlenmesi

Bu çalışma kapsamında kitosan ve propolis kullanılarak gümüş nanopartikül sentezlenmesi amacıyla şu işlemler gerçekleştirilmiştir. Gümüş nitrat (AgNO_3) 0,085 gr hassas terazide tartılmış ve 10 ml saf su ile gümüş nitrat çözeltisi elde edilmiştir. Benzer şekilde sodyum sitrat ($\text{C}_6\text{H}_5\text{Na}_3\text{O}_7$) 0.884 gr hassas terazide tartılarak 100 ml saf suda çözünmüş ve sodyum sitrat çözeltisi elde edilmiştir. Sodyum sitrat çözeltisi ısıtıcılı manyetik karıştırıcıda karıştırarak, gümüş nitrat çözeltisinden damlalar halinde eklenerek rengin kahverengine dönmesi sağlanmıştır. %1'lik asetik asit-kitosan çözeltisi hazırlamak için; kitosan hassas terazide 1 gr tartılmış ve üzerine 90 ml saf su eklenerek karıştırılmıştır. Daha sonra üzerine 10 ml asetik asit koyularak %1'lik asetik asit-kitosan çözeltisi hazırlanmıştır. %70'lik etil alkol-propolis çözeltisi hazırlamak için; toz haline getirilen propolisten hassas terazide 3,660 gr tartılmış ve üzerine % 70'lik etil alkolden 20 ml eklenerek karıştırılmıştır. Çözeltinin pH'sı 10.50 olacak şekilde ayarlanmış ve 1 gün boyunca karıştırılmaya bırakılmıştır ve %70'lik etil alkol-propolis çözeltisi hazırlanmıştır. Propolis ve kitosan çözeltilerinde ayrı ayrı 10 ml alınmış ve renk karamel rengini alana kadar karıştırılmıştır. Son olarak hazırlanan gümüş nitrat çözeltisinden 10µl alınarak propolis ve kitosan karışımına eklenerek kitosan-propolis destekli gümüş nanopartikülleri (KP@AgNP) sentezlenmiştir. Sentezlenen nanopartiküller santrifüjlenerek süpernatant kısmı ayrılmış ve partikül kısmı etüve konularak kurutulmaya bırakılmıştır. Toz haline getirilen nanopartiküller çalışmalarda kullanılmak için muhafaza edilmiştir.

Kp@Ag Nanopartiküllerinin Sitotoksitesinin Belirlenmesi

Bingöl Üniversitesi Merkezi Laboratuvar Uygulama ve Araştırma Merkezinde temin edilen prostat kanseri (PC-3) hücre hattı sitotoksik çalışmalar için kullanılmıştır.

Hücre kültürü çalışmaları için; 89 ml RPMI 1640, 10 ml fetal sıgır serumu ve 1 ml penisillin-streptomisin içeren medyum hazırlanmıştır. PC-3 hücreleri öncelikle %5 CO_2 içeren inkübatörde 37°C 'de 25 cm^2 lik flasklarda çoğaltılmıştır. Cansız hücrelerin ortamdan uzaklaştırılması için her flaska 1 mL olmak üzere PBS (phosphate buffer saline) eklenmiş ve eklenen PBS geri çekilerek cansız hücreler uzaklaştırılmıştır. Canlı hücreleri kaldırmak için her



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flaska 1 ml tripsin-EDTA enzimi eklenerek %5 CO₂ içeren inkübatörde 3 dk inkübe edilmiştir. Hücreler kaldırıldıktan sonra her flaska 1 ml RPMI-1640, fetal sığır serumu ve penisillin-streptomisin medyumunu eklenerek tripsin enziminin inaktif hale gelmesi sağlanmıştır. Her flastaki çözelti otomatik pipetle çekilerek falkon tüplere aktarılmıştır. Falkon tüpteki çözelti 2500 rpm’de 2 dakika santrifüj edildikten sonra süpernatant kısmı uzaklaştırılmıştır. Hücrelerin üzerine 1 ml RPMI 1640 medium eklenmiştir. Hücre sayımı için falkon tüpten 10 µl örnek alınmış ve üzerine 10 µl tripan blue eklenerek canlı hücre sayımı gerçekleştirilmiştir. Hücre ekimi 96 kuyucuklu plakalara ve her kuyucukta toplam olarak yaklaşık 2x10⁴ hücre miktarı 200 µL’de hesaplanarak kuyucuklara ekim yapılmıştır. Hücreler %5 CO₂ içeren karbondioksit inkübatörde 48 saat süresince inkübe edilmiştir. 48 saat sonunda her bir kuyucuğa 15 µL XTT eklenerek hücreler %5 CO₂ inkübatörde 37°C 4 saat inkübe edilmiştir. İnkübasyondan sonra 96 kuyucuklu plate ELISA reader cihazında 440 nm de absorbands değerleri alınmıştır.

ARAŞTIRMA BULGULARI

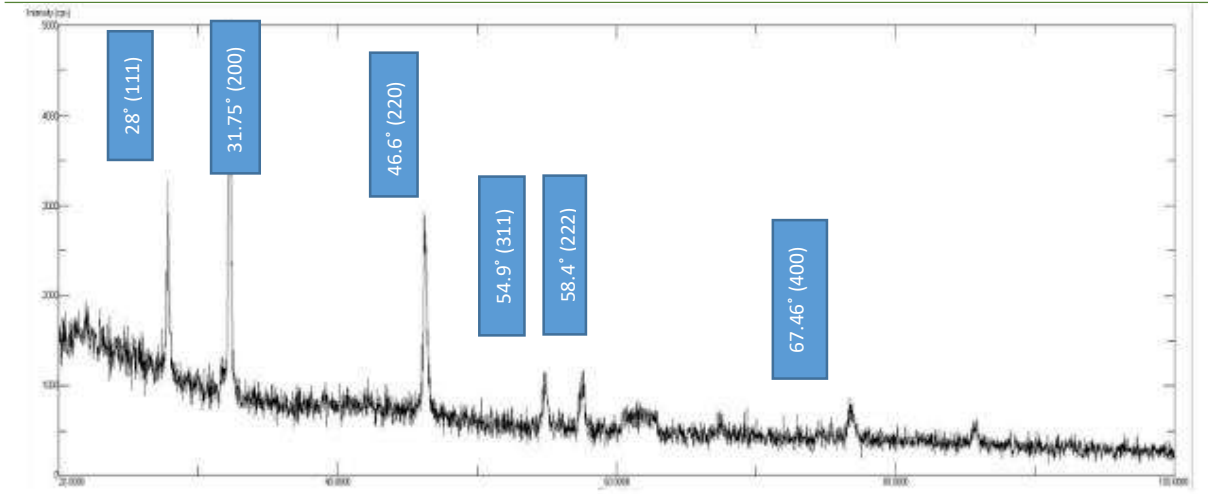
Kp@Ag Nanopartiküllerinin Karakterizasyonu

X-Işını Kırınımı (XRD) Analizi

KP@AgNP’ nin kristal yapısı ve faz tanımlaması, XRD ile karakterize edildi. XRD analizi sonucu Şekil 1’ de verilmiştir. 2θ ölçeğinde yapılan XRD analizinde KP@AgNP 28°, 31.75°, 46.6°, 54.9°, 58.4° ve 67.46° de karakteristik pikler vermiştir. Elde edilen piklerin magnetite ait olan karakteristik pikler olduğu tespit edilmiştir. Sırasıyla bu piklere karşılık gelen endeksler (111),(200),(220),(311),(222) ve (400)’ dür. XRD analizi sonucu, manyetite nanopartiküllerinin sentezini doğrulamaktadır. AgNP (JCPDS No. 87-0717) bir referans kodu olarak belirlenmiştir (Wang et al. 2012).



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Şekil 1. KP@AgNP XRD görüntüsü

Taramalı Elektron Mikroskobu (SEM)

Sentezlenen nanopartiküllerin boyutları ve morfolojik özellikleri (JEOL JSM 6510) taramalı elektron mikroskop (SEM) cihazı ile incelenmiştir (Şekil 2). Yapılan görüntüleme sonucunda KP@AgNP'lerin genellikle küresel ve 100 nm' den daha küçük boyutlarda olduğu belirlenmiştir.



Şekil 2. KP@AgNP SEM görüntüsü



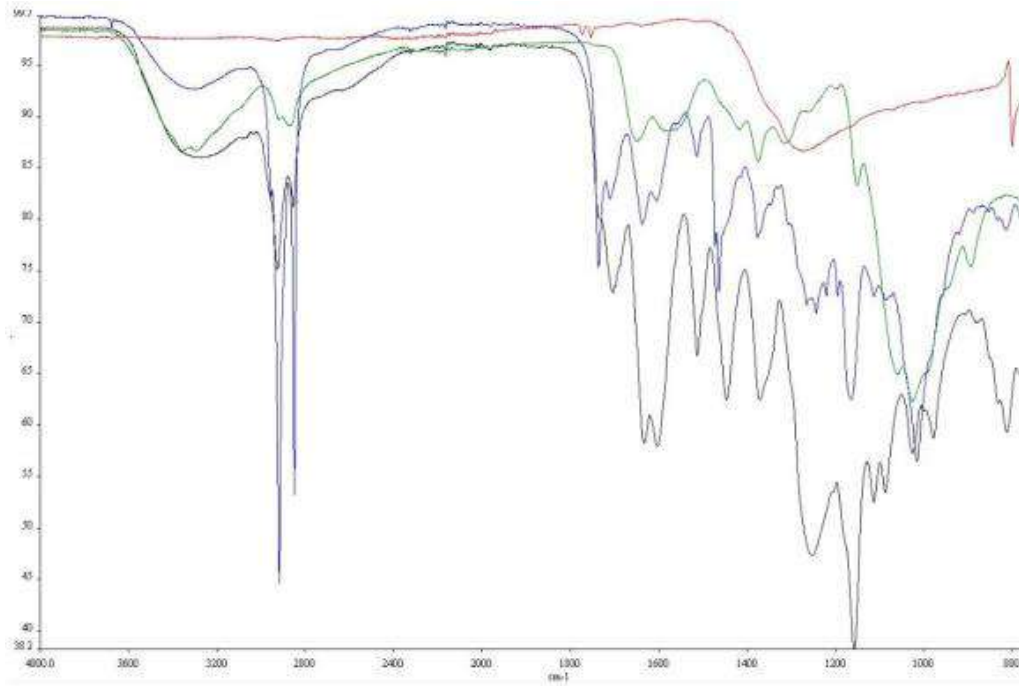
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Fourier Dönüşümlü Kızıl Ötesi (FT-IR) Spektroskopisi

FT-IR spektroskopisi ile nanopartiküller üzerinde bulunan fonksiyonel grupların sayısı, spektrumun tepe noktalarının büyüklüğü ile belirlenmektedir. (Chauhan et al. 2012). Numunelerin fonksiyonel gruplarının belirlemek için FT-IR spektrumu, bir spektrometre (Perkin Elmer Spectrum 100) ile ölçülmüştür. Yapılan ölçümlerden sonra propolis, kitosan ve gümüş nitrat ekstraktındaki tüm pikler Şekil 3’ de verilmiştir. FT-IR spektrumunda yaklaşık $1500-1600\text{ cm}^{-1}$ C=C aromatik halka, 3325 cm^{-1} –OH grubunun, $1050-1300\text{ cm}^{-1}$ karboksilik asit, $1690-1760\text{ cm}^{-1}$ de karbonil, $2100-2260\text{ cm}^{-1}$ alkinler ve 2910 cm^{-1} alken grubunun varlığı yapılan çalışmaları destekleyici şekildedir.

Tüm spekturumlarda küçük kaymalarla benzer piklerin varlığı, sentezlenen AgNP' lerin yeşil sentez için kullanılan ekstraktlardan kaynaklanan doğal bileşikler içerdiğini ortaya koymaktadır (Heydari and Rashidipour 2015).



Şekil 3. Kitosan (yeşil), propolis (mavi), gümüş nitrat (kırmızı) ve KP@AgNP (siyah) FT-IR Spektrumu

Kp@Ag Nanopartiküllerinin Sitotoksitesi

Kitosan ve propolis ile biyosentezlenen gümüş nanopartiküllerin in vitro sitotoksitesi PC-3 hücre hattında değerlendirilmiştir. Hücre canlılığı XTT metabolik aktivite deneyi kullanılarak belirlenmiştir. Çalışmanın prensibi temel olarak bölünmeye, çoğalmaya uğrayan hücrelerin artan dehidrojenaz enzim aktivitesi ile XTT'nin sarı renginin mor renge dönmesi sonucu

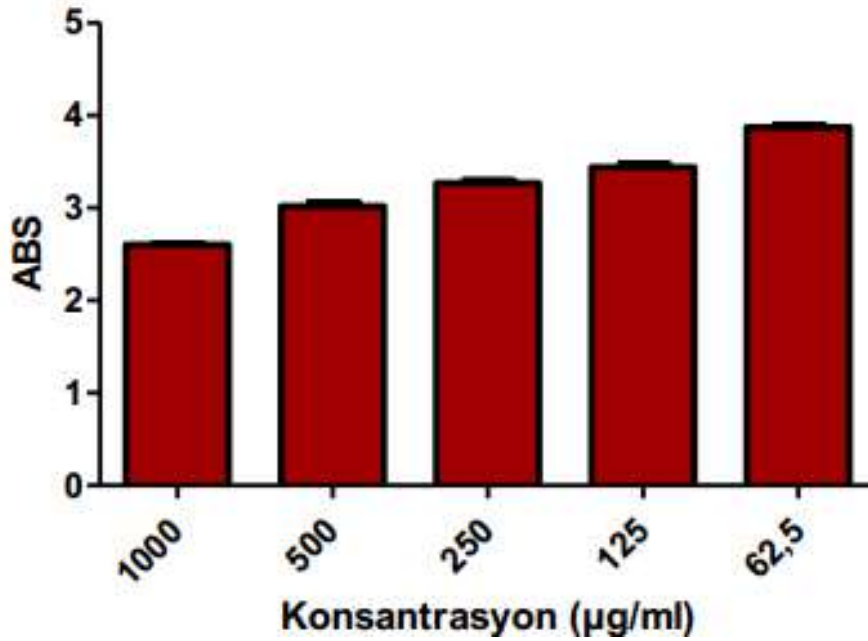


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görülen renk değişiminin absorbans olarak spektrofotometre ile ölçülmesi esasına dayanmaktadır (Terzioğlu vd. 2013).

Prostat kanseri (PC-3) hücrelerine farklı konsantrasyonlarda (6,25-1000 $\mu\text{g/ml}$) KP@AgNP'nin muamelesi sonucu görülen sitotoksik etki Şekil 4'de gösterilmiştir. Sonuçlar PC-3 hücre hattında en çok hücre canlılığını engelleyen konsantrasyonun 1000 $\mu\text{g/ml}$ olduğu ancak genel itibarıyla 125 $\mu\text{g/ml}$ 'ye kadar KP@AgNP'lerinin sitotoksik etki gösterdiği tespit edilmiştir. Bu sonuç literatürde gümüş nanopartikülünün prostat kanserine etkisi ile ilgili yapılan çalışmalarla benzerlik göstermektedir (Rajathi et al. 2017; Satyanarayana and Subhashini Devi 2020). Martins vd. (2010) gümüşün sitotoksik etkisinin, gümüş atomlarının hücre içi proteinlerin fonksiyonel grupları ve nitrojen bazları ile aktif fizikokimyasal etkileşiminin bir sonucu olduğunu bildirmiştir. Gümüş nanoparçacıkların konsantrasyonundaki artışla yüzde toksisite artışı, biyosentezlenmiş gümüş nanopartiküllerin, belirli bir ölçüde antikanser ajanı olarak tıp alanında kullanım alanı bulabileceğini düşündürmektedir.



Şekil 4. KP@AgNP'lerin (PC-3) hücre canlılık grafiği

SONUÇ VE TARTIŞMA

Bilimsel çalışmalar ilerledikçe hızla yeni uygulama alanları ortaya çıkmaktadır, nanoteknoloji de bu alanlardan biridir. Dünyada son yıllarda nanopartiküllerin üretimi, kullanım alanları, antikanser, antioksidan ve antimikrobiyal özellikleri konusunda kapsamlı çalışmalar yapılmaktadır. Gümüş yüzyıllardır çeşitli şekillerde insanlığın kullanımında olan bir metal



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olmakla birlikte, nanoteknolojik gelişmelerle birlikte bitki özütleri kullanılarak gümüş nanopartiküllerin (AgNP) sentezlenmesi ve etkinlilerinin yeterince belirlenmesi ile yeni bir çıkır açılacağı düşünülmektedir. Çalışma kapsamında geniş kullanım alanları bulunan kitosan ve propolis kullanılarak, çevre dostu olan yeşil sentez ile gümüş nanopartiküller (AgNP) sentezlenmiştir.

Çalışmada AgNP'lerin sitotoksik etkisinin belirlenmesi için XXT hücre canlılık testi yapılmıştır. XTT testinde farklı konsantrasyonlarda (62.5-1000 µg/ml) KP@AgNP'ler kullanılmış ve gümüş nanopartiküller, prostat kanseri (PC-3) hücrelerinin canlılığını, doza bağlı bir şekilde azaltabildiği görülmüştür. Sonuç olarak çalışmamızda, sitotoksik etki gösteren KP@AgNP'lerin geliştirilerek antikanser çalışmalarında kullanılabilir hale getirilmesi hedeflenmiştir. Yani mevcut sentezlenmiş partikül boyutlarının ve ebatlarının değiştirilmesi yada içlerine etken maddelerin enkapsüle edilmesiyle kanser hücrelerinde uygulanması düşünülmektedir.



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KAYNAKÇA

Akkurt MD (2012) Kitin, Kitosan ve Diş Hekimliğindeki Kullanım Alanları: Kısa Derleme. (Chitin, Chitosan and Their Application Areas in Dentistry: Short Review). ADO Klinik Bilimler Dergisi 6(2): 1206-1211

Chauhan RPS, Gupta C, Prakash D (2012) Methodological advancements in green nanotechnology and their applications in biological synthesis of herbal nanoparticles. International Journal of Bioassays, 1(7): 6-10

Duran N, Marcato PD, De Conti R, Alves OL, Costa FTM, Brocchi M (2010) Potential use of silver nanoparticles on pathogenic bacteria, their toxicity and possible mechanism of action. J. Braz. Chem. Soc. 20(6): 949-959

Güney F, Yılmaz M (2013) Propolisin Kimyasal İçeriği ile Antibakteriyel, Antiviral, Antitümör, Antifungal ve Antioksidan Aktivitesi. Arıcılık Araştırma Dergisi, 25-28

Heydari R, Rashidipour M. (2015) Green synthesis of silver nanoparticles using extract of Oak fruit hull (jaft): synthesis and in vitro cytotoxic effect on MCF-7 cells. International Journal of Breast Cancer (7):846743

Martins D, Frungillo I, Anazzetti MC et al. (2010) Antitumoral activity of L-ascorbic acid-polyD, L-(lactide-co-glycolide) nanoparticles containing violacein. Int J Nanomed, 5: 77-85

Miller JC, Serrato R, Represas Cardenas JM, Kundahl G (2004) The Handbook of Nanotechnology, John Wiley & Sons, Inc., Hoboken, New Jersey

Navarro E, Piccapietra F, Wagner B, Marconi F, Kaegi R, Odzak N, Sigg L, Behra R (2008) Toxicity of silver nanoparticles to *Chlamydomonas reinhardtii*. Environ. Sci. Technol. 42: 8959-8964

Papatsoris AG, Papavassiliou AG (2001) Prostate Cancer: horizons in the development of novel anti-cancer strategies. Curr. Med. Chem. Anti-Canc. Agents 1: 47-70

Patrulea V, Ostafe V, Borchard G, Jordan O (2015) Chitosan as a starting material for wound healing applications. European Journal of Pharmaceutics and Biopharmaceutics, 97: 417-426

Pereira L, Mehboob F, et al. (2015) Metallic nanoparticles: microbial synthesis and unique properties for biotechnological applications, bioavailability and biotransformation. Critical Reviews in Biotechnology 35:1, 114-128



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Porte RT, Moreno DS, Striano MC, Munoz MM, Garcia-Ramos JV, Cortes SS, Koudoumas E (2002) Laser Ablation Studies of Deposited Silver Colloids Active in Sers. Laser. Chem. 20(1): 23-32

Rajathi K, Kannikaparameswari N, Suja S (2017) In vitro cytotoxicity testing of biosynthesised silver nanoparticle of andredera cordifolia in prostate cancer cells (PC-3). European Journal of Pharmaceutical and Medical Research (EJPMR) 4 (1): 401-407

Rao CNR, Müller A, Cheetham AK (2005) The Chemistry of Nanomaterials. Volume 1, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim

Satyanarayana B, Subhashini Devi P (2020) Callus Extract Mediated Green Synthesis of Silver Nanoparticles, Their Characterization and Cytotoxicity Evaluation Against MDA-MB-231 and PC-3 Cells. BioNanoScience 10:11–22

Sileikaite A, Prosycevas I, Puiso J, Juraitis A, Guobiene A (2006) Analysis of Silver Nanoparticles Produces by Chemical Reduction of Silver Salt Solution. ISSN 1392-1320 Materials Science (Medziagotyra) 12(4)

Terzioğlu G, Keskin AÜ, Yanikkaya Demirel G (2013) Hücre Proliferasyonu Ölçüm Yöntemleri ve Çeşitli Ticari Proliferasyon Kitlerinin Karşılaştırılması. Turkish Journal of Immunology 1(3): 74-89

Wang J, An C, Zhang M, Qin C, Ming X, Zhang Q (2012) Photochemical conversion of AgCl nanocubes to hybrid AgCl–Ag nanoparticles with high activity and long-term stability towards photocatalytic degradation of organic dyes. Canadian Journal of Chemistry 90(10)



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**DOĞAL ANTIOKSİDAN KAYNAĞI BİTKİLERİN FONKSİYONEL GIDA
BİLEŞENİ OLARAK KULLANIMI**

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ÖZET

Fonksiyonel gıdalar fikir olarak yetersiz doğal kaynak sorunlarını gidermek amacıyla üretilmiş olsalar bile günümüzde birçok hastalığı önlemek ve tedavi etmek amacıyla kullanılmaktadır. Literatürde kesinleşmiş bir fonksiyonel gıda tanımı olmamakla birlikte çeşitli otoriteler tarafından fonksiyonel gıdalar için farklı tanımlamalar yapılmıştır. Genel olarak fonksiyonel gıdalar ya gıda içerisinde az veya çok miktarda bir bileşenin bulunmasıyla ya da belirli bir bileşenin gıdaya katılması veya çıkarılmasıyla meydana gelmektedir. Fonksiyonel gıdalar içerdikleri biyoaktif bileşikler (diyetsel bileşenler, antioksidanlar, antimikrobiyaller, fitokimyasallar, probiyotik ve prebiyotikler vb.) ile vücudun savunma mekanizmasını güçlendirmekte ve hastalık riskini azaltmaktadırlar. Bu nedenle günümüzde fonksiyonel gıdalara olan ilgi gün geçtikçe artmaktadır. Son yıllarda en çok kullanılan fonksiyonel gıda bileşenleri antioksidanlardır ve gıdalardaki oksidasyonu inhibe eden doğal maddelerin kaynakları bitki esaslı bileşenlerdir. Bitkiler serbest radikal temizleme özellikleri sayesinde antioksidan savunma sistemlerini düzenleyerek, serbest radikallerin neden olduğu zararlı etkileri önlemektedir. Bitkilerde bulunan polifenoller ve fenolik bileşiklerin en aktif antioksidanlar olduğu birçok çalışma ile tespit edilmiştir. Bu fenolik bileşikler gıdalar yoluyla alınmakta ve organizmada güçlü antioksidan madde olarak rol almaktadırlar. Bu nedenle fenolik bileşikler, doğal ürün formülasyonlarında yer alarak fonksiyonel gıda geliştirmede yaygın olarak kullanılmaktadır. Antioksidan özelliklerinin yanında sahip oldukları birçok özellik sayesinde bitkiler gıda sanayiinde geniş bir kullanım alanı bulmaktadır. Bu bitkilerin kullanım alanları başta baharatlar olmak üzere, bitkisel çay, gıda takviyesi ve gıda katkı maddesi olarak kullanımıdır. Bu derlemede doğal antioksidan kaynağı olarak bilinen bitkilerin, fonksiyonel gıda üretiminde kullanımı ile ilgili yapılan çalışmalara yer verilmiştir. İncelenen çalışmalarda doğada bulunan birçok bitkinin doğal bir antioksidan özelliğe sahip olduğu ve gıdalarda sentetik antioksidanlara alternatif olarak kullanılabileceği tespit edilmiştir.

Anahtar Kelimeler: Tıbbi ve aromatik bitkiler, doğal antioksidanlar, fonksiyonel gıdalar



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**USE OF NATURAL ANTIOXIDANT SOURCE PLANTS AS FUNCTIONAL FOOD
COMPONENT**

ABSTRACT

Even though functional foods were produced to eliminate insufficient natural resource problems, they are used to prevent and treat many diseases today. Although there is no definite functional food definition in the literature, different definitions for functional foods have been made by various authorities. In general, functional foods are formed either by the presence of a small or large amount of a component in the food, or by adding or removing a certain component from the food. Functional foods strengthen the body's defense mechanism and reduce the risk of disease with the bioactive compounds (dietary components, antioxidants, antimicrobials, phytochemicals, probiotics and prebiotics, etc.) they contain. Therefore, the interest in functional foods is increasing day by day. In recent years, the most used functional food ingredients are antioxidants and the sources of natural substances that inhibit oxidation in foods are plant-based ingredients. Thanks to their free radical scavenging properties, plants regulate their antioxidant defense systems and prevent the harmful effects caused by free radicals. It has been determined by many studies that polyphenols and phenolic compounds in plants are the most active antioxidants. These phenolic compounds are taken through foods and act as strong antioxidants in the organism. Therefore, phenolic compounds are widely used in functional food development by taking place in natural product formulations. In addition to their antioxidant properties, plants find a wide area of use in the food industry, thanks to their many properties. The usage areas of these plants are as spices, herbal tea, food supplement and food additive. In this review, studies on the use of plants known as natural antioxidant sources in functional food production are included. In the studies examined, it has been determined that many plants found in nature have a natural antioxidant feature and can be used as an alternative to synthetic antioxidants in foods

Keywords: Medicinal and aromatic plants, natural antioxidants, functional foods



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GİRİŞ

Fonksiyonel gıda fikri ilk olarak yetersiz doğal kaynak sorunlarını gidermek için 1984 yılında Japonya’da “FOSHU” (Foods For Specified Health Use) terimiyle ortaya atılmıştır. Günümüzde ise fonksiyonel gıdalar daha çok hastalıkları önlemek veya tedavi etmek amacıyla kullanılmaktadır (Martirosyan and Singh 2015; Soylu 2019). Gıda mühendisliği, sağlık bilimi gibi disiplinler arası çalışmalar ile geliştiren fonksiyonel gıdalar daha net bir ifadeyle; doğal, vitamin ve mineral gibi maddeler içeren, günlük tüketime uygun, sağlığa yararlı bir besin ögesi olarak tanımlanabilir (Pelvan 2009). Ülkemizde ise fonksiyonel gıdaların tanımı 5179 sayılı kanunumuza göre; “Besleyici etkilerinin yanında bilimsel ve klinik çalışmalar ile ispat edilen aynı zamanda bir veya birden çok etkili bileşene bağlı olarak sağlığı koruyan, düzelten ya da hastalık riskini azaltabilen etkiye sahip olan gıdalar” olarak yapılmıştır (Taş 2012). Genel olarak fonksiyonel bir gıda tanımlaması için iki farklı durum bulunmaktadır. Bunlardan biri gıda içerisinde az veya çok miktarda bir bileşenin bulunmasıyla gıdanın fonksiyonellik kazanması iken, bir diğeri ise belirli bir bileşenin gıdaya katılması veya çıkarılmasıyla gıdanın fonksiyonellik kazanmasıdır. İlk sınıftaki gıdalar daha çok doğal ürünler iken, diğer sınıftaki gıdalar belirli tasarım ile oluşturulmuş gıdalardır (Remarckle and Reusens 2004). Bu durumdan yola çıkılarak fonksiyonel gıdalar; takviye edilmiş, zenginleştirilmiş, değiştirilmiş ve güçlendirilmiş gıdalar olarak sınıflandırılmaktadır (Bigliardi and Galati 2013). İçerisinde doğal olarak antioksidan bileşen bulunduran gıdaların yanı sıra, gıda içerisine sonradan doğal antioksidan madde eklenen gıdalar son zamanlarda fonksiyonel gıda oldukça ilgi çekmektedir.

Fonksiyonel Gıda Bileşeni: Antioksidanlar

Gelişen teknoloji ile birlikte organizma çevre kirliliği, UV ışınlar, sigara gibi birçok toksik madde ile etkilenmektedir ve bu etkiler kendini vücutta serbest radikal oluşumuyla göstermektedir. Serbest radikaller yok edilmezlerse vücutta ciddi hasarlara neden olmakla birlikte serbest radikallerin vücutta etkilerini önleyen bileşiklere antioksidan adı verilmektedir. Antioksidanların endojen (doğal) kaynaklı veya eksojen (doğal olmayanlar) kaynaklı olabilirler. Endojen kaynaklı antioksidanlar ise enzim (SOD, GST, CAT) ve enzim olmayanlar (miyogloblin, hemoglobin) olmak üzere iki gruba ayrılabilirler. Eksojen antioksidanlar ise vitaminler (A,C,E), ilaçlar (NADPH, Trolox-C) veya gıdalar (BHA, BHT, TBHQ) aracılığıyla dışarıdan alınabilirler (Dawn et al. 1996; Akkuş 1995; Tietz 1995; Burtis and Aswood 1999; Kurt 2008).



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Son yıllarda en çok tercih edilen fonksiyonel gıda bileşenlerinin antioksidanlar olduğu görülmektedir. Antioksidanlar, Amerikan Gıda ve İlaç İdaresi (FDA) tarafından “Oksidasyonun sebep olduğu bozulma, ransidite veya renk bozulmalarını geciktirerek gıdaları korumak için kullanılan maddelerdir” şeklinde tanımlanmıştır (Nanditha and Prabhasankar 2009). Gıdalardaki oksidasyonu inhibe eden doğal maddelerin orijinleri bitki esaslı bileşenlerdir. Bunlar kimyasal değişimler sonucunda üretilir veya gıda olmayan bileşenlerden ekstrakte edilmektedirler. En aktif antioksidanların fenolik bileşikler ve polifenoller olduğu bilinmektedir (Papas 1999). Bu nedenle gıdalarda bulunan fenolik bileşikler, doğal ürün formülasyonlarında yer almakta ve fonksiyonel gıda geliştirmede yaygın olarak kullanılmaktadır. Bu bileşiklerin, antioksidan etkileri ile kan kolesterol düzeyini düzenlediği, osteoporoz ve kanseri önlemede etkili olduğu birçok çalışmada tespit edilmiştir (Coşkun 2005; Mehenktaş ve Bayaz 2004; Savcıgil 2003).

Günümüzde fonksiyonel gıda tercihinin gün geçtikçe artmasının nedeni; tüketicilerin daha kaliteli yaşama, yaşlanma belirtilerini azaltma ya da hastalıkların önüne geçerek, yüksek sağlık hizmet maliyetlerini azaltma isteğinden kaynaklanmaktadır (Soylu 2019). Fonksiyonel gıdalar içerdikleri diyetel antioksidanlar, fitokimyasallar, diğer biyoaktif bileşikler, probiyotik mikroorganizmalar ve prebiyotik maddeler ile vücudun savunma mekanizmasını güçlendirmekte ve hastalık riskini azaltmaktadırlar (Erbaş 2006).

Doğal Antioksidan Kaynağı: Bitkiler

Tıp biliminin kurucusu olarak bilinen Hipokrat: “Besinler ilacınız, ilacınız besinler olsun.” sözüyle gıda ile sağlık arasındaki ilişkiye dikkat çekmektedir. Bu nedenledir ki Anadolu kültüründe gıdalar ve bitkiler fonksiyonel özelliklerinden yararlanılarak tedavi amacıyla yüzyıllardır kullanılmaktadır (Büken 2003). Dünya genelinde 422.000 bitki türü olduğu tahmin edilmekle birlikte, bu bitki türlerinden 50.000 ile 80.000 arasında ki aromatik özeliğe sahip bitkilerin tıbbi amaçlı kullanıldığı bilinmektedir (Marinelli 2005; Duke 2009). Aromatik bitkiler doğal antioksidanların en önemli kaynağını oluşturmaktadır ve bu bitkilerin ekstraktları depolama sırasında yağ oksidasyonu seviyesini düşürme ve hızını yavaşlatma özelliğine sahiptir (Tsimogiannis et al. 2006). Antioksidan özelliğinin yanı sıra antimikrobiyal aktiviteye de sahip olabilen bu aromatik bitkilerin, soğuk algınlığından kansere kadar çeşitli hastalıkların tedavisinde kullanıldığı saptanmıştır (Liang et al. 2009; Öztürk vd. 2010). Tıbbi ve aromatik bitkilerin sahip olduğu birçok özellik gıda sanayiinde de geniş bir kullanım alanı bulmasına



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neden olmuştur. Bu bitkilerin kullanım alanları başta baharatlar olmak üzere, bitkisel çay, gıda takviyesi ve katkı maddesi olarak kullanımındır (Toker vd. 2020).

Son yıllarda doğal antioksidanlar, güvenilir olması ve istenmeyen yan etkileri olmaması sebebiyle sentetik antioksidanlara göre daha fazla tercih edilmektedir (Tozoğlu 2011; Pellegrini et al. 2009). Bu nedenle doğal antioksidan kaynağı olarak bilinen bitkilerin fonksiyonel gıda üretiminde kullanımı ile ilgili birçok çalışma yapılmıştır. Yapılan bu çalışmalardan bazıları aşağıda başlıklar halinde verilmiştir.

Et Ürünlerinde Bitki Uygulamaları

Yağ oranı oldukça yüksek olan et ürünleri için raf ömrü önemli bir konudur ve et ürünlerinin raf ömrü içerdikleri yağın stabilitesine bağlı olarak değişmektedir. Et ürünlerinde meydana gelen lipid oksidasyonu besinsel kayıplara neden olmasının yanı sıra tat, koku ve lezzet bozulmaları gibi değişimlere de neden olmakta ve kanser gibi hastalıklara yol açmaktadır. Bu nedenle et ürünlerinde söz konusu istenmeyen değişimlerin meydana gelmesini önlemek ve insan sağlığını korumak amacıyla çeşitli sentetik antioksidanlar veya bitki ekstraktları kullanılmaktadır. Bununla birlikte deney hayvanları üzerinde yapılan çalışmalar sonucunda yapay antioksidanların toksikolojik ve kanserojenik etkileri tespit edildiğinden, gıdalarda kullanımı sınırlandırılmıştır (Lorenzo et al. 2007). Son zamanlarda doğal antioksidanların et ürünlerinde kullanımına yönelik araştırmalara ilgi artmakta ve bu tür ürünler tüketici tarafından da tercih edilir hale gelmektedir.

Bitkilerden elde edilen antioksidanlarla ilgili çalışmaların çoğu biberiye ekstraktı üzerinde yoğunlaşmaktadır (Botsoglu et al. 2007; Pszczola 2001). Biberiye güçlü antioksidan aktiviteye sahip olup, BHA ve BHT gibi sentetik antioksidanlarla kıyaslandığında, doğal bir antioksidan kaynağı olarak öne çıkmaktadır (Tewari and Virmani 1987; Banyai et al. 2003). Biberiye ekstraktları lipid oksidasyonunu engellemesi, duyuşal olarak iyi algılanması nedeniyle birçok çalışmada gıda formülasyonuna ilave edilmiştir. Barbut et al. (1985) hindi etine 20 ppm; Stoick et al. (1991) sığır bifteklerine 500-1000 ppm; Sanchez-Escalante et al. (2001) köftelere 1000 ppm biberiye ile 500 ppm C vitamini kombinasyonunu ilave etmişlerdir. Çalışmalarda biberiye ekstraktlarının hidropersit oluşumunu inhibe ettiği belirtilmektedir.

Biberiye'ye ek olarak kekik, adaçayı ve defne gibi çeşitli bitkilerden izole edilen doğal fenolik antioksidanların işlenmiş gıdaların tazeliğini korumada ve kanser önlemede önemli bir potansiyele sahip olduğu da tespit edilmiştir (Ho 2008). Bir başka çalışmada ise adaçayı, kekik ve zencefilin kavurmanın lipid oksidasyonu üzerine oldukça etkili antioksidanlar olduğu ifade



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edilmiştir (Kayaardı vd. 2005). Çeşitli bitki ekstralarının et ürünlerinde antioksidan olarak kullanımı ile ilgili çalışmalar Tablo 1’de verilmiştir.

Tablo 1. Et ürünlerinde kullanılan bitkisel katkıların oksidasyon özellikleri üzerine etkileri

Örnek	Etkisi İncelenen Bitkiler	Elde Edilen Bulgular	Referans
Dana köftesi	Isırgan otu ekstraktı ve E vitamini (250 ppm ve 500 ppm)	250 ppm ısırgan otu ekstraktı eklenen örnek grubunda lipit oksidasyonu diğer örnek gruplarından daha düşük düzeyde saptanmıştır.	Öz 2014
Köfte	Beyaz şakayık, kırmızı şakayık, sappanwood (kırmızı veya sarı boya veren bir ağaç), moutan şakayığı, biberiye ve melekotu bitkilerinin ekstraktları (% 0,25)	Çiğ veya pişirilmiş köftelerde depolama boyunca oksidasyonun minimum seviyede olduğu belirlenmiştir.	Han and Rhee 2005
Sucuk	Yeşil çay	Yüksek polifenol içeren yeşil çayın antioksidan olarak ilave edildiği sucukta oluşan oksidasyon (0,40 mg/kg) miktarının sentetik antioksidan eklenmiş sucuktaki oksidasyon (0,95 mg/kg) miktarına göre daha düşük olduğu bildirilmektedir.	Bozkurt 2006
Tavuk kıyması	Aloe vera, yeşil çay ve amla ekstraktları (% 0,25)	Örneklerin toplam antioksidan ve radikal süpürücü aktivitelerinin BHT kadar yüksek olduğu belirtilmiştir.	Kumar and Langoo 2016
Kolyoz burgeri	Kekik, defne, adaçayı ve yeşil çay ekstraktları (% 0,3 ve % 0,6)	Kontrol grubunun 7. ayda, kekik ve yeşil çay gruplarının 9. ayda, adaçayı ve defne gruplarının ise 8. ayda tüketilemez özellikte olduğu belirtilmiştir. Adaçayı hariç kekik, yeşil çay ve defne özütleri lipit oksidasyonunu azaltmıştır.	Ozogul ve Uçar 2013

Hububat Ürünlerinde Bitki Uygulamaları

Hububat ürünlerinde fonksiyonel özelliğe sahip bileşenler kullanılarak, bu gıdaların tüketimi ile insan sağlığına faydalı olan bileşenlerin de vücuda alınmasını sağlar. Unlu mamullerde en yaygın olarak kullanılan fonksiyonel bileşenler besinsel lifler olmakla birlikte, son yıllarda antimikrobiyal ve antioksidan özelliğe sahip doğal bileşenler de kullanılmaya başlanmıştır (Meral ve Doğan 2009).

Son yıllarda özellikle fonksiyonel ekmek üretimi üzerine yapılmış çalışmaların sayısı artmıştır. Biberiye özleriyle zenginleştirilmiş tam buğday ekmeğinde raf ömrü (Jensen et al. 2011), keten tohumu ununun ekmeğin fiziko-kimyasal ve duyuşal özelliklerine etkisi (Marpalle et al. 2014), kinoa yaprağı tozu ile zenginleştirilmiş ekmek (Gawlik-Dziki et al. 2015), karabuğday ile zenginleştirilmiş antihiperlipidemik etkili ekmek üretimi, (Stokić et al. 2016), fermente edilmiş öğütme yan ürünleri kullanılarak düşük glisemik indeksli ekmek geliştirme, (Pontonio et al. 2017), zenginleştirilmiş glutensiz ekmek üretimi, (Mert 2013; Marti et al. 2017; Conte et al.



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2018) üzerine yapılmış güncel araştırmalar mevcuttur. Farkı bitki ekstralarının hububat ürünlerinde antioksidan olarak kullanımı ile ilgili çalışmalar Tablo 2’de verilmiştir.

Tablo 2. Hububat ürünlerinde kullanılan bitkisel katkıların oksidasyon özellikleri üzerine etkileri

Örnek	Etkisi İncelenen Bitkiler	Elde Edilen Bulgular	Referans
Ekmek	Karadut (% 1, % 2 ve % 3)	Karadut ekmeğe ilave edildiği en düşük seviyede (% 1) bile serbest radikallerin inhibisyonunu sağlayarak ekmeğin fonksiyonelliğini arttırdığı bildirilmektedir.	Meral ve Doğan 2012
Bisküvi	Uşkun bitkisi (% 0,5 % 1 ve % 2)	Uşkun bitkisinin, bisküvilerin toplam fenolik madde miktarını arttırdığı ve serbest radikallerin inhibisyonunu sağlayarak bisküvilere fonksiyonellik kazandırdığı belirlenmiştir.	Doğan ve Meral 2016
Ekmek	Sarı haşhaş, mavi haşhaş, çörekotu, keten, kişniş, mahlep, tarçın ve zerdeçal	Ekmek yapımında özellikle tarçının toplam fenolik madde içeriğine katkısı oldukça fazla bulunmuştur. Bunun aksine, ekmeklerde mavi haşhaş toplam fenolik madde içeriğinde azalmaya neden olmuştur.	Arslan Burnaz vd. 2018
Bisküvi	Vanilya çekirdeği ekstraktı ve yapan vanilinin (200 ppm)	Vanilya ekstraktının radikal tutucu aktivitesi % 70; yapay vanilinin kullanıldığı bisküvilerde ise % 43 olarak ve kontrol grubundan daha yüksek olduğu belirlenmiştir.	Anuradha et al. 2010

Süt Ürünlerinde Bitki Uygulamaları

Oksidasyona duyarlı olan lipit içeriği yüksek ürünler arasında süt, süt tozu, peynir ve tereyağı gibi süt ürünleri de yer almaktadır. Bu ürünlerde biberiye, askorbik asit gibi doğal antioksidan kullanımıyla hem ürünlerin raf ömrü artırılabilir hem de duyusal kaliteleri geliştirilebilir (Baladura ve Şimsek 2013). Uzun yıllardır dana, tavuk ve balık gibi et ürünlerinin muhafaza edilmesinde bitki ekstraktları kullanılmasına rağmen süt ürünlerindeki kullanımı ise sınırlıdır. Bunun yanı sıra sütün kendisinin de iyi bir antioksidan kaynağı olduğu da bilinmektedir (Ahn et al. 2002; Almeida-Doria and Regitano-Darce 2000). Süt ürünlerinde bitkilerin kullanımı ile ilgili yapılan çalışmalarda bitkinin kendisi, yağı/esansiyel yağı veya ekstrakt formu kullanılmıştır. Böylelikle ürünlere antimikrobiyal etki kazandırılıp, antioksidan kapasitelerinin de artırıldığı saptanmıştır (El-Nawawy et al. 1998). Farkı bitki ekstralarının süt ürünlerinde antioksidan olarak kullanımı ile ilgili çalışmalar Tablo 3’de verilmiştir.



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Tablo 3. Süt ürünlerinde kullanılan bitkisel katkıların oksidasyon özellikleri üzerine etkileri

Örnek	Etkisi İncelenen Bitkiler	Elde Edilen Bulgular	Referans
Süt Ürünleri	19 ticari meyve preparatı	% 13 oranındaki yaban mersini ve frenk üzümü ekstraktları karışımların antioksidan kapasiteleri normal değerlere göre 5 kat artırmıştır.	Skrede et al. 2004
Tereyağı	Hint fesleğeni yapraklarının tozu	% 0,6 oranında tereyağına ilave edilmesiyle 80° C'de 8 günlük bir depolama periyodunda BHA'nın otooksidasyonu engellenmiştir.	Merai et al. 2003
Tereyağı	Biberiyenin etanolik ekstraktı	Biberiye ekstraktı metal şelatları oluşturarak oksidasyonu engellemiştir.	Zegarska et al. 1996

SONUÇ VE ÖNERİLER

Günümüzde antioksidanların gıda sanayiinde kullanımı oldukça yaygınlaşmıştır ve hemen hemen üretilen her gıdaya antioksidan maddeler katılmaktadır. Gıda işletmelerinde antioksidanlar; yağ içeren ürünlerin üretimi, depolanması, taşınması ve pazarlanması sırasında meydana gelen oksidasyondan kaynaklanan zararları önleme nedeniyle gıdalara katkı maddesi olarak ilave edilmektedir (Sökmen vd. 2004). Gıda sanayisinde yaygın olarak sentetik antioksidan olan BHT (bütillenmiş hidroksi tolüen) ve BHA (bütillenmiş hidroksi anisol) kullanılmaktadır. Bu bileşiklerin toksik olabileceği nedeniyle son yıllarda yeni, daha güvenli ve ucuz antioksidan maddelerin bulunması için doğal ürünler üzerinde yaygın çalışmalar yapılmaktadır (Dawn et al. 1996; Akkuş 1995; Tietz 1995; Burtis and Aswood 1999).

Antioksidanlar gıdaları lipid oksidasyonuna karşı korumasının yanında, insan sağlığını tehdit eden serbest radikallerin neden olabileceği tüm rahatsızlıklara karşı vücudun korunabilmesi için önemli bir yer teşkil etmektedir. Bu nedenle antioksidanların ilaç olarak alınmasından ziyade doğal olarak alınması önerilmektedir. Bitkilerden elde edilen doğal bileşenler sentetik antioksidanlar yerine kullanılmakta olup, günümüzde bu tür çalışmalar fonksiyonel gıdalar tabiri ile gelişen bir alanı ifade etmektedir (Sökmen vd. 2004).

Son yıllarda baharat ve aromatik bitkilerin antioksidan özelliklerinden dolayı gıdalarda koruyucu ajan olarak kullanımı yaygınlaşmıştır. Antioksidan özellikler bitkilerin içerdikleri vitaminler, flavonoidler, terpenoidler, karotenoidler, kumarinler, kurkuminler gibi



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fitokimyasallardan kaynaklanmaktadır (Calucci et al. 2003). Endüstriyel uygulamalarda kullanılmak üzere; meyve, sebze, aromatik bitki ve özellikle çeşitli baharatların tohum, meyve, yaprak, kök, kabuk gibi kısımları kullanılarak antioksidan zengin ekstraktlar tanımlamak üzere yapılmış çok sayıda çalışma bulunmaktadır (Karpinska et al. 2001; Tepe vd. 2006). Bitki veya bitkisel bileşenlerin et, hububat ve süt ürünlerinde doğal bir antioksidan olarak kullanımıyla ilgili yapılan çalışmalar ayrıntılı olarak incelenmiştir. Baharat ve aromatik bitkilerin antioksidan özelliklerinden dolayı endüstride ve bilimsel araştırmalarda çok fazla ilgi gördüğü tespit edilmiştir. Bununla birlikte doğal antioksidan kaynağı olarak bilinen birçok bitkinin (*Alchemilla*, *Plantago* vb.) gıdalarda kullanımıyla ilgili çalışmalara rastlanılmamıştır. Bu gibi bitkilerin gıdalarda kullanımı gelecek çalışmalar için önemli bir alanı işaret etmektedir.

TEŞEKKÜR

Bu derleme YÖK 100/2000 doktora bursu, yenilikçi gıda işleme teknolojileri ve gıda biyoteknolojisi tematik alanı kapsamında hazırlanmıştır.



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KAYNAKÇA

Ahn J, Grun IU, Fernando LN (2002) Antioxidant properties of natural plant extract containing polyphenolic compounds in cooked ground beef. *Journal of Food Science*, 67(4): 1364-1369

Akkuş İ (1995) Serbest Radikaller ve Fizyopatolojik Etkileri. Mimoza Yayınları, Konya

Almeida-Doria RF, Regitano-Darce AB (2000) Antioxidant level of rosemary and oregano ethanol extracts in soybean oil under thermal oxidation. *Cienciae Tecnologia de Alimentos*, 20(2): 100-102

Anuradha K, Naiudu MM, Manohar RS, Indiramma AR (2010) Effect of vanilla extract on radical scavenging activity in biscuits. *Flavour Fragr. J.*, 25(6): 488-492

Arslan Burnaz N, Hendek Ertop M, Karataş ŞM (2018) Tıbbi ve Aromatik Bitkilerin Kullanımı ile Ekmeğin Fenolik Madde İçeriğinin Zenginleştirilmesi. *GIDA*, 43 (2): 240-249

Baladura E, Şimsek B (2013) Doğal Antioksidanlar ve Süt ve Süt Ürünlerinde Kullanımı. *U.Ü. Ziraat Fakültesi Dergisi*, 27(2): 155-162

Banyai ES, Tulok MH, Hgedüs A, Renner C, Vargai S (2003) Antioxidant effect of various rosemary (*Rosmarium officinalis* L.) clones. *Acta Biologica Szegediensis*, 47(1-4): 111-113

Barbut S, Josephson DB, Maurer AJ (1985) Antioxidant properties of rosemary oleoresin in turkey sausage. *Journal of Food Science*, 50, 1356-1359, 1363

Bigliardi B, Galati F (2013) Innovation trends in the food industry: The case of functional foods. *Trends in Food Science & Technology*, 118-129

Botsoglu NA, Govaris A, Giannenas I, Papageorgiou G (2007) The incorporation of dehydrated rosemary leaves in the rations of turkeys and their impact on the oxidative stability of the produced raw and cooked meat. *International Journal of Food Sciences and Nutrition*, 58, 312-320

Bozkurt H (2006) Utilization of natural antioxidants: Green tea extract and *Thymbra spicata* oil in Turkish dry-fermented sausage. *Meat Science*, 73(3): 442-450

Burtis CA, Ashwood ER (1999) Tietz Textbook of Clinical Chemistry. W.B. Saunders Company, Philadelphia, Pennsylvania.

Büken NÖ (2003) Folklorik Değerler ve Folklorik Tıp. *Türkiye Klinikleri Journal of Medical Ethics*, 11, 45-47



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Calucci L, Pinzino C, Zandomenighi M, Capocchi A, Ghiringhelli S, Saviozzi F, Tozzi S, Galleschi L (2003) Effects of irradiation on the free radical and antioxidant contents in nine aromatic herbs and spices. *J. Agric. Food Chem.*, 51; 927-934

Conte P, Del Caro A, Balestra F, Piga A, Fadda C (2018) Bee Pollen as a functional ingredient in gluten-free bread: A physical-chemical, technological and sensory approach. *LWT-Food Sci Tech*, 90: 1-7

Coşkun T (2005) Fonksiyonel Besinlerin Sağlığımız Üzerine Etkileri. *Çocuk Sağlığı ve Hastalıkları Dergisi*. 48: 69-84

Dawn BM, Allan DM, Colleen MS (1996) *Basic Medical Biochemistry a Clinical Approach*. Lippincott Williams & Wilkins, Baltimore, Maryland

Doğan H, Meral R (2016). Uşkun Bitkisinin Bisküvi Üretiminde Fonksiyonel Bileşen Olarak Kullanımı. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 6(4): 91-99

Duke JA (2009) *Duke's Handbook of Medicinal Plants of Latin America*. CRC Press, Taylor & Francis Group. Boca Raton, FL

El-Nawawy MA, El-Kenany YM, El-Ghaffar EA (1998) Effect of Some Herb Plants on the Use of Yoghurt Culture. *Annals of agriculture Sci*, 7th. Conf. Agric. Dev. Res. Fac. Agric. 15-17 December, Ain Shams University of Cairo, Egypt, 103-109

Erbaş M (2006) Yeni Bir Gıda Grubu Olarak Fonksiyonel Gıdalar. *Türkiye 9. Gıda Kongresi*, Akdeniz Üniversitesi, Gıda Mühendisliği Bölümü, Antalya, 791-794

Gawlik-Dziki U, Dziki D, Świeca M, Sęczyk Ł, Różyło R, Szymanowska U (2015) Bread enriched with *Chenopodium quinoa* leaves powder–The procedures for assessing the fortification efficiency. *LWT-Food Sci Tech*, 62(2): 1226-1234

Han J, Rhee KS (2005) Antioxidant properties of selected Oriental non-culinary/nutraceutical herb extracts as evaluated in raw and cooked meat. *Meat Science*, 70, 25-33

Ho J (2008) Singapore Country Report. A Regional Review on the Economics of Climate Change in Southeast Asia, Report submitted for RETA 6427

Jensen S, Ostdal H, Skibsted LH, Thybo AK (2011) Antioxidants and shelf life of whole wheat bread. *J Cereal Science*, 53(3): 291-297

Karpinska M, Borowski J, Danowska-Oziewicz M (2001) The use of natural antioxidants in ready-to-serve food. *Food Chemistry*, 72, 5-9

Kayaardı S, Durak F, Kayacier A, Kayaardı M (2005) Chemical characteristics of kavrma with selected condiments. *International Journal of Food Properties*, 8 (3): 513-520



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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Kumar Y, Langoo BA (2016) Effects of Aloe, green tea, and amla extracts on microbiological and oxidative parameters of refrigerated raw meat batter. *Agricultural Research*, 5(1): 81-88

Kurt N (2008) Yaşa Bağlı Olarak Antioksidan Enzimlerinin Süperoksit Dismutaz (Sod), Katalaz (Cat) Aktivitelerinin ve Malondialdehit (Mda) Seviyesinin İncelenmesi. Yüksek Lisans Tezi, Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Kimya Anabilim Dalı, Adana

Liang C, Mcclean MD, Marsit C, Christensen B, Peters E, Nelson HH, Kelsey KT (2009) A population-based case-control study of marijuana use and head and neck squamous cell carcinoma. *Cancer Prevention Research*, 2:759-768

Lorenzo JM, Martínez S, Franco I, Carballo J, (2007) Biogenic amine content during the manufacture of dry-cured lomo, a Spanish traditional meat product: Effect of some additives. *Meat Science*, 77: 287-293

Marinelli J (2005) *Plant: the ultimate visual reference to plants and flowers of the world*. New York: DK Publ

Marpalle P, Sonawane SK, Arya SS (2014). Effect of flaxseed flour addition on physicochemical and sensory properties of functional bread. *LWT-Food Sci Tech*, 58(2): 614-619

Marti A, Marengo M, Bonomi F, Casiraghi MC, Franzetti L, Pagani MA, Iametti S (2017) Molecular features of fermented teff flour relate to its suitability for the production of enriched gluten-free bread. *LWT-Food Sci Tech*, 78: 296-302

Martirosyan DM, Singh J (2015) A new definition of functional food by FFC. *Functional Foods in Health and Disease*, 5(6): 209-223

Mehenktas C, Bayaz M (2004) Fonksiyonel gıdalar: Önemi ve üretiminde kullanılan teknikler. *GIDA*, 29(5): 367-71

Meraı M, Boghra VR, Sharma RS (2003) Extraction of antioxygenic principles from Tulsi leaves and their effects on oxidative stability of ghee. *Journal of Food Science and Technology*, 40, 52-57

Meral R, Doğan İS (2009) Fonksiyonel öneme sahip doğal bileşenlerin unlu mamullerin üretiminde kullanımı. *GIDA* 34(3): 193-198

Meral R, Doğan İS (2012) Karadut (*Morus nigra*) Katkılı Ekmeğin Antioksidan Aktivitesi ve Fenolik Kompozisyonu. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 2(4): 43-48



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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Mert İD (2013) Development of Gluten Free Bread Formulation of Baking in Infrared-Microwave Combination Oven. Doktora Tezi, Orta Doğu Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Gıda Mühendisliği Anabilim Dalı, Ankara, 425

Nanditha B, Prabhasankar P (2009) Antioxidants in bakery products: A Review. Critical Reviews in Food Science and Nutrition, 49: 1-27

Oz F (2014) Effects of water extract of *Urtica dioica* L. on the quality of meatballs. Journal of food processing and preservation, 38(3): 1356-1363

Öztürk M, Altundağ E, Gücel S (2010) Medicinal and Aromatic Plants (Turkey). Ethnopharmacology, 1-11

Papas AM (1999) Antioxidant status, diet, nutrition and health. Boca Raton (CRC Press), 672

Pellegrini N, Miglio C, Del Rio D, et al. (2009) Effect of domestic cooking methods on the total antioxidant capacity of vegetables. International Journal of Food Sciences and Nutrition, 60 (Suppl 2): 12-22

Pelvan E (2009) Günümüz ve Geleceğin Gıdaları Fonksiyonel Gıdalar. Bilim ve Teknik, 26-29

Pontonio E, Lorusso A, Gobbetti M, Rizzello CG (2017) Use of fermented milling by-products as functional ingredient to develop a low-glycaemic index bread. J Cereal Sci, 77: 235-242

Remarckle C, Reusens B (2004) Functional Foods Ageing and Degenerative Disease. Woodhead Publishing Limited

Sanchez-Escalante A, Djenane D, Torrescano G, Gimenez B, Beltran JA, Roncales P (2001) The effects of ascorbic acid, taurine, carnosine and rosemary powder on colour and lipid stability of beef patties packaged in modified atmosphere. Meat Science, 58(4): 421-429

Savcigil Ü (2003) Fonksiyonel Besinler. Süt Endüstrisinde Yeni Eğilimler Sempozyumu, 11-18, 22-23 Mayıs, İzmir

Skrede G, Bryhn Larsen V, Aaby K, Skivik Jorgensen A, Birkeland SE (2004) Antioxidative properties of commercial fruit preparations and stability of bilberry and black currant extracts in milk products. Journal of Food Science, 69, 351-356



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and RURAL DEVELOPMENT
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Soylu P (2019) Bal, Propolis, Arı Sütü, Civanperçemi (*Achillea millefolium*) ve Ekinezya (*Echinacea paradoxa*) Otları Karışımından Fonksiyonel Gıda Üretimi, Fizikokimyasal, Biyokimyasal ve Antimikrobiyal Özelliklerinin İncelenmesi. Yüksek Lisans Tezi, Gümüşhane Üniversitesi, Fen Bilimleri Enstitüsü, Gıda Mühendisliği Anabilim Dalı, Gümüşhane

Sökmen A, Sökmen M, Daferera D, Polissiou M, Candan F, Ünlü M, Akpulat HA (2004) The in vitro antioksidant ve Antimicrobial Activities of the Essensial Oil and Methanol Extracts of *Achillea biebersteini* Afan. (Asteraceae). Phytotherapy Research, 18, 451-456

Stoick SM, Gray JI, Booren AM, Buckley DJ (1991) Oxidative stability of restructured beef steaks processed with oleoresin rosemary, tertiary butylhydroquinone, and sodium tripolyphosphate. Journal of Food Science, 56, 597-600

Stokić E, Mandić A, Sakač M, Mišan A, Pestorić M, Šimurina O, Jambrec D, Jovanov P, Nedeljković N, Milovanović I, Sedej I (2015) Quality of buckwheat-enriched wheat bread and its antihyperlipidemic effect in statin treated patients. LWT-Food Sci Tech, 63(1): 556-561

Taş KT (2012) Türkiye’de Fonksiyonel Gıdaların Tüketim Araştırmaları, Ürün Çeşitliliği ve Yasal Düzenlemeler. [PDF Belgesi] 14.05.2020 tarihinde <http://www.gidadernegi.org/TR/Genel/KOK%20TASe6f1.pdf?DIL=1&BELGEANAH=5740&DOSYASIM=KOK+TAS.pdf> adresinden erişildi

Tepe B, Sökmen M, Akpulat HA, Sökmen A (2006) Screening of the antioxidant potentials of six *Salvia* speices from Turkey. Food Chemistry, 95, 200-204

Tewari R, Virmani OP (1987) Chemistry of Rosemary Oil. C.I.M.A.P. India, 9(4): 185-198

Tietz NW (1995) Clinical Guide to Laboratory Tests. W.B. Saunders Company, Philadelphia, Pennsylvania.

Toker R, Gölükcü M, Tokgöz H (2020) [PDF Belgesi] 28.05.2020 tarihinde <https://www.turktob.org.tr/dergi/makaleler/dergi15/54-59.pdf> adresinden erişildi

Tozoğlu F (2011) Erzincan kirazı (*Cerasus erzincanica*; Ş. Yıldırım) sap ve tohum kısımlarının antioksidan aktivitelerinin belirlenmesi. Yüksek Lisans Tezi, Erzincan Üniversitesi, Fen Bilimleri Enstitüsü, Kimya Anabilim Dalı, 7



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Tsimogiannis D, Stavrakaki M, Oreopoulou V (2006) Isolation and characterisation of antioxidant components from oregano (*Origanum heracleoticum*). International journal of food science & technology, 41, 39-48

Zegarska Z, Amarowicz R, Karmac M, Rafalowski R (1996) Antioxidative effect of rosemary ethanolic extract on butter. Milchwissenschaft, 51, 195-198



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ÇİLEK YETİŞTİRİCİLİĞİ VE HASAT SONRASI MUHAFAZA YÖNTEMLERİ

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ÖZET

Üzümsü meyve türlerinden olan çilek Rosaceae familyasının *Fragaria* cinsine ait çok yıllık bir meyvedir. Çilek yetiştiriciliği tarihinin çok eskiye dayanması, birçok ekolojide yetiştiriciliğin yapılabilmesi, tadı, aroması yönünden cezbedici olması, meyvesinin uzun süre pazarda bulunabilmesi çileği üzümsü meyveler içerisinde yetiştiriciliği en çok yapılan meyve konumuna getirmiştir. Dahası taze meyvenin üretiminin az olduğu dönemde çilek üretiminin yapılabilmesi pazar açısından önemli bir avantaj sağlamaktadır. Taze olarak tüketiminin yanı sıra işlenerek reçel, dondurma ve kurutulup çerez olarak tüketimi çileğin aranan ve tercih edilen bir meyve olmasını sağlamaktadır. Yetiştiricilikte iyi verim ve kaliteli ürün elde etmek için bölge şartlarına uygun çeşit tercihi yapılması gereklidir. Ayrıca fide dikim zamanı verimlilik üzerinde büyük bir etkiye sahiptir. En fazla verim yaz dikiminde alınmaktadır. Kış dikiminde ise verim az ama kaliteli ürün elde edilmektedir. Çilek farklı birçok iklim koşulunda yetişebilen bir meyvedir. Soğuklama ihtiyacı duyar ve yıllık soğuklama ihtiyacı 400 ile 500 saat aralığındadır. Yetiştiriciliğinde en uygun toprak tipi kumlu-tınlı, su tutma kapasitesi düşük, hafif bünyeli topraklar olup toprak pH'sının 6,5-7 olması istenir. Toprak hastalık ve zararlılardan arı olmalıdır. Çileklerde çiçek tomurcuğu oluşması üzerindeki en önemli unsur gün uzunluğu ve sıcaklıktır. Ekonomik değeri yüksek ve sevilerek tüketilen çileğin hasat sonrası ömrü oldukça kısadır. Meyvelerin tüketiciye fizyolojik olarak bozulma gerçekleşmeden önce ulaştırılması için uygun derim zamanının belirlenmesi, mekanik olarak zarar görmeden derim yapılması, hasat sonrası uygulamalar, ön soğutma ve soğuk zincirin korunmasından geçmektedir. Çilek iklimakterik olmayan ve derim sonrası hızlı bozulma gösteren bir meyvedir. Dolayısıyla tam olgunluğa erişen meyvelerin derimi ve derim sonrası muhafazası kaliteyi korumak amacıyla oldukça önem arz etmektedir.

Anahtar Kelimeler: Çilek, Depolama, Yetiştiricilik



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STRAWBERRY GROWING AND POST-HARVEST CONSERVATION METHODS

ABSTRACT

Strawberry is a perennial fruit belonging to the *Fragaria* genus of the Rosaceae family. The fact that the history of strawberry cultivation goes back to the past, that it can be cultivated in many ecologies, that it is attractive in terms of taste and aroma, and that its fruit can be found in the market for a long time has made the strawberry the most cultivated fruit inside the berry-like fruits. In addition, the continuation of strawberry production during the period when fresh fruit production is low provides a significant advantage in terms of the market. In addition to its consumption as fresh, its consumption as jam, ice cream and dried snacks makes the strawberry in demand and preferred fruit. In order to obtain good yield and quality products in cultivation, it is necessary to choose varieties suitable for the conditions of the region. Moreover, the time of planting seedlings has a great influence on productivity. The highest yield is obtained in summer planting. Winter planting, yield is low but quality product is obtained. Strawberry is a fruit that could be grown in many different climatic conditions. The annual need for cooling is between 400 and 500 hours. The most suitable soil type for cultivation is sandy-loamy, light textured soils with low water holding capacity and the soil pH should be between 6.5-7. The soil should be free from diseases and pests. The most important factors on flower bud formation in strawberries are day length and temperature. Strawberry, which has a high economic value and is consumed with love, has a very short post-harvest life. Determination of the appropriate harvesting time, harvesting without mechanical damage, post-harvest applications, pre-cooling and preservation of the cold chain are necessary for the delivery of fruits to the consumer before physiological deterioration occurs. Strawberry is a non-climacteric fruit with rapid deterioration after harvest. Therefore, the skin and post-harvest preservation of the fruits that have reached full maturity is very important in order to preserve the quality.

Keywords: Strawberry, Storage, Cultivation



1. GİRİŞ

Çilek, *Rosaceae* familyasının *Fragaria* cinsine ait çok yıllık, otsu, yüzeysel kök sistemine sahip üzüksü bir meyvedir. Çilek yetiştiriciliği tarihinin çok eskiye dayanması, birçok ekolojide yetiştiriciliğin yapılabilmesi, tadı, aroması yönünden cezbedici olması, meyvesinin uzun süre pazarda bulanabilmesi çileği üzüksü meyveler içerisinde yetiştiriciliği en çok yapılan meyve konumuna getirmiştir (Ağaoğlu, 1986; Yılmaz, 2009; Türemiş ve Ağaoğlu, 2013). Anavatanı Güney Amerika-Şili olarak kabul edilmekte olup 700 yılı aşkın bir süredir Avrupa'da kültürünün yapıldığı bilinmektedir (Keçecioğlu 2009).

Farklı toprak ve iklim şartlarında ekonomik yetiştiricilik yapılabilmesi çileği hem ülkemizde hem de dünyada önemli bir meyve konumuna ulaştırmıştır. Dahası taze meyvenin üretiminin az olduğu dönemde çilek üretiminin yapılabilmesi pazar açısından önemli bir avantaj sağlamaktadır. Çileğin taze olarak tüketiminin yanı sıra işlenerek reçel, dondurma ve kurutulup çerez olarak tüketimi çileğin aranan ve tercih edilen bir meyve olmasını sağlamaktadır. Birim alandan elde edilen kar ve kısa sürede yatırım maliyetini çıkarması birçok ürüne kıyasla daha iyi durumdadır (Nacar, 2012).

Ülkemizde çilek üretimi hızla artış göstermektedir, 50 yıl önce 8 bin ton olan çilek üretimi 2017 yılında 400 bin tona ulaşmıştır (TUİK, 2018). Çilek üreticisi ülkeler arasında ülkemizi 5. Sırada yer almaktadır (FAO, 2018).

Yetiştiricilikte iyi verim ve kaliteli ürün elde etmek için bölge şartlarına uygun çeşit tercihi yapılması gereklidir. Ayrıca fide dikim zamanı verimlilik üzerinde büyük bir etkiye sahiptir. En fazla verim yaz dikiminde alınmaktadır. Kış dikiminde ise verim az ama kaliteli ürün elde edilmektedir. Kışları soğuk geçen bölgelerde ilkbahar dikimi yapılmaktadır (Kaşka ve ark., 1986; Ağaoğlu, 1986). Ülkemizde yaygın olarak frigo fide ile yaz dikimi yapılmaktadır.

Çilekler meyve verme dönemlerine göre sınıflandırılmaktadır. Tek ürün verenler, iki ürün verenler ve yediverenler olarak sınıflara ayrılırlar. Bu durum fotoperiyot ve sıcaklığa göre değişkenlik göstermektedir (Güneş, 2011).

Ekonomik değeri yüksek ve sevilerek tüketilen çileğin hasat sonrası ömrü oldukça kısadır. Meyvelerin tüketiciye fizyolojik olarak bozulma gerçekleşmeden önce ulaştırılması için uygun derim zamanının belirlenmesi, mekanik olarak zarar görmeden derim yapılması, ön soğutma ve soğuk zincirin korunmasından geçmektedir.

Derim sonrası soğukta muhafaza hasat sonrası ömrünü uzatmada oldukça önemli olup soğukta muhafazasının yanında kontrollü atmosferde muhafaza (Almenar ve ark. 2006), modifiye



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atmosfer paketlenme (MAP) uygulaması (Yanh ve ark. 2010) çilekte hasat sonrası kalitenin korunması ve depo ömrünün uzatılması bakımından etkili olmaktadır.

2. MORFOLOJİSİ

Çilek çok yıllık, otsu bir meyvedir. Saçak köke sahip olup %90'ı 15cm derinlikte yer almaktadır, kısa bir gövdesi vardır. Gövdeden stolon (kol) çıkışları görülür. Stolonların toprak ile temas ettiğinde köklenme meydana gelir böylelikle yeni bitkiler oluşturur. Çiçeklenme ve stolon arasında ters bir ilişki bulunmaktadır. Yetiştiricilikteki amaç bunların bitki üzerindeki olma durumunu belirler. Meyve üretimi amaçlanıyorsa stolonun koparılması, fide üretimi amaçlanıyorsa çiçeklerin koparılması gerekmektedir. Çiçekler salkım şeklinde olup erselik karakterdedir. 5 taç, 5 çanak yaprak ve çok sayıda erkek ve dişi organ bulunmaktadır. Meyveler çiçek tablasının etlenmesi sonucu oluştuğundan yalancı meyve olarak tanımlanır (Güneş, 2011).

3. İKLİM İSTEĞİ

Çilek farklı birçok iklim koşulunda yetişebilen bir meyvedir. Soğuklama ihtiyacı duyar ve yıllık soğuklama ihtiyacı 400-500 saattir. Çileklerde çiçek tomurcuğu oluşması üzerindeki en önemli unsur gün uzunluğu ve sıcaklıktır. Kısa gün şartları genaratif gelişmeyi teşvik ederken, uzun gün şartları ise vejetatif gelişmeyi teşvik etmektedir. Tomurcuk ve stolon oluşması için gerekli olan kritik sıcaklık 16 °C'dir (Güneş, 2011).

4. TOPRAK İSTEĞİ

Çilek yetiştiriciliğinde en uygun toprak tipi kumlu tınlı su tutma kapasitesi düşük hafif bünyeli topraklar olup toprak pH'sının 6,5-7 olması istenir. Toprak hastalık ve zararlılardan ari olmalıdır. Çilek dikimi yapılmadan önce toprakta fumigasyon veya solarizasyon işlemi yapılmalıdır (Nacar, 2012; Güneş, 2011).

5. DİKİM ZAMANLARI

Çilek bahçesi kurulum zamanı ürünün yetiştirilme amacına, iklim faktörlerine ve fidenin özelliğine göre değişkenlik göstermektedir.



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5.1. Yaz Dikimi

Frigo fide kullanılarak yaz döneminde yapılan dikimdir. Sıcak bölgelerde ağustos ayında, serin ve soğuk bölgelerde ise haziran, temmuz aylarında yapılmaktadır. Frigo fide fideliklerden kış ayında sökülüp soğuk hava depolarında muhafaza edilen fidelerdir. Dikimden hemen sonra çıkan çiçekler ve stolonlar bitki kuvvetli büyüsün diye koparılır. Dekara 5000-6000 fide dikilmektedir. Dekara 5-6 ton ürün alınabilmektedir (Nacar, 2012). Dikim yapılmadan önce fideler bordo bulamacına daldırılıp açılan çukurlara kök boğazı hizasında dikim yapılmalıdır.

5.2. Kış Dikimi

Ilık iklime sahip bölgelerde ekim-kasım aylarında taze fideler kullanılarak yapılan dikimdir. Dikim yapılacak fidelerin kökleri 8-10 cm bırakılacak şekilde ve yapraklar 2-3 genç yaprak kalacak şekilde budanıp yapılmaktadır. Verim düşük olup ilk yıl dekara 1-15 ton verim alınırken ikinci yıl dekara 4-5 ton verim alınmaktadır (Nacar, 2012). Dikim yapılmadan önce fideler bordo bulamacına daldırılıp açılan çukurlara kök boğazı hizasında dikim yapılmalıdır.

5.3. Sonbahar Dikimi

Fideler ilkbahar ayında dikilmektedir. Dikilen bu fidelerden oluşan kol fiderin sonbaharda yeni yerlerine dikilmesi sonbahar dikimi olarak adlandırılır. Bu dikim yöntemi ile sıcak iklime sahip bölgelerde erken ürün alma sağlanabilmektedir (Güneş, 2011). Fakat yapılan bu dikimde kaliteli ürün elde edilememekte ve soğuk zararı görme riski yüksektir.

5.4. İlkbahar Dikimi

İlkbahar aylarında kışları sert geçen bölgelerde yapılan dikimdir. Bu dikim zamanında frigo fideler kullanılmaktadır. İlk yıl az meyve vermekte olup asıl ürün sonraki yıl alınmaktadır.

6. BAKIM İŞLERİ

6.1. Malçlama

Çilek yetiştiriciliğinde yapılan malçlama erkencilik sağlamak, yabancı ot çıkmasını engellemek, meyvenin toprağa teması engellenip toprak sebebiyle patojenlerin bulaşmasını engellemek ve kaliteli ürün elde etmek için masuraların siyah örtü ile örtülmesidir.

6.2. Sulama

Çilek suya oldukça duyarlı olan bir bitkidir. Dolayısıyla düzenli sulama ister. Aşırı sulama mantari hastalıkların çıkmasına zemin hazırlar. Damla sulama yapılmalıdır. Damla sulama boruları malç örtüsü altında kalacak şekilde sulama sistemi kurulmalıdır.



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6.3. Gübreleme

En uygun gübreleme toprak analiz sonuçlarına göre ihtiyaç duyulan gübrenin verilmesidir. Gübreleme hem yapraktan hem de topraktan yapılabilmektedir. Topraktan gübre uygulamaları damla sulama ile verilmelidir. Çilek en çok azota ihtiyaç duymaktadır. Yetiştirme periyodu boyunca dekara 25-30 kg saf azot verilmelidir. Gübreler damla sulama ile belli periyotlarda verilmesi gerekmektedir. Kışları soğuk geçen bölgelerde kış aylarına doğru gübrelemeye ara verilmelidir (Nacar, 2012).

7. HASAT VE DEPOLAMA

Çilek klimakterik olmayan ve derim sonrası hızlı bozulma gösteren bir meyvedir. Dolayısıyla tam olgunluğa erişen meyvelerin derimi ve derim sonrası muhafazası kaliteyi korumak amacıyla oldukça önem arz etmektedir.

Hasadın gecikmesi meyvede yumuşamaya ve renk kaybına neden olmaktadır. Ürün uzak pazarlara gönderilecekse hasat, meyve tam iriliğe ulaştığında ve dörtte üçü kızardığında yapılmalıdır (Anonim, 2008). Olgunlaşmış çileklerde, titre edilebilir asit (TEA) değeri en fazla %0,8 ve suda çözünür kuru madde (SÇKM) miktarı ise en az %7 olmalıdır. Yüksek TEA ve düşük SÇKM miktarına sahip meyvelerde tat oluşumu tam anlamıyla gerçekleşmediğinden tüketiciler tarafından pek tercih edilmemektedir. Meyveler sanayide kullanılacaksa meyvenin tam olgunlaşması ve renk oluşumunun %90'ın üzerinde olması istenmektedir. Sofralık olarak üretim yapılıyorsa hasattan hemen sonra solunum hızını düşürmek amacıyla hızlı bir ön soğutma yapılmalı, zararlanma görülen meyveler ayıklanmalı ve paketlenmelidir. Hasat sonrasında ön soğutmanın 2 saat gecikmesi %20, 8 saat gecikmesi ise %70 pazarlanabilir meyve kaybına neden olmaktadır (Kargı ve Sarıdaş, 2012). Hasat sonrası bozulmanın hızlı olduğu sebze ve meyvelerde, ürünün hasat edildikten sonra yüksek kalite ve düşük kayıpla tüketiciye ulaştırılması amaçlanmaktadır. Çilek meyveleri 0°C' de 10 gün muhafaza edilebilirken, 2-5°C'de ve %90-95 oransal nemde ancak 2-4 gün muhafaza edilebilmektedir (Bal ve Çelik, 2005). Ayrıca muhafaza süresince kayıplara neden olan Botrytis ve Rhizopus hastalıkları depolama teknikleri ile engellenememektedir ancak yavaşlatılabilmektedir. Depolama teknikleri yanı sıra fungus etmenli kayıpların engellenmesi amacıyla meyvelere birçok uygulama yapılmaktadır. En yaygın olarak kullanılan uygulamalar arasında uçucu yağ (Yılmaz ve ark., 2019), Sıcak su + ultraviyole (Çavuşoğlu, 2018), klor (Aday ve Caner, 2011), salisilik asit (Babalar ve ark., 2007), kitosan kaplama (Reddy ve ark., 2000), ozon uygulamaları (Nadas



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ve ark., 2003) yapılmaktadır. Sıcak su + ultraviyole uygulaması yapılan çilekler 0°C' de %90-95 oransal nemde 20 gün ve 5°C'de %90-95 oransal nemde ise 12 gün muhafaza edilebilmektedir (Tekin ve Çavuşoğlu, 2018). Çilek, meyve türleri arasında hasat sonrası ömrü en kısa olan meyvelerden biridir. Dolayısıyla hasat esnasında, ambalajlanmasında, depolanmasında ve taşınmasında oldukça dikkatli olmak gerekmektedir. Meyveler en az kayıp ile tüketiciye ulaştırılmalıdır.



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KAYNAKÇA

Nacar, Ç. (2012). Çilek Yetiştiriciliği. Gıda, Tarım ve Hayvancılık Bakanlığı, Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü, Alata Bahçe Kùltürleri Araştırma İstasyonu, Erdemli/Mersin.

Kaşka, N., Özgüven, A.I., Paydaş, S., Biçici, M., Türemiş, N., Küden, A. (1986). Türkiye için yeni bazı çilek çeşitlerinin Adana’da yaz ve kış dikim sistemleriyle örtüaltında yetiştiriciliğinin verim, kalite ve erkencilik üzerine etkileri. Tübitak Doğa Bilim Dergisi, 10(1), 84–100.

Ağaoğlu, Y.S. (1986). Üzümsü Meyveler. Ankara Üniversitesi Ziraat Fakùltesi Yayınları, Yayın No: 984, 290 s. Ankara.

Güneş, M. (2011). Üzüm ve Üzümsü Meyve Türleri Yetiştiriciliği, Bahçe Tarımı-II. Anadolu Üniversitesi, Açıköğretim Fakùltesi, Ders Kitabı, Ünite 4 Yayın No: 1355

Almenar, E., Hernández-Muñoz, P., Lagarón, J. M., Catalá R. & Gavara R. (2006). Controlled atmosphere storage of wild strawberry fruit (*Fragaria vesca* L.). Journal of agricultural and food chemistry, 54(1), 86- 91.

Yang, F. M., Li, H. M., Li, F., Xin, Z. H., Zhao, L. Y., Zheng, Y. H. & Hu, Q. H. (2010). Effect of nano-packing on preservation quality of fresh strawberry (*Fragaria ananassa* Duch. cv Fengxiang) during storage at 4 C. Journal of food science, 75(3), C236-C240.

Keçecioğlu, A. (2009). Dünya ve Türkiye Çilek Üretimi ve Ticareti. Akdeniz İhracatçı Birlikleri, Araştırma Serisi.

Anonim, (2008). Bahçecilik Çilek Yetiştiriciliği. <http://megep.meb.gov.tr>- (Erişim tarihi: 27.08.2021).

Kargı, S.P. & Sarıdaş, M.A. (2012). Modern Çilek Yetiştiriciliği. Tarım Gündem Dergisi, 2(8): 36-41.

Bal, E. & Çelik, S. (2005). Bazı Çilek Çeşitlerinin Meyvesindeki Anatomik Yapılaşmanın Muhafaza Süresi Üzerine Etkisi. Tekirdağ Üniversitesi, Ziraat Fakùltesi Dergisi, 2(3): 260-267.

Yılmaz, F., Kasım, M. U., Koşumcu, S., & Kasım, R. (2019). Çilekte (*Fragaria x ananassa* Duch.) Hasat Sonrası Enfeksiyon ve Kalite Üzerine Bazı Uçucu Yağların Etkisi. *Kocaeli Üniversitesi Fen Bilimleri Dergisi*, 2(1), 27-35.



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Tekin, O. & Çavuşoğlu, Ş. (2018). The effects of different postharvest applications on some physicochemical properties in 'Rubygem' and 'Sabrina' strawberry (*Fragaria × ananassa* Duch.) cultivars. *Applied Ecology and Environmental Research*, 16(4), 5299-5310.

Çavuşoğlu, Ş. (2018). Effects of hot water and UV-C on mineral content changes in two strawberry cultivars stored at different temperatures. *Turkish Journal of Agriculture and Forestry*, 42(6), 423-432.

Aday M. S. & Caner C. (2011). The applications of 'active packaging and chlorine dioxide' for extended shelf life of fresh strawberries. *Packaging Technology and Science*, 24(3), 123-136.

Reddy M. B., Belkacemi K., Corcuff R., Castaigne F. & Arul J. (2000). Effect of pre-harvest chitosan sprays on post-harvest infection by *Botrytis cinerea* and quality of strawberry fruit. *Postharvest Biology and Technology*, 20(1), 39-51.

TÜİK, (2018). www.tuik.gov.tr (Erişim Tarihi: 02.03.2021).

FAO, (2018). www.fao.org (Erişim Tarihi: 02.03.2021).

Babalar M., Asghari M., Talaei A. & Khosroshahi A. (2007). Effect of pre-and postharvest salicylic acid treatment on ethylene production, fungal decay and overall quality of Selva strawberry fruit. *Food chemistry*, 105(2), 449-453.

Nadas A., Olmo M. & Garcia J. M. (2003). Growth of *Botrytis cinerea* and strawberry quality in ozone-enriched atmospheres. *Journal of food science*, 68(5), 1798-1802.



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**KAVUN YETİŞTİRİCİLİĞİNDE DİKKAT EDİLMESİ GEREKEN TEKNİKLER ve
HASAT SONRASI MUHAFAZA YÖNTEMLERİ**

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ÖZET

Kavun (*Cucumis melo*) tek yıllık bir sebze olup ılık ve sıcak iklim bitkisidir. Kavun bitkisinin olgunlaşmış meyvelerinin taze olarak tüketilmesinin ve çekirdeklerinin çerez olarak tüketilmesinin yanı sıra reçel, pasta, dondurma, turşu, kozmetik yapımında kullanılmaktadır. Kullanım alanının geniş olması nedeniyle hem ülkemizde hem de dünyada aranan bir sebze konumundadır. Optimum gelişme sıcaklığı 20-30°C arasındaki sıcaklıklardır. Bu sıcaklığın altındaki ve üstündeki sıcaklıklarda büyüme yavaşlamaktadır. Yetiştirme periyodu boyunca güneşli, kurak bir hava ve yeterli miktarda toprak nemi istemektedir. İlkbahar geç donları tehlikesi bittikten sonra toprak sıcaklığının 15°C'ye ulaştığı dönemde tohum ekimi yapılmaktadır. Kısa ve kalın bir kazık kök yapısına sahiptir. Tohumlar çimlendikten sonra ilk olarak 20-30cm uzunluğunda kazık kökler oluşur. Daha sonra yan kökler oluşmaktadır. Kavun yetiştiriciliğinde toprak neminin %60-70 olması istenir. Kavun yüksek ve düşük nemden hoşlanmaz yüksek nem fungal ve bakteriyel hastalıkların oluşmasına zemin hazırlar. Dahası yüksek nem vejetatif gelişmeyi artırır dolayısıyla meyve verimi düşer ve meyvelerin olgunlaşma süresi uzar. Kavunlar yazlık, kışlık, şekil, meyve özelliklerine göre birçok şekilde sınıflandırılabilir en yaygın olarak benimsenen yazlık-kışlık olarak sınıflandırmadır. Ülkemizde kavun üretiminin %85'i kışlık, %15 ise yazlık çeşitlerden yapılmaktadır. Kavunlar genel olarak iklimakterik özelliğe sahip olup hasat sonrası olgunlaşma devam etmektedir. Hasat olgunluğuna erişen kavun meyveleri çeşide özgü aroma, tat, ağırlık, irilik, şekil, şeker içeriği ve kabuk rengini kazanmış olur. Meyve sapında ve gövde üzerindeki kulakçıklar kurur. Meyvenin dip kısmında yumuşama görülür ve çeşide özgü koku oluşur. Kavunlarda aroma, tat ve sululuk önemli kalite parametrelerindendir. Kalitenin muhafazası ise hasat zamanının doğru tayin edilmesi, hasatta fiziksel yaralamalardan kaçınmak ve uygun depolama koşulları ile mümkündür. Bu çalışmada kavun yetiştiriciliğinde dikkat edilmesi gereken unsurlar ve hasat sonrası depolama şartları incelenmiştir

Anahtar Kelimeler: Kavun, Yetiştiricilik, Depolama



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**TECHNIQUES TO BE CONSIDERED IN MELON GROWING AND POST-
HARVEST STORAGE METHODS**

ABSTRACT

Melon (*Cucumis melo*) is an annual vegetable, a plant of warm and hot climates. In addition to consuming the ripe fruits of the melon plant as fresh and consuming its seeds as a snack, it is used in making jams, cakes, ice cream, pickles and cosmetics. Due to its wide area of use, it is a in demand vegetable both in our country and in the world. Optimum growth temperatures are between 20-30°C. Growth slows down at temperatures below and above this growth temperature. It requires a sunny, dry weather and sufficient soil moisture during its growing period. After the danger of late spring frosts is over, seed planting is done when the soil temperature reaches 15°C. It has a short and thick pile root structure. After the seeds germinate, first 20-30 cm long pile roots are formed. Later, lateral roots are formed. In melon cultivation, soil moisture is required to be 60-70%. Melon does not like high and low humidity, high humidity causes fungal and bacterial diseases. Moreover, high humidity increases vegetative growth, so fruit yield decreases and fruit ripening time increases. Although melons are classified in many ways according to summer, winter, shape and fruit characteristics, they are commonly classified as summer-winter. In our country, 85% of melon production is made from winter and 15% from summer varieties. Melons generally have climacteric properties and ripening continues after harvest. Melon fruits that reach harvest maturity gain flavor, taste, weight, size, shape, sugar content and skin color specific to the variety. The auricles on the fruit stalk and stem dry up. Softening is seen at the bottom of the fruit and a variety-specific odor is formed. Aroma, taste and juiciness are important quality parameters in melons. The preservation of quality is possible with the correct determination of the harvest time, avoiding physical injuries in the harvest and appropriate storage conditions. In this study, the factors to be considered in melon cultivation and post-harvest storage conditions were determined.

Keywords: Melon, Cultivation, Storage



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1.GİRİŞ

Kavun (*Cucumis melo*) hem ülkemizde hem de dünyada en çok üretimi ve tüketimi yapılan sebzeler arasında yer almaktadır. Ülkemiz, kavunun önemli gen merkezlerinden biridir. Dahası Çin'den sonra dünyada en çok üretim yapan ikinci ülke konumunda yer almakta olup birçok bitkinin üretimi için uygun ekolojik koşullara sahiptir.

Anadolu çok sayıda sebze ve meyve türlerinin anavatanı olduğu bilinmektedir ve ülkemiz kavunun ikincil gen merkezi olduğu kabul edilmektedir (Şensoy ve ark., 2007). Kavun yetiştiriciliğinin ülkemizde bu denli yaygın olmasının başlıca nedenleri arasında kavunun anavatanı olmasından kaynaklanmaktadır. Ülkemizde genellikle açık arazide kavun yetiştiriciliği yapılmaktadır, Akdeniz Bölgesi'nde ise yoğun bir şekilde örtüaltı kavun yetiştiriciliği yapılmaktadır (Tatar ve Şensoy, 2020).

Kavun içerdiği antikanserojen, antioksidan, antiplatelet, hepatoprotektif, antidiyabetik, antihelmintik ve antiinflamatuvar özelliğinin yanında analjezik ve diüretik etkisinin de olduğu bilinmektedir (İtliyavırah ve ark., 2014; Rodríguez-Perez ve ark., 2013; Mıllı ve Kulwant, 2011; Chan ve ark., 2010; Lester, 2008; Cui ve ark., 2007; Vouldoukis ve ark., 2004).

Fenol, flavonoller ve karotenoid bakımından zengin olan kavunlar göğüs kanseri, prostat ve lösemi gibi kanserli hücrelerde sitotoksik etki oluşturarak ve inhibe ederek kansere karşı tedavi edici ve koruyucu etki göstermektedir (İtliyavırah ve ark., 2014; İtliyavırah ve Çerçyan, 2014; Chan ve ark., 2010; Cui ve ark., 2007). Ayrıca içeriğinde bulunan A ve C vitaminleri, terpenoid, flavon, flavanon, potasyum inflamasyon, kardiyovasküler hastalıklara karşı da koruyucu ve tedavi edici etki göstermektedir (Toker,2020).

Kavun bitkisini olgunlaşmış meyvelerinin taze olarak tüketilmesinin ve çekirdeklerinin çerez olarak tüketilmesinin yanı sıra reçel, pasta, dondurma, turşu, kozmetik yapımında kullanılmaktadır. Kullanım alanının geniş olması nedeniyle hem ülkemizde hem de dünyada aranan bir sebze konumundadır. Kavunlar yazlık, kışlık, şekil, meyve özelliklerine göre birçok şekilde sınıflandırılrsa da en yaygın olarak benimsenen yazlık-kışlık olarak sınıflandırmadır.

Kavunlarda aroma, tat ve sululuk önemli kalite parametrelerindendir. Kalitenin muhafazası ise hasat zamanının doğru tayin edilmesi, hasatta fiziksel yaralamalardan kaçınmak ve uygun depolama koşulları ile mümkündür.



2. MORFOLOJİSİ

2.1. Çiçek

Kavunlar üç tip çiçek yapısına sahiptir. Bunlar erkek, dişi ve erselik çiçeklerdir. Genel olarak erkek çiçekler bitki üzerinde ana kollarda bulunurken, dişi ve erselik çiçekler ise bitkide yan kollar üzerinde bulunmaktadır. Kavunlar kısa gün şartlarında dişi çiçekler oluşturur, ışık miktarının artması ile erkek çiçek sayısında artışa neden olmaktadır. Kavun çiçekleri sabah erken saatte açar, sıcaklıklarda düşür, yüksek nem ve havanın kapalı olması çiçeklerin açmasında gecikmeye neden olmaktadır. Kavun çiçekleri kendini tozlama yeteneğine sahip değildir. Dişi ve erselik çiçeklerde tozlanmanın olabilmesi için dişicik tepesine tepesine çiçek tozlarının taşınması gerekmektedir. Kavunda çiçek tozları yapışkan ve ağır olduğundan rüzgarla taşınması mümkün olmamaktadır. Böcekler ile tozlanma olmaktadır. Kavun yetiştiriciliğinde verimli ve kaliteli pazarlanabilir ürün elde etmek için tozlayıcı olarak arılar kullanılmalıdır.

2.2. Kök

Kısa ve kalın bir kazık kök yapısına sahiptir. Tohumlar çimlendikten sonra ilk olarak 20-30cm uzunluğunda kazık kökler oluşur. Daha sonra yan kökler oluşmaktadır. Köklerin %80'i 30-40cm'de teşekkül ederken %20'si 40-100cm derinlikte teşekkül etmektedir.

2.3. Gövde ve Dallar

İlk çimlenmenin gerçekleşmesi akabinde bitkide yaprak sayısı 3-4'e ulaşınca kadar büyüme dik olarak gözlemlenir, bu büyüme evresinden sonra gelişimini sürünerek devam ettirir. Gövde üzerinde bulunan boğumlarda vejetatif tomurcuk vardır. Kavunun ana gövdesi üzerinde bulunan ilk 2-4 tomurcukta gelişim kuvvetli olmaktadır ve bir o kadar koltuk sürgünü oluşturur. Bunlar ikincil dallardan çıkar. Üçüncül dallar ise meyve dallarıdır, bunlar ilk iki göz dişi çiçek, sonrakiler ise erkek çiçek oluşturur (Aras, 2015).

2.4. Meyve

Meyve şekli, rengi ve ağırlığı büyük bir varyasyon göstermektedir (Şekil 1). Meyveler; yuvarlak, basık-yuvarlak, uzun-yuvarlak, uzun ve yumurta şeklinde Kabuk; dilimli, buruşuk, düz ve dilimsiz Meyve eti rengi; beyaz, sarı, yeşil ve turuncu renkte olabilir. Meyveler çeşite özgü karakteristik özellik gösterir.



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Şekil 1. Farklı tipte kavun meyveleri (Anonim 2020)

3. İKLİM VE TOPRAK İSTEĞİ

Kavun tek yıllık bir sebze olup ılık ve sıcak iklim bitkisidir. Optimum gelişme sıcaklığı 20-30°C arasındaki sıcaklıklardır. Bu sıcaklığın altındaki ve üstündeki sıcaklıklarda büyüme yavaşlamaktadır. Yetiştirme periyodu boyunca güneşli, kurak bir hava ve yeterli miktarda toprak nemi istemektedir. İlkbahar geç donları tehlikesi bittikten sonra toprak sıcaklığının 15°C'ye ulaştığı dönemde tohum ekimi yapılmaktadır.

Kavun yetiştiriciliğinde toprak neminin %60-70 olması istenir. Kavun yüksek ve düşük nemden hoşlanmaz yüksek nem fungal ve bakteriyel hastalıkların oluşmasına zemin hazırlar. Dahası yüksek nem vejetatif gelişmeyi artırır dolayısıyla meyve verimi düşer ve meyvelerin olgunlaşma süresi uzar. Düşük nemde ise kırmızı örümcek ve thrips gibi zararlıların artışı ile külleme gibi fungal hastalıkların yayılımı hızlanır.

Derin, geçirgen, organik maddelerce zengin, su tutma yeteneği yüksek, pH'sı 6-6.7 olan tınlı topraklarda iyi gelişim gösterir. Kumlu topraklarda da yetiştiriciliği yapılabilir ve erkencilik sağlanabilir fakat bu topraklarda düzenli sulama yapılması gerekmektedir (Anonim, 2015).

4. TOPRAK HAZIRLIĞI VE YETİŞTİRME TEKNİĞİ

Ülkemizde kavun üretiminin %85'i kışlık, %15 ise yazlık çeşitlerden yapılmaktadır. Toprak hazırlığı sonbahar ilk yağışlarından sonra toprak tavadayken sürüm yapılır. İkinci sürüm ise ilkbahar döneminde kültivatör ile yapıp toprak ekim-dikime uygun hale getirilir. Açık alanda yetiştiricilikte dekara 4-5 ton, serada 10 ton çiftlik gübresi verilmelidir. Açıkta yetiştiricilikte 150-205 gr tohum atılır. Erkencilik kazanmak için fide ile dikim yapılabilmektedir. En uygun aralık ve mesafe açıkta yetiştiricilikte; sıra üzeri 100 cm, sıra arası 120-140 cm'dir. Dekara 600-



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700 bitki dikilir. Serada ise; sıra üzeri 40-80, sıra arası 130-140 cm olacak şekilde dekara 1800-2000 bitki dikilir. Dikim yapıldıktan 35 gün sonra bitkide ilk olarak dişi çiçek teşekkül eder, ilk çiçek oluşumundan 35 gün sonra ilk hasat yapılmakta olup bunu takiben 30 gün sonra hasat sonu olmaktadır. Çeşide bağlı olarak değişmekle birlikte vejetasyon süresi kavunlarda ortalama olarak 100 gündür, kışlık kavunlarda ise bu süre 150 güne kadar çıkabilmektedir (Aras, 2015). Kavunlar sıcak havayı sever. Tohumların çimlenebilmesi için gerekli olan minimum sıcaklığın 15°C olması istenir. Tohumlar 20°C'de 8 günde, 25°C'de 4 günde, 30°C'de 3 günde çimlenebilmektedir. Sıcaklık 35°C ve üstüne çıktığında çimlenmede bozukluklar görülür, Sıcaklık 40°C ve üzerinde olduğunda çimlenme gerçekleşmemektedir.

5. HASAT VE DEPOLAMA

Kavunlar genel olarak klimakterik özelliğe sahip olup hasat sonrası olgunlaşma devam etmektedir. Hasat olgunluğuna erişen kavun meyveleri çeşide özgü aroma, tat, ağırlık, irilik, şekil, şeker içeriği ve kabuk rengini kazanmış olur. Meyve sapında ve gövde üzerindeki kulakçıklar kurur. Meyvenin dip kısmında yumuşama görülür ve çeşide özgü koku oluşur. Hasada gelmiş meyveler bitki üzerinde uzun süreli bırakılmamalıdır. Olgunluğa erişmiş kavunlarda hasat saplarından elle koparılması veya bıçakla kesilmesiyle yapılmaktadır. Hasat yapılırken veya taşınırken oluşabilecek mekanik zararlanmalar meyvede su kaybı, solunum hızı ve etilen sentezinin artmasına neden olmaktadır. Ayrıca açılan yaralar hastalık etmenlerinin girişini kolaylaştırmaktadır. Hasat yapılırken veya taşınırken mekanik zararlanma ürünün pazarlamasında soruna neden olabileceği gibi depolama ömrünü azaltmaktadır. Dolayısıyla hasat yapılırken ve taşınırken çok dikkatli olunması gerekmektedir. Meyvelerin sıcak zararından etkilenmemesi için hasat sabah erken saatlerde yapılmalı ve serin bir alanda muhafaza edilmelidir. Kavunlarda depolama çeşit özelliğine göre farklılık göstermektedir. Yazlık çeşitler depolamaya elverişli değildir. 1-2 hafta içerisinde tüketilmesi gerekmektedir. Kışlık çeşitlerin ise soğuk hava depolarında, kasalarda veya tek tek iplere asılarak ışıktan almayan serin, hava akımının iyi olduğu yerlerde çok uzun süre muhafazası yapılabilmektedir. Yazlık kavunlar genel olarak 5-10° C'de %85-90 oransal nemde 1-2 ay muhafaza edilebilmektedir. Kantalop kavunlar ise 1-5° C'de %90-95 oransal nemde 1-2 hafta muhafaza edilebilmektedir.



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Sensoy, S., Büyükalaca, S. & Abak, K. (2007). Evaluation of genetic diversity in Turkish melons (*Cucumis melo* L.) based on phenotypic characters and RAPD markers. *Genetic Resources and Crop Evolution*, 54(6), 1351-1365.

Tatar, M., & Şensoy, S. (2020). Diyarbakır İli Bazı Yerel Kavun Genotiplerinin Meyve Özellikleri. *Yüzüncü Yıl Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 25(2), 56-63.

Toker, C. (2020). Kavun. *Apelasyon Dergisi*. Sayı: 83.

Vouldoukis, I., Lacan, D., Kamate, C., Coste, P., Calenda, A., Mazier, D., Conti, M. & Dugas, B. (2004). Antioxidant and anti-inflammatory properties of a *Cucumis melo* LC extract rich in superoxide dismutase activity. *J. Ethnopharmacol.* 94: 67-75.



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TÜRKİYE'DE TURUNÇGİLLERİN FİDAN ÜRETİMİNİN DEĞERLENDİRİLMESİ

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ÖZET

Turunçgillerin anavatanı Güneydoğu Asya olmasına rağmen besin içeriğinin ve ekonomik değerinin yüksek olması nedeniyle subtropik iklim özelliği gösteren hemen hemen tüm bölgelerde yetiştiriciliği yapılmaktadır. Turunçgiller yaklaşık 135 milyon ton üretimi ile dünyada üretilen meyve gurupları arasında ön plana çıkmaktadır. Türkiye ise yaklaşık 1.354.660 da alanda 4.293.007 ton üretimi ile Akdeniz ülkeleri içerisinde önemli bir üretici konumundadır. Anadolu'da turunçgiller tarımının başlangıcı Cumhuriyet'in kurulduğu tarihe kadar dayanmaktadır. Türkiye'de 1960'tan sonra turunçgillere olan talebin artmasıyla bu türün yetiştiriciliğinde ve fidan üretiminde de artışlar meydana gelmiştir. Türkiye'de sertifikasyon sisteminin 2009 yılında yürürlüğe girmesinin ardından aşılı turunçgil fidanı üretiminde de artış olduğu görülmektedir. Turunçgil fidanı üretimi 2010 yılında 1.406.220 adet iken bu sayı 2020 yılına gelindiğinde 3.596.910 adete yükselmiştir. Tarım ve Orman Bakanlığı'nın 2020 yılı verilerine göre Türkiye'de en fazla sırasıyla mandarin (1.722.680 adet), limon (1.208.295 adet), portakal (626.145 adet) ve altıntop (8.550 adet) fidanı üretildiği görülmektedir. Türkiye turunçgil fidanı üretiminde %75'ten daha yüksek oran ile en fazla üretimin yapıldığı ilin Hatay olduğu belirlenmiştir. Turunçgil fidan üretiminde büyük orana sahip diğer önemli iller ise



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Adana (441.400 adet) ve Mersin’dir (312.534 adet). Sertifikasyon sistemiyle turunçgil fidan üretimine hem resmi kurum ve kuruluşlarının hem de özel sektörün önemli ölçüde katkıları olmuş ve olmaya devam etmektedir. Diğer meyve türlerinde olduğu gibi kayıt dışı ve ismine doğru olmadan fidan üretimi gibi problemler turunçgil fidanı üretiminde de görülmektedir. Ancak bu durumun turunçgil fidan üretiminde daha yaygın olduğu gözlenmektedir. Subtropik iklim koşullarında yetiştirilebilen turunçgiller gibi spesifik ekolojilere uyum sağlayan meyve türlerinde gerek fidan gerekse bahçe tesisinde stratejinin doğru belirlenmesi oldukça önemli bir husustur. Bu nedenle turunçgil üretiminde sertifikalı fidan üretiminin ve kullanımının artırılması, Türkiye turunçgil üretimi için oldukça önemlidir.

Anahtar Kelimeler: Turunçgiller, Fidan üretimi, Standart, Sertifikalı.



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EVALUATION OF CITRUS SAPLING PRODUCTION IN TURKEY

ABSTRACT

Although the homeland of citrus fruits is Southeast Asia, it is grown in almost all regions with subtropical climate due to its high nutritional content and economic value. Citrus fruits stand out among the fruit groups produced in the world with a production of approximately 135 million tons. Turkey, on the other hand, is an important producer among the Mediterranean countries with a production of 4.293.007 tons in an area of approximately 1,354,660 da. The beginning of citrus agriculture in Anatolia dates back to the establishment of the Republic. With the increase in the demand for citrus fruits in Turkey after 1960, there has been an increase in the cultivation of this species and in the production of saplings. After the certification system came into effect in 2009 in Turkey, it is observed that there has been an increase in the production of grafted citrus saplings. While the production of citrus saplings was 1.406.220 in 2010, the production amount increased to 3.596.910 in 2020. According to the 2020 data of the Republic of Turkey Ministry of Agriculture and Forestry, the most produced citrus saplings species in Turkey are mandarin (1.722.680), lemon (1.208.295), orange (626.145) and goldentop grapefruit (8.550), respectively. It was determined that Hatay was the province with the highest production rate of more than 75% in the production of citrus saplings in Turkey. Other important provinces with a large ratio in citrus sapling production are Adana (441.400) and Mersin (312.534). With the certification system, both official institutions and organizations and the private sector have made and continue to contribute significantly to the production of citrus saplings. As with other fruit species, problems such as the production of saplings that are unregistered and not true to the name are also seen in the production of citrus saplings. However, it is observed that this situation is more common in citrus sapling production. For fruit species that adapt to specific ecologies, such as citrus fruits that can be grown in subtropical climate conditions, it is very important to determine the strategy correctly, both in the nursery and in the garden plant. For this reason, increasing the production and use of certified saplings in citrus production is very important for citrus production in Turkey.

Keywords: Citrus, Sapling production, Standard, Certified.



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1. GİRİŞ

Turunçgiller, dünyada yetiştiriciliği yapılan en önemli meyve gruplarından birini oluşturmaktadır. Turunçgillerin sahip olduğu yüksek besin içeriği, tür zenginliği ve artan nüfus gibi çeşitli faktörler nedeniyle bu grup içerisinde yer alan meyvelere olan talep her geçen gün artmaktadır. Turunçgiller, dünyada önemli ekonomik değere sahip meyve gruplarından birisidir. Tropik ve subtropik iklim alanlarında yetiştirme alanı bulan turunçgiller Citrus cinsi içerisinde yer almaktadır. Bu cins içerisinde ise turunç (*Citrus aurantium* L.), portakal (*Citrus sinensis* L.), mandarin (*Citrus reticulata* Blanco), altıntop (*Citrus paradisi*), bergamot (*Citrus bergamia*) ve limon (*Citrus limon* L.) gibi meyvecilik açısından oldukça önemli türler bulunmaktadır. Ülkemizde narenciye olarakta adlandırılan turunçgillerin anavatanı Çin, Güneydoğu Asya ve Hindistan olduğu bildirilmektedir (Kayabaşı ve Etikan, 2019). Türkiye'nin çok geniş iklim çeşitliliğine sahip olması, bu türlerin yetiştiriciliğinin yaygın bir şekilde yapılmasına olanak sağlamaktadır.

Dünyada turunçgiller üretiminde 1960'lı yıllardan günümüze kadar önemli artışların olduğu görülmektedir. 1961 yılında 25.055.243 ton olan turunçgiller üretimi, 2019 yılına gelindiğinde 157.979.260 tona yükselmiştir. Dünya'da en fazla turunçgiller üretiminin yapıldığı ülkeler sırasıyla Çin (43.539.916 ton), Brezilya (19.652.788 ton), Hindistan (14.013.000 ton), Meksika (8.756.488 ton), Amerika (7.230.854 ton), İspanya (6.010.050 ton), Mısır (4.638.980 ton) ve Türkiye'dir (FAO, 2021). Türkiye'nin 1990'da turunçgiller üretim miktarı 288.931 ton iken 2019 yılına gelindiğinde 4.301.415 tona yükselmiştir. Türkiye'de en fazla üretilen turunçgilleri ise sırasıyla portakal, mandarin, limon ve altıntop oluşturmaktadır.

Antalya ilindeki turunçgiller ihracatı yapan firmalar genellikle Belarus Cumhuriyeti, AB ülkeleri, Ukrayna ve Rusya gibi ülkelere ihracat gerçekleştirmektedir. Yapılan araştırmada turunçgil ihracatının belirlenmesinde etkili olan unsurlar müşteri istekleri, rakip ülke fiyatları ve firma maliyetleridir (Tat ve Sarıca, 2021).

Tüm meyvecilikte olduğu gibi turunçgillerde de üretimin ilk basamağını fidan oluşturmaktadır. İyi bir fidan ise sağlıklı, kaliteli ve ismine doğru olmalıdır (Kamiloğlu ve Canbaz, 2020). Dünya narenciye üretiminde söz sahibi olan Türkiye'nin bu ürünlerin ticaretinde rekabet gücünü arttırabilmesi için üretimde kullanılan fidanlar büyük öneme sahiptir. Tesis edilecek bahçelerde kullanılacak fidanların ismine doğruluğundan, kalitesinden, sağlığından emin olunmazsa ileriki yıllarda verim ve kalite bakımından telafisi mümkün olmayan sorunlarla karşılaşma riski çok büyüktür. Bu sorun ise Türkiye'de sertifikalı fidan üreten işletme sayısının az olması ve halen



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bahçe tesislerinde ismine doğru olmayan, hastalık ve zararlılardan arındırılmamış fidanların kullanılması nedeniyle büyük bir sorun oluşturmaktadır (Karaman ve Alican, 2017).

Türkiye’de son yıllardaki meyve fidan üretiminin büyük bir çoğunluğu özel sektör tarafından karşılanmaktadır. Turunçgillerin fidan üretim değerleri incelendiğinde 1970’li yıllarda üretimin çoğu kamu kurumları tarafından yapılırken son zamanlarda büyük oranda özel sektör tarafından yapıldığı gözlenmektedir. Meyve fidancılığında daha sonraki yıllarda ortaya çıkabilecek sorunların önüne geçilmesi amacıyla tüm dünyada olduğu gibi Türkiye’de de fidancılıkta sertifikasyon kavramı oluşturulmuştur. Önceleri yoğun olarak devlet kontrolünde yapılan fidan üretiminin, özel sektörde yaygınlaşması ile birlikte bu kavram önemli bir konu haline gelmiştir. Türkiye’de ilk olarak fidan sertifikasyon sistemi 1989 yılında yayımlanarak 1991 yılında uygulanmaya başlanmıştır. Tescil edilen meyve çeşitleri 1990 yılında ‘Milli Çeşit Listesine’ kaydedilmeye başlanmıştır. Fidan sertifikasyon sistemi 2009 yılında yapılan düzenleme ve 2012 yılında yapılan değişiklik ile bugünkü halini almıştır. Fidan sertifikasyonunda; üretilen bitki için kullanılan kaynak, ismine doğruluk ve bitki sağlığı ön planda yer almaktadır (Çelen ve ark., 2020). Böylece fidanların tescil edilmiş çeşitlerde ismine doğruluk, kaynak materyalinin belirli olması, hastalık ve zararlılarla bulaşık olmama, fidanın standartlara uygun olması sağlanmıştır. Böylece bu yönetmeliğin yayınlanması ile Türkiye meyve fidanı üretimi üzerine olumlu yönde etkileri olmuştur. Bunlardan ilki fidan üretim miktarları kayıt altına alınarak kayıt dışı üretimlerin tespiti sağlanmıştır. Bu kayıtlar ile daha sağlıklı fidan üretim verileri oluşturulmuştur (Sesli ve Tekintaş, 2017).

Türkiye turunçgillerin yetiştiriciliğinde dünyada söz sahibi olan ülkelerden birisidir. Bu durumun korunması ve arttırılmasında temel öncelikler uygun ekolojilerde doğru çeşitlerle ve kaliteli fidanlarla, bilinçli üretimin yapılmasıdır. Bu nedenle Türkiye’nin turunçgiller yetiştiriciliğinde rekabet gücünü koruyabilmesi için sertifikalı fidan üretiminin miktarı oldukça önemlidir. Bu çalışmanın amacı, Türkiye’de 2010-2020 yılları arasında turunçgiller fidan üretimini değerlendirmektir.

2. MATERYAL VE YÖNTEM

Bu çalışmada T.C. Tarım ve Orman Bakanlığı, Bitkisel Üretim Genel Müdürlüğü (BÜGEM) kaynaklarından elde edilen verilerden yararlanılmıştır. Araştırma kapsamında 2010-2020 yılları arasındaki fidan üretim değerleri sunulmuştur. Elde edilen verilerin yorumlanmasında % ve ortalama değerler hesaplanarak sunulmuştur.



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3. BULGULAR

Turunçgiller dünyada üretimin en fazla yapıldığı ve ticarete en çok konu olan yetiştiriciliği eski yıllara dayanan meyve grubudur. Türkiye’de turunçgillerin üretiminin çok büyük bir oranı Akdeniz Bölgesindeki tarım alanlarından karşılanmaktadır. Bu bölgede en fazla üretimin yapıldığı iller sırasıyla Adana, Mersin, Hatay ve Antalya’dır (Tüik, 2021). Türkiye’de sertifikasyon sistemine geçiş ile 2009 yılından itibaren meyve fidanı üretimi her geçen yıl artış göstermiştir. Buna bağlı olarak fidan üretimi ve fidan işletmeleri sayısında da artış olmuştur. 1960’lı yıllardan sonra turunçgillerin yetiştiriciliğinde de hem ağaç sayısı hem de ağaç başına alınan verim miktarlarında önemli bir artış gözlenmiştir.

Türkiye’de 2020 yılı verilerine göre tüm meyve türlerinde toplam 122.224.406 adet fidan üretilmiş olup, bu grup içerisinde yer alan turunçgillerin sayısı 3.596.910 adettir. Bu değerler ile Türkiye’de üretilen tüm meyve fidanlarının yaklaşık %2,9’unu narenciye fidanı oluşturmaktadır. Türkiye’nin 2010 yılında narenciye fidanı üretim miktarı 1.406.220 adet iken, yaklaşık 2,5 kat artış göstererek bugünkü halini almıştır (Tablo 1; Çizelge 1).

Yıllar bazında Türkiye’de toplam meyve ve narenciye fidanı üretim değerleri Tablo 1’de sunulmuştur. Tablodan görüldüğü üzere 2010-2020 yılları arasındaki dönemde hem meyve fidanı üretim miktarında hem de turunçgillerin fidan üretim değerlerinde önemli değişimler gözlenmiştir. 2019 yılında toplam meyve fidan üretiminde önemli bir düşüş yaşansa da 2020 yılında %39,9’luk bir artış meydana gelmiştir. Türkiye’de 2010-2020 yılları arasında 821.204.742 adet toplam meyve fidan üretimi, 31.801.721 adet ise toplam narenciye fidanı üretimi gerçekleşmiştir. Her ne kadar yıllar bazında genel olarak turunçgillerin fidan üretiminde artış gözlenirse de toplam meyve fidanı üretiminde turunçgillerin fidan üretiminin oranı 2010 yılında %4,5 iken bu oran 2020 yılında %2,9’a gerilemiştir. Yani toplam meyve türlerindeki fidan üretim değerlerinde artış söz konusu iken turunçgillerde düşüş görülmüştür.



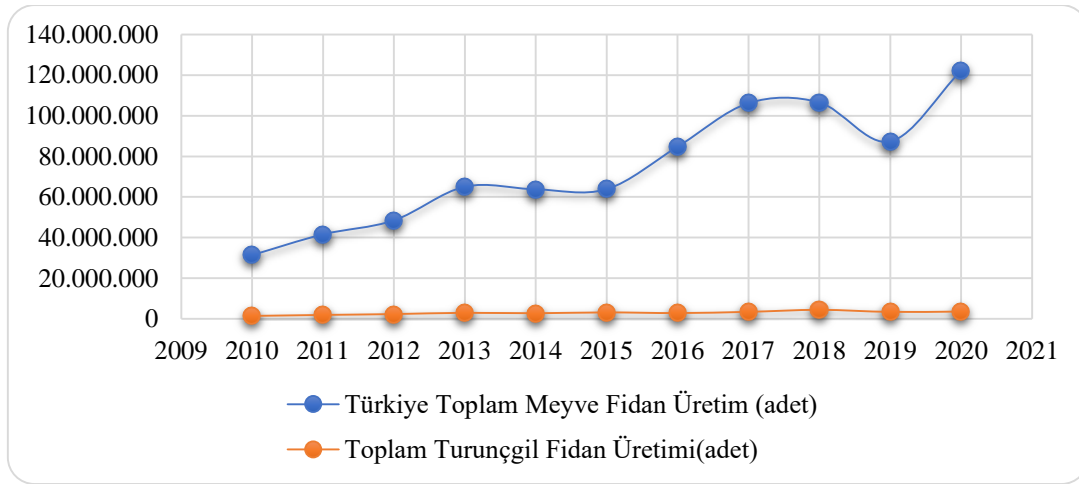
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Tablo 1. Türkiye’deki toplam meyve ve turunçgillerin fidan üretim değerleri (2010-2020)

Table 1. Total fruit and citrus sapling production values in Turkey (2010-2020)

Yıllar	Türkiye toplam meyve fidan üretim (adet)	Yıllar içerisindeki artış hız oranı (%)	Toplam turunçgil fidan üretimi (adet)	Yıllar içerisindeki artış hız oranı (%)
2010	31.361.586	-	1.406.220	-
2011	41.579.090	32,6	1.879.989	33,7
2012	48.477.743	16,6	2.268.426	20,7
2013	65.058.906	34,2	2.944.307	29,8
2014	63.771.974	-2,0	2.628.493	-10,7
2015	63.842.803	0,1	3.226.964	22,8
2016	84.718.045	32,7	2.782.297	-13,8
2017	106.217.719	25,4	3.309.792	19,0
2018	106.580.329	0,3	4.446.236	34,3
2019	87.372.151	-18,0	3.419.979	-23,1
2020	122.224.406	39,9	3.596.910	5,2
Toplam	821.204.742		31.801.721	



Şekil 1. Türkiye’deki toplam meyve ve turunçgillerin fidan üretim değerleri (2010-2020)

Figure 1. Total fruit and citrus sapling production values in Turkey (2010-2020)

2019 yılı verilerine göre Türkiye’deki turunçgillerin fidan üretimi iller bazında incelendiğinde ilk sırada Hatay (2.570.350 adet) yer almaktadır. Bu ili sırasıyla Adana (441.400 adet) ve Mersin (312.534 adet) takip etmektedir. Bu durumda turunçgillerin fidan üretiminin yaklaşık %75,2’si gibi büyük bir oranı Hatay ilinde, %12,9’u Adana ilinde ve %9,1’i ise Mersin ilinde gerçekleşmektedir. Bu iller zaten turunçgiller meyve üretiminde de üst sıralarda yer almaktadır.



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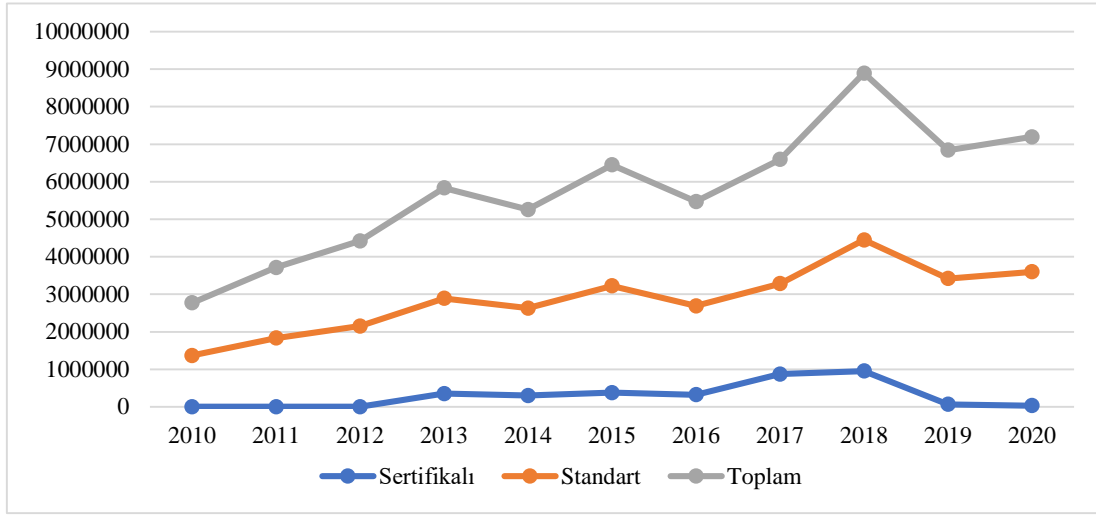


T.C. Tarım ve Orman Bakanlığı tarafından yürürlüğe konulan Meyve Fidanı ve Üretim Materyali Sertifikasyonu ile Pazarlaması yönetmeliğinde fidan ve üretim materyallerinde etiket rengi; ön temel üretimlerde ‘beyaz üzeri mor kuşaklı’, temel üretimlerde ‘beyaz’, sertifikalı üretimlerde ‘mavi’ ve standart üretimlerde ‘sarı’ olarak belirtilmektedir.

Türkiye’de 2010-2020 yılları arasında toplam 28.256.306 adet standart (sarı etiketli) narenciye fidan üretimine karşın, sertifikalı (mavi etiketli) fidan üretiminin 3.270.507 adet olduğu görülmektedir. Turunçgillerin üretiminde standart fidan üretiminin yıllar bazında düzenli olarak artış gösterdiği belirlenmiştir. Ancak sertifikalı fidan üretiminde yıllara göre dalgalanmalar olduğu görülmektedir. Sertifikalı fidan üretimi 2018 yılında 954.600 adet ile en yüksek seviyeye ulaşmış olup takip eden yıllarda bu türlerin Türkiye’de sertifikalı fidan üretiminin az miktarlarda gerçekleştiği görülmüştür (Tablo 2). Benzer çalışmalar incelendiğinde turunçgillerde diğer meyve türlerine göre sertifikalı fidan üretiminin oransal olarak çok daha sınırlı kaldığı gözlenmektedir (Bükücü ve ark., 2021; Özcan ve ark., 2021; Sütyemez, 2021a; 2021b). Bu nedenle sertifikalı üretimin artırılması turunçgillerin yetiştiriciliği açısından oldukça önemlidir.

Tablo 2. Sertifikasyon sınıflarına göre turunçgil fidan miktarlarının yıllara göre dağılımı
Table 2. Distribution of the amount of citrus saplings according to the certification classes by years

Yıllar	Sınıflar				Toplam
	Ön Temel	Temel	Sertifikalı	Standart	
2010	40.390	-	-	1.365.830	1.406.220
2011	48.045	-	-	1.831.944	1.879.989
2012	107.980	7.500	-	2.152.946	2.268.426
2013	10.260	45.570	350.000	2.538.477	2.944.307
2014	-	-	300.000	2.328.493	2.628.493
2015	40	5.500	376.900	2.844.524	3.226.964
2016	30.000	1.050	320.680	2.370.567	2.782.297
2017	25.270	750	871.552	2.412.220	3.309.792
2018	-	420	954.600	3.491.216	4.446.236
2019	-	25	65.500	3.354.454	3.419.979
2020	-	-	31.275	3.565.635	3.596.910
Toplam	261.985	60.815	3.270.507	28.256.306	31.801.721



Şekil 2. Sertifikasyon sınıflarına göre turuncgil fidan miktarlarının yıllara göre dağılımı
Figure 2. Distribution of the amount of citrus saplings according to the certification classes by years

2020 yılı verilerine göre Türkiye’de en fazla fidan üretimi yapılan narenciye türü 1.722.680 adet ile mandarindir. Bu türü 1.199.920 adet ile limon ve 621.595 adet ile portakal takip etmektedir. Aynı yılın verilerine göre az miktarlarda da olsa kamkat, altıntop, tangor ve ağaç kavunu fidanı üretiminin olduğu görülmektedir (Anonim, 2021). Turunçgiller içerisinde yer alan limon, portakal ve mandarin türlerinin 2019-2020 yılları arasında Türkiye’deki fidan üretim miktarları Çizelge 4-6’da sunulmuştur.

Türkiye’nin mandarin türündeki fidan üretim değerleri incelendiğinde, 2020 yılı verilerine göre en fazla 1.652.550 adet ile W. Murcott çeşidinin fidan üretiminin yapıldığı görülmektedir. Bu değer ile Türkiye’de üretilen mandarin fidanlarının yaklaşık %96’sının W. Murcott çeşidine ait olduğu hesaplanmıştır. Bu çeşidin haricinde az miktarlarda da olsa Okitsu Wase, Dabashi Beni, Satsuma Clausellina ve Nova çeşitlerine ait fidan üretiminin de yapıldığı belirlenmiştir. Mandarin fidan üretiminde 2020’de 2019 yılına göre 252.860 adet daha fazla üretimin yapıldığı belirlenmiştir. Ayrıca Satsuma Clausellina çeşidinin üretiminde önemli bir azalışın olduğu görülmektedir (Tablo 4).



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Tablo 4. Türkiye’de fidan üretimi yapılan mandarin çeşitleri
Table 4. Mandarin varieties produced in Turkey

Çeşitler	Fidan Üretim Miktarı (adet)	
	2019	2020
W. Murcott	1.232.450	1.652.550
Okitsu Wase	19.780	18.200
Satsuma Clausellina	52.500	17.000
Nova	10.000	10.000
Dabashi Beni	45.000	7.500
Yerli Apireno	28.300	6.800
Klemantin Fino	12.950	4.350
Robinson	31.000	2.500
Toros Kırmızısı	1.340	2.000
Klemantin Oroval	9.320	1.780
Tango	26.000	-
Sarıca	500	-
Satsuma Sugiyama	380	-
Miho Wase	300	-
Toplam	1.469.820	1.722.680

Türkiye’de fidan üretimi yapılan limon çeşitleri Tablo 5’te sunulmuştur. Tabloda görüldüğü üzere Türkiye toplam limon fidanı üretiminde bir önceki yıla kıyasla çok az miktarda da olsa düşüş yaşanmıştır. Hem 2019 hem de 2020 yıllarında en fazla fidan üretimi yapılan limon çeşidi Meyer’dir. Bu çeşidi ise sırasıyla Kütdiken ve Zagara Bianca çeşitleri takip etmektedir.

Tablo 5. Türkiye’de üretilen limon çeşitleri
Table 5. Lemon varieties produced in Turkey

Çeşitler	Fidan Üretim Miktarı (adet)	
	2019	2020
Meyer	673.594	728.400
Kütdiken	209.700	199.250
Zagara Bianca	178.000	125.600
Yediveren	52.830	69.770
İnterdonato	80.340	45.200
Karalimon	12.800	18.750
Enter	500	10.100
Molla Mehmet	3.500	1.700
Erdemli33	800	1.150
Lamas	10.000	-
Kıbrıs	250	-
Toplam	1.222.314	1.199.920

Dünyada turunçgil grubunda yer alan türler içerisindeki üretimin yaklaşık %50’sini portakal oluşturmaktadır. Ülkemiz ise dünya portakal üretiminde 7. sırada yer alarak üretiminin yaklaşık



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%4'ünü karşılamaktadır. Portakalın tüketimindeki artışına bağlı olarak ekonomik değeri de yukarı yönlü bir ivme kazanmaktadır (Atlı ve Sahin, 2021). Bunda portakalın dış pazarda daha çok portakal suyu olarak rağbet görmesi de etkili olmaktadır. Ülkemizde bazı bölgelerde kolay şekilde yetiştiriciliği yapılan bu türün fidan üretim değerleri Tablo 6'da verilmiştir. Türkiye'de 2020 yılı verilerine göre en çok üretilen portakal çeşidinin 280.300 adet ile Fukumoto Navel olduğu görülmektedir. Bu çeşidi ise sırasıyla Cara Cara (148.450 adet) ve Lane Late (113.700 adet) takip etmektedir. Türkiye'de en fazla üretimi yapılan Washington portakal çeşidinin fidan üretiminin artık yapılmıyor olması dikkat çekicidir (Tablo 6).

Türkiye'de 2020 yılı verilerine göre toplamda 8.550 adet altıntop fidanı üretilmiştir. Bu üretimin tamamı 2 çeşitten oluşmakta olup, bu çeşitler Rio Red (7.900 adet) Star Ruby (650 adet)'dir (Anonim, 2021).

Tablo 6. Türkiye'de üretilen portakal çeşitleri
Table 6. Orange varieties produced in Turkey

Çeşitler	Fidan Üretim Miktarı (adet)	
	2019	2020
Fukumoto Navel	335.400	280.300
Cara Cara	49.900	148.450
Lane Late	170.000	113.700
Navelina	38.650	35.000
Washington Navel	25.980	27.745
Valencia	21.580	14.400
Moro	490	1.500
Yafa 45-A	100	500
Washington	700	-
Batem Fatihi	400	-
Toplam	643.200	621.595

Bu çalışmada Türkiye'de üretimi yapılan önemli turunçgillerin iller bazında fidan üretim miktarları da incelenmiş ve elde edilen veriler Çizelge 7-10'da sunulmuştur.

Türkiye'deki 2019 yılı mandarin fidan üretim değerleri incelendiğinde en fazla üretimin Hatay (1.086.850 adet) iline ait olduğunu ve bu ili Adana (207.700 adet) ilinin takip ettiği tespit edilmiştir. Hatay ilinin Türkiye toplam mandarin fidanı üretiminin %73,9'unu tek başına gerçekleştirmesi oldukça önemlidir. Bu ilde ise en fazla üretilen mandarin çeşidi W. Murcott'tur. Hatay ilini ise 207.700 adet fidan üretim değeri ile Adana ve 163.200 adet fidan üretim değeri ile Mersin ili takip etmektedir (Çizelge 8).

Limon fidanı üretim miktarında olduğu gibi mandarin fidanı üretiminde de Hatay ili ön plana çıkmaktadır. Hatay ilinde bahsi geçen yıl içerisinde toplam 947.550 adet limon fidanı üretilmiş



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olup bu değer ile Türkiye toplam limon fidanı üretiminin %73,9'unun bu ilde gerçekleştiği hesaplanmıştır. Adana ili 154.700 adet limon fidanı üretim değeri ile ikinci sırada yer almaktadır. Her iki ilde de fidan üretiminde önde gelen çeşidin Meyer olduğu ve bu çeşidi Kütdiken'nin takip ettiği görülmektedir (Çizelge 9).

Çizelge 7. Türkiye’de mandarin fidan üretiminin illere göre dağılımı (2019)
Table 7. Distribution of mandarin sapling production by provinces in Turkey (2019)

Çeşitler	İller							
	Hatay	Adana	Mersin	İzmir	Antalya	Muğla	Aydın	İstanbul
W. Murcott	924.350	185.200	122.900	-	-	-	-	-
Okitsu Wase	12.500	4.500	-	1.180	1.100	-	500	-
Satsuma	46.000	6.000	-	-	-	-	500	-
Clausellina								
Nova	28.000	-	300	-	-	-	-	-
Dabashi	34.000	8.000	3.000	-	-	-	-	-
Beni								
Yerli	-	-	-	-	150	230	-	-
Apireno								
Klemantin	10.000	-	-	-	2.700	250	-	-
Fino								
Robinson	5.000	-	5.200	-	-	-	-	-
Toros	-	-	500	-	-	-	-	-
Kırmızı								
Klemantin	-	-	-	1.240	100	-	-	-
Oroval								
Tango	-	-	26.000	-	-	-	-	-
Sarıca	-	-	300	-	-	-	-	-
Satsuma	-	-	5.000	3.830	-	-	-	490
Sugiyama								
Miho Wase	27.000	4.000	-	-	-	-	-	-
Toplam	1.086.850	207.700	163.200	6.250	4.050	480	1000	490

Çizelge 8. Türkiye’de limon fidan üretiminin illere göre dağılımı (2019)
Table 8. Distribution of lemon sapling production by provinces in Turkey (2019)

Çeşitler	İller							
	Hatay	Adana	Mersin	İzmir	Antalya	Muğla	Aydın	İstanbul
Meyer	531.300	104.000	30.434	1.360	6.100	-	400	-
Kütdiken	165.000	18.200	26.500	-	-	-	-	-
İnterdonato	50.000	22.500	4.000	880	1.010	1.950	-	-
Yediveren	27.250	-	14.000	6.990	3.300	-	800	490
Karalimon	-	-	-	-	11.150	1.650	-	-
Zagara	164.000	10.000	4.000	-	-	-	-	-
Bianca								
Erdemli33	-	-	800	-	-	-	-	-
Enter	-	-	500	-	-	-	-	-
Molla	-	-	3.500	-	-	-	-	-
Mehmet								
Lamas	10.000	-	-	-	-	-	-	-
Kıbrıs	-	-	-	-	250	-	-	-
Toplam	947.550	154.700	83.734	9.230	21.810	3.600	1.200	490



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Dünyada ve Türkiye’de sevilerek tüketilen diğer önemli bir narenciye türü olan portakalın fidan üretim değerleri incelendiğinde, diğer turunçgillerin fidan üretim değerinde olduğu gibi Hatay ilinin ön plana çıktığı görülmektedir. Hatay ilinde 2019 yılı verilerine göre toplamda 493.500 adet portakal fidanı üretilmiştir. Bu değer ile Türkiye’nin toplam portakal fidanın %76,7’sinin bu ilde üretildiği hesaplanmıştır. Hatay ilindeki üretimin yaklaşık %54’ü Fukumoto Navel çeşidi ile yapılmaktadır. Hatay’dan sonra en fazla üretimi yapılan il 70.850 adet ile Adana’dır (Çizelge 10).

Altıntop fidan üretimi açısından yapılan değerlendirme sonucunda; 2019 yılında Hatay’da 12.200 adet, Mersin’de 6.200 adet, Adana’da 1.650 adet, Antalya’da 600 ve İzmir’de 320 adet olmak üzere toplamda 20.970 adet altıntop fidan üretildiği belirlenmiştir. Bu illerde üretilen altıntop fidan çeşitlerinin yaklaşık %53’ünün Star Ruby çeşidine, yaklaşık %47’sinin ise Rio Red çeşidine ait olduğu tespit edilmiştir (Çizelge 11).

Kamiloğlu ve Canbaz (2020), Hatay ilindeki turunçgil fidanı üreten işletmelerinin Samandağ ilçesinde yoğunlaştığını ve burasının Türkiye’nin ilk turunçgil merkezlerinden birisi olması, fidancılığın baba mesleği olarak devam etmesi nedeniyle fidan üretiminde sağlanan deneyimin bir sonucu olarak yoğun üretim yapıldığını bildirmişlerdir.

Çizelge 9. Türkiye’de portakal fidan üretiminin illere göre dağılımı (2019)
Table 9. Distribution of orange sapling production by provinces in Turkey (2019)

Çeşitler	İller							
	Hatay	Adana	Mersin	İzmir	Antalya	Muğla	Aydın	İstanbul
Fukumoto	263.500	37.200	34.700	-	-	-	-	-
Navel								
Navelina	29.000	7.650	2.000	-	-	-	-	-
Washington	5.000	2.000	4.300	3.740	8.850	800	800	490
Navel								
Cara cara	36.000	3.000	10.900	-	-	-	-	-
Valencia	10.000	1.000	200	330	9.400	650	-	-
Batem	-	-	-	-	400	-	-	-
Fatih								
Moro	-	-	-	190	300	-	-	-
Lane Late	150.000	20.000	-	-	-	-	-	-
Yafa 45-A	-	-	-	-	100	-	-	-
Washington	-	-	-	-	700	-	-	-
Toplam	493.500	70.850	52.100	4.260	19.750	1.450	800	490



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Çizelge 10. Türkiye’de altıntop fidan üretiminin illere göre dağılımı (2019)
Table 10. Distribution of Altıntop sapling production by provinces in Turkey (2019)

Çeşitler	Hatay	Mersin	İller Adana	Antalya	İzmir
Star	5.100	4.200	-	450	100
Ruby					
Rio Red	7.100	2.000	1.650	150	220
Toplam	12.200	6.200	1.650	600	320

SONUÇLAR

Türkiye’de 2010-2020 yılları arasında toplam meyve fidanı ve turunçgil fidan üretim miktarında genel olarak artış meydana gelmiştir. Fakat turunçgil fidan üretiminde artış olsa da toplam meyve fidan üretimindeki artış kadar büyük oranda olmamıştır. Son yıllarda ismine doğru turunçgillerin fidan miktarında geçmiş yıllara göre önemli artış kaydedilmiştir. Bu artışların en önemli nedenlerinden birisi 2009 yılından sonra sertifikasyon sisteminin daha etkin bir şekilde uygulanması olmuştur. Üreticilerin bahçe tesis ederken daha özenli ve titiz davranıp, üretim materyali seçerken ve temin ederken daha bilinçli hareket etmesi de bu artışlarda etkili olan diğer faktörlerdir. Fakat önemli olan bu sistemin devamlılığının sağlanmasıdır.

Fidan sertifikasyon sistemi yönetmeliği 2009 yılında yayınlanmasına rağmen ne yazık ki turunçgillerin fidan üretiminde sertifikalı (mavi etiketli) fidan üretimi ilk olarak 2013 yılında gerçekleşmiştir. 2013-2018 yılları arasında sertifikalı fidan üretiminde düzenli artış gerçekleşse de maalesef ki son iki yılda ciddi oranda azalma kaydedilmiştir. Standart (sarı etiketli) fidan üretiminin sertifikalı (mavi etiketli) fidan üretimine göre çok daha yüksek miktarlarda olduğu belirlenmiştir. Bu nedenle turunçgillerin fidan üretiminde sertifikalı fidan üretimin artırılması gerekmektedir.

Turunçgillerde fidan üretiminde kullanılan anacın ve üzerine aşıl原因an çeşidin üretim materyalinin ismine doğru olması çok önemlidir. Türkiye’de turunçgillerin fidan üretimine baktığımızda en fazla sertifikalandırılan fidan miktarı mandarin türüne aittir. Ardından sırayla limon, portakal ve turunç türleri gelmektedir. 2019 yılı verilerine göre ise Türkiye’de sertifikalı fidan miktarının en fazla olduğu il Hatay’dır.

Kurulacak olan bahçe tesislerinde kullanılacak fidanların ismine doğruluğundan, kalitesinden, sağlığından emin olunmazsa ileriki yıllarda verim ve kalite bakımından telafisi mümkün olmayan sorunlarla karşılaşma riski çok büyüktür. Bu yüzden meyve üreticileri aldıkları fidanların, belirli anaç ve çeşit olmasına, kalitesine, sertifikalı ve standart olup olmadığına



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dikkat etmeleri gerekmektedir. Ayrıca fidan üreticileri de aynı hassasiyeti güderek sertifikalı fidan üretmeli ve bu doğrultuda tüketicilerin ihtiyaçlarına cevap vermelidir.

Fidan üretimindeki sertifikasyon sisteminin geliştirilmesiyle yapılan üretimler kayıt altına alınabilmektedir ve böylece kayıt dışı yapılan üretimlerde tespit edilmektedir. Fidan üreticileri ve çiftçiler ismine doğru, hastalıklardan arı, kaliteli, verimli ve özellikle sertifikalı (mavi etiketli) fidan kullanımı konusunda bilinçlendirilirse bu sorunların önüne geçilebileceği düşünülmektedir.



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KAYNAKÇA

Anonim (2021). Tarım ve Orman Bakanlığı, Bitkisel Üretim Genel Müdürlüğü İstatistikleri (BÜGEM), Ankara.

Atlı, H.F., Sahin, A. (2021). Hatay İli Dörttyol İlçesinde Portakal Üretim ve Pazarlaması. Türk Tarım ve Doğa Bilimleri Dergisi, 8(3), 834-846.

Bükücü, Ş.B., Yıldırım, E., Özcan, A. (2021). Status of Apple Saplings Production in Turkey. 7th International Conference on Agriculture, Animal Science and Rural Development, Muş, Turkey. Proceedings Book, p. 1125-1139.

Çelen, H., Elen, İ., Özdemir, M. (2020). Türk Fidan Sertifikasyon Sistemi; Değerlendirmeler ve Öneriler. Journal of Agriculture, 3(2), 10-22.

Fao, (2021). <https://www.fao.org/faostat/en/#data/QCL>.

Kamiloğlu, M, Canbaz, A. (2020). Turunçgil Fidan Yetiştiriciliğinde Hatay. Uluslararası Anadolu Ziraat Mühendisliği Bilimleri Dergisi, 2(1), 1-12.

Karaman, S., Alican, M. (2017). Meyve Fidanı Üretimi ve Pazarlaması: Antalya İli Örneği. Atarım, 16 (1): 77-83.

Kayabaşı, N., Etikan, S. (2019). Bazı Turunçgil (*Rutaceae*) Yapraklarından Elde Edilen Renklerin Subjektif ve Objektif Yöntemle Değerlendirilmesi. Teknik Bilimler Dergisi, 5(1), 20-28.

Özcan, A., Ayaz, İ.B., Bükücü, Ş.B., Sütyemez, M. (2021). Türkiye'nin Badem Fidanı Üretiminin Durumu. 8.Ulusal Tarım Kongresi. Ege Üniversitesi, Türkiye, 9 Ekim 2021.

Sesli, Y., Tekintaş E. (2017). Türkiye Ceviz Fidan Üretimine Bakış Bahçe 46 (özel sayı 2):77-82. Yalova.

Sütyemez, M. (2021a). BÖLÜM 2: Türkiye Ceviz Fidanı Üretiminin Değerlendirilmesi. Tarımsal ve Doğal Kaynakları Endüstriyel Avantaja Dönüştürmek. S:15-44. ISBN: 978-625-7562-58-4.

Sütyemez, (2021b). Evaluation of Turkish Apricot Seedling Production. ISPEC 7th International Conference on Agriculture, Animal Sciences and Rural Development, Syf. 1174-1185. 18-19 September 2021-Muş/Turkey.

Tat., A, SARICA, D. (2021). Turunçgiller İhracatı Yapan Firmaların Yapısal Analizi: Antalya İli Örneği. Çukurova Tarım ve Gıda Bilimleri Dergisi, 36(1), 101-110.

Tüik (2021). <https://data.tuik.gov.tr/Kategori/GetKategori?p=tarim-111&dil=1>.



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**NUT TRAITS AND BIOACTIVE CONTENTS OF KALINKARA HAZELNUT
CULTIVAR GROWN IN DIFFERENT REGION**

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ABSTRACT

The study was conducted to determine nut traits and bioactive compounds of Kalinkara hazelnut cultivar grown in Ordu, Samsun and Sakarya regions. Significant differences were detected depend on regions in terms of other nut traits and bioactive compounds, except nut dimensional, kernel ratio and shell thickness traits. The highest nut and kernel weight was determined in Samsun and Sakarya regions, and the lowest in Ordu region. The highest kernel dimensional traits were measured in Samsun and Ordu regions. While the highest total phenolics content was determined in Sakarya region, the lowest was detected Ordu region. The highest total flavonoids were determined in Samsun and Sakarya regions. The lowest total flavonoids were detected in Ordu regions. While the highest antioxidant activity was determined in Ordu region, the lowest was detected in Samsun region. As a result, the effect of the region on nut traits and bioactive compounds of Kalinkara hazelnut cultivar was found to be significant. Also, it has been determined that Samsun and Sakarya regions come to the forefront in terms of several properties investigated.

Keywords: Hazelnut, nut weight, kernel ratio, phenolic, antioxidant



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INTRODUCTION

Hazelnut (*Corylus avellana* L.) is in the genus *Corylus* of the subfamily Corylaea of the Betulaceae family of the Fagales order (Erdoğan and Mehlenbacher, 2000). Hazelnut is the most widely grown nuts species in the world after almonds. Wild species of hazelnut are grown in a wide area as from Japan, extending to China, Anatolia, Europe and the California region of the USA. The cultural source of hazelnut is the coastal region of the Eastern Black Sea Region (Özbek, 1978).

The world's best quality hazelnut cultivars are grown in Turkey, which is the homeland of hazelnuts. Hazelnut production in Turkey is carried out in the region the between 40-41° latitude and 37-42° longitude. The hazelnut growing area in the region is divided into two as the first standard zone and the second standard zone. Production areas in the first standard region the provinces of Giresun, Ordu, Trabzon and Rize (Eastern Black Sea Region). The second standard region includes the provinces of Samsun, Sinop, Kastamonu, Zonguldak, Bolu, Düzce, Bartın, Sakarya and Kocaeli (Köksal, 2002; Beyhan et al., 2007). In the first standard zone, hazelnut cultivation can be done up to 80 km inland and 1200-1300 m elevation (Karadeniz et al., 2009). Hazelnut is a nut that is fondly consumed by people due to its nutritive and sensory properties (Yılmaz et al., 2019). Besides natural consumption, hazelnuts are also consumed by roasting (separated from its skin). It is also used as flavoring for many food products (Koyuncu and Kılıç, 2018). Hazelnut is rich in mineral matter, proteins, vitamins (Vitamin E), fatty acids, phenolics and antioxidants and is very valuable for health. Thanks to the unsaturated fatty acids in the hazelnut content, it prevents the rise of cholesterol (Yücesan et al., 2010). In addition, it provides protection against the harmful effects of cancer and oxidative stress in terms of antioxidant and phenolic compounds in its content (Blomhoff et al., 2006; Alasalvar and Bolling, 2015).

In different studies on hazelnut, it has been reported that the biochemical properties of hazelnuts vary depending on the genotype, cultivar (Balta et al., 2006; Pycia et al., 2020), region, ecological condition (Amaral et al., 2010), harvest (Seyhan et al., 2007; Pycia et al., 2020), cultural practices (Balta et al., 2021), altitude and direction (Bostan, 2003; Şengül, 2019).

This study was carried out to determine the nut traits and biochemical properties of Kalınkara cultivars grown in three different districts (Ordu, Samsun and Sakarya).



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MATERIAL AND METHODS

Material

The study was conducted in Ordu, Samsun and Sakarya districts, in the 2020 and 2021 years. Nuts of Kalinkara hazelnut cultivar were used as material in the study. Similar technical and cultural practices were made in the orchards where the fruit samples were harvested, and the age of the orchards are close to each other (40-45 aged). Cultural practices were carried out regularly in the orchards, except for irrigation.

Methods

The study was designed according to randomized blocks experiments design with replications three and three 'ocak' in each replication. In the labelled ocaks, approximately 200 cluster were picked at the harvest time. After harvesting, the nuts were separated from their husks and dried naturally. Nut traits and biochemical properties were investigated after drying.

Nut traits were determined by using twenty nuts. Nut and kernel weight were detected with digital balance (Radwag, Poland). Shell thickness, nut and kernel dimension (width, thickness and length) were measured by using digital caliper (Mitutoyo, Japan). The kernel ratio was calculated as the ratio between kernel and nut weight. Nut and kernel size were calculated as geometric mean of nut and kernel dimensional (Güler and Balta, 2020).

Biochemical properties were determined in defeated kernel samples. Total phenolics content was detected using the chemical Folin-ciocalteu's. The prepared samples were read at 760 nm in the spectrophotometer and the results were expressed as mg 100 g⁻¹ (Beyhan et al., 2010).

Total flavonoids content was determined by modifying the method of Chang et al. (2002). The prepared samples were read at 415 nm in the spectrophotometer and the obtained results were expressed as mg 100 g⁻¹.

Antioxidant activity was detected according to FRAP and DPPH assays. According to the FRAP method, the antioxidant activity was determined by modifying the method of Benzie and Strain (1996). The samples were read at 700 nm in the spectrophotometer and the obtained results were expressed as µmol 100 g⁻¹. According to the DPPH method, the antioxidant activity was determined by modifying the method of Blois (1958). The prepared samples were read at 517 nm in the spectrophotometer and the obtained results were expressed as µmol 100 g⁻¹.

Statistical analysis

Data were evaluated by using Minitab 17 statistical program. The difference between the means was determined by the Tukey multiple comparison method.



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Results and Discussion

According to the regions, the difference observed in terms of nut and kernel weight in Kalinkara cultivar was significant, while the difference observed with regard to kernel ratio and shell thickness was not significant ($p < 0.05$). The highest nut and kernel weight was determined in Samsun (3.02 g and 1.60 g, respectively) region, and the lowest in Ordu (2.36 g and 1.25 g, respectively) region. The kernel ratio ranged from 52.80% (Ordu) to 54.13% (Sakarya). Shell thickness was measured from 1.13 mm (Ordu) to 1.22 mm (Sakarya). In Kalinkara cultivar grown in different regions, nut weight, kernel weight, kernel ratio and shell thickness were reported from 1.77 g to 2.17 g, 0.92 g to 1.13 g, 51.98% to 52.73% and 0.94 mm to 1.06 mm, respectively (Beyhan and Demir, 2001; Bostan and Günay, 2009). In researches conducted on different hazelnut cultivars, it has been reported that nut and kernel weight, kernel ratio and shell thickness vary depending on the region (Bostan, 2003; Santos et al., 2005; Krol and Gantner, 2020).

In the present study, the effect of the region on the nut and kernel weight was found to be significant. While the nut and kernel weight values obtained were higher than the findings of the researchers, the kernel ratio and shell thickness values were found to be similar. Observed differences in terms of these traits are thought to be due to ecological conditions, technical and cultural practices.

Table 1. Nut weight, kernel weight, kernel ratio and shell thickness of Kalinkara hazelnut cultivar grown in different region

Region	Nut weight (g)	Kernel weight (g)	Kernel ratio (%)	Shell thickness (mm)
Ordu	2.36 b*	1.25 b	52.80 a	1.13 a
Samsun	3.02 a	1.60 a	53.15 a	1.19 a
Sakarya	2.75 a	1.49 a	54.13 a	1.22 a

* The differences between mean values shown on the same line with the same letter is not significant ($p < 0.05$)

The effect of regions on the nut sizes of Kalinkara cultivar was not significant ($p < 0.05$). according to regions, nut width, thickness and length were measured from 17.79 mm (Ordu) to 18.70 mm (Samsun), 15.93 mm (Ordu) to 16.63 mm (Sakarya) and 20.80 mm (Sakarya) to 21.42 mm (Samsun). Nut size was determined from 18.10 mm (Ordu) to 18.76 mm (Samsun). Beyhan and Demir (2001) reported that nut width, thickness and length in Kalinkara cultivar was determined as 15.83 mm, 15.06 mm and 19.37 mm, respectively. Also, same researchers reported as 16.65 mm nut size. In general, the nut sizes of the investigated Kalinkara cultivar were higher than the findings of the researchers. It has been reported that the nut sizes in hazelnut vary depending on the region (Köksal et al., 2012; Krol and Gantner, 2020). In



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addition, Köksal et al. (2012) stated that hazelnut cultivars grown in the Western Black Sea Region are larger than those grown in the Eastern Black Sea Region.

Table 2. Nut dimensional traits of Kalinkara hazelnut cultivar grown in different region

Region	Nut width (mm)	Nut thickness (mm)	Nut length (mm)	Nut size (mm)
Ordu	17.79 a*	15.93 a	20.92 a	18.10 a
Samsun	18.70 a	16.50 a	21.42 a	18.76 a
Sakarya	17.90 a	16.63 a	20.80 a	18.36 a

* The differences between mean values shown on the same line with the same letter is not significant ($p < 0.05$)

Many researchers reported that the kernel sizes of hazelnut vary depending on the region (Köksal et al., 2012; Krol and Gantner, 2020). In the present study, significant differences were determined between the kernel sizes of Kalinkara cultivar according to regions ($p < 0.05$). The highest kernel width, length and size were measured in Samsun (14.16 mm, 17.67 mm and 14.91 mm, respectively) region, while the lowest was determined in Ordu (13.08 mm, 16.55 mm and 13.73 mm, respectively) region. The kernel thickness was determined as the highest 13.44 mm (Sakarya) and the lowest 11.96 mm (Ordu). In Kalinkara cultivar, kernel width, thickness and length were reported as 12.80 mm, 10.50 mm and 15.10 mm, respectively (Köksal, 2018). In addition, the kernel size of the Kalinkara cultivar was reported as 13.23 mm by Bostan and Günay, (2009). In general, the kernel width and thickness of the investigated Kalinkara cultivar were higher than the findings of the researchers. Besides, kernel length and kernel size of the investigated Kalinkara cultivar were similar with findings of the researchers. Observed differences in terms of kernel width and thickness are thought to be due to ecological conditions, technical and cultural practices.

Table 3. Kernel dimensional traits of Kalinkara hazelnut cultivar grown in different region

Region	Kernel width (mm)	Kernel thickness (mm)	Kernel length (mm)	Kernel size (mm)
Ordu	13.08 b*	11.96 b	16.55 b	13.73 b
Samsun	14.16 a	13.26 a	17.67 a	14.91 a
Sakarya	14.14 a	13.44 a	16.60 b	14.66 a

* The differences between mean values shown on the same line with the same letter is not significant ($p < 0.05$)

Many researchers have reported that the chemical properties of hazelnut vary significantly depending on the regions (Beyhan et al., 2011; Bacchetta et al., 2018). In present study, the effect of the region on the total phenolics, total flavonoids and antioxidant activities of the Kalinkara cultivar was found to be significant ($p < 0.05$). The highest total phenolics content was determined as 118.1 mg 100 g⁻¹ (Sakarya) and the lowest as 70.9 mg 100 g⁻¹ (Samsun). The highest total flavonoids content was found in Samsun region (10.6 mg 100 g⁻¹) and the lowest in Ordu (5.8 mg 100 g⁻¹) region. According to FRAP and DPPH assays, the highest antioxidant



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activity was determined in Ordu (1195.2 $\mu\text{mol } 100 \text{ g}^{-1}$ and 1372.0 $\mu\text{mol } 100 \text{ g}^{-1}$, respectively) region, and the lowest in Samsun (465.0 $\mu\text{mol } 100 \text{ g}^{-1}$ and 603.6 $\mu\text{mol } 100 \text{ g}^{-1}$, respectively) region. Total phenolics, total flavonoids and antioxidant activity (according to FRAP and DPPH) in Kalinkara cultivar grown in Giresun region were reported as 43.6 mg 100 g^{-1} , 1.3 mg 100 g^{-1} , 2049.6 $\mu\text{mol } 100 \text{ g}^{-1}$ and 237.3 $\mu\text{mol } 100 \text{ g}^{-1}$, respectively (Balık, 2021). The total phenolics, total flavonoids and antioxidant values obtained were higher than those of Balık (2021). In addition, in accordance with the results of the current study, it was reported that the effect of the region on the bioactive properties of Çakıldak hazelnut cultivar is important. In addition, in accordance with the results of the present study, it has been reported that the region has a significant effect on the bioactive properties of Çakıldak hazelnut cultivar (Kul, 2020). It has been reported that ecological conditions and cultural practices have a significant effect on bioactive compounds in hazelnut (Tonkaz et al., 2019; Kul, 2020).

Table 4. Total phenolics, total flavonoids and antioxidant activity of Kalinkara hazelnut cultivar grown in different regions

Region	Total phenolics (mg GAE 100 g^{-1})	Total flavonoids (mg QE 100 g^{-1})	Antioxidant activity	
			FRAP ($\mu\text{mol TE } 100 \text{ g}^{-1}$)	DPPH ($\mu\text{mol TE } 100 \text{ g}^{-1}$)
Ordu	110.3 b	5.8 b	1195.2 a	1372.1 a
Samsun	70.9 c	10.6 a	465.0 b	603.6 c
Sakarya	118.1 a	9.8 a	636.6 b	1177.4 b

* The differences between mean values shown on the same line with the same letter is not significant ($p < 0.05$)

Conclusion

The effect of the region on nut traits and bioactive compounds of Kalinkara hazelnut cultivar was found to be significant. Nut and kernel weight, nut and kernel size, which are important quality characteristics, were found to be higher in Kalinkara cultivar grown in Samsun region compared to other regions. Sakarya region come to the forefront in terms of phenolic compounds that promote human health, and Ordu region in terms of antioxidant activity. These results showed that ecological conditions have a significant effect on the quality characteristics of hazelnut.



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REFERENCES

Alasalvar, C., Bolling, B. W. (2015). Review of nut phytochemicals, fat-soluble bioactives, antioxidant components and health effects. *British Journal of Nutrition*, 113(S2), S68-S78.

Amaral, J. S., Valentão, P., Andrade, P. B., Martins, R. C., Seabra, R. M. (2010). Phenolic composition of hazelnut leaves: Influence of cultivar, geographical origin and ripening stage. *Scientia Horticulturae*, 126(2), 306-313.

Bacchetta, L., Aramini, M., Procacci, S., Zinni, A., Di Giammatteo, V., Battarelli, M. R., Spera, D. (2018). Influence of genotype and geographical origin on lipid fraction of hazelnuts (*Corylus avellana*) in Europe. *Acta Horticulturae*, 1226, 333-338.

Balık, H. I. (2021). Bioactive compounds and fatty acid composition of new Turkish hazelnut cultivars. *International Journal of Fruit Science*, 21(1), 106-114.

Balta, M. F., Yarılgac, T., Aşkın, M. A., Kuçuk, M., Balta, F., Özrenk, K. (2006). Determination of fatty acid compositions, oil contents and some quality traits of hazelnut genetic resources grown in eastern Anatolia of Turkey. *Journal of Food Composition and Analysis*, 19(6-7), 681-686.

Balta, M.F., Yaman, İ., Kırkaya, H., Karakaya, O. (2021). Change of yield and nut traits of Çakıldak hazelnut cultivar grown in different cultivation conditions. *Academic Journal of Agriculture*, 10(2): 265-274.

Benzie, I. F., Strain, J. J. (1996). The ferric reducing ability of plasma (FRAP) as a measure of “antioxidant power”: the FRAP assay. *Analytical Biochemistry*, 239(1), 70-76.

Beyhan, N., Demir, T. (2001). Performance of the local and standard hazelnut cultivars grown in Samsun province, Turkey. *Acta Horticulturae*, 556, 227-234.

Beyhan, N., Demir, T., Turan, A. (2007). İlkbahar dönemi iklim koşullarının fındığın verim ve gelişmesi üzerine etkileri. Türkiye V. Ulusal Bahçe Bitkileri Kongresi. Atatürk Üniversitesi Ziraat Fakültesi, Erzurum.

Beyhan, Ö., Elmastas, M., Gedikli, F. (2010). Total phenolic compounds and antioxidant capacity of leaf, dry fruit and fresh fruit of feijoa (*Acca sellowiana*, Myrtaceae). *Journal of Medicinal Plants Research*, 4(11), 1065-1072.

Beyhan, O., Elmastas, M., Genc, N., Aksit, H. (2011). Effect of altitude on fatty acid composition in Turkish hazelnut (*Coryllus avellana* L.) varieties. *African Journal of Biotechnology*, 10(71), 16064-16068.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
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24-25 December 2021
BINGOL, TURKEY**



Blois, M. S. (1958). Antioxidant determinations by the use of a stable free radical. *Nature*, 181(4617), 1199-1200.

Blomhoff, R., Carlsen, M. H., Andersen, L. F., Jacobs, D. R. (2006). Health benefits of nuts: potential role of antioxidants. *British Journal of Nutrition*, 96(S2), S52-S60.

Bostan, S. Z. (2003). Important chemical and physical traits and variation in these traits in 'Tombul' hazelnut cultivar at different elevations. *Grasas y Aceites*, 54(3), 234-239.

Bostan, S. Z., Günay, K. (2009). Variation of important quality characteristics in hazelnut at different years and correlations between husk number and nut and kernel traits. *Acta Horticulturae*, 845, 641-646.

Chang, C. C., Yang, M. H., Wen, H. M., Chern, J. C. (2002). Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *Journal of Food and Drug Analysis*, 10(3).

Erdogan, V., Mehlenbacher, S. A. (2000). Interspecific hybridization in hazelnut (*Corylus*). *Journal of the American Society for Horticultural Science*, 125(4), 489-497.

Güler, E., Balta, F. (2020). Determination of yield and quality characteristics of hazelnut populations of Taskesti district (Mudurnu-Bolu). *International Journal of Agricultural and Wildlife Sciences*, 6(2), 115-128.

Gülsoy, E., Şimşek, M., Çevik, C. (2019). Determination of fruit quality traits in some hazelnut cultivars grown at different altitudes and locations in Ordu province. *International Journal of Agricultural and Wildlife Sciences*, 5(1), 25-30.

Karadeniz, T., Bostan, S.Z., Tuncer, C., Tarakçıoğlu, C. (2009). Fındık Yetiştiriciliği. Ziraat Odası Başkanlığı Bilimsel Yayınlar Serisi, Yayın No: 1, Ordu.

Köksal, A. I., Gunes, N. T., Belge, B. (2012). The effect of sampling year and geographical regions on some physical characteristics of hazelnut cultivars grown in Turkey. *Acta Horticulturae*, 940, 301-307.

Köksal, İ. (2018). Türk fındık çeşitleri. Fındık tanıtım Grubu Yayınları, 136s, Ankara.

Koyuncu, A., Kılıç, T. (2018). Fındık ve fındık yağının insan beslenmesindeki önemi. *Ordu'da Gıda Güvenliği*, 12, 47-49.

Król, K., Gantner, M. (2020). Morphological traits and chemical composition of hazelnut from different geographical origins: A review. *Agriculture*, 10(9), 375.

Kul, E. (2020). Çakıldak fındık çeşidinde kimyasal özelliklerin eko-coğrafik bölgelere göre değişimi (Master's thesis, Fen Bilimleri Enstitüsü).



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



Özbek, S. (1978). Özel Meyvecilik (Kışın Yapragını Döken Meyve Türleri), Çukurova Üniversitesi Ziraat Fakültesi Yayınları, No:128, Adana.

Pycia, K., Kapusta, I., Jaworska, G. (2020). Changes in antioxidant activity, profile, and content of polyphenols and tocopherols in common hazel seed (*Corylus avellana* L.) depending on variety and harvest date. *Molecules*, 25(1), 43.

Santos, A., Carvalho, J. L., Lopes, A., Assunção, A., Silva, A. P., Santos, F. (2005). Phenological tree traits and fruit properties of several hazelnut cultivars grown under different microclimates. *Acta Horticulturae*, 686, 79-86.

Şengül, S. (2019). *Fındık Yağı Kimyasal Kompozisyonu Antioksidan Kapasitesi ve Kalite Parametreleri Üzerine Fındık Hasat Tarihi ve Rakımın Etkisi* (Master's thesis, Fen Bilimleri Enstitüsü).

Seyhan, F., Ozay, G., Saklar, S., Ertaş, E., Satır, G., Alasalvar, C. (2007). Chemical changes of three native Turkish hazelnut varieties (*Corylus avellana* L.) during fruit development. *Food Chemistry*, 105(2), 590-596.

Tonkaz, T., Şahin, S., Bostan, S. Z., Korkmaz, K. (2019). Effect of supplementary irrigation on total antioxidant capacity and phenolic content of hazelnut. *Academic Journal of Agriculture*, 8(special issue), 79-84.

Yılmaz, M., Karakaya, O., Balta, M. F., Balta, F., Yaman, İ. (2019). Change of biochemical characteristics depending on kernel size in Çakıldak hazelnut cultivar. *Academic Journal of Agriculture*, 8(special issue), 61-70.

Yücesan, F. B., Orem, A., Kural, B. V., Orem, C., Turan, İ. (2010). Hazelnut consumption decreases the susceptibility of LDL to oxidation, plasma oxidized LDL level and increases the ratio of large/small LDL in normolipidemic healthy subjects. *The Anatolian Journal of Cardiology*, 10(1), 28-35.



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ALAKLOR HERBİSİTİNİN MUZ POLİFEOL OKSİDAZ ENZİMİ İLE ETKİLEŞİMİ

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ÖZET

Polifenol oksidaz (PPO), tirozinaz veya katekol oksidaz olarak da bilinir. PPO enziminin aktif merkezinde üç histidin rezidüsü tarafından koordine edilen, korunmuş bakır çifti içerir. PPO, monofenollerin o-difenollere hidroksilasyonu (monofenolaz aktivitesi) ve o-difenollerin o-kinonlara oksidasyonu (difenolaz aktivitesi) olmak üzere iki farklı reaksiyonu katalize eder. Fenoller kinonlara okside olduktan sonra fenolik bileşikler, amino asitler ve proteinler gibi diğer maddelerle enzimatik olmayan bir şekilde reaksiyona girerek meyve ve sebzelerde besin niteliklerinin azalmasından sorumlu olan “enzimatik esmerleşme” denilen kahverengimsi polimerler oluşur. Ayrıca, fenol oksidazlar böceklerde ve diğer eklem bacaklılarda konak savunması, yara iyileşmesi ve sklerotizasyon gibi birçok önemli reaksiyona katılır. Normal melanin pigmentasyonu insan derisini esas olarak ultraviyole ışığa karşı korurken, anormal durumlarda melazma veya yaşlılık lekeleri gibi çeşitli ciddi hastalıklara ve estetik sorunlara sebep olabilir. Pestisitler ve herbisitler, zararlılarla savaşmak için faydalı tarımsal ajanlar olmalarına ve gıda üretimini kesinlikle artırabilmelerine rağmen, insan sağlığına ve çevreye de zararlıdır. Alaklor, yabancı otların neden olduğu ekonomik kayıpları en aza indirmek ve bu nedenle mevcut üretim ve verim seviyelerini korumak ve yüksek kaliteyi korumak için yaygın olarak kullanılan bir herbisittir. Literatürde glutatyon transferaz enziminin, alaklor ile etkileşimi saptanmış ve alaklorun tespit edilebilmesi için uygun bir biyosensör olarak kullanılacağı bildirilmiştir. Bu çalışmada, alaklorun, PPO enzimi ile etkileşimi incelenmiş ve söz konusu enzimi güçlü bir şekilde inhibe ettiği saptanmıştır. Artan inhibitör (alaklor) derişimine karşı yüzde aktivite grafiği çizilmiş ve enzim aktivitesini yarıya indirdiği inhibitör konsantrasyonu olan IC50 değeri hesaplanmış ve bu değer 12,57 μ M olarak hesaplanmıştır. Alaklorun enzimimizle etkileşime girmesi, alaklorun tespiti için biyosensör materyali olarak kullanılabileceğini göstermiştir.

Anahtar Kelimeler: Herbisit, alaklor, polifenol oksidaz, inhibisyon



INTERACTION OF ALACHLOR HERBICIDE WITH BANANA POLYPHENOL OXIDASE ENZYME

ABSTRACT

The polyphenol oxidase (PPO) enzyme is also known as tyrosinase or catechol oxidase. It contains a conserved copper pair coordinated by three histidine residues at the active site of the PPO enzyme. PPO catalyzes two different reactions: hydroxylation of monophenols to o-diphenols (monophenolase activity) and oxidation of o-diphenols to o-quinones (diphenolase activity). After phenols are oxidized to quinones, they react non-enzymatically with other substances such as phenolic compounds, amino acids and proteins to form brownish polymers called "enzymatic browning", which is responsible for the reduction of nutritional qualities in fruits and vegetables. In addition, phenol oxidases participate in many important reactions in insects and other arthropods, such as host defense, wound healing, and sclerotization. While normal melanin pigmentation mainly protects human skin against ultraviolet light, it can cause various serious diseases such as melasma or age spots and aesthetic problems in abnormal situations. Pesticides and herbicides are also harmful to human health and the environment, although they are useful agricultural agents to combat pests and can certainly increase food production. Alachlor is a widely used herbicide to minimize economic losses caused by weeds and therefore maintain current production and yield levels and maintain high quality. In the literature, the interaction of glutathione transferase enzyme with alachlor has been determined and it has been reported that it will be used as a suitable biosensor to detect alachlor. In this study, the interaction of alachlor with the PPO enzyme was investigated and it was determined that it strongly inhibited the enzyme. The percent activity graph was drawn against the increasing inhibitor (alachlor) concentration and the IC₅₀ value, which is the inhibitor concentration where the enzyme activity was halved, was calculated and this value was calculated as 12.57 μ M. The interaction of alachlor with the enzyme has shown that it can be used as a biosensor material for the detection of alachlor.

Keywords: Herbicide, alachlor, polyphenol oxidase, inhibition



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1. GİRİŞ

Polifenol oksidaz, aktif merkezde üç korunmuş histidin rezidüsü tarafından koordine edilen bakır çifti içeren, tirozinaz veya katekol oksidaz olarak da bilinen bir metalloproteindir (Klabunde ve diğerleri, 2000). Doğada yaygın olarak bulunan bu enzim, hem prokaryotik hem de ökaryotik canlılarda olduğu kadar hayvanlarda ve bitkilerde de bulunur. Tirozinaz, omurgalı ve omurgasız hayvanların melanin pigmentasyonunda son derece önemli bir role sahiptir (Jaenicke ve Decker, 2003; Marusek, Trobaugh, Flurkey ve Inlow, 2006). PPO, Monofenollerin o-difenollere hidroksilasyonu (monofenolaz, tirozinaz aktivitesi) ve o-difenollerin o-kinonlara oksidasyonu (difenolaz, katekolaz aktivitesi) olmak üzere iki farklı reaksiyonu katalize ederler. Oluşan kinonlar daha sonra agregasyona uğrar ve fenolik bileşikler, amino asitler ve proteinler gibi diğer maddelerle enzimatik olmayan bir şekilde reaksiyona girerek, işleme/depolama sırasında meyve ve sebzelerde besin niteliklerinin azalmasından sorumlu olan karmaşık kahverengi polimerler üretir (Chaisakdanugull, Theerakulkait ve Wrolstad, 2007; Parvez, Kang, Chung ve Bae, 2007). PPO'lar böceklerde ve diğer eklembacaklılarda konak savunması, yara iyileşmesi ve sklerotizasyon gibi birçok önemli reaksiyona katılır (Cerenius, Sö ve Söderhäll, 2004; Perdomo-Morales, Montero-Alejo, Perera, Pardo-Ruiz ve Alonso-Jiménez, 2007). Ek olarak, normal melanin pigmentasyonu insan derisini ultraviyole ışığa karşı korurken (Sánchez-Campillo ve diğerleri, 2009), anormal durum melazma, yaşlılık lekeleri gibi çeşitli cilt hastalıklarına ve estetik sorunlara yol açabilir (Zhu ve Gao, 2008). Kozmetik, tarım ve tıp gibi endüstrilerde güvenli ve etkili tirozinaz inhibitörlerinin geliştirilmesi esastır. Ancak kojik asit, arbutin, tropolon ve 1-fenil 2-tiyoüre gibi sadece birkaç bileşik vardır. (Nixha, Ergun, Gencer, Arslan ve Arslan, 2019). Makro halkalı tiyocrown eterler (ERGÜN ve ÇİÇEK, 2018) ve benzimidazole gümüş komplekslerinin (ERGÜN ve KARATAŞ, 2020) söz konusu enzimi önemli ölçüde inhibe ettiği daha önceden yapılan çalışmalarda tespit edilmiştir.

İnsan sağlığı üzerindeki doğrudan etkisi nedeniyle gıda güvenliği, dünya çapında ilgi çeken bir alandır (Darko ve Akoto, 2008; Kaushik, Satya ve Naik, 2009). Bu çalışmada PPO enzimi ile etkileşimi araştırılan alaklor (2-kloro-2',6'-dietil-N-(methoksimetil) asetanilid), insanlar ve hayvanlar için yüksek toksisite gösteren bir herbisittir (Chesters ve diğerleri, 1989; Heydens ve diğerleri, 1999). Tarımda yaygın olarak uygulanması nedeniyle, gıda, su ve havanın kontaminasyonuna neden olarak tüm organizmaların sağlığını olumsuz yönde etkilemektedir (Chesters ve diğerleri, 1989; Heydens ve diğerleri, 1999). Yakın tarihli bir çalışmada, (Rung ve Schwack, 2005), organofosforlu bir insektisit foto-indirgeme ürünü olan aminoparathion'un,



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PPO'lar için bir substrat olduğunu bildirmiştir. Bu kimyasallardan bazıları, doğal fenol oksidaz substratları ile bariz yapısal benzerlikleri paylaşır (Glezer, 2009). Bu, mühendislere, gıda ve çevresel numunelerdeki pestisit kalıntılarını tespit etmek için özellikle immobilize enzimler kullanan bir dizi biyosensör geliştirme konusunda ilham verdi (Anh ve diğerleri, 2002, 2004). Bu çalışmada, yaygın olarak kullanılan bir herbisit olan alaklorun, muz meyvesinden saflaştırılan PPO enzimini önemli ölçüde inhibe ettiği tespit edilerek, söz konusu enzim ile olan etkileşimi belirlenmiş oldu.

2. ARAŞTIRMA VE BULGULAR

2.1. PPO enziminin saflaştırılması

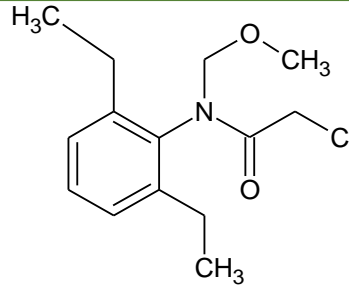
Piyasadan temin edilen yerli muz, PPO enzim kaynağı olarak seçildi. 50 g muz, 0,5 M fosfat tamponu (%0,5 PEG, 10 mM askorbik asit, pH; 7) ile yaklaşık 2 dakika boyunca ev tipi blender ile ekstrakte edildi. Ekstraksiyon çözeltisi süzülerek 15000 rpm ve +4 °C'de 45 dakika santrifüj edildi. Elde edilen supernetanta %80 amonyum sülfat ile çöktürme işlemi yapıldı ve aynı şartlarda tekrar santrifüj işlemi gerçekleştirildi. Oluşan çökelek olabildiğince az miktarda 5 mM fosfat tamponunun 'da (pH 6.3) çözülüp, aynı tampon kullanılarak diyaliz işlemi gerçekleştirilerek kısmi olarak saflaştırıldı. Bu işlemten sonra, Diyaliz işleminden sonra Sepharose-4B-L-tirozin-p-aminobenzoik asit kimyasal yapısına sahip afinite jeli kullanılarak PPO enzimi saflaştırıldı (Arslan, Erzengin, Sinan ve Ozensoy, 2004).

2.2. PPO enziminin aktivite tayini

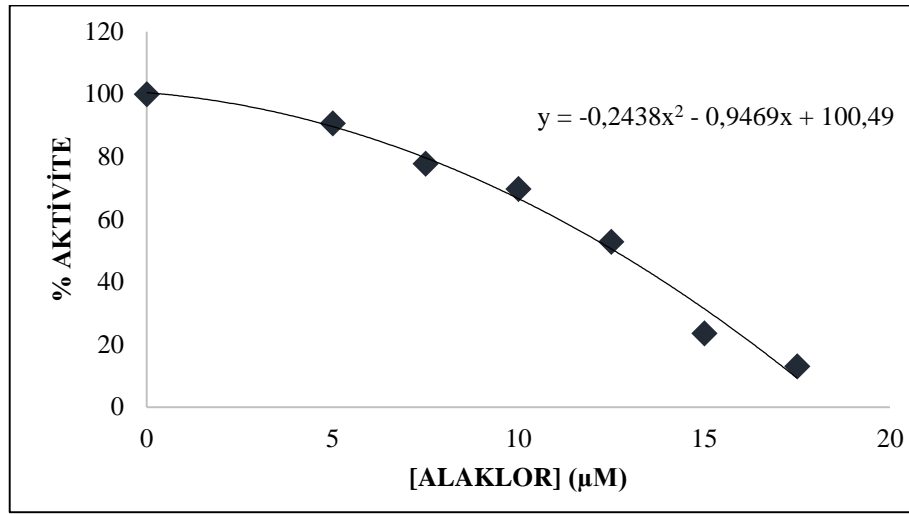
Enzimin aktivitesi, substrat olarak 0,1 M katekol kullanıp spektrofotometrede 420 nm dalga boyunda 1 dakika içinde absorbanstaki meydana gelen değişiklik ölçülerek hesaplandı. Aktivite tampon olarak pH 6,8 olan 0,1 M fosfat tampon kullanılmıştır.

2.3. IC₅₀ değerlerinin hesaplanması

Söz konusu herbisit, saflaştırdığımız PPO enziminin aktivitesini %50 oranda azalttığı konsantrasyon değerini (IC₅₀) hesaplamak için, PPO enziminin inhibitörsüz ortamdaki aktivitesi 2.2'ye göre bulundu ve bu değer %100 olarak kabul edildi. Daha sonra alaklor artan hacimlerde ortama eklenerek aktiviteler ölçüldü ve % aktiviteler hesaplandı. Eklenen inhibitör hacimlerinin konsantrasyonları hesaplanarak, % Aktivite-[inhibitör] grafiği çizildi (Şekil 2.2).



Şekil 2.1. Alaklor (2-kloro-2',6'-dietil-N-(methoksimetil) asetanilid)



Şekil 2.2. Alaklora ait IC₅₀ grafiği

Grafikten elde ettiğimiz denklem yardımıyla, IC₅₀ değeri, 12,57 µM olarak hesaplanmıştır.

3. SONUÇ

- PPO enzimi üzerindeki etkileri araştırılan Alaklor herbisiti, PPO'yu güçlü bir şekilde inhibe etmiştir.
- IC₅₀ değeri 12,57 µM olarak tespit edilmiştir.
- Alaklorun PPO enzimi ile olan ilgisi sayesinde, immobilize PPO enzimi, alaklor için biyosensör olarak kullanılabilir.



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KAYNAKÇA

Anh, T. M., Dzyadevych, S., Soldatkin, A., Duc Chien, N., Jaffrezic-Renault, N., Chovelon, J. Nam, V. (2002). *Development of tyrosinase biosensor based on pH-sensitive field-effect transistors for phenols determination in water solutions. Talanta* (C. 56). www.elsevier.com/locate/talanta adresinden erişildi.

Anh, T. M., Dzyadevych, S. V., Van, M. C., Renault, N. J., Duc, C. N. ve Chovelon, J. M. (2004). Conductometric tyrosinase biosensor for the detection of diuron, atrazine and its main metabolites. *Talanta*, 63(2), 365–370. doi:10.1016/j.talanta.2003.11.008

Arslan, O., Erzengin, M., Sinan, S. ve Ozensoy, O. (2004). Purification of mulberry (*Morus alba* L.) polyphenol oxidase by affinity chromatography and investigation of its kinetic and electrophoretic properties. *Food Chemistry*, 88(3), 479–484. doi:10.1016/j.foodchem.2004.04.005

Cerenius, L., Sö, K. ve Söderhäll, K. (y.y.). *The prophenoloxidase-activating system in invertebrates*.

Chaisakdanugull, C., Theerakulkait, C. ve Wrolstad, R. E. (2007). Pineapple juice and its fractions in enzymatic browning inhibition of banana [*Musa* (AAA group) Gros Michel]. *Journal of Agricultural and Food Chemistry* içinde (C. 55, ss. 4252–4257). doi:10.1021/jf0705724

Chesters, G., Simsiman, G. V., Levy, J., Alhajjar, B. J., Fathulla, R. N. ve Harkin, J. M. (1989). Environmental fate of alachlor and metolachlor. *Reviews of Environmental Contamination and Toxicology*, 110, 1–74. doi:10.1007/978-1-4684-7092-5_1

Darko, G. ve Akoto, O. (2008). Dietary intake of organophosphorus pesticide residues through vegetables from Kumasi, Ghana. *Food and Chemical Toxicology*, 46(12), 3703–3706. doi:10.1016/j.fct.2008.09.049

ERGÜN, A. ve ÇİÇEK, B. (2018). Bazı makroalkalı tiyocrown eterlerin polifenol oksidaz enzimi üzerindeki inhibisyon etkilerinin araştırılması. *Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 20(1), 1–8. doi:10.25092/baunfbed.427644

ERGÜN, A. ve KARATAŞ, M. O. (2020). Yeni N-benzilbenzimidazol-gümüş(I) komplekslerinin sentezi, karakterizasyonu, karbonik anhidraz ve polifenol oksidaz enzimleri üzerindeki inhibitör özellikleri. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 10(1), 320–327. doi:10.21597/jist.551498

Glezer, V. (2009). Environmental Effects of Substituted Phenols. *PATAI'S Chemistry of Functional Groups*. doi:10.1002/9780470682531.pat0294



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



Heydens, W. F., Wilson, A. G. E., Kier, L. D., Lau, H., Thake, D. C. ve Martens, M. A. (1999). An evaluation of the carcinogenic potential of the herbicide alachlor to man. *Human and Experimental Toxicology*, 18(6), 363–391. doi:10.1191/096032799678840219

Jaenicke, E. ve Decker, H. (2003). *Tyrosinases from crustaceans form hexamers. Biochem. J* (C. 371).

Kaushik, G., Satya, S. ve Naik, S. N. (2009, Ocak). Food processing a tool to pesticide residue dissipation - A review. *Food Research International*. doi:10.1016/j.foodres.2008.09.009

Klabunde, T., Eicken, C., Sacchettini, J. C., Krebs, B., Henson, M. J. ve Solomon, E. I. (2000). Crystal structure of a plant catechol oxidase containing a dicopper center. *Chemtracts*, 13(2), 97–102.

Marusek, C. M., Trobaugh, N. M., Flurkey, W. H. ve Inlow, J. K. (2006). Comparative analysis of polyphenol oxidase from plant and fungal species. *Journal of Inorganic Biochemistry*, 100(1), 108–123. doi:10.1016/j.jinorgbio.2005.10.008

Nixha, A. R., Ergun, A., Gencer, N., Arslan, O. ve Arslan, M. (2019). Development of carbazole-bearing pyridopyrimidine-substituted urea/thiourea as polyphenol oxidase inhibitors: synthesis, biochemistry, and theoretical studies. *Archives of Physiology and Biochemistry*, 125(3). doi:10.1080/13813455.2018.1453523

Parvez, S., Kang, M., Chung, H.-S. ve Bae, H. (2007). TYROSINASE INHIBITORS FROM NATURAL SOURCES 805 Naturally Occurring Tyrosinase Inhibitors: Mechanism and Applications in Skin Health, Cosmetics and Agriculture Industries. *Phytother. Res*, 21, 805–816. doi:10.1002/ptr

Perdomo-Morales, R., Montero-Alejo, V., Perera, E., Pardo-Ruiz, Z. ve Alonso-Jiménez, E. (2007). Phenoloxidase activity in the hemolymph of the spiny lobster *Panulirus argus*. *Fish and Shellfish Immunology*, 23(6), 1187–1195. doi:10.1016/j.fsi.2007.04.001

Rung, B. ve Schwack, W. (2005). Aminoparathion: A highly reactive metabolite of parathion. 1. Reactions with polyphenols and polyphenol oxidase. *Journal of Agricultural and Food Chemistry*, 53(23), 9140–9145. doi:10.1021/jf051520m



**ISPEC 8th INTERNATIONAL CONFERENCE
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and RURAL DEVELOPMENT
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Sánchez-Campillo, M., Gabaldon, J. A., Castillo, J., Benavente-García, O., Del Baño, M. J., Alcaraz, M., ... Lozano, J. A. (2009). Rosmarinic acid, a photo-protective agent against UV and other ionizing radiations. *Food and Chemical Toxicology*, 47(2), 386–392. doi:10.1016/j.fct.2008.11.026

Zhu, W. ve Gao, J. (2008). The use of botanical extracts as topical skin-lightening agents for the improvement of skin pigmentation disorders. *Journal of Investigative Dermatology Symposium Proceedings* içinde (C. 13, ss. 20–24). Nature Publishing Group. doi:10.1038/jidsymp.2008.8



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**TÜRKİYE VE DÜNYA GENELİNDE BİYOGAZ SİSTEMLERİNİN KIRSAL
KALKINMAYA ETKİSİ**

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ÖZET

Artan dünya nüfusu ile doğru orantılı olarak oluşan atıkların miktarı ve enerji ihtiyacı da sürekli olarak artmaktadır. Oluşan atıkların çevresel açıdan oluşturduğu olumsuz etki sebebiyle bertaraf edilme zorunluluğu ve fosil kökenli enerji kaynaklarının gün geçtikçe azalması ile enerji açığının giderek artması mevcut kaynakların daha etkin kullanımını ve yenilenebilir enerji kaynaklarına olan yönelimi gerekli kılmaktadır. Biyogaz üretiminde organik atıkların kullanılıyor olması hem atık bertarafı hem de atıklardan enerji eldesi konularında etkin bir atık yönetim adımı ortaya koymaktadır. Biyogazın elde edilmesinde kullanılan organik atıkların başında hayvansal atıklar gelmektedir. Özellikle kırsal kesimde oldukça fazla miktarda bulunan hayvansal atıklar, biyogaz sistemleri için oldukça önemli girdilerdir. Biyogaz sistemleri hayvansal atıkların bekletilmeden kullanılmasına olanak tanımakta, ayrıca enerji içeriği yüksek olan biyogazla birlikte fermente edilmiş organik gübre sağlamaktadır. Kırsal alanda yaşayan, geçimini genellikle tarım ve hayvancılıktan kazanan bireylerin daha iyi yaşam koşullarına kavuşturulabilmeleri için onlara maddi ve manevi açıdan sürdürülebilir olanaklar sağlamak gerekmektedir. Kırsal kalkınmanın sürdürülebilir olabilmesi için bu bölgelere kurulacak olan biyogaz sistemlerinin ele alınması oldukça önemlidir. Bu çalışma, Türkiye ve Dünya'daki biyogaz sistemlerinden örnekler ile bu sistemlerin kuruldukları bölgelerde kırsal kalkınmaya yönelik etkileri, ekonomik, sağlık ve çevresel açıdan incelenerek ele alınmıştır.

Anahtar Kelimeler: Biyogaz, Biyogaz Sistemleri, Kırsal Kalkınma



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**THE EFFECTS OF BIOGAS SYSTEMS ON RURAL DEVELOPMENT IN TURKEY
AND WORLDWIDE**

ABSTRACT

The need for energy is constantly increasing in a direct proportion with the increasing world population. It also affects the amount of waste and disposals worldwide. The necessity to dispose of the wastes due to the negative environmental impact and the increasing energy deficit with the decrease of fossil-based energy sources day by day necessitate more efficient use of existing resources and a tendency towards renewable energy sources. It is an undeniable fact that the usage of energy production methods that produce organic wastes are more environmentally friendly and beneficial with their effective waste management steps. Biogas is one of the production methods which reveals an effective waste management procedure. The most vital materials of energy production from biogas are animal waste which presents in large quantities in rural areas. Biogas systems allow the use of animal wastes by producing fermented organic fertilizer with biogas, which has a high energy content. It also financially provides the individuals who are living in rural areas and generally live off from agriculture and animal husbandry, in order to achieve better living conditions. In order for rural development to be sustainable, it is undoubtedly necessary to consider the biogas systems to be established in these regions. In this study, the effects of these systems on rural development in the regions where they are installed are examined in detail in terms of economic, health and environmental aspects by giving examples from Turkey and the World.

Keywords: : Biogas, Biogas Systems, Rural Development



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1. GİRİŞ

Günümüzde Dünya nüfusunun hızla artması ile doğru orantılı olarak enerjiye ve dolayısı ile enerji kaynaklarına olan ihtiyaç her geçen gün artmaktadır. Dünya'daki enerji ihtiyacının karşılanmasında fosil kökenli yakıtlar uzun süredir kullanılmaktadır. Ancak bu kaynakların kullanılıyor olması başta hava kirliliği ve küresel ısınma olmak üzere özellikle çevresel anlamda büyük sorunlara neden olmaktadır. Tüm bunların yanı sıra fosil yakıtların fiyatlarındaki ani dalgalanmalar ve bu kaynakların bir gün tükenecek olması günümüzde yenilenebilir enerjiye olan talebi artırmaktadır [1].

Son zamanlarda artan çevre kirliliği sebebi ile, tüm dünyada en önemli tartışma konularından biri kullanılan enerji kaynakları ve bu kaynaklarının çevresel anlamda yarattığı etkiler olmuştur. Enerji ihtiyacının karşılanmasında ortaya çıkan olumsuz çevresel etkileri en aza indirmek hem sosyal hem de ekonomik anlamda kalkınma için çok önemlidir. Enerji talebinin temiz ve güvenilir enerji kaynaklarından sürdürülebilir bir şekilde ve düşük maliyetler ile karşılanması ülkelerin kalkınması için zorunlu bir parametredir [2].

Bu nedenle literatürde enerji ihtiyacının karşılanmasında %100 yenilenebilir ve sürdürülebilir enerji kaynaklarının kullanımı ile ilgili bazı çalışmalar gerçekleştirilmiştir [3]. Yapılmış çalışmalardan bir örnek olarak, 2050 yılına kadar Avrupa Birliği'nde enerji ihtiyacının karşılanmasında %100 yenilenebilir enerji kaynakları kullanılması senaryosu vardır. Bu çalışmada bahsedilen senaryonun uygun politik güç, ekonomik ve teknolojik şartlar altında teknik olarak mümkün olduğu ve uygulanabileceği sonucuna varılmıştır [4].

Yenilenebilir enerji kaynakları içinde; güneş enerjisi, jeotermal enerji, hidrolik enerji, rüzgar enerjisi, biyokütle enerjisi, dalga enerjisi, hidrojen enerjisi yer almaktadır [5]. Temiz enerji kaynakları arasında yer alan biyokütle enerjisi hem çevreci hem de oluşan atık problemlerini ortadan kaldırmak açısından oldukça önemli bir enerji kaynağıdır. Biyokütle bitkisel ve hayansal kaynaklı organik atıkların işlemden geçirilerek farklı yakıtlara dönüştürülmesi ya da bu organik atıkların direkt olarak yakılması olarak tanımlanabilir [6]. Biyokütle enerji kaynakları; biyogaz, biyoetanol ve biyodizeli kapsamaktadır [7]. Biyokütle enerji kaynakları arasında yer alan biyogaz üretiminde özellikle hayvansal kaynaklı atıklar kullanılıyor olması kırsal kalkınma açısından oldukça önemlidir. Kırsal kesimde yaşayan ve genellikle geçimini tarım ve hayvancılıktan sağlayan insanların biyogaz sistemlerini kullanması sürdürülebilir bir kalkınma sağlamanın önemli bir ayrıntısıdır.



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Tüm bu bağlamda, bu çalışmada sürdürülebilir bir kalkınma için gerekli olan kırsal kalkınma biyogaz sistemleri ile birleştirilerek Türkiye ve Dünya açısından değerlendirilmiş, örnekler ile zenginleştirilmiştir.

2. BİYOGAZ

Biyogaz, organik atıkların oksijensiz ortamda fermentasyonu sonucu açığa çıkan doğal gaz benzeyen renksiz ve yanıcı bir gazdır. Biyogaz içinde metan (%60-70), karbondioksit (%30-40) hidrojen sülfür, hidrojen, karbon monoksit ve azot bulunan bir gaz karışımıdır [8]. Doğa koşullarında oldukça yaygın olarak görülen anaerobik çürütme işlemi, bataklıklarda ve deniz tabanlarında ayrıca geviş getiren hayvanların işkembelerinde de meydana gelmektedir. Bu işlem organik girdinin mikroorganizmalar tarafından bir dizi proses sonucu biyogaza çevrilme işlemidir [9]. Biyogaz oluşumu, hidroliz, asetik asidin oluşumu ve metan üretimi olarak üç ana başlık altında incelenmektedir. Birinci aşama olarak kabul edilen hidroliz aşaması organik atığın mikroorganizmalar tarafından parçalanarak çözünmesi işlemidir. İkinci aşama olarak kabul edilen asetik asidin oluşumu aşaması ise, mikroorganizmalar tarafından çözünen organik atıkların, asit oluşturucu bakteriler tarafından asetik asit gibi çok küçük yapıli maddelere dönüştürölme prosesidir. Üçüncü ve son aşama, küçük yapıli maddelerin metan oluşturucu bakteriler tarafından biyogaza dönüştürölme işlemidir [10].

Biyogaz üretiminde kullanılan başlıca organik atıklar; mısır, buğday, yosun gibi bitkisel kökenli atıklar, evlerden atılan meyve ve sebze atıkları gibi evsel atıklar, sanayi atıkları ve hayvansal atıklardır [11]. 1 m³ biyogazın sağladığı ısıli değeri içeriğindeki metan oranına bağlı olarak 4700-5700 kcal/m³ arasında değışmektedir. Bu değeri bize 1 m³ biyogazın; 0,62 litre gaz yağına, 3,47 kg oduna, 1,46 kg odun kömürüne, 12,3 kg tezege, 0,43 kg bütan gazına, 4,70 kWh elektrik enerjisine eşdeğer olduğunu gösterir [12]. Biyogazın ısıli değeriini oluşturan temel etken içerdiği metan oranıdır. Metan gazı karbondioksite kıyasla 20 kat daha fazla sera gazı etkisine sebep olmakta ve dolayısı ile küresel ısınmaya daha fazla etki etmektedir. Dolayısı ile biyogaz üretiminde hammadde olarak bitkisel, hayvansal ve sanayi atıklarının kullanılıyor olması iktisadi anlamda getiri sağlamanın yanı sıra çevresel anlamda da oldukça önemlidir. Ayrıca biyogaz prosesinin bir sonucu olarak elde edilen fermente gübre tarımsal faaliyetlerde kullanılmaktadır. Bu fermente gübrenin özelliği, anaerobik çürütme prosesinin bir sonucu olarak meydana gelmesi sebebi ile içeriğindeki toprağa zararlı maddelerin büyük ölçüde yok edilmiş olmasıdır. Dolayısı ile bu durum da toprak verimliliğini artırmaktadır [9].



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2.1 Biyogazın Sağladığı Faydalar

- Biyogaz çevreye zarar vermeyen bir enerji kaynağı olmasının yanı sıra maliyet açısından daha avantajlı bir enerji kaynağıdır.
- Organik atıklardan anaerobik işlem sonucunda organik gübre sağlar, ayrıca hayvan gübresinin içinde bulunan yabancı maddelerin yok olmasına yardımcı olmaktadır.
- Atıkların bertaraf edilmesini sağlamaktadır.
- Hayvansal atık kaynaklı kötü kokular biyogaz prosesi sonucunda ortadan kaybolmaktadır.
- Yer altı sularını tehdit eden hayvansal atıkların içindeki bileşenler biyogaz üretimi neticesinde ortadan kaybolmaktadır.
- Biyogaz enerjisi; ısıtma ve aydınlatma gibi ihtiyaçları karşılamak amacıyla kullanılabilir.
- İçerisinde %95 oranına kadar metan barındıran biyogaz, doğalgaza ve sıvılaştırılmış petrol gazı ile çalıştırılan sobalara alternatif olarak kullanılabilir. Tüm bu faydaların yanı sıra yenilenebilir enerji kaynakları içerisinde ulusal ve bölgesel biyokütle kaynaklarının zenginliğine bağlı olan biyogaz enerjisi, enerji arz güvenliğini artıracak gibi aynı zamanda enerji kullanımında dışa bağımlılığı da azaltacaktır. Ayrıca biyogaz bir ülkenin sadece enerji dengesini sağlamaya yardımcı olmakta kalmamakta, aynı zamanda doğal kaynakları ve çevreyi korumada da çok önemli bir rol oynamaktadır [14].

3. KIRSAL KALKINMA VE BİYOGAZ

Kalkınma bir ülke yapısının niteliksel olarak pozitif yönde değişimi olup, temel olarak ekonomik, sosyal ve insani kalkınma olarak üç başlıkta incelenen önemli bir kavramdır. Kırsal kalkınma ise kırsal kesimde yaşayan insanların yaşam standartlarının ve çevre koşullarının iyileştirilmesini tanımlayan bir kavramdır [15]. Kırsal kalkınmanın sürdürülebilirliği açısından bu bölgelerde yenilenebilir enerji kaynaklarının kullanımı oldukça önem arz etmektedir. Yenilenebilir enerji kaynakları içerisinde yer alan biyogaz sistemleri için en önemli girdiler özellikle kırsal alanlarda daha çok bulunan hayvansal atıklardır. Kırsal alanlarda hayvansal atıklar genellikle tezek olarak verimi çok düşük bir şekilde yakılmakta ya da uzun bir dönem boyunca bekletilip çevre kirliliğine neden olduktan sonra tarımsal faaliyetlerde kullanılmak üzere gübre olarak tercih edilmektedir. Bu bölgelere kurulacak olan biyogaz sistemleri, çevre kirliliğine sebep olan hayvansal atıkların bekletilmeden bertaraf edilmesini sağlamakta, ayrıca



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enerji ihtiyacının karşılanmasında kullanılabilecek biyogaz eldesi sağlamaktadır. Tüm bunların yanı sıra yüksek azot değerine sahip, toprağa zarar veren patojenlerin yok edildiği organik gübre çıktısını elde etmektedir [16]. Şekil 1’de kırsal alanlarda hayvansal atıkların kontrolsüzce depolanması örneği gösterilmiştir.



Şekil 1. Hayvansal Atıkların Kontrolsüzce Depolanması [17]

Şekil 1’de görüldüğü üzere kırsal alanlarda atıl olarak bırakılan hayvansal atıklar hem çevre kirliliğine sebep olmakta hem de koku ve sinek gibi problemler yaratarak bu bölgelerde yaşayan insanların yaşam kalitesini düşürmektedir.

Biyogaz sistemleri havasız ortamda anaerobik çürütme işlemini gerçekleştirerek organik atıkların kontrollü bir şekilde bertaraf edilmesini sağlamakta ayrıca çevreye zararlı olan mikroorganizmaların da yok olmasını sağlamaktadır. Biyogaz üretimi sonucu ortaya çıkan fermente gübre seperatörle arıtıldıktan sonra sıvı ve katı gübre olarak kullanılabilmektedir (Şekil 2, Şekil.3) [17].



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Şekil 2. Biyogaz Prosesi Sonucunda Elde Edilen Katı Gübre [17]



Şekil 3. Biyogaz Prosesi Sonucunda Elde Edilen Sıvı Gübre [17]

Hayvansal organik atıklar genellikle kurutulup, kırsal bölgelerde ısınma ihtiyacını karşılamak için kullanılmaktadır. Ancak bu atıkların tezek olarak yakılmasındansa, tarımsal alanlarda doğrudan kullanılmasından sağlanan verim 2,66 kat, bu organik atıklardan biyogaz ya da fermente gübre elde edilmesinde sağlanan verim ise 4,15 kat daha fazladır. [18].



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Kırsal kesimde çevre kirliliği yaratacakken biyogaz sistemlerinde girdi olarak kullanılan organik atıklar, bulundukları bölgelerde ekonomik bir değere dönüşmüş olurlar. Biyogaz sisteminin bir parçası olan anaerobik reaktörden çıktığında organik atıkların kütlesi yaklaşık %96-98 oranında azalır. Bu kütlenin ortalama %7-8'i katı %75-93'ü sıvı olarak bulunmaktadır. Bu katı ve sıvı organik gübre karışımı işletmeler ve kırsal alandaki çiftçiler için oldukça önemli bir değere sahiptir [19].

Kırsal kesimde yaşayan insanların gelir seviyeleri, kentlerde yaşayan insanlara oranla daha düşüktür. Bu nedenle bir biyogaz sistemi bir bölgeye kurulmadan önce dikkat edilmesi gereken parametreler vardır. Bu parametrelerden ilki; fayda/maliyet analizleri ile kırsal alana kurulacak olan biyogaz sistemlerinin bölge halkına sağlayacağı getirinin mali olarak hesaplanmasıdır. Burada yaşayan kişilerin maksimum borçlanma miktarları çeşitli sosyo-ekonomik çözümlemeler ile belirlenmeli ve krediler direkt kullanıcılara değil belirlenmiş olan kurumlar aracılığı ile verilmelidir. Ayrıca bu kurumların aracılığı ile verilen krediler likit para olarak değil malzeme ya da işçilik yöntemi ile kullanıcıya ulaştırılmalıdır [20]. Parametrelerden bir diğeri ise; biyogaz sistemlerini kırsal alanlara kurmadan önce bu bölgelerin ulaşım ve iletişim yollarının iyice araştırılmış olması gerekir. Ayrıca bu sistemler için kullanılacak olan ekipmanlar öncelikle lokal malzeme üreticilerinden temin edilmeye çalışılmalı ve bölgesel pazar araştırması yapılmalıdır [20].

Kavramlar çerçevesinde Şekil 4'te kırsal kesimde kurulacak olan biyogaz tesislerinin bölgede yaratacağı olumlu etkiler ekonomik, sosyal, çevresel ve sağlık açısından değerlendirilmiştir.



Şekil 4. Biyogaz Sistemlerinin Kırsal Kalkınmaya Etkisi



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Şekil 4'te görüleceği üzere bir biyogaz sisteminin birçok önemi bulunmaktadır. Biyogaz tesisleri kurulacakları kırsal bölgelerde sosyo-ekonomik katkı sağlayacak olup, istihdam yaratacaktır. Ayrıca hayvansal atıkların taşınmasında işçi, nakliye hizmetleri gibi sebepler ile iş ve getiri olanakları sağlayacaktır [21].

4. DÜNYA'DA BİYOGAZ SİSTEMLERİ VE KIRSAL KALKINMA

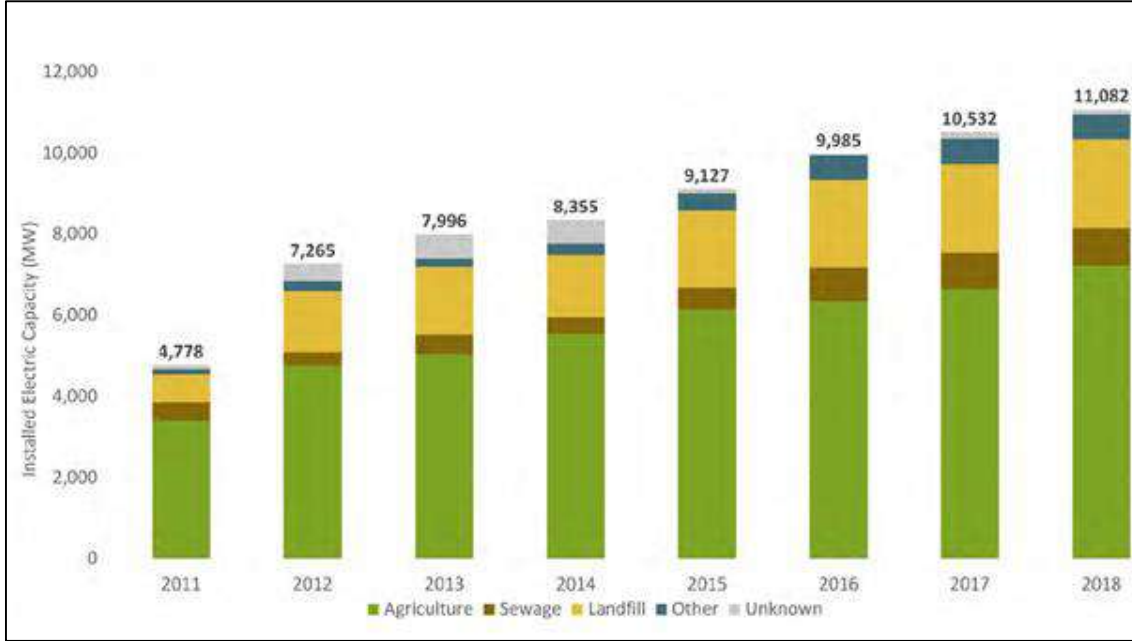
Dünya'daki biyogaz sistemleri incelendiğinde; hayvansal atıklardan biyogaz eldesi için kurulan sistemlerin %80'i Çin'de, %10'u Hindistan, Nepal ve Tayvan'dadır. Geri kalan %10'u ise diğer ülkelerdedir [22]. Çin'de 11 ile 13 milyon arasında aile tipi biyogaz tesisi mevcuttur. Bu tesislerden bir yılda toplam 3.3 giga-m³ biyogaz eldesi sağlanmaktadır [16]. Çin'de biyogaz tesislerinden elde edilen biyogaz ile yaklaşık 25 milyon insan 8-10 aylık pişirme ihtiyacını karşılayabilmektedir [22]. Ancak, Çin, Bangladeş ve Hindistan'ın kırsal kesimlerinde kurulan aile tipi küçük ölçekli biyogaz sistemlerinde bir takım tesis ve işletme zorlukları ortaya çıkabilmektedir. Bu nedenle kırsal alana kurulacak biyogaz sistemlerini seçerken bölgenin yapısına göre köyü kapsayan ya da en azından birkaç aileyi kapsayan sistemlerin yapılmasına dikkat edilmelidir [23].

Çin, Nepal, Bangladeş gibi ülkelerden farklı olarak 2018 yılı verilerine göre Avrupa'da toplam biyogaz tesisi sayısı 18.202 adet olarak belirlenmiştir. 11.084 adet biyogaz tesisi ile Almanya ilk sırada yer almakta onu sırasıyla 1.655 adet tesis ile İtalya, 837 tesis ile Fransa, 715 tesis ile İngiltere, 634 tesis ile İsviçre takip etmektedir. [24]

Avrupa'daki biyogaz tesislerindeki kurulu elektrik gücü kapasitesi ise önceki yıllarla paralel olarak gelişmiş ve 2018 yılında %5 artarak toplam 11.082 MW'a ulaşmıştır. Şekil 5'te görüleceği üzere 2018 yılında tarımsal biyogaz tesisleri (hayvansal atıklar ve tarımsal atıklardan enerji elde etme prosesini içeren) 558 MW ile toplam kapasitedeki genel kazancın çoğunu oluşturmaktadır. [24]



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Şekil 5. Toplam Biyogaz Kurulu Güç Kapasitesinin Yıllara Göre Değişimi [24]

Tüm bu verilere ek olarak Avrupa ülkelerinde biyogazdan elde edilen toplam elektrik miktarı 63.511 GWh'dir [24] .

Kırsal alanlar ile tarım birbirinden ayrı düşünölemeyecek kavramlardır. Aralarında çift yönlü ilişki vardır; birindeki değişim, diğesindeki dönüşöme neden olur. Dolayısı ile kırsal alanların etkin ve uzun vadeli kalkınması, tarımsal çeşitliliğinin artmasına ve çok işlevli gelişimine neden olacaktır. Tarımsal kaynaklara dayalı yeni ekonomik faaliyetler sadece çiftçiler için değil kırsal alanda yaşayan herkes için yeni ve ek gelir kaynaklarına yol açacaktır [25]. Bu bağlamda kırsal alanlardaki atıklardan biyogaz enerjisi üretimi tarımın çok yönlü işlevselliğine katkı sağlayan önemli bir olgu olarak incelenmektedir. Bu olgular çerçevesinde Polonya ve Slovakya'yı kapsayan bir anket çalışması yapılmıştır. Bu anket çalışmasında, belirli bölgelerde kurulmuş olan tarımsal biyogaz tesislerinin hammadde tedariginden, enerji üretimine kadar olan süreç çerçevesinde kuruldukları bölgelerde yerel halk, yerel yönetimler, çevre, yapısal değişiklikler üzerinde yarattığı etkileri araştırmak amaçlanmıştır. Çeşitli açılardan ele alınan araştırmanın sonucunda tarımsal alanlarda kurulan biyogaz tesislerinin sadece tarımdaki değişiklikleri etkileyen bir etken değil aynı zamanda kırsal kalkınmanın da önemli bir unsuru olduğu doğrudan vurgulanmaktadır. Ayrıca tarımsal biyogaz sistemlerinin enerji kaynaklarının daha eşit dağılımı üzerindeki olumlu etkisinin yanı sıra kırsal alanlarda doğrudan yeni iş imkanları sağladığı ya da mevcut iş olanaklarının korunmasında yardımcı olduğu ortaya konulmuştur.



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Tarımdaki istihdamın azaldığı ve genellikle iş sıkıntısı çekildiği bilinen kırsal alanlarda kurulan biyogaz tesislerinin kırsal kalkınma için oldukça önemli olduğu vurgulanmıştır [26].

Biyogaz sistemlerinin kırsal kalkınmada yarattığı etkilerden bir diğer örnek; Nepal kırsalındaki 600 biyogaz kullanıcısı ve 600 de biyogaz kullanıcısı olmayan kişiler arasında yapılan bir çalışmadır. Bu çalışmada araştırmacılar biyogazın göz enfeksiyonu, yanma, akciğer problemleri, solunum problemleri ve astım gibi hastalıkların azaltılmasına veya hafifletilmesine yardımcı olduğunu bulgusuna ulaşmışlardır [27].

Çin’de işlenmemiş insan ve hayvan atıklarının tarımsal kullanımı yüzyıllardır yaygın olan fekal kaynaklı paraziter rahatsızlıklara neden olmaktadır. 800.000 insan enfekte durumda olup yaklaşık 60 milyon insan enfeksiyon riski altındadır. Biyogaz kullanılan bölgelerde bu rahatsızlıkların azaldığı bulgusuna ulaşılmıştır [28].

Güneybatı Çin'deki karşılaştırmalı bir araştırmada, biyogaz kullanan hanelerin kullanmayan hanelere göre yaklaşık yüzde 20 daha az kimyasal gübre ve böcek ilacı tükettiği bilgisine ulaşılmıştır [27].

Verilen örneklerde de görüldüğü üzere gelişmiş ülkelerde biyogaz sistemleri daha çok büyük ölçekli yapılmakta olup global çevre kirliliğini önlemek birincil amaç olmaktadır. Gelişmekte olan ülkeler de ise biyogaz sistemleri daha çok küçük ve orta ölçekli olmakta ve kurulmadaki birincil amaç, yoksulluğun ve yaşam standartlarının iyileştirilmesi olmaktadır [20].

5. TÜRKİYE’DE BİYOGAZ SİSTEMLERİ VE KIRSAL KALKINMA

Türkiye’ kırsal alan açısından oldukça geniş bir coğrafyaya sahip olup, 213.188 kilometrekare tarım alanı ile dünyada 14. büyük tarımsal alana sahip ülke konumundadır. Bunun yanı sıra kişi başına düşen tarımsal alan ise 3 dekadır ve bu oranla dünyada 40. sırada yer almaktadır. Karasal yüz ölçümünün %27,7’si tarım alanı olarak kullanılmaya elverişlidir. Toprak yapısının da verimli olması sayesinde toplam tarımsal alanın %38,4’ü ekili, %44,1’i orman, %10,4’ü nadasa bırakılmış, %7,1’i ise meyve ve sebze ekim alanı olarak kayıtlarda yerini almıştır. Tüm bu bilgilerin yanı sıra 14,5 milyon büyükbaş hayvan, 38,5 milyon küçükbaş hayvan ve 270 milyon kümes hayvanı sayısı ile büyük bir hayvansal atık potansiyeline de sahiptir [29]. Türkiye’de üretilen toplam enerjinin üç katında tüketim vardır. Bu nedenle ülkemiz enerji gereksinimini karşılamak için dışarıya bağımlı bir ülkedir. Tüketilen enerjinin karşılanması için dış ülkelere bağımlılık oranı %70’tir. Toplam biyogaz potansiyelimiz ise tüketilen toplam doğal gazın %88’ine eşittir [13]. Bir başka deyişle Türkiye bir kişi için bir yılda 10 m³ ile 30 m³



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arasında metan gazı üretebilme potansiyeline sahip bir ülkedir. Bu oran yaşam tarzına ya da yerleşim yeri gibi özelliklere göre değişmekle birlikte, kırsal kesimde yaşayan insanlar için kişi başı ortalama 10 m³ metan gazı olmaktadır [10]. Biyogaz tesislerinden elde edilen enerji kırsal kesimde yaşayan kişilerin günlük ihtiyaçlarını karşılamak amacıyla kullanılmaktadır (Şekil 6.)



Şekil 6. Bir Biyogaz Tesisinden Elde Edilen Enerjinin Köylüler Tarafından Kullanılması [16]

Ülkemizde çeşitli illerde yapılan birçok bilimsel araştırmaya göre enerji ihtiyacının karşılanmasında biyokütle enerjisinden ve biyogazdan faydalanmanın elverişli olduğu çok fazla bölge tespit edilmiştir. Bunlardan bir tanesi tarımsal alanın çok fazla olduğu Bursa Karacabey bölgesidir. Araştırmaya göre yüksek tarımsal verimliliğe rağmen kalkınamayan yerel halk için uzun vadede sürdürülebilir enerji olan biyokütleden enerji eldesi çalışmalarına başlanmalı ve kırsal kalkınma sağlanmalıdır [30]. Yapılmış bir diğer çalışmada ise Eskişehir ilindeki biyogaz potansiyeli incelenmiş olup bir yılda toplam 2.050.383 hayvansal atıktan 66.620.541,32 m³ metan gazı üretilbileceği hesaplanmıştır. Doğru teşvikler ile bu bölgede kurulacak biyogaz tesislerinin bölgesel olarak kalkınmaya doğrudan etki edeceği bilgisine ulaşılmıştır [31]. Erzincan ilini kapsayan bir başka çalışmada Erzincan'ın hayvansal atıklardan 4.3 MW'lık bir biyogaz elektrik enerjisi üretim potansiyeli olduğu ve her geçen yıl hayvansal atıkların arttığı bunun da oldukça kayda değer bir veri olduğu bilgisine ulaşılmıştır [2]. Bu araştırmaların yanı sıra Adana ilinde yapılmış olan bir başka çalışmada Adana'nın toplam hayvan sayısı 3.062.992 olarak belirlenmiş ve bu hayvanlardan bir yılda üretililecek metan gazının 88.367,417 m³ olduğu tespit edilmiştir. Bu veriler ışığında Adana'daki hayvansal atıklardan biyogaz eldesi ile



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bir yılda yaklaşık olarak 179,4 ton karbondioksit salınımının engellenebileceği öngörüsüne ulaşılmıştır [32].

Tüm bu verilerin yanı sıra ülkemizde şu anda çeşitli büyüklüklerde biyogaz tesisleri bulunmaktadır. Bu biyogaz tesislerinin en büyüğü İstanbul'da olup yaklaşık 34 MW'lık kurulu güce sahip Odayeri Çöp Gazı Santrali'dir. Onu Balıkesir'de bulunan ve yaklaşık 30 MW'lık kurulu güce sahip olan Mutlular Biyokütle Santrali takip etmektedir [33].

6. SONUÇ VE DEĞERLENDİRME

Bir ülkede kalkınmadan söz edilebilmesi için yalnızca ekonomik değerlerden değil aynı zamanda sosyal ve kültürel alanlardaki yapısal gelişmelerden de bahsetmek gerekmektedir. İşte bu sebeple kırsal kalkınmadan bahsederken de o bölgede yaşayan insanların şehirlere göçünü azaltabilecek aynı zamanda yaşam standartlarını yükseltebilecek kalıcı çözümlerden ve gelişmelerden bahsetmek gerekmektedir. Bu nedenle bu kırsal alanlarda kurulabilecek biyogaz sistemleri sadece istihdamı ve bu bölgelerden yaşayan insanların ekonomik durumunu iyileştirmekle kalmayacak aynı zamanda çevresel iyileşme, sağlık ve hijyen koşullarının da iyileşmesini sağlayacaktır. Ayrıca bu bölgelere biyogaz sistemleri kurulması ile ısınma için kullanılan kömür ve odun gibi evin iç hava sahasını kirleten ürünlerden uzak kalınacak böylece sağlık açısından da iyileşmeler sağlanacaktır. Fermente gübrenin tarımda kullanılması ile toprak verimi artacak ve daha kaliteli gıdaya ulaşım kolaylaşmış olacaktır.

Kırsal kalkınmanın yaşanmadığı hiçbir toplum gerçek bir kalkınma sağlayamaz. Bu nedenle bu çalışmada tüm bu örnekler ve veriler çerçevesinde Dünya'da ve ülkemizde kırsal alanlarda kurulmuş ve kurulacak olan biyogaz tesislerinin sayısının artmasının ülkelerin menfaatleri açısından oldukça önemli olduğu vurgulanmış ayrıca Türkiye ve Dünya'daki biyogaz tesislerinin hem ülke kalkınmasında hem de kırsal alanlarda yaşanan gelişmelerde yarattığı etkiler incelenmiştir.



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7. KAYNAKÇA

Abdeshahian, P., Lim, J. S., Ho, W. S., Hashim, H., & Lee, C. T. (2016). Potential of biogas production from farm animal waste in Malaysia. *Renewable and Sustainable Energy Reviews*, 60, 714-723.

Seyhan, A. K., & Badem, A. (2018). Erzincan ilindeki hayvansal atıkların biyogaz potansiyelinin araştırılması. *Academic Platform Journal of Engineering and Science*, 6(1), 25-35.

Olabi, A. G. (2014). 100% sustainable energy.

Connolly, D., Lund, H., & Mathiesen, B. V. (2016). Smart Energy Europe: The technical and economic impact of one potential 100% renewable energy scenario for the European Union. *Renewable and Sustainable Energy Reviews*, 60, 1634-1653.

Erdem, K. O. Ç., & Kadir, K. A. Y. A. (2015). Enerji Kaynakları–Yenilenebilir Enerji Durumu. *Mühendis Ve Makina*, 56(668), 36-47.

Üçok, S. (2021). Çorum İli Kullanılabilir Hayvansal Atık Kaynaklı Biyogaz Potansiyelinin Belirlenmesi. *Alatarım*, 20(1), 51-59.

Kapluhan, E. Enerji Coğrafyası Açısından Bir İnceleme: Biyokütle Enerjisinin Dünyadaki Ve Türkiye’deki Kullanım DURUMU. *Marmara Coğrafya Dergisi*, (30).

Kumbur, H., Özer, Z., Özsoy, H. D., & Avcı, E. D. (2005). Türkiye’de geleneksel ve yenilenebilir enerji kaynaklarının potansiyeli ve çevresel etkilerinin karşılaştırılması. *Yeksem 2005, III. Yenilenebilir Enerji Kaynakları Sempozyumu ve Sergisi*, 19-21.

Karaca, C. (2017). Hatay ilinin hayvansal gübre kaynağından üretilen biyogaz potansiyelinin belirlenmesi. *Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi*, 22(1), 34-39.

Kiliç, F. Ç. (2007). Biyogaz, önemi, genel durumu ve Türkiye'deki yeri. *Renewable Energy World*, 8(6).

Korkmaz, Y., Aykanat, S., & Çil, A. (2012). Organik Atıklardan biyogaz ve enerji üretimi. *SAÜ Fen Edebiyat Dergisi*, 1, 489-497.

Çelikkaya, H. (2016). Biyogaz. *Fırat Kalkınma Ajansı*.

Şenol, H., Elibol, E. A., AÇIKEL, Ü., & Şenol, M. (2017). Türkiye’de biyogaz üretimi için başlıca biyokütle kaynakları. *Bitlis Eren Üniversitesi Fen Bilimleri Dergisi*, 6(2), 81-92.

Al Seadi T., Rutz D., Prassl H., Köttner M., Finsterwalder T., Volk S., Janssen R., 2008. Biogas Handbook, University of Southern Denmark Esbjerg, Denmark.



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Tolunay, A., & Akyol, A. (2006). Kalkınma Ve Kırsal Kalkınma: Temel Kavramlar Ve Tanımlar. *Turkish Journal of Forestry*, 7(2), 116-127.

Koçar, G., 2013. “Kırsal Kesim Biyogaz Teknolojilerinin Geliştirilmesi ve Yaygınlaştırılması, GÜDÜMLÜ TEKNOLOJİ GELİŞTİRME PROJESİ”, Proje No: 07/Dpt/003, Ege Üniversitesi, Güneş Enerjisi Enstitüsü, İzmir

Çevik, A. (2016). *Çanakkale İli’ndeki hayvansal atıkların biyogaz potansiyelinin değerlendirilmesi* (Master's thesis, Çanakkale Onsekiz Mart Üniversitesi Sosyal Bilimler Enstitüsü).

Acaroğlu, M. (2003). *Alternatif Enerji Kaynaklar* (p. 343). İstanbul: Atlas Yayın & Dağıtım.

Doruk, İ., & Bozdeveci, A. (2017). Denizli İlinin Kırsal Kesimlerinde Hayvansal Kaynaklı Atıklardan Biyogaz Potansiyelinin Belirlenmesi. *Journal Of The Institute Of Science And Technology*, 7(3), 181-186.

Koçar, G., Eryaşar, A., Ersöz, Ö., Arıcı, Ş., & Durmuş, A. (2010). Biyogaz Teknolojileri (P. 241-251). *Ege Üniversitesi Basımevi, İzmir*

Kaynarca, H., Kılıç, T., Açıkalp, E., & Kandemir, S. Y. (2021). Eskişehir’in Biyogaz Potansiyelinin Değerlendirilmesi. *Coğrafya Dergisi*, (42), 271-282.

Öztürk, M. (2005). Hayvan gübresinden biyogaz üretimi. *Çevre ve Orman Bakanlığı, Ankara*, 5, 8-18.

Mutlu, S. F., & Müh, K. (2003). Biyogazın kırsal kesimde kullanımı ve tasarım temelleri. *Türk Tesisat Mühendisleri Derneği Dergisi*, 27, 39-41.

URL 1. European Biogas Association Statistical Report 2020 - UABIO, Erişim Tarihi: 13.12.2021

Van der Ploeg, J. D., Renting, H., Brunori, G., Knickel, K., Mannion, J., Marsden, T., ... & Ventura, F. (2000). Rural development: from practices and policies towards theory. *Sociologia ruralis*, 40(4), 391-408.

Chodkowska-Miszczuk, J., Kulla, M., & Novotny, L. (2019). Biogas energy—a chance for agriculture and rural development? Insight from the post-communist Central Europe. *Deturope Cent. Eur. J. Reg. Dev. Tour*, 11, 30-53.

Jian, L. (2009). Socioeconomic barriers to biogas development in rural southwest China: an ethnographic case study. *Human Organization*, 68(4), 415-430.



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Song, Z., Zhang, C., Yang, G., Feng, Y., Ren, G., & Han, X. (2014). Comparison of biogas development from households and medium and large-scale biogas plants in rural China. *Renewable and Sustainable Energy Reviews*, 33, 204-213.

Öztürk, B. (2019). *Aydın ili biyogaz potansiyelinin belirlenmesi* (Master's thesis, Fen Bilimleri Enstitüsü).

Balcı, P., & Evren, Y. (2015). Biyokütle Enerjisi Karacabey'in Kırsal Kalkınması İçin Bir Potansiyel Olabilir mi?. *Planlama*, 25(3), 227-237.

Kaynarca, H., Kılıç, T., Açikkalp, E., & Kandemir, S. Y. (2021). Eskişehir'in Biyogaz Potansiyelinin Değerlendirilmesi. *Coğrafya Dergisi*, (42), 271-282.

YAĞLI, H., & Yıldız, K. O. Ç. (2019). Hayvan gübresinden biyogaz üretim potansiyelinin belirlenmesi: Adana ili örnek hesaplama. *Çukurova Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi*, 34(3), 35-48.

URL 2. En Büyük 10 Biyogaz Enerji Santrali (enerjiatlası.com), Erişim tarihi 14.12.2021



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**FARKLI TUZ KONSANTRASYONLARININ ve SU SEVİYELERİNİN KADİFE
ÇİÇEĞİNİN (TAGETES ERECTA “TİTANIA”) GELİŞİMİ ÜZERİNE ETKİSİ**

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ÖZET

Dünya genelinde meydana gelen iklim değişikliği tarımsal üretimi tehdit etmektedir. Özellikle su kıtlığı nedeniyle son yıllarda tarımsal üretimde verim ve kalite düşüklüğü meydana gelmiştir. Su kıtlığı aynı zamanda peyzajda bitki seçimini de etkilemiş, peyzaj alanlarında su ihtiyacı az olan bitki türleri ve kırsal alanlarda doğal olarak gelişimini sürdüren bitkilerin kullanılması yoluna gidilmiştir. Bu araştırmada peyzaj alanlarında, park ve bahçelerde sıklıkla kullanılan Kadife Çiçeğinin su ihtiyacının ve bağlantılı olarak tuzluluğa olan direncinin belirlenmesi amaçlanmaktadır. Bu amaçla açık alanda kontrollü ortamda (saksıda) üç tekerrürlü olarak kurulan denemede *Tagetes erecta* “Titania” hibrit tohumları kullanılmıştır. Denemede üç su dozu (tam sulama, 2/3 sulama, 1/3 sulama) ve dört tuz dozu (0, 50, 100 ve 200 mM NaCl) kullanılmıştır. Yapılan gözlemler sonucuna göre 1/3 sulama grubunda olan bitkiler 30-35 dayandığı, diğer su grubu bitkilerinin ise fizyolojik gelişimlerini sürdürdüğü görülmüştür. Ayrıca araştırma sonuçları deneme bitkisinde su seviyesi ile vejetatif gelişim ve çiçek özellikleri arasında önemli ilişki olduğunu göstermektedir. Tuz stresine dayanıklılık bakımından ise kadife çiçeğin tuza karşı kısmen dayanıklı olduğu görülmüştür. Sonuç olarak deneme bitkisinin peyzaj amaçlı kullanımında 2/3 kısıtlı su uygulamasının yapılabileceği, ancak ticari yetiştiricilikte kısıtlı su uygulamasının kalite ve verimde önemli kayıplara yol açacağı düşünülmektedir.

Anahtar Kelimeler: Kadife çiçeği (*Tagetes erecta*), su ve tuz stresi, çiçek verim ve kalite, süs bitkisi yetiştiriciliği



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**THE EFFECT OF DIFFERENT SALT CONCENTRATIONS AND WATER LEVELS
ON THE DEVELOPMENT OF MARIGOLD (*TAGETES ERECTA* “TITANIA”)**

ABSTRACT

Global climate change occurring all around the world threatens agricultural production. Recently, agricultural production has decreased in terms yield and quality, specifically due to water scarcity. Water scarcity also affected the choice of plants in the landscape therefore, plant species with low water needs in landscape areas and plants that continue to develop naturally in rural areas were specifically used. In the current study, it is aimed to determine the water requirement of Marigold, which is frequently used in landscape areas, parks and gardens, and identify its resistance to salinity. For this purpose, *Tagetes erecta* “Titania” hybrid seeds were used in the experiment, which was established in an open field in a controlled environment (pot) in triplicate. Three level of water (full irrigation, 2/3 irrigation, 1/3 irrigation) and four salt doses (0, 50, 100 and 200 mM NaCl) were used in the experiment. According to the findings of the observations, it was seen that the plants in the 1/3 irrigation group lasted 30-35 years, while the other water group plants continued their physiological development. In addition to these, the findings of the research indicate that there is a significant relationship between the water level and the vegetative growth and flower characteristics of the experimental plant. In terms of resistance to salt stress, it was observed that marigolds were partially resistant to salt. As a result, it is thought that 2/3 restricted water application can be made in the use of the trial plant for landscaping purposes, however, limited water application in commercial cultivation will lead to significant losses in quality and yield.

Keywords: Marigold (*Tagetes erecta*), water and salt stress, flower yield and quality, ornamental plant cultivation



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GİRİŞ

Küresel ısınma son dönemlerde neden olduğu çevresel stres faktörleri ile tarımsal üretimi faaliyetlerini olumsuz bir şekilde etkilemektedir. Bu çevresel streslerin başında tuzluluk ve su stresi gelmektedir. Kuraklık ve toprakların tuz konsantrasyonlarının artması tarımda ve süs bitkilerinin yetiştirilmesinde ürün kalitesi ve verimini düşüren önemli çevresel faktörlerdir (Çelik, 2019).

Kültür bitkilerinde tuz stresine neden olan tuzlu topraklar, dünyada geniş alanlar kaplamaktadır. Toprak tuzluluğu, tarımsal üretimi sınırlandıran önemli etmenlerden birisi olup, yüksek düzeyde ekonomik kayıplara neden olmaktadır (Mahajan ve Tuteja, 2005). Toprak tuzluluğu, diğer bir adı ile elektriksel geçirgenlik (EC); toprakta bulunan eriyebilir tuzların bir göstergesidir (Turhan, 2020). Tuz stresi, bitki büyüme ve gelişmesini dolayısı ile verimliliğini olumsuz yönde etkilemektedir (Zahra ve ark., 2010). Tuzluluk bitkileri her gelişim evresinde önemli ölçüde etkilemektedir (Akçay ve Tan, 2018). Tuzluluğa maruz kalan bitkilerde çimlenmenin azaldığı, bitkinin topraktan su alımının güçleştiği, bitki çıkışının geciktiği, bitki çıkışının düzensiz olduğu ve bunun sonucunda bitki veriminin düştüğü görülmektedir (Ertekin ve ark., 2018; Kıran ve ark., 2019).

Tuz stresi ile ilişkili bir diğer stres çeşidi de su stresidir. Su stresi, bitki büyümesini ve verimini sınırlandıran önemli bir streslerin başında gelmektedir (Riaz ve ark., 2013; Uçak, 2018). Su stresi, bitkilerin ihtiyacı olan suyu alamaması durumudur. Bunun çeşitli sebepleri vardır. En önemlisi ve bitkilerin en çok karşılaştıkları ise toprakta yeterli suyun bulunmayışıdır. Bitki toprakta Tarla kapasitesi ve solma noktası arasındaki sudan faydalanabilmektedir. Tarla kapasitesi; uygulamalarda 1/3 atmosfer basınç altında toprakta bulunan nem miktarıdır. Solma noktası değeri ise uygulamada 15 atmosfer basınç altında tutulan nem miktarı olarak ifade edilmektedir. (Okuroğlu ve Yağanoğlu, 2015; Er ve ark., 2020). Küresel ısınma ve nüfusun hızlı bir şekilde artması su kaynaklarını azaltmaktadır. Bu nedenle doğal kaynaklarımızı daha etkin kullanmamız gerekmektedir (Cook ve ark., 2007). Su kaynaklarının etkin kullanımı, su yönetiminin sürdürülebilirliğinin anahtarı olarak giderek daha fazla kabul görmektedir. Su kaynaklarını etkin kullanımda kısıtlı sulama uygulamaları önde gelmektedir. Kısıtlı sulama, tarımsal su gereksiniminin azaltılmasında, bitki su kullanım etkinliğinin artırılabilmesinde ve sulanmayan alanların sulamaya açılmasına olanak sağlayan önemli bir sulama stratejisidir (Khalid ve ark., 2021). Özellikle verime katkısı en az olan bitki gelişme dönemlerinde sulama gereksiniminin kısmen karşılanmasıyla önemli ölçüde su tasarrufu sağlanabileceği birçok



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araştırma ile ortaya konulmuştur (Hammad ve ark., 2017). Kısıtlı suya karşı bitkilerin vereceği tepkinin farklı iklim, toprak ve bitki gruplarında araştırılması ve öncelikli olarak gıda gereksiniminin karşılanmasında önemli rol oynayan bitkilerin ele alınması gelecek için oldukça önemlidir (Li ve Ren, 2019).

Bitkiler içerisinde görünüşleri, yapıları, renk ve kokularıyla insanların dikkatlerini çeken ve bu özellikleri nedeniyle bireyler tarafından ortamı güzelleştirmek veya çevrelerini değişik şekillerde düzenlemek için yararlanılan, hobi ya da ticari olarak çok amaçlı kullanılabilen bitkiler, süs bitkileri olarak adlandırılmaktadır (Huylensbroeck, 2018). Artan nüfus ile beraber hızlı kentleşme, yeşil alanların azalmasına neden olmaktadır. Doğadan uzaklaşan insanların doğa özlemlerini giderebilmek ve yeşil alanları daha güzel değerlendirebilmek, kalabalık kentlerde insanlara pozitif duygular hissettirebilmek için süs bitkilerine ihtiyaç duyulmaktadır (Dhakar ve ark., 2017). Bunlar arasında, kuraklığa dayanıklı süs bitkileri türlerinin tanıtılması ve geliştirilmesi, kuraklık durumuyla başa çıkmak için en sürdürülebilir yaklaşım olarak kabul edilmektedir. Bu tür bitki türlerinin su ihtiyaçları, kuraklığa dayanıklı olmayan bitkilerin su ihtiyacının yaklaşık %50'si kadardır. Süs çiçekli bitkiler arasında Marigold (*Tagetes erecta* L.) bu koşullarda iyi gelişebilen bitkilerden biri olarak kabul edilmektedir (Ahmad ve ark., 2011). Kadife çiçeği (*Tagetes erecta*), Asteraceae familyasının *Tagetes* cinsine ait yıllık otsu bir bitkidir (Asrar ve Khalid, 2011). İlk olarak 16. yüzyılda Orta Amerika'da Portekizliler tarafından keşfedilmiştir. Avrupa ve Hindistan'a satılan çiçeklerin ilerleyen dönemde Hindistan'da üretimi artmış ve yaygınlaşmıştır (Khanal, 2014). Çiçekleri; sarı, kırmızı, turuncu, koyu portakal ve portakal kahverengi gibi çeşitli renklerde (Villar-Martinez ve ark., 2005). Kadife çiçeği süs bitkisi kullanılmasının yanı sıra sağlık, tekstil, gıda ve kozmetik sanayisinde de kullanılmaktadır. (Vankar ve ark., 2009; Ingkasupart ve ark., 2015). Deneme bitkisi olarak kullanılan Aztek Kadife Çeşidi (*Tagetes erecta* "Titania") Şekil 1'de verilmiştir.



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Şekil 1. Deneme bitkisi (Aztek Kadife Çiçeği/Tagetes erecta “Titania”)

Yapılan bu çalışmada su ve tuz stresi koşulları altında yetiştirilen süs bitkilerinde meydana gelen morfolojik özelliklerde ki değişimler konusunda yapılan çalışmaların sınırlı olduğu belirlenmiştir. Bu amaçla süs bitkilerinden olan kadife çiçeğinin su ve tuz stresi koşullarında morfolojik özellikleri üzerindeki etkisini değerlendirmek için bir çalışma yapılmıştır.

MATERYAL VE YÖNTEM

Bu proje Bingöl Üniversitesi Tarımsal Araştırma ve Uygulama Merkezi seralarında yürütülmüştür. Çalışmada “Aztek Kadife Çiçeği (Tagetes erecta “Titania”) bitkisi kullanılmıştır. Denemede kullanılan kadife çeşitlerine ait tohumlar 20 Nisan 2021 tarihinde strafor kasalara ekimi yapılmıştır. Tohumlar fide haline geldikten sonra viyollere 19 Mayıs 2021 tarihinde şaşırtılmıştır. İstenilen boya ulaşılan fideler 14.06.2021 tarihinde 1/3 toprak, 1/3 yanmış ahır gübresi ve 1/3 torf ile dolu 3 lt hacme sahip saksılara dikilmiştir. Bitki gelişimleri ve bakım işlemleri (gövde desteği, yabancı ot mücadelesi, sulama, vb.) düzenli olarak gerçekleştirilmiştir. Denemede 4 farklı tuz dozu (0, 50, 100 ve 200 mM NaCl) ve 3 farklı sulama seviyesi (tam sulama, 2/3 sulama ve 1/3 sulama) uygulanarak tesadüf parselleri deneme desenine göre faktöriyel düzende 3 tekerrürlü olarak açık alanda 36 saksı da yürütülmüştür. Araştırma kapsamında arazide yapılan çalışmalar Şekil 2’de verilmiştir.



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Şekil 2. Araştırmada yapılan arazi çalışmalarından görünümeler.

Çalışmada deneme konuları, 3 gün sulama aralığında A sınıfı buharlaşma kabından ölçülen açık su yüzeyi buharlaşma miktarının farklı oranlarının uygulanması şeklinde oluşturulmuştur. Sulama, bitkinin fiziksel görünümleri ve iklim koşulları doğrultusunda 2 veya 3 gün aralıklı olarak belirlenen ölçülerde ve eş zamanlı olarak yapılmıştır.

Deneme konuları;

S₁ konusu: Toplam buharlaşma miktarının %100' inin uygulandığı tam sulama veya kontrol grubu sulama uygulaması,

S₂ konusu: Toplam buharlaşma miktarının %67' inin uygulandığı sulama uygulaması, 2/3 Sulama

S₃ konusu: Toplam buharlaşma miktarının %33' nün uygulandığı sulama uygulaması, 1/3 Sulama biçiminde uygulanmıştır.

T₁ konusu: 0 mM NaCl saf suda çözelti olarak toprağa verilmesi,

T₂ konusu: 50 mM NaCl saf suda çözelti olarak toprağa verilmesi,

T₃ konusu: 100 mM NaCl saf suda çözelti olarak toprağa verilmesi,

T₄ konusu: 200 mM NaCl saf suda çözelti olarak toprağa verilmesi biçiminde uygulanmıştır.

Sulama suyu hesabı (Doorenbos ve Pruitt, 1984; Kanber, 1984);

$$I = A \times E_{pan} \times K_{pc} \dots \dots \dots 1$$



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Eşitlikte: I: sulama suyu miktarı, A: yetiştirme alanı (m^2), Epan: buharlaşma miktarı (mm), Kpc: pan katsayısı ve bitki katsayısı değerlerini içermektedir.

Araştırma sonucunda elde edilen veriler JMP istatistik programından yararlanılarak Tesadüf Parselleri Deneme Deseni'ne göre varyans analizine tabi tutulmuştur. Ortalamalar arasındaki farklılıklar LSD testine göre belirlenmiştir.

BULGULAR VE TARTIŞMA

Araştırmada farklı seviyede tuz ve su uygulamasının Kadife çiçeğinin verim ve kalitesi üzerine etkisi incelenmiştir. Araştırma bulguları başlıca iki kısımda incelenmiştir. Birinci kısımda deneme bitkisinin bitki boyu, gövde çapı, bitki yaş ve kuru ağırlığı gibi vejetatif gelişme özellikleri, ikinci kısımda ise çiçek sayısı, çiçek çapı, çiçek boyu ve çiçek ağırlığı gibi generatif özellikler ele alınmıştır. Ancak öncelikle denemede kullanılan toprağın temel özelliklerinin açıklanması gerekmektedir. Buna göre:

Deneme Toprağının Özellikleri

Deneme toprağı olarak 1/3 oranında tuzsuz toprak, 1/3 oranında yanmış hayvan gübresi ve 1/3 oranında torf toprağı kullanılmıştır. Kullanılan toprak Bingöl Üniversitesi Ziraat Fakültesi Toprak Laboratuvarında analiz edilmiş ve yapılan toprak analiz sonuçları Tablo 1'de verilmiştir.

Tablo 1. Deneme toprağının özellikleri

Yapılan Analiz	Değer	Sonuç
Saturasyon (%)	46,2	Tınlı
pH	8,09	Hafif Alkali
Tuzluluk (%)	0,011	Tuzsuz
Organik Madde (%)	0,36	Çok Az
Kireç ($CaCO_3$), %	6,91	Orta Kireçli
Potasyum (K_2O), kg/da	18,18	Az
Fosfor (P_2O_5), kg/da	2,86	Çok Az

Denemede araştırmanın amacına uygun olarak tuzluluk oranı oldukça düşük toprak kullanılmıştır. Bunun yanında deneme toprağının hafif alkali, tınlı ve orta düzeyde kireçli toprak yapısına sahip olduğu, temel besin elementleri ve organik madde içeriğinin ise oldukça düşük olduğu görülmektedir. Bu nedenle organik madde ve temel besin elementi noksanlıklarının giderilmesine yönelik olarak deneme toprağına torf ve ahır gübresi takviyesi yapılmıştır.



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3.2. Bitkinin Vejetatif Gelişimi

Araştırma kapsamında üç farklı sulama ve dört doz tuz uygulamasının bitkinin vejetatif gelişimine etkisi belirlenmeye çalışılmıştır. Üç farklı sulama modelinde tam sulama, 2/3 oranlı sulama ve 1/3 oranlı sulama uygulanmış bu kapsamda her bir bitki için tam sulamada 750 ml/bitki, 2/3 oranlı sulamada 500 ml/bitki ve 1/3 oranlı sulamada 250 ml/bitki su verilmiştir. Tuz konsantrasyonlarında ise 0, 50, 100 ve 200 mM NaCl ölçüleri hesaplanmış ve bitkinin saksıya şaşırtılma/dikiminde fidelere bir kez olmak üzere uygulanmıştır. Bitkilerin gelişimleri sürekli olarak gözlemlenmiştir. Yapılan gözlemlerde 14.06.2021 tarihinde saksıya dikilen ve 1/3 oranlı sulama grubunda yer alan bitkilerin ortalama 30-35 gün dayandığı ve son bitkinin 19.06.2021 tarihinde kuruduğu gözlemlenmiştir. Tam sulama ve 2/3 oranlı sulama grubunda yer alan bitkilerin ise hasad tarihine (11.08.2021) kadar yaşam ve gelişim fonksiyonlarını sürdürdüğü görülmüştür. Vejetatif gelişim özelliklerinden bitki boyu ve gövde çapı hasat esnasında, bitki yaş ve kuru ağırlığı ise laboratuvar ortamında yapılan ölçümlerle belirlenmiştir. Yapılan ölçümlere ait sonuçlar Tablo 2’de verilmiştir.

Tablo 2. Farklı su ve tuz dozu uygulamasının deneme bitkisinin vejetatif gelişimine etkisi

Su \ Tuz	T1: 0 mM NaCl	T2: 50 mM NaCl	T3: 100 mM NaCl	T4: 200 mM NaCl	Ortalama
Ortalama bitki boyu (cm)					
S1: Tam sulama	60,7 a*	52,00 b	47,00 bc	49,3 bc	52,25 A**
S2: 2/3 Sulama	48,00 bc	46,00 c	50,3 bc	51,7 bc	49,00 B
S3: 1/3 Sulama	35,00 d	34,00 d	30,33 de	25,00 e	31,25 C
Ortalama	47,88 A*	44,22 B	42,55 B	42,00 B	44,2
Ortalama gövde çapı (mm)					
S1: Tam sulama	6,37 bcd*	6,93 ab	6,27 bcd	5,73 bcd	6,33 A**
S2: 2/3 Sulama	5,17 c	8,07 a	5,30 cd	6,50 bc	6,26 A
S3: 1/3 Sulama	3,30 e	2,87 e	2,67 e	2,37 e	2,80 B
Ortalama	4,94 B*	5,96 A	4,74 B	4,87 B	5,10
Bitki yaş ağırlığı ort. (g)					
S1: Tam sulama	23,00 a**	20,01 b	15,43 d	18,01 c	19,13 A**
S2: 2/3 Sulama	12,50 e	16,30 cd	16,20 cd	15,83 d	15,21 B
S3: 1/3 Sulama	2,77 f	3,00 f	1,83 f	2,26 f	2,47 C
Ortalama	12,76 A*	13,12 A	11,16 B	12,03 AB	12,30
Bitki kuru ağırlığı ort. (g)					
S1: Tam sulama	6,35 a**	5,10 b	3,85 d	3,65 e	4,74 A**
S2: 2/3 Sulama	3,14 g	4,07 c	3,52 f	3,52 f	3,56 B
S3: 1/3 Sulama	0,64 h	0,54 ı	0,33 j	0,29 j	0,45 C
Ortalama	3,38 A**	3,24 B	2,57 C	2,49 D	2,9

* p<0,05, **p<0,01 not: Aynı harfler aynı grubu ifade etmektedir.



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Tablo 2'ye göre sulama düzeyleri Kadife çiçeğinin bitki boyu, gövde çapı, bitki yaş ağırlığı ve bitki kuru ağırlığına önemli düzeyde etki etmiştir ($p<0,01$). Verilen su miktarı azaldıkça bitki boyunun, gövde çapının, bitki yaş ve kuru ağırlığının paralel olarak azaldığı ve bu azalmanın da istatistik olarak önemli bulunduğu görülmüştür. Deneme bitkisine verilen tuz miktarında ise biraz daha farklı durumun ortaya çıktığı görülmüştür. Tuz seviyesi bitki boyuna, gövde çapına ve bitki yaş aralığına %5 ($p<0,05$) oranında önemde etki etmişken, sadece bitki kuru ağırlığında %1 oranında ($p<0,01$) etki ettiği görülmüştür. Ancak bitki boyunda, gövde çapında ve bitki yaş aralığında görülen farklar doz ile orantılı olmadığı, sadece bitki kuru ağırlığı ile uygulanan tuz dozu arasında paralel bir azalma tespit edilmiştir. Bu durum esasen tuzun bitkinin vejetatif gelişimine etkisinin sınırlı olduğunu göstermektedir.

Araştırma kapsamında su ve tuz intereksiyonunun deneme bitkisinin vejetatif gelişimine etkisi de incelenmiştir. Analiz sonuçlarına tuz ve su intereksiyonun bitki boyu ve gövde çapında %5 ($p<0,05$), bitki kuru ve yaş aralığında ise %1 ($p<0,01$) düzeyinde önemli bulunmuştur. Ancak tüm değişkenlerde değişim düzeyleri intereksiyonlarda farklı düzeylerde seyretmektedir. En yüksek ortalama değerler bakımından bitki boyu, bitki yaş ve kuru ağırlığı ortalamalarında S1T1 intereksiyonunda, gövde çapı ortalamasında S1T2 intereksiyonunda görülmüştür. En düşük ortalama değerler bakımından ise bitki boyu, gövde çapı ve bitki kuru ağırlığı ortalamalarında S3T4, bitki yaş ağırlık ortalamasında S3T3 intereksiyonunda izlenmiştir. Genel bir değerlendirme olarak Kadife çiçeğinin vejetatif gelişiminde sulama suyu miktarının yüksek düzeyde, tuz oranı ise orta düzeyde etki ettiği belirlenmiştir. Tuz seviyesi ile bitki boyu arasında ters ve kademeli oranda değişim meydana gelmişken, diğer parametrelerde tuz seviyesinin farklı dozunda değişimler meydana gelmiştir.

3.3. Generatif Özellikler

Deneme bitkisinin vejetatif gelişiminin yanında çiçek özellikleri de incelenmiştir. Çiçek sayısı, çiçek çapı, çiçek boyu ve çiçek ağırlıklarını içeren generatif özellikler Tablo 3'de verilmiştir. S3 grubundaki bitkilerin hasad tarihi öncesi ölümü göz önünde bulundurulduğunda bitki başına 250 ml lik suyun yetersiz kaldığı ve dolayısıyla deneme sonuçlarını etkilediği görülmüştür.



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Tablo 3: Deneme bitkisinin çiçek özelliklerinde ki değişim

Su \ Tuz	0 mM NaCl	50 mM NaCl	100mM NaCl	200 mM NaCl	Ortalama
Çiçek sayısı (adet)					
S1: Tam sulama	4,67	6,00	7,67	6,33	6,17 A**
S2: 2/3 Sulama	6,33	4,67	4,67	6,33	5,50 A
S3: 1/3 Sulama	0,66	0,33	0,33	0,00	0,33 B
Ortalama	3,88	3,67	4,22	4,22	4
Çiçek çapı (mm)					
S1: Tam sulama	4,68 a*	3,78 b	3,98 ab	3,68 b	4,03 A**
S2: 2/3 Sulama	3,71 b	4,53 a	3,29 bc	2,63 c	3,54 B
S3: 1/3 Sulama	0 d	0 d	0 d	0 d	0 C
Ortalama	2,80 A*	2,77 A	2,42 AB	2,10 B	2,52
Çiçek boyu (cm)					
S1: Tam sulama	3,39* bc	3,45 b	3,38 bc	2,96 d	3,29 A**
S2: 2/3 Sulama	2,87 d	3,88 a	3,01 cd	2,89 d	3,17 A
S3: 1/3 Sulama	0 e	0 e	0 e	0 e	0 B
Ortalama	2,08 B**	2,44 A	2,15 B	1,95 B	2,15
Çiçek ağırlığı (g)					
S1: Tam sulama	3,17 b**	2,86 bc	2,98 bc	2,14 d	2,79 A**
S2: 2/3 Sulama	2,72 c	3,59 a	1,72 e	1,30 f	2,34 B
S3: 1/3 Sulama	0 g	0 g	0 g	0 g	0 C
Ortalama	1,96 A**	2,15 A	1,57 B	1,15 C	1,70

* p<0,05, **p<0,01 not: Aynı harfler aynı grubu ifade etmektedir.

Tablo 3'e göre sulama dozu ile çiçek sayısı, çiçek çapı, çiçek boyu ve çiçek ağırlığı arasında ilişki anlamlı bulunmuştur ($p<0,01$). Ancak çiçek sayısı ve boyu S1 ve S2 uygulamalarında aynı grupta yer almıştır. Çiçek ağırlığı ve çiçek çapı değişkenlerinde S1 ve S2 grupları farklılaşmaktadır. Tuz dozu uygulamalarında ise bazı sonuçlarda anlamlı görünmesine karşılık tuzun çiçek özelliklerine etki ettiği ile ilgili kesin bir sonuç göstermemektedir. Özellikle sonuçlara S3 grubu bitkilerinin erken ölümünün etki ettiği anlaşılmaktadır. Benzer durum su ve tuz interaksiyonlarında da söz konusudur. S3 grubu bitkileri dışarda bırakıldığında en yüksek değerler çiçek sayısında S1T3, çiçek çapı ve ağırlığında S1T1, çiçek boyunda S2T2, en düşük değerler ise çiçek çapında ve ağırlığında S2T4, çiçek boyunda S2T1, çiçek sayısında 3 grupta görülmüştür.

Kadife çiçeğinin tuz ve su stresine dayanıklılığı ile ilgili yapılan araştırmalarda da benzer sonuçlar alınmıştır. Bu araştırmalardan Türkoğlu ve ark. (2013)'e göre 20, 40, 60 ve 80 mM NaCl uygulamasında gövde uzunluğu, bitki boyu, gövde yaş ağırlığı ve gövde çapı gibi



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değişkenlerde büyük oranda dozlar arasında fark görülmemiş, en uygun tuz dozu olarak ise 40 nM NaCl ön görülmüştür. Ayrıca araştırma sonuçlarının kadife çiçeğinin tuza dayanıklı olduğunu gösterdiği vurgulanmıştır (Türkoğlu ve ark., 2013). Su stresi ile ilgili yapılan araştırma sonuçları da mevcut araştırma sonuçlarını desteklemektedir. Bunlardan Riaz ve ark. (2013)'e göre %70 su kısıtlamasının kadife çiçeğinin yaşam fonksiyonlarını fazla etkilemediği, ancak daha az su verilmesi durumunda bitki kalitesinde belirgin azalma meydana getirdiğini ön görmektedirler. Yine Assar ve Elhindi, (2010)'a göre kadife çiçeğinde %100, %75, %50 ve %25 su uygulamasında bitki yüksekliğinde, çiçek çapı, çiçek ağırlığı, bitki kuru ağırlığı ve klorofil miktarında su kısıtlamasına paralel biçimde azalma meydana geldiğini öne sürmektedirler. Ancak mikoriza mantar uygulaması ile bitkinin su stresine karşı dayanıklı hale geldiğini vurgulamaktadırlar (Assar ve Elhindi, 2010).

Mevcut araştırma sonuçları ve daha önce yapılan araştırmalar birlikte değerlendirildiğinde Kadife çiçeğinin (*Tagetes erecta* "Titania") vejetatif gelişiminde suyun önemli bir etken olduğu, generatif gelişmeye ise kısmen etki ettiği görülmüştür. Görsel amaçlı kadife çiçeği kullanımında kısıtlı su uygulamasının (2/3 oranında kısıtlama) kullanılabileceği, ancak ticari yetiştiricilikte suyun kalite ve verimde önemli kayıplara yol açacağı düşünülmektedir. Tuz stresine dayanıklılığı bakımından ise kadife çiçeğin tuza karşı kısmen dayanıklı olduğu söylenebilir. Küresel iklim değişikliği ve ısınma sonucu tüm Dünya'da etkisini gösteren kuraklık ve su kıtlığı düşünüldüğünde peyzaj amaçlı kadife çiçeği kullanımının sınırlandırılması gerekliliği ortaya çıkmaktadır. Ancak arazi koşullarında da benzer çalışmaların yapılması gerektiği düşünülmektedir.



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KAYNAKÇA

Ahmad, I., Asif, M., Amjad, A., & Ahmad, S. (2011). Fertilization enhances growth, yield, and xanthophyll contents of marigold. *Turkish Journal of Agriculture and Forestry*, 35(6), 641-648.

Akçay, E., Tan, M., (2018). Farklı tuz konsantrasyonlarında kinoa (*Chenopodium quinoa* Willd.)'nın çimlenme özelliklerinin belirlenmesi. *Alinteri Journal of Agriculture Science*, 33(1), 85-91.

Asrar, Abdul-Wasea A., and Khalid M. Elhindi. (2011). Alleviation of drought stress of marigold (*Tagetes erecta*) plants by using arbuscular mycorrhizal fungi. *Saudi journal of biological sciences* 18.1: 93-98.

Cook, E.R., R. Seager, M.A. Cane and D.W. Stahle. (2007). North-American drought reconstructions: causes, and consequences. *Earth Sci. Rev.*, 81: 93-134.

Çelik, E., (2019). Açıkta ve Örtüaltında Yetiştirilen Kadife Çiçeğinin (*Tagetes Erecta* L.) Verim ve Kalite Özelliklerinin Belirlenmesi. *Bursa Uludağ Üniversitesi Fen Bilimleri Enstitüsü Bahçe Bitkileri Anabilim Dalı Yüksek Lisans Tezi*, Bursa.

Dhakar, S., Soni, A., & Kumari, P. (2017). Breeding for Abiotic Stress Tolerance in Ornamental Crops: A Review. *Chemical Science Review and Letters*, 6(23), 1549-1554.

Doorenbos J, Pruitt WO., (1984). Crop water requirements. *FAO, Irrigation and Drainage Paper No. 24*. 144 pp.

Er, H., Doğan Demir A., Demir, Y., Meral, R., (2020). Toprak Su Tutma Eğrisi Elde Ediliş Yöntemleri ve Kullanım Alanları. *Tarımda Yenilikçi Yaklaşımlar Sürdürülebilir Tarım ve Biyoçeşitlilik*, Ed. Prof. Dr. Kağan Kökten, İksad Yayın Evi, S:118 -147, 2020.

Ertekin, İ., Yılmaz, Ş., Atak, M., & Can, E., (2018). Effects of different salt concentrations on the germination properties of Hungarian vetch (*Vicia pannonica* Crantz.) cultivars. *Türk Tarım ve Doğa Bilimleri Dergisi*, 5(2), 175-179.

Ghoulam, C., Foursy, A. and Fores, K., (2002). Effects of Salt Stress on Growth Inorganic ions and Proline Accumulation in Relation to Osmotic Adjustment in Five Sugar Beet Cultivars, *Environmental and Exp. Botany*, 47 : 39-50.

Hammad, H. M., Farhad, W., Abbas, F., Fahad, S., Saeed, S., Nasim, W., & Bakhat, H. F. (2017). Maize plant nitrogen uptake dynamics at limited irrigation water and nitrogen. *Environmental Science and Pollution Research*, 24(3), 2549-2557.



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Ingkasupart, P., Manochai, B., Song, W.T., Hong, J.H. (2015). Antioxidant activities and lutein content of 11 marigold cultivars (*Tagetes* spp.) grown in Thailand. *Food Science Technology*, 35(2): 380-385.

Kanber, R., (1984). Çukurova koşullarında açık su yüzeyi buharlaşmasından (Class A pan) yararlanarak birinci ve ikinci ürün yerfıstığının sulanması. Bölge toprak su araştırma enstitüsü yayın no: 114 (64) 93 sayfa.

Khalid, S., Khalil, F., Elshikh, M. S., Alwahibi, M. S., & Alkahtani, J. (2021). Growth and dry matter partitioning response in cereal-legume intercropping under full and limited irrigation regimes. *Scientific Reports*, 11(1), 1-15.

Khanal, B. (2014). Effects of Growing Conditions of Marigold in Ilam District, Nepal. Faculty, Department of Horticulture and Floriculture Management, Mahendra Ratna Multiple Campus, Institute of Science and Technology, Tribhuvan University, Nepal. *American Journal of Plant Sciences*, 2014, 5, 3389-3395.

Kıran, S., Kuşvuran, Ş., Ateş, Ç., & Ellialtıoğlu, Ş., (2019). Tuz ve kuraklık stresi altında yetişen farklı patlıcan anaç/kalem kombinasyonlarının bazı özellikleri arasındaki ilişkiler. *Mediterranean Agricultural Sciences*, 32(3), 395-400.

Li, P., & Ren, L. (2019). Evaluating the effects of limited irrigation on crop water productivity and reducing deep groundwater exploitation in the North China Plain using an agro-hydrological model: I. Parameter sensitivity analysis, calibration and model validation. *Journal of hydrology*, 574, 497-516.

Mahajan S & Tuteja N (2005). Cold, Salinity and Drought stresses: An overview. *Biochemistry and Biophysics* 444: 139-158.

Okuroğlu, M., Yağanoğlu, A.V., (2015). Kültürteknik. Atatürk Üniversitesi Ziraat Fakültesi Yayınları, No: 886, Erzurum.

Riaz, A., Younis, A., Taj, A. R., Karim, A., Tariq, U., Munir, S., & Riaz, S. (2013). Effect of drought stress on growth and flowering of marigold (*Tagetes erecta* L.). *Pakistan Journal of Botany*, 45(S1), 123-131.

Turhan, A. (2020). Fasulyede (*Phaseolus vulgaris* L.) Farklı Tuz Dozlarının Çimlenme, Tane Verimi ve Verim Özellikleri Üzerine Etkileri. *Erciyes Tarım ve Hayvan Bilimleri Dergisi*, 3(2), 12-17.

Türkoğlu, N., Ayyıldız, L., & Gülser, F. (2013). Mevsimlik Çiçeklerde Tuzun Bitki Gelişimine Etkisi. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 3(4), 15-19.



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Ucak, A. B. (2018). Identification of Sunflower (*Helianthus annuus* L.) Genotypes Tolerant to Water Stres. *Journal of Agricultural Sciences*, 24(3), 312-322.

Van Huylenbroeck, J. (Ed.). (2018). *Ornamental crops*. Springer International Publishing.

Vankar PS, Shanker R, Wijayapala S (2009) Utilization of temple waste flower – *Tagetes erecta* for dyeing of cotton, wool and silk on industrial scale. *J. Textile Apparel Tech Manag* 6: 1-15.

Villar-Martinez, A.D., Garcia-Saucedo, P.A., Carabez-Trejoc, A., Cruz- Hernandez, A., Paredes-Lopez, O. (2005). Carotenogenic gene expression and ultrastructural changes during development in marigold. *Journal of Plant Physiology*, 162:1046-1056.

Zahra S, Amin B & Mehdi Y (2010). The salicylic acid effect on the tomato (*Lycopersicum esculentum* Mill.) germination, growth and photosynthetic pigment under salinity stress (NaCl). *Journal of Stress Physiology and Biochemistry* 6(3): 4-16



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**TÜRKİYEİN TOPRAK TOPLULAŞTIRMA SÜRECİNDE KURUMSAL VE YASAL
YAPILANMA DENEYİMİ VE ÇIKARIMLAR**

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ÖZET

Parçalı ve dağınık parsellerden oluşan tarımsal mülk işletmelerde parsellerin birleştirilmesi olarak tanımlanabilen toprak toplulaştırmasının anlamı, amaçları, görevleri, gereksinimleri ve modelleri uygulama ile birlikte değişmiştir. Süreç, tarımsal toprak mülkiyetinin genişliğinin artırılması ve tarımsal yapıyı düzenleyici bir içeriği kapsayacak şekilde genişlemiştir. Ayrıca toplulaştırmanın sosyal ve ekonomik değişimlerle yakından ilgili olduğu ve kapsamının kırsal alanın planlanması ve odak noktasının kırsal kalkınmayı destekleyici şekilde olabileceği anlaşılmıştır. Tarımda toprak mülkiyetinin mekânsal düzenlenmesinin gıda güvencesi, çevre, doğal yaşam ve tarım dışında kalan alanların planlanması ile ilişkili olduğu görülmüştür. Doğa koruma ile çevrenin önemindeki artışın ve küresel iklim değişikliklerinin de bu gelişmeye etkisi büyüktür. Türkiye’de 1961 yılında başlayan toprak toplulaştırması uygulamaları özel bir toplulaştırma yasası ile düzenlenmeden uygulayıcı kuruluşların kuruluş yasaları, ilgili tüzükler ve tarım reformu yasaları gereğince yürütülmüştür. 2020 yılı verilerine göre toplam 4 766 941 hektar alanda toplulaştırma yapılmıştır. Devlet Su İşlerinin (DSİ) kuruluş yasasında 2018 yılında yapılan değişiklikle toplulaştırmada farklı bir dönem başlamıştır. Toplulaştırma konusunda ülke genelinde tek yetkili kurum DSİ olarak belirlenirken, tarım topraklarının planlanması ve korunması ile ilgili konular toplulaştırma kapsamı dışında bırakılmıştır. Türkiye’de etkin bir toprak toplulaştırması politikasının yürütülmediği, mülk işletmelerde toprak mülkiyetinin mekânsal ve şekilsel olarak yeniden düzenlenmesinin tarla içi geliştirme hizmetleri ile birlikte uygulandığı anlaşılmaktadır. DSİ’nin çalışma konusu açısından toplulaştırmayı bu kapsamda yürüteceği ilgili kuruluş yasasında görülmektedir. Oysaki tarım topraklarının tarımsal işlevlerini birincil olarak ele alan planlamalara göre düzenlenmesi ve gereken iyileştirmelerin yapılması, doğal alanların oluşturulması, verimli tarım alanlarının ve tarım dışı kullanım taleplerinin yoğun bulunduğu bölgelerde öncelikli olarak toplulaştırmanın tamamlanması gerekmektedir. Bu alanlarda tüm toprak kullanım planlamalarının yapılarak toplulaştırmanın sonuçlarının korunmasına ilişkin yasal ve kurumsal desteklemeler oluşturulmalıdır. Bu çalışma, Türkiye’deki toprak toplulaştırmasının evrimini, yasal ve kurumsal yapılanmasını sistematik olarak gözden geçirmiş ve ardından toprak toplulaştırmasının mevcut durumunu, özelliklerini ve potansiyel etkisini ortaya koyarak toplulaştırmanın kırsal alanın planlanmasında etkin bir önlem olarak kullanılma olasılığının yollarını araştırmıştır.

Anahtar Kelimeler: Toprak toplulaştırması, tarım toprakları, mevzuat



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**EXPERIENCES OF THE INSTITUTIONAL AND LEGAL STRUCTURING IN
TURKEY'S LAND CONSOLIDATION PROCESS AND ITS INFERENCES**

ABSTRACT

The meaning, purposes, tasks, requirements, and models of land consolidation, which can be defined as merging fragmented and scattered plots in property farms, have changed during its implementation process. The process has expanded to broaden the scope of agricultural land ownership and regulate the agricultural structure. In addition, it has been understood that land consolidation is closely related to social and economic changes, and it should cover the planning of rural areas and focus on rural development. It has been seen that the spatial arrangement of land ownership in agriculture is related to food security, environment, natural life, and the planning of non-agricultural land. The increases in the importance of nature conservation and the environment, and also global climate changes have a great impact on this development. The land consolidation practices started in 1961 in Turkey and were carried out under the establishment laws of the implementing organizations, relevant regulations, and agricultural reform laws, without being regulated by a specific land consolidation law. According to the data for the year 2020, the total consolidated land area in the country is 4 766 941 hectares. With the amendment of the founding law of the State Hydraulics Institute (DSI) in 2018, a different period began regarding land consolidation. While the only authorized institution in the country for the consolidation was determined as the DSI, issues related to the planning and protection of agricultural lands were excluded from the scope of land consolidation. It is obvious that the country has been lacking an effective land consolidation policy, and the spatial and formal reorganization of land ownership in property farms have been implemented together with on-farm development services. It is seen in the relevant establishment law that the DSI will carry out the land consolidation within this scope in terms of its mandate area. However, it is necessary to organize agricultural lands according to the plans that primarily deal with their agricultural functions, to make necessary improvements, create natural areas, and complete land consolidation in the regions where productive agricultural lands and demands for non-agricultural uses are high. In these areas, all land-use plans should be made, and legal and institutional supports should be established for the protection of the results of land consolidation. This study systematically reviewed the evolution, legal and institutional structure of land consolidation in Turkey and then explored the possibility of using the consolidation as an effective measure in rural planning through revealing the current status, characteristics, and potential impact of land consolidation.

Keywords: Land consolidation, agricultural land, legislation



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GİRİŞ

Tarım topraklarındaki mülkiyet haklarının mekânsal boyutta yeniden düzenlenmesi, iyileştirilmesi temel anlamda toprak toplulaştırması kavramını açıklamaktadır. Yasal olarak tanımlanmış amaçlar ülkeden ülkeye değişmekteyse de genel amaç, toprağı iyileştirmek ve verimli kullanımını desteklemeyi içermektedir (Vitikainen, 2004). Başlangıçta tarımsal mülk işletmelerin parçalılıktan kaynaklanan altyapı sorunlarının giderilmesi ve daha verimli bir işletme yapısının oluşturulması süreci giderek genişlemiştir ve tarımsal amaçlar giderek kırsal kalkınmanın araçları haline gelmiştir. Çiftçinin çalışma ve yaşam alanlarının iyileştirilmesi, çevrenin ve doğal kaynakların korunması, tarım dışı alanların planlama içine alınması ile bütünüyle kırsal alanın yeniden düzenlenmesine doğru kapsamı genişlemiştir. Tanımlama, belirli bir kırsal yerleşim bölgesinde, verimli ve sürdürülebilir tarımsal işletmelerin oluşturulması amacıyla altyapılarının iyileştirilmesi, doğal kaynakların korunması ve yönetimini içeren bir planlama ile kırsal kalkınmayı sağlayacak önlemler olarak düşünülebilir. Kırsal alandaki üretim ve yaşam koşullarını iyileştirmeye çalışan toplulaştırma toprağın yönetim aracıdır, kırsal ve mekânsal yeniden yapılandırma olarak da adlandırılabilir, esas olarak kırsal üretimin, yaşam alanlarının ve ekolojik alanların yeniden yapılandırılmasını içermektedir (Long, 2020). Toprak toplulaştırması işletme parçalarının büyüklüğünü ve yeniden yapılanmasını sağlamak için karmaşık yasal ve teknik eylemleri içeren bir uygulamadır (Dumitrache, 2018). Ayrıca kırsal alandaki yaşam kalitesini ve uygulandığı bölgenin çevresini etkili bir şekilde iyileştirmenin yollarından biridir. Tarımsal işletmedeki yapısal iyileştirmeler özellikle küçük toprak mülkiyetine sahip işletmelerin gelirlerine, tarımsal üretime, kırsal kalkınmaya ve yoksulluğun azaltılmasına katkı oluşturacaktır. Tarım dışı amaçlarla tarım alanlarında yaşanan alan kaybından kaynaklanan tarımsal üretim azalışının önüne geçilmesi, köylerin nüfus açısından yeniden canlandırılması, doğal yaşama ve çevreye duyarlı yerleşimlerin oluşturulması kırsal toprak sisteminin reform edilmesiyle gerçekleşebilecektir. Toplulaştırma projelerinde çok yönlü kazanımların elde edilme olasılığının yüksek olduğu, alanın mekânsal yapısındaki sorunların giderilmesinde en uygun parametrelere sahip alanların belirlenmesi önem kazanmaktadır. Toplulaştırma projelerinin alan seçiminin bu şekilde önceden belirlenmesi uzun vadeli planlama sürecini kolaylaştıracaktır. Tarımsal potansiyeli yüksek olan, ancak kullanılmayan ve boş bırakılan tarım alanlarının yeniden üretime kazandırılması, kırsal alandaki nüfusun yapısal dönüşümünü de olumlu etkileyecektir.



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Türkiye’de tarım işletmelerinin dağınık, şekilsiz ve küçük parsellerden oluşan mekânsal yapısındaki sorunların temel nedeni yer aldığı coğrafyanın binlerce yıllık sosyal, ekonomik ve tarihsel dönüşümüdür. İstatistiki veriler 2000-2020 yılları arasında, Türkiye’nin toplam tarım alanları ve işlenen alanlarında büyük düşüşlerin olduğunu göstermektedir. Tarım alanları 20 yılda % 12,3 oranında kaybedilerek 26.4 milyon hektardan 23.1 milyon hektara gerilemiştir(TÜİK, 2021). Bu kayıpta tarım dışı kullanım için verilen kararların etkisi büyüktür. Benzer durum işlenen alanlar için de geçerlidir. Bu alanlar da aynı dönem için % 17,6 oranında azalarak 23.8 milyon hektardan 19.6 milyon hektara düşmüştür(TÜİK, 2021). Kırsal alandaki nüfusun azalmasının, köylerde yaşayan nüfusun yaşlanmasının, genç nüfusun tarımı terk etmesinin ve tarım sektöründe artan maliyetler daha az verimli tarım topraklarının ekilmeden boş bırakılmalarına neden olmaktadır. Toprak toplulaştırmasının uygulandığı mülk işletmeler tarım işletmelerinin %81,3 ünü oluşturmakta ve tarım topraklarının % 73,9 unu işlemektedir(TÜİK, 2021). Tarım topraklarının mülkiyet ve tasarruf durumuna ilişkin son tarım sayımı olan 2001 verilerinden yorum yapma zorunluluğu sağlıklı ve kesin bir bilgiye ulaşmayı engellemektedir. Ayrıca tarım topraklarının tapu ve kadastro tamamlanmış olmaktan uzak ve güncel değildir. Son sayıma göre yalnız kendi toprağını işleyen 20 dekara kadar olan mülk işletmelerin oranı % 35,9’dur. Bu mülk sahipleri toplam mülk toprakların %6,2’sine sahiptir. Mülk tarım işletmelerinin küçüklüğü ile birlikte mülkiyet-nüfus dağılımında dengesiz bir dağılım gösteren tarımsal yapı, tarım-mülkiyet ilişkilerinin düzenlenmesi gerektiğinin bir göstergesidir. Tarımsal yapı araştırması 2016 verilerine göre tarım işletmelerinde ortalama parça sayısı 5.9 ve ortalama parça genişliği 12,9 dekardır(TÜİK, 2021). Son Tarım Sayımında bu değerler sırasıyla 4,1 ve 15 dekardır(TÜİK, 2021). On beş yıllık süreçte bu değişim parçalanmayı ortadan kaldıracak etkin bir sistemin kurulmadığını ve parsel sayısının gelecekte de hızla artacağını, bu da tarım topraklarının niteliğinin kaybolması riskinin yanında başta yoksulluk olmak üzere ekonomik, sosyal ve çevre sorunlarının hızla artacağını göstermektedir(Gün vd, 2012). Ekilen tarım alanlarını toprağa emek veren nüfusla birlikte korumak, toprağın ekilmesinin sürdürülebilirliğini sağlamak ve verimliliğini tüketim-koruma dengesi içinde planlamak, Türkiye’nin toprak politikasının temel amacı olmalıdır. Bu amaca ulaşmada kırsal alanların sürdürülebilir kalkınmasının temelinde toprak toplulaştırmasının kapsamlı bir biçimde uygulanması önemli bir rol oynamaktadır.



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Türkiyede Toprak Toplulaştırmasının Evrimi

Türkiye'de toprak toplulaştırması uygulamaları 1961 yılında başlamış, yasal ve kurumsal nedenlerle başlangıçta genellikle sınırlı bir alanda uygulama alanı bulmuştur. Türkiye'de toplulaştırmaya ilişkin yasal düzenlemeler oldukça karışıktır. Bu konuda çıkarılmış özel bir toplulaştırma yasası bulunmamaktadır. Toplulaştırma projeleri; tüzükler, kuruluşların görev yasalarında düzenlemeler, toprak ve tarım reformu yasaları kapsamında toprak dağıtımını düzenleyen ilgili yasalar, toprak koruma ve planlama ile ilgili yasanın içeriğinde yer almıştır. Toplulaştırmanın 60 yıllık uygulama ve DSİ dosyalarına göre toplulaştırması tamamlanan 4 766 941 hektar alan sonucu, Türkiye'de toplulaştırmayı gerektiren nedenlerin dikkate alınmadan yapıldığı ve ulusal bir toprak toplulaştırması politikasının yürütülmediğini göstermektedir. Bu konudaki yasal düzenlemelerin toprak toplulaştırması ilkeleri:

Tüzükler Dönemi

Ülke genelinde 1966-2005 yılları arasında istemli toplulaştırma 1966 ve 1979 tarihlerinde çıkarılan tüzükler gereğince gerçekleştirilmiştir(T.C. Resmi Gazete, 1966;1979). Belirli bir çoğunluğun kabul etmesi ile yapılan bu toplulaştırmalar köylerin tarım alanları ile küçük ölçekte uygulanmıştır. Toprak Su Genel Müdürlüğü ve 1984 yılında yapılan reorganizasyon ile Köy Hizmetleri Genel Müdürlüğü uygulayıcı kuruluşlardır. 1966 tarihli tüzükte projenin hazırlandıktan sonra ilgililerin onayına sunulması ilkesi ile toplulaştırma işlemi sırasında aynı derece içindeki toprakların birleştirilmesi ve tüzükte yer almasına rağmen diğer derecelerden dönüşüm yapılmaması nedeniyle bu tüzüğe göre yapılan toplulaştırma projelerinde toplulaştırma oranı düşük gerçekleşmiştir. İkinci tüzükte bu ilkeler terkedilse de toplulaştırma sonuçlarına itiraz durumunda ilgililere yargı yolunun düzenlenmemiş olması, her iki tüzükte de ortak kullanım alanları için toprak sahiplerinin toprak kaybının hangi oranlarda olacağının belirlenmemesi gibi toplulaştırmanın en önemli konularında eksiklikleri vardır. Tüzükler arasında toplulaştırma alanı, yöntemi, ilkeleri, uygulama gibi konularda çok fazla farklılık bulunmamaktadır. 1979 tarihli tüzükte yer alan daha ayrıntılı kurallar 1757 sayılı yasanın reform bölgeleri dışında uygulanmasından elde edilen deneyimlerden kaynaklanmaktadır.

Toprak ve Tarım Reformu Yasaları Dönemi:

1757 sayılı yasa, diğer yasal düzenlemelere göre daha ayrıntılı kurallar içeren ve toplulaştırmayı ayrıntılı bir biçimde ele alan ve kırsal alan planlamasına uygun olacak biçimde düzenleyen bir yasadır(T.C.Resmi Gazete, 1973). Yasada, toplulaştırmanın uygulama alanları genişlemiş, işletme genişliklerinin artırılması ve tarımsal mülklerin aile işgücünü değerlendirmeye



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yetmeyecek derecede parçalanması ve küçülmesinin önlenmesi amaçlanmıştır. Bu yasa ile toplulaştırma hukukuna ilk kez küçük işletme ölçeğinin genişletilmesi ve toprak parçalanmasının önlenmesi kuralları girmiş bulunmaktadır. Çok yıllık bitkilerin bulunduğu alanların toplulaştırılması, ilgililere itirazlarında yargı yolu açılması, zorunlu yöntemin kabul edilmesi, toplulaştırma sonrası toprakların parçalanması durumunda dağıtımda verilecek toprak miktarının asgari işletme büyüklüğü olarak belirlenerek toplulaştırma sonuçlarının korunması önemli ilkler arasında yer almaktadır. 1757 sayılı yasa ayrıca tarım topraklarının korunması ve amaç dışı kullanımında oldukça sıkı kurallar getirmiştir. Genel kuralları toprak reformu bölgeleri için geçerli olan yasanın toplulaştırmaya ilişkin kuralları tüm ülke için 1973-1978 yılları arasında geçerli olmuştur.

3083 sayılı yasa, sulama alanlarında ve Bakanlar Kurulunca gerekli görülen alanlarda tarım reformu önlemlerinin alınmasına ilişkin kuralları düzenlemektedir(T.C.Resmi Gazete, 1984). Yasanın kapsamında yer alan kurallar daha çok genel başlıklar altında ele alınmıştır. Toprak toplulaştırmasının yapılma amacı, toplulaştırma sonuçlarının korunmasına ilişkin kuralları 1757 sayılı yasa ile aynıdır. Ancak yasanın toplulaştırmanın kapsamına ilişkin uygulama yönetmeliğinde toplulaştırmanın kapsamına kamulaştırma, az topraklı veya topraksız çiftçilerin topraklandırılması, sahibine bırakılacak toprakların belirlenmesi gibi, aslında toprak reformu önlemleri içinde yer alması gereken uygulamalar da alınarak bir kavram karmaşıklığı yaratılmıştır. 3083 sayılı yasanın tarım topraklarının amaç dışı kullanımında reform bölgelerini kapsayacak biçimde getirdiği ilkeler ise 1757 sayılı yasadaki anlayıştan yoksun olup tarım topraklarını korumaktan çok tarım dışı amaçlarla nasıl kullanılabileceğini düzenleyici kurallardır. Ortak kullanım alanlarına katılımın nereden karşılanacağı yasa ve yönetmelikte unutulmuş konulardandır. Bu eksiklik hazırlanan teknik talimatname ile düzenlenmeye çalışılmış ve 2001 yılında bu konudaki yasal boşluk giderilmiştir(T.C.Resmi Gazete, 2001). 3083 sayılı yasanın uygulama yönetmeliğinde istemli yöntemin öncelikli önemi ortadan kalkmış, yalnız uygulamada başvuru alan ilk yöntem olarak bir önceliği kalmıştır(T.C.Resmi Gazete, 1985). İstemli toplulaştırma için gereken çifte çoğunluğun sağlanamadığı durumlarda zorunlu toplulaştırmaya başvurulabilecektir. Bu kuraldan yönetmeliğin asıl benimsediği yöntemin zorunlu toplulaştırma olduğu anlaşılmaktadır. Toprak malikleri toplulaştırmayı kabul etseler de, etmeseler de toplulaştırma gerçekleşecektir. Kabul ettikleri durumda toplulaştırma kararını kendileri almış olacaklar, etmedikleri durumda ise yasa gereği toplulaştırma yine yapılacaktır. Yasanın uygulama yönetmeliği toplulaştırmayı ilgilendiren diğer bazı kuralları da



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düzenlemektedir. Köy yerleşim alanlarının düzenlenmesi ve gelişme alanlarının belirlenmesi toplulaştırmayı yakından ilgilendirmektedir. Uygulama bölgesinde uygun görülen yerlerde köy gelişme ve yeni köy yerleşme alanlarının seçileceği öngörülmüştür. Kuşkusuz kırsal yerleşimin düzenlenmesine ilişkin ilkelerin daha ayrıntılı bir biçimde ele alınması gerekirdi. Ancak, daha önce çıkarılan yasa ve yönetmeliklerde yer almayan bu konunun yönetmelikte benimsenmesi bir yenilik olarak kabul edilebilir. Tarım reformu alanlarında Tarım Reformu Genel Müdürlüğü 1984-2018 yılları arasında bu yasa gereğince toplulaştırma projelerini yürütmüştür.

Toprak Koruma ve Arazi Kullanımı Yasası Dönemi:

Türkiye'de tarım topraklarının kullanımı, planlanması ve korunmasına ilişkin yasa kapsamında ülke geneline yönelik ilk düzenleme olan 2005 tarihli 5403 sayılı Toprak Koruma ve Arazi Kullanımı Yasasının “toprağın korunması, geliştirilmesi, tarım topraklarının sınıflandırılması, asgari parsel büyüklüklerinin ve yeter gelirli mülk işletme genişliklerinin belirlenmesi ve bölünmelerinin önlenmesi, bu alanların çevre öncelikli sürdürülebilir kalkınma ilkesine uygun olarak, plânlı toprak kullanımını sağlayacak usûl ve esasları belirlemek” olarak geniş kapsamlı bir amacı bulunmaktadır(T.C.Resmi Gazete, 2005). Yasa “toprakların doğal ve yapay etkilerle bozulmasını ve parçalanmasını önlemek, parçalanmış topraklarda ise doğal özellikleri, kullanım bütünlüğü ve mülkiyet hakları gözetilerek birden fazla toprak parçasının birleştirilip ekonomik, ekolojik ve toplumsal yönden daha işlevsel yeni parsellerin oluşturulmasını ve bu parsellerin toprak özellikleri ve alanı değerlendirilerek kullanım şekillerinin belirlenmesini, köy ve toprağa ilişkin gelişim hizmetlerinin sağlanması” olarak toplulaştırmayı tanımlamaktadır. Toplulaştırma toprakların doğal özelliklerini koruyucu, işletmenin toprak bütünlüğünü sağlayıcı, mülkiyet haklarını koruyucu ve iyileştirici fonksiyonu kapsamında gerçekleştirilecektir. Toprakların doğal ve yapay nedenlerle özelliklerini kaybetmesini engellemek, toprakların özellikleri ve alanın değerlendirilerek kullanım şekillerinin belirlenmesi amacıyla kullanım planlanmasının yapılmasının toplulaştırmanın tanımına alınmış olması, geniş ölçekli bir planlama içinde gerçekleştirileceğine ilişkin ilkedir. Toplulaştırma sonuçlarının korunması amacıyla parçalanmayı önlemek toplulaştırmayı gerektiren nedenlerin süreç içinde yeniden ortaya çıkmasını engellemek amacıyla kapsamın içinde yer almaktadır. Köylerin gelişimine yönelik hizmetlerle kapsam kırsal alanı planlayıcı bir şekilde genişlemektedir. Yasa gereğince çıkarılan tüzüğün toplulaştırma tanımında köye ait gelişim hizmetleri yer almamış; köy gelişimi, kırsal alan düzenlemesi ve toprak toplulaştırması ayrı başlıklar ve konular olarak düzenlenmiştir. Tüzüğün toplulaştırmaya ilişkin kapsamı tarım



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kesiminde yaşayabilir işletmeler kurmak ve tarım topraklarının rasyonel kullanımını sağlamak amacıyla parsel büyüklüklerinin optimum ölçülerde oluşması, mevcut parsel deseninin parseller arası ulaşım, modern sulama ve tarımsal mekanizasyon tekniklerinin gereksinimlerine göre yeniden düzenlenmesi ve gerekli olması durumunda tarla içi geliştirme hizmetlerinin yapılmasından oluşmaktadır. Tüyük toplulaştırmayı tarım işletmelerinin altyapısını iyileştirme ile sınırlandırmıştır.

Toplulaştırma, Bakanlar Kurulunca karar verilen bütün alanlarda uygulanabilecektir. Uygulama bölgesindeki kamusal tarım alanları ekonomik ölçekte, yaşayabilir ve gelişebilir tarım işletmeleri oluşturmak için tarım toprağı bulunmayan veya yetersiz olan çiftçilere, tarımsal işletme kurabilmeleri veya mülk topraklarını büyötmeleri amacıyla bedeli karşılığında dağıtılabilecektir. Ayrıca gerekli durumlarda asgari büyüklükte olmayan parseller gerektiğinde toplulaştırma ve bu yasa kapsamında değerdendirmek üzere kamulaştırılabilecektir. Toplulaştırma uygulamalarında, tahsisli yerler ile birlikte asgari büyüklüğün altındaki topraklar kullanılarak asgari büyüklükte yeni parseller oluşturulup bu parseller; toplulaştırma veya kamulaştırma konusu olan toprak maliklerine öncelikli olmak üzere bu kişiler satın almadığı takdirde, yeter gelirli tarımsal toprak büyüklüğü bulunmayan yöre çiftçilerine rayiç bedeli üzerinden satışı yapılabilecektir. Bu bedelin aslında toprağın verim ya da gelir değeri üzerinden belirlenerek topraksız veya az topraklıların desteklenmesi ve mülk işletme genişliklerinin artırılması katkısında düzenlenmesi, asgari büyüklükte olmayan parsellerin kamulaştırılmasının devlete getireceğı mali yük ve topraksızlanmayı desteklemesi nedeniyle aslında bu parsellerin yalnız toplulaştırma kapsamında değerdendirilmesi gerekmektedir(Gün, 2015). Toplulaştırma, toprakların yarısından çoğuna malik bulunan ve sayıca maliklerin yarısından fazlasını oluşturanların onayı üzerine istemli, Tarım Bakanlığının veya kurulların talebi üzerine kamu yararı gözetilerek zorunlu olarak yapılabilecektir.

Yasa kurumsal ve alansal genişleme için özel toplulaştırmayı kabul ederek köy tüzel kişiliğı, belediyeler, kooperatifler, birlikler gibi tüzel kişilikler veya kamu kuruluşlarının, hizmet konuları ile ilgili özel toprak toplulaştırması ve/veya tarla içi geliştirme hizmetini Tarım Bakanlığının denetiminde yapabileceklerini de kurala bağlamıştır. Özel toplulaştırma yapan kurum veya kuruluşlar kamu yatırımları için gereksinim duyulan alanı toplulaştırma yoluyla karşılayabilecektir. Bu yatırımlar için ortak kullanım alanı kesinti payı ile karşılanamayan alan, öncelikle hazine topraklarından, daha sonra bu yatırımların yapılacağı alana bağılı kalınmaksızın gerçek ve tüzel kişilerinden anlaşma yoluyla alınabilecektir. Özel toplulaştırma



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ile tarım topraklarının toplulaştırılması daha kısa bir sürede bitirilebilme olanağı ile birlikte çeşitli kuruluşlarca kırsal alana götürülen hizmetlerin etkinliği artabilecektir. Toplulaştırma alanlarında, gölet, baraj, yol, sulama ve tahliye kanalları, elektrik iletim tesisleri ve diğer tesislerin sadece toplulaştırma proje alanına hizmet eden ayrıntıları için gerekli olan alan, öncelikle en fazla yüzde on oranında ortak katılım payından karşılanacaktır. Daha fazla alana gereksinim olduğunda bu alan, hazine topraklarından veya devletin hüküm ve tasarrufu altında bulunan topraklardan, bunların yeterli olmadığı durumlarda gerçek ve tüzel kişilerden anlaşma veya kamulaştırma yoluyla sağlanabilecektir. Kamuya ait karayolları, demiryolları, havaalanları, elektrik iletim tesisleri, barajlar, göletler ve buna benzer kamu yatırımları için gerekli olan alanın, varsa ortak katılım payı için kesilen miktardan bedeli ödenerek alınacağı kurala bağlanmıştır.

Parsellerin yeniden düzenlenmesi; çevre ve doğanın korunması ve iyileştirilmesi ve maliklerin istekleri de dikkate alınarak hisseli mülkiyet ve parsel sayısının azaltılması şeklinde planlanacaktır. Uygulama alanında bulunan meyve ağaçları, meyvesiz ağaçlar ile geniş çalı topluluğu ve diğer doğal varlıkların proje ile korunması ve iyileştirilmesi esastır. Erozyon tehlikesi bulunan alanlarda bitki örtüsünün korunması ve geliştirilmesi için doğal dengeyi bozmamak kaydıyla proje idaresi tarafından gerekli önlemler alınacaktır. Köylerin yaşam ve çevre koşullarının iyileştirilmesi amacı ile yerleşim yerinin ve tarım topraklarının koruma, ıslah, sulama gibi köy gelişimi için tüm altyapı hizmetlerinin ve yerleşim birimlerine ait kadastral sınırların toplulaştırma amacına uygun olarak planlanması ve uygulanması yasanın kırsal alan düzenlemesine ilişkin kuralıdır. Tüzükte bu kapsamda yapılacak işlemler daha ayrıntılı olarak belirtilmiştir. Proje alanlarında, gerçek ve tüzel kişiler ile kamuya ait tarım topraklarının toplulaştırılması, gerektiğinde genişletilmesi, toprakların verimli bir şekilde işletilmesi ve bu durumun korunması, ucuz ve kaliteli üretimin artırılmasına olanak sağlayan önlemlerin alınması, toprakların ekonomik bir şekilde işlenmesini sağlamak için yol, sulama ve drenaj şebekelerinin kurulması, toprak tesviyesi, erozyon önleyici tesisler ve yan dere yatağı ıslahının yapılması, toprağın yeteneği ve özelliklerine göre çayır, mer'a dahil tüm bitkisel üretim alanları ile yerleşim ve sanayi yerlerinin belirlenmesi, mevcut mer'a alanlarının 4342 sayılı Mer'a Yasası gereğince düzenlenmesi, çevrenin ve doğanın korunması ve iyileştirilmesi, yerleşim alanları ve sosyal ve kültürel kamu tesisleri ile proje alanındaki ortak yatırımların kapladığı alanlar için alan gereksiniminin karşılanması ve köy yerleşim yerlerinin düzenli oluşturulmasını kapsamaktadır. Kuşkusuz bu kural kırsal alanın tüm topraklar ölçeğinde



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planlanmasını sağlayıcı olup özellikle tarım topraklarının korunmasına, tarımsal üretimin sürdürülebilirliğine ve doğal kaynakların ve çevrenin korunmasına olumlu katkılar verebilecektir(Gün, 2015). Ancak bu planlamanın diğer planlamalar karşısında bağlayıcılığı oldukça önemli olup sektörel, kurumsal ve yasal düzenlemeleri eksik kalmıştır. Ayrıca bu planlama bütün toplulaştırma projelerinde de uygulanmamıştır. Toprak Koruma ve Arazi Kullanımı Yasasının 2005-2018 yılları arasında ülke genelinde yürütücü kuruluşu Tarım Reformu Genel Müdürlüğü olmuştur.

7139 Sayılı Devlet Su İşleri Genel Müdürlüğünün Teşkilat ve Görevleri Hakkındaki Yasada Değişiklik Yapan Yasa

Bu yasa ile toprak toplulaştırmasında yasal ve kurumsal yapı değişikliği sağlanmıştır. Yasaya alınan toplulaştırmaya ilişkin kurallar 5403 sayılı yasa ile benzer özelliklerdedir(T.C. Resmi Gazete, 2018). Toplulaştırmanın kapsamı daraltılarak kırsal alanın planlanması ölçeğinde düzenlemesi ortadan kaldırılmıştır. Doğal olarak 5403 sayılı yasanın bütünü böyle bir uygulamaya olanak tanıyordu. DSİ'nin kurumsal görev tanımının farklı bir alanda olması kırsal alanı planlama yetkisini bu kuruma tanımamaktadır. Sulu tarım alanlarında ve sulamaya açılacak yeni alanlarda sulama hizmetini yürüten kuruluşun toplulaştırma çalışmalarını da yapabilmesi sulama verimliliği, kaynakların doğru ve etkin kullanımı açısından fayda sağlayacaktır. Ancak 5403 sayılı yasada yer alan özel toplulaştırma kuralı zaten bu olanağı sağlayan bir düzenlemeydi. O nedenle DSİ'nin hizmet götürdüğü alanlarda özel toplulaştırma kuralları gereğince sulama ve toplulaştırma hizmetlerini yürütme olanağı bulunuyordu. Bu değişiklik Köy Hizmetleri Genel Müdürlüğü'nün kapatılması sürecinde olduğu gibi kurumların tüm bilgi, belge deneyimleri ile yetişmiş insan kaynakları kaybına yol açan ve kurumsal hafızalarını, birikimlerini ortadan kaldıran bir tekrar olmuştur.

DEĞERLENDİRME

Türkiye'de tarım toprakları üzerindeki mülkiyet hakkının şekilsel ve mekânsal olarak yeniden düzenlenmesi ve işletme alt yapısının iyileştirilmesi kapsamında uygulanan toprak toplulaştırması sürecinin 1961 yılından itibaren kapsamının ve uygulama amaçlarının zaman içinde geliştiği anlaşılmaktadır. Tarımsal işletmenin toprak parçalılığının azaltılması, tarımsal üretime uygun şekilsel düzenlemelerin yapılması, mülkiyet haklarının belirlenmesi, güncellenmesi, yol ve sulama ağının gerçekleştirilmesi, toprak ıslahı ve kalitesinin iyileştirilmesi gibi işlemlerin tarıma ve kırsal alana katkısının boyutları anlaşılmıştır. Farklı



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yasal düzenlemeler ve kurumsal yapılanmaların uygulamaları incelendiğinde bu süreçte, doğal bir kaynak olan tarım topraklarının toplulaştırılmasında geliştirdiği kırsal alanların planlanması anlayışını terk ettiği görülmektedir.

Toprak Koruma ve Arazi Kullanımı Yasası, toprak toplulaştırmasının kırsal alanın planlanması bağlamında düzenleyebilecek ilkelere sahip olup çevre öncelikli sürdürülebilir kalkınma için kapsamlı bir toprak yönetimini desteklemekteydi. Böylece toplulaştırmanın planlama kapsamında yürütülmesinden dolayı tarım topraklarının ve diğer alanların amaçlarına uygun, işlevsel kullanımının sağlanma olasılığı ile kentsel alanların, tarım dışı sektörlere ilişkin politikaların ve planların yürütülmesine uygun koşullar yaratılabilecekti. Elbette yasanın kırsal alanın planlanmasına ilişkin yetki ve görev tanımlamaları ile planlamalarının denetim ve yaptırım fonksiyonlarına ilişkin eksikliklerin giderilmesi gerekliydi.

Toplulaştırmanın sulama alanlarında gerçekleştirilmesi tartışmasız önemli olup sulanan alanlarda öncelikli olarak toplulaştırmanın tamamlanması gerekmektedir. Yeni düzenlemenin ve uygulayıcı kuruluşun sulama yatırımları ile ilgilenmesi toplulaştırmanın uygulama alanlarını ve kapsamını daraltmıştır. Oysaki Türkiye'de verimli tarım alanlarında, tarım dışı kullanım taleplerinin yoğun bulunduğu bölgelerde ve ekilmeyen tarım alanlarının ve köylerin nüfusunun azaldığı bölgelerde kırsal canlanma için toplulaştırmanın tamamlanması gerekmektedir.

Toprak toplulaştırmasında ekonomik kaynakların sınırlılığı ve kurumsal yeterlilikler uygulamada başarıyı ve sonucu etkileyen ancak genellikle arka planda kalan bir konudur. Sınırlı ekonomik kaynakların yerinde, verimli ve etkin bir şekilde kullanılması olarak da ele alınabilecek olan kaynak yönetimi ve gereksinimin ivedi ve öncelikli olduğu alanlara yönlendirilmesiyle en yüksek faydaya ulaşım sağlanabilecektir.

Kapsamlı toprak toplulaştırma projeleri genellikle geniş kamusal bir ağı ilgilendirdiği için doğal bir kaynak olan toprak ve su kaynaklarının yönetimine ilişkin yasal ve kurumsal yapılanma tamamlanmalıdır. Bu yapılanmada mülkiyet haklarının korunması, sürdürülebilirlik, doğal kaynakların ve çevrenin korunması katılımcı bir yaklaşımla ele alınmalı, şeffaflık ve izlenebilirlik öncelikli ilkeleri olmalıdır.



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KAYNAKLAR

- Dumitrache, C.G., 2018. Land Consolidation in Scandinavian Countries, International Journal of Scientific Engineering and Science, Volume 2, Issue 4, pp. 78-82, <https://ijses.com/wp-content/uploads/2018/05/653-IJSES-V2N4.pdf>
- Gün, S., Dellal, İ., Ünüvar, İ.F., 2012. Türkiye'de Toprak Politikası ve Kırsal Yoksulluk, 10. Ulusal Tarım Ekonomisi Kongresi, Bildiri Kitabı, Cilt:1, s:217-223, Konya.
- Gün, S., 2015. Kırsal Alanın Planlanması ve Toprak Toplulaştırması, Tarım Ekonomisi Araştırmaları Dergisi, Cilt 1, Sayı 2, 52 – 61.
- Long, H., 2020. Land Consolidation: A Way of Rural Restructuring and Vitalization. In: Land Use Transitions and Rural Restructuring in China. Springer, Singapore. pp 473-490. https://doi.org/10.1007/978-981-15-4924-3_10, Son Erişim: 05.12.2021
- T.C. Resmi Gazete, 1966. Arazi Tevhidi Tüzüğü, Sayı:12358.
- T.C. Resmi Gazete, 1979. 7/18231 Sayılı Arazi Toplulaştırma Tüzüğü, Sayı:16820.
- T.C. Resmi Gazete, 1973. Toprak ve Tarım Reformu Kanunu, Sayı:14599.
- T.C. Resmi Gazete, 1984. Sulama Alanlarında Arazi Düzenlemesine Dair Tarım Reformu Kanunu, Sayı:18592.
- T.C. Resmi Gazete, 1985. Sulama Alanlarında Arazi Düzenlemesine Dair Tarım Reformu Kanunu Uygulama Yönetmeliği, Sayı:18796.
- T.C. Resmi Gazete, 2001. Sulama Alanlarında Arazi Düzenlenmesine Dair Tarım Reformu Kanununda Değişiklik Yapılması Hakkında Kanun, Sayı: 24327.
- T.C. Resmi Gazete, 2005. Toprak Koruma ve Arazi Kullanımı Kanunu, Sayı: 25880.
- T.C. Resmi Gazete, 2018. Devlet Su İşleri Genel Müdürlüğünün Teşkilat ve Görevleri Hakkında Kanun ile Bazı Kanunlarda ve Gıda, Tarım ve Hayvancılık Bakanlığının Teşkilat ve Görevleri Hakkında Kanun Hükmünde Kararnamede Değişiklik Yapılmasına Dair Kanun, Sayı: 30405.
- TÜİK, 2021. İstatistik Veri Portalı, <https://data.tuik.gov.tr/Kategori/GetKategori?p=Tarim-111>, Son Erişim: 07.12.2021
- Vitikainen, A., 2004. An Overview of Land Consolidation in Europe. Nordic Journal of Surveying and Real Estate Research 1: 19 p.



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**GİBBERELLİK ASİT UYGULAMALARININ İNTERDONATO LİMON ÇEŞİDİNDE
MEYVE SUYU ORANI VE DİĞER KALİTE KRİTERLERİNE ETKİSİ**

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ÖZET

İnterdonato, ülkemizde en erken olgunlaşan limon çeşididir. Bu çeşidin derim kriteri meyve su oranıdır. Fakat çok erken derildiği için su oranı genellikle diğer limon çeşitlerine göre daha düşük olmaktadır. Bu çalışma değişik gibberellik asit dozlarının İnterdonato limon çeşidinde meyve suyu oranı ve diğer kalite kriterleri üzerine etkisini incelemek amacıyla yürütülmüştür. Deneme Alata Bahçe Kùltürleri Araştırma Enstitüsünde 15 yaşındaki İnterdonato limon parselinde tesadüf blokları deneme desenine göre 5 yinelemeli olarak kurulmuştur. Denemede, derimden 1 ay önce İnterdonato limon çeşidinin ağaçlarına 0, 25 ve 50 ppm gibberellik asit uygulaması yapılmıştır. Derimden sonra, ortalama meyve ağırlığı, meyve su oranı, meyve eni, meyve boyu, kabuk kalınlığı, kabuk pürüzlülüğü özellikleri incelenmiştir. Deneme sonucunda, derim öncesi gibberellik asit uygulamalarının İnterdonato limon çeşidinde meyve su oranı üzerine önemli bir etkiye sahip olmadığı belirlenmiştir.

Anahtar Kelimeler: Limon, İnterdonato, Derim, Meyve su oranı.



EFFECT OF GIBBERELIC ACID APPLICATIONS ON FRUIT JUICE RATIO AND OTHER QUALITY CRITERIA IN INTERDONATO LEMON VARIETY

ABSTRACT

Interdonato is the earliest maturing lemon variety in our country. The harvest criterion for this variety is the fruit juice rate. However, since it is harvested very early, the water rate is usually lower than other lemon varieties. This study was carried out to examine the effects of different gibberellic acid doses on the fruit juice ratio and other quality criteria of Interdonato lemon variety. The experiment was set up in a 15-year-old Interdonato lemon plot in Alata Horticultural Research Institute in a randomized block design with 5 replications. In the experiment, 0, 25 and 50 ppm gibberellic acid was applied to the trees of the Interdonato lemon variety 1 month before the harvest. After harvesting, average fruit weight, fruit juice rate, fruit width, fruit length, skin thickness, skin roughness were investigated. As a result of the experiment, it was determined that preharvest gibberellic acid applications did not have a significant effect on the fruit juice ratio of Interdonato lemon variety.

Keywords: Lemon, Interdonato, Harvest, Fruit juice rate



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1. GİRİŞ

Dünyada limon ve laym üretimi 2020 yılında 20 milyon ton civarında gerçekleşmiştir. Bu üretimin 950 bin tonunu Türkiye karşılamıştır (FAO, 2020). Ülkemizde sahil bölgelerinde yettirilebilmesine rağmen ticari olarak Akdeniz Bölgesinde yoğunlaşmaktadır. Mersin ili, ülkemizin toplam limon üretiminin yarısından fazlasını karşılamaktadır (TUIK, 2021).

Limon ağaçları, 3-8m dolaylarında orta büyüklükte taç oluşturur. Taçlar genellikle dağınık yapılıdır. Köşeli dal özelliği limonlarda çok belirgindir. Bunlarda salkım şeklinde çiçek açarlar. Yaprakların kanatçıkları iz şeklindedir. Bazı çeşitlerde genç sürgünler mor renklidir. Meyveleri yuvarlağa yakından silindirik şekle kadar değişir ve still ucu tarafında meme şeklinde çıkıntı bulunur. Meyveleri 7-10 dilimlidir. Limonların en önemli özelliği birden fazla dönemde çiçek açmasıdır (Şeker, 2020).

Limonlar kendi içinde Eureka ve Lizbon olmak üzere 2 ana grupta incelenir. Lizbon çeşit grubunda, Eureka'ya göre kabuklar biraz daha pürüzlüdür, yediverenlik özelliği daha belirgindir. Yaprak rengi Eureka'ya göre daha koyudur ve daha sivricidir. Göreceli olarak soğuklara ve uçkurutan hastalığına Eureka'ya göre daha çok dayanıklıdır. İnterdonato çeşidi Lizbon çeşit grubunda yer almaktadır.

İnterdonato, ülkemizde en erken olgunlaşan limon çeşididir. Bu çeşidin derim kriteri meyve su oranıdır. Fakat çok erken derildiği için su oranı genellikle diğer limon çeşitlerine göre daha düşük olmaktadır.

Bu çalışma, değişik gibberellik asit dozlarının İnterdonato limon çeşidinde meyve suyu oranı ve diğer kalite kriterleri üzerine etkisini incelemek amacıyla yürütülmüştür.

2.MATERYAL VE METOT

Deneme Alata Bahçe Kültürleri Araştırma Enstitüsünde 15 yaşındaki turunc üzerine aşıllı İnterdonato limon (Şekil 1 ve 2) parselinde tesadüf blokları deneme desenine göre 5 yinelemeli olarak kurulmuştur.

Denemede, derimden 1 ay önce İnterdonato limon çeşidinin ağaçlarına 0, 25 ve 50 ppm gibberellik asit uygulaması yapılmıştır. Uygulamalar, tüm ağacı kapsayacak şekilde yapılmıştır. Uygulama esnasında (1 Eylül) ve bir ay sonra hasat zamanı meyve örneklemeleri yapılmıştır. Derim öncesi ve derimden sonra, ortalama meyve ağırlığı, meyve eni ve boyu, meyve su oranı, kabuk kalınlığı, SÇKM ve kabuk pürüzlülüğü özellikleri incelenmiştir.



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Elde edilen verilerin varyans analizi (ANOVA) kullanılarak Jump (JMP) istatistiksel yazılımı (Ver. 7.0, SAS Institute Inc., Kuzey Carolina, ABD) ile analiz edilmiştir. Ortalamalar arasındaki önemli farklılıklar Tukey (HSD) testi ile %5 önem seviyesinde belirlenmiş ve olasılık düzeyi $p < 0.05$ 'teki farklılıklar istatistiksel olarak anlamlı kabul edilmiştir.

Şekil 1. İnterdonato limon çeşidine ait meyveler



Şekil 2. İnterdonato limon çeşidine ait meyveler





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3. BULGULAR ve TARTIŞMA

Derim öncesi gibberellik asit uygulamalarının İnterdonato limon çeşidinde meyve kalitesi üzerine etkileri Tablo 1. de sunulmuştur.

Tanık uygulamasının gibberellik asit uygulama zamanındaki (1 Eylül) özellikleri incelendiğinde, meyve ağırlığının 112 g, meyve eninin 54,52 mm, meyve boyunun 69,42 mm, meyve su randımanının %37, SÇKM oranının %10 ve toplam asit oranının %7,24 olduğu tespit edilmiştir (Tablo 1).

Gibberellik asit uygulamalarının meyve özellikleri üzerine etkisi incelendiğinde, meyve eni ve meyve boyu üzerinde istatistiksel olarak önemli olduğu, meyve ağırlığı, meyve su oranı, SÇKM oranı, toplam asit oranı ve kabuk pürüzlülüğü üzerinde önemli bir etkisini olmadığı saptanmıştır (Şekil 3, 4 ve 5).

Meyve ağırlığı, kontrol uygulamasında 140 g olarak belirlenirken, 25 ppm GA₃ uygulamasında 154 g, 50 ppm GA₃ uygulamasında ise 148 g olarak ölçülmüştür. İstatistiksel olarak önemli olmasa da GA₃ uygulamalarının meyve iriliğini kısmen arttırdığı görülmüştür. Meyve boyutlarının da önemli ölçüde artması bunu desteklemektedir. Hasat dönemindeki meyve su oranı, tanık uygulamasında %41 olarak, 25 ve 50 ppm GA₃ uygulamasında ise %40 olarak belirlenmiştir (Tablo1).

Tablo 1. Derim öncesi gibberellik asit uygulamalarının İnterdonato limon çeşidinde meyve kalitesi üzerine etkileri

Zaman	Uygulama-lar	Meyve ağırlığı (g)	Meyve eni (mm)	Meyve boyu (mm)	Meyve su oranı (%)	SÇKM (%)	Toplam asit oranı (%)
1 Eylül	Tanık	112.0	54.52	69.42	37.0	10.0	7.24
30 Eylül	Tanık	140.0	60.83 a	78.46 a	41.0	9.8	7.17
	25ppm GA ₃	154.0	61.11 a	76.08 b	40.0	10.0	6.95
	50ppm GA ₃	148.0	56.96 b	69.72 c	40.0	10.0	7.27
	LSD ₅	ö.d.	1.77	0.72	ö.d.	ö.d.	ö.d.

ö.d.: Önemli değil

SÇKM ve toplam asit oranı incelendiğinde, SÇKM, tanık uygulamasında %9,8 olurken, 25 ve 50 ppm GA₃ uygulamasında %10, toplam asit oranı, tanık uygulamasında %7,17 belirlenirken,



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25 ppm GA₃ uygulamasında %6,95 ve 50 ppm GA₃ uygulamasında %7,27 olarak saptanmıştır (Tablo 1). Elde edilen veriler, Fidelibus ve ark., (2002) bulguları ile paralellik göstermektedir.

Şekil 3. Tanık uygulamasına ait meyveler



Şekil 4. 25 ppm GA₃ uygulamasına ait meyveler





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Şekil 5. 50 ppm GA₃ uygulamasına ait meyveler



4. SONUÇ

Deneme sonucunda, derim öncesi gibberellik asit uygulamalarının İnterdonato limon çeşidinde meyve su oranı üzerine önemli bir etkiye sahip olmadığı belirlenmiştir. Bununla birlikte hasattan 1 ay önce yapılan GA₃ uygulamalarının, İnterdonato limon çeşidinde meyve ağırlığını, meyve eni ve boyunu arttırdığı saptanmıştır.



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KAYNAKÇA

- TÜİK, 2021. Bitkisel üretim istatistikleri. Türkiye İstatistik Kurumu, www.tuik.gov.tr
- Fidelibus, M. W., Davies, F. S., Campbell, C. A. (2002). Gibberellic Acid Application Timing Affects Fruit Quality of Processing Oranges, HortScience HortSci, 37(2), 353-357.
- FAO, 2020. FAOSTAT istatistik veritabanı. <https://www.fao.org/faostat/en/#home>
- Şeker, M., 2020. Turunçgiller ders notları. Çanakkale 18 Mart Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü, Çanakkale.



WONDERFUL NAR ÇEŞİDİNDE KENDİLEME VE AÇIK TOZLAMANIN MEYVE KALİTESİ ÜZERİNE ETKİLERİ

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ÖZET

Nar kendine verimli bir tür olarak bilinmekle birlikte bazı çeşitlerinde kendine verimsizlik görülmektedir. Bununla birlikte ülkemizde en çok yetiştirilen Hicaznar ve Wonderful çeşitlerinde kendine verimsizlik sorunu bulunmamaktadır. Bu çeşitlerle tozlayıcı kullanmadan kapama nar bahçesi kurulmasına rağmen herhangi bir tozlayıcı çeşit kullanımının verim üzerinde olumlu etkisi bulunmaktadır. Bu çalışmada Wonderful nar çeşidinde açık tozlama ve kendileme uygulamalarının meyve kalite özellikleri üzerine etkisi incelenmiştir. Araştırma, 5x3 m mesafeyle dikilmiş Wonderful çeşidiyle, Mersin Alata Bahçe Kùltürleri Araştırma Enstitüsünde yürütölmüştür. Deneme, 4 tekerrürlü olarak tesadüf blokları deneme desenine göre kurulmuştur. Açık tozlama uygulamasında çiçekler etiketlenmiş fakat herhangi bir uygulama yapılmamıştır. Kendileme uygulamasında balon aşamasına gelmiş çiçeklerde taç yapraklar açılarak fırça ile tozlama yapılmış ve çiçekler etiketlenerek bez torba içine alınmıştır. Fırça ile tozlama 2 defa tekrarlanmıştır. Meyveler olgunluk aşamasına gelince hasat edilip pomolojik analizleri yapılmıştır. Deneme sonucunda, kendileme uygulamasına ait nar meyvelerinin serbest tozlama uygulamasına göre daha küçük oldukları tespit edilmiştir. Kendileme uygulamasındaki meyvelerin küçük olmasının nedeninin meyve dane sayısının azalmasından kaynaklandığı belirlenmiştir.

Anahtar Kelimeler: Nar, Wonderful, kendileme, açık tozlama, meyve kalitesi.



THE EFFECTS OF SELF AND OPEN POLLINATION TREATMENTS ON FRUIT QUALITY IN WONDERFUL POMEGRANATE VARIETY

ABSTRACT

Although pomegranate is known as a self-fertile species, some varieties are self- incompatible. However, there is no self-incompatible problem in Hicaznar and Wonderful varieties, which are the most grown in our country. Although a regular pomegranate orchard is established with these varieties without using pollinators, the use of any pollinator pomegranate variety has a positive effect on yield. In this study, the effects of open and self-pollination treatments on fruit quality characteristics of Wonderful pomegranate variety were investigated. The research was carried out in Mersin Alata Horticultural Research Institute with the Wonderful variety planted at a distance of 5x3 m. The experiment was set up in a randomized block design with 4 replications. In the open-pollination application, the flowers were labeled, but no application was made. In the self-pollination application, the petals were opened and dusted with a brush in the flowers that had reached the balloon stage, and the flowers were labeled and put into a cloth bag. Dusting with a brush was repeated 2 times. When the fruits reached the maturity stage, they were harvested and their pomological analyzes were made. As a result of the experiment, it was determined that the pomegranate fruits belonging to the self-pollination application were smaller than the open-pollination application. It was determined that the reason for the small fruit size in the self-pollination application was due to the decrease in the number of arils in the fruit.

Keywords: Pomegranate, Wonderful, Self-pollination, open-pollination, fruit quality



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1. GİRİŞ

Nar meyvesinde kaliks 5-7 parçalı, kalın, etli, sivri kenarlı ve tüysüzdür. Çanak yapraklar birleşik bir yapıdadır. Taç yapraklar çanak yapraklarla aynı sayıda, çanak yaprakların iç tarafındadır. Taç yapraklar parlak kırmızı renkte ve büyüklüğü çeşide göre değişmektedir. Yumurtalık kaliks tüpünün alt kısmında küre şeklinde ve gömülü bir vaziyettedir. Çok sayıda yumurta hücresi içermektedir. Yumurtalık genellikle 1-2 katmanlıdır. Stil tek, stigma ise kapitat yapıdadır. Nar çiçeğinde çok sayıda erkek organ bulunmaktadır. Erkek organlar kaliksin iç kısmında dairesel olarak 5-6 sıra yer almaktadır. Anterler sarı renkli ve eliptik şekilli, filamentler ise açık kırmızı renklidir (Yılmaz, 2007).

Nar, andromonoik bitkiler grubunda yer alır. Narlarda, A tipi ve B tipi olmak üzere 2 tip çiçek oluşmaktadır. Narda, stigma, çiçek açılmadan 24 saat önce reseptif hale gelir. Dolayısıyla nar çiçekleri açıldığında döllenme için hazır durumdadır. Açılan çiçeğin henüz anterleri patlamadığı için yabancı tozlanmaya açık bir durumdadır. Dişi organın reseptif olma durumu çiçek açınımdan 3 gün sonraya kadar devam etmektedir (Özgüven ve ark., 2015).

Nar kendine verimli bir tür olarak bilinmekle birlikte bazı çeşitlerinde kendine verimsizlik görülmektedir. Bununla birlikte ülkemizde en çok yetiştirilen Hicaznar ve Wonderful çeşitlerinde kendine verimsizlik sorunu bulunmamaktadır (Özgüven ve Yılmaz, 2000). Bu çeşitlerle tozlayıcı kullanmadan kapama nar bahçesi kurulmasına rağmen herhangi bir tozlayıcı çeşit kullanımının verim üzerinde olumlu etkisi bulunmaktadır. Bu çalışmada Wonderful nar çeşidinde açık tozlama ve kendileme uygulamalarının meyve kalite özellikleri üzerine etkisi incelenmiştir.

2.MATERYAL VE METOT

Araştırma, 5x3 m mesafeyle dikilmiş Wonderful çeşidiyle, Mersin Alata Bahçe Kültürleri Araştırma Enstitüsünde yürütülmüştür. Deneme, 4 tekerrürlü olarak tesadüf blokları deneme desenine göre kurulmuştur.

Açık tozlama uygulamasında, çiçekler etiketlenmiş fakat herhangi bir uygulama yapılmamıştır. Kendileme uygulamasında balon aşamasına gelmiş çiçeklerde taç yapraklar açılarak fırça ile tozlama yapılmış ve çiçekler etiketlenerek bez torba içine alınmıştır. Fırça ile tozlama 2 defa tekrarlanmıştır. Meyve tutumundan 1 ay sonra torbalar çıkarılmıştır.

Meyveler olgunluk aşamasına gelince hasat edilip pomolojik analizleri yapılmıştır. Pomolojik analizde meyve ağırlığı, meyve eni, meyve boyu, meyve şekil indeksi, kabuk kalınlığı, kaliks



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sayısı, kaliks uzunluğu, kaliks çapı, SÇKM, asitlik, kabuk rengi, 100 dane ağırlığı, meyve dane sayısı, dane ağırlığı, dane randımanı ve meyve su oranı belirlenmiştir.

Elde edilen verilerin varyans analizi (ANOVA) kullanılarak Jump (JMP) istatistiksel yazılımı (Ver. 7.0, SAS Institute Inc., Kuzey Carolina, ABD) ile analiz edilmiştir. Ortalamalar arasındaki önemli farklılıklar Tukey (HSD) testi ile %5 önem seviyesinde belirlenmiş ve olasılık düzeyi $p < 0.05$ 'teki farklılıklar istatistiksel olarak anlamlı kabul edilmiştir.

Şekil 1. Wonderful nar çeşidine ait meyveler



3. BULGULAR ve TARTIŞMA

Wonderful nar çeşidinde açık tozlama ve kendileme uygulamalarının meyve özellikleri üzerine etkileri Tablo 1, 2 ve 3'te sunulmuştur. Wonderful nar çeşidinde açık tozlama ve kendileme uygulamalarının meyve ağırlığı, meyve eni, meyve boyu, meyve dane sayısı, dane ağırlığı, dane randımanı ve meyve su randımanı üzerine istatistiksel olarak önemli olduğu tespit edilmiştir.



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Tablo 1. Wondeful nar çeşidinde açık tozlama ve kendileme uygulamalarının meyve ağırlığı, meyve boyutları, meyve şekli ve kabuk kalınlığı özellikleri üzerine etkisi

Uygulamalar	Meyve ağırlığı (g)	Meyve eni (mm)	Meyve boyu (mm)	Meyve şekil indeksi	Kabuk kalınlığı (mm)
Açık tozlama	470,82 a	99,56 a	86,58 a	0,87	3,08
Kendileme	322,22 b	87,13 b	74,97 b	0,86	3,22
Ortalama	396,52	93,34	80,77	0,87	3,15
p<0,05	0,0038	0,0054	0,0045	0,4998	0,6698

Elde edilen veriler incelendiğinde açık tozlama uygulamasında hasat edilen meyvelerin (470,82 g), kendileme uygulamasındaki meyvelerden (322,22 g) daha ağır ve boyutlarının daha iri olduğu saptanmıştır. Uygulamaların meyve şekil indeksi ve kabuk kalınlığı üzerine etkisi bulunmamıştır (Tablo 1).

Açık tozlama ve kendileme uygulamalarının kaliks sayısı, kaliks uzunluğu, kaliks çapı, SÇKM ve asitlik üzerine önemli bir etkisi saptanmamıştır. Kabuk renginde uygulamalar arasında farklılık belirlenmiştir. Açık tozlama uygulamasında meyve kabuğu rengi, kendileme uygulamasındaki meyvelerden daha kırmızı olarak saptanmıştır. Kendileme uygulamasındaki meyvelerin erken aşamada bez torbalar içine alınması, meyve kabuk renginin daha açık renkte olmasını açıklayabilir (Tablo 2) (Şekil 2).

Tablo 2. Wondeful nar çeşidinde açık tozlama ve kendileme uygulamalarının kaliks özellikleri, SÇKM, asitlik ve kabuk rengi özellikleri üzerine etkisi

Uygulamalar	Kaliks sayısı (No.)	Kaliks uzunluğu (mm)	Kaliks çapı (mm)	SÇKM (%)	Asitlik (%)	Kabuk rengi
Açık tozlama	5,89	18,46	17,63	17,80	1,30	Pembe kırmızı
Kendileme	6,00	16,88	17,28	17,50	1,35	Sarı-pembe
Ortalama	5,94	17,67	17,45	17,65	1,33	
p<0,05	0,3466	0,1954	0,7801	0,636	0,7512	

Wonderful nar çeşidinde açık tozlama ve kendileme uygulamalarının 100 dane ağırlığı üzerine önemli bir etkisi olmamasına rağmen açık tozlama uygulamasında meyve dane sayısı, dane



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ağırlığı, dane randımanı ve meyve su randımanı değerleri, kendileme uygulamasına göre daha yüksek olarak belirlenmiştir. Açık tozlama uygulamasında meyve dane sayısı 759,41 adet/meyve olarak belirlenirken, kendileme uygulamasında 471,24 adet/meyve olarak saptanmıştır (Tablo 3).

Tüm veriler değerlendirildiğinde açık tozlama uygulamasında elde edilen meyvelerin, kendileme uygulamasına göre daha ağır ve daha iri boyutlu olduğu, bununla birlikte daha fazla dane sayısına, dane ağırlığına, dane ve su randımanına sahip olduğu görülmektedir. Bu sonuçlara göre kendileme uygulaması ile meyvede daha az sayıda dane oluşmakta ve bunun sonucunda meyvelerin ağırlığı ve boyutları azalmaktadır. Kendileme ile daha az dane oluşmasının sebebi, fırça ile tozlama işleminin serbest tozlama faaliyet gösteren böcekler kadar etkin olmaması ve çapraz tozlamamanın olmaması olabilir. Vazifeshenas ve ark. (2015), nar çeşitlerinde yürüttükleri tozlama çalışmada bir nar bahçesinde iyi bir verim ve meyve kalitesi için en az 2 çeşit olması gerektiğini bildirmişlerdir. Gharaghani ve ark. (2017), benzer şekilde nar yetiştiriciliğinde tozlayıcının verim ve meyve kalite kriterlerini değiştirdiğini ve yüksek verim ve kalite için iyi bir tozlayıcı etkinliğinin bulunması gerektiğini bildirmiştir. Karimi ve Mirdehghan (2015), narda yaptıkları araştırmada, kendileme uygulamasında meyve, dane ve çekirdek ağırlığının ve dane sayısının azaldığını, açık tozlama uygulamasında ise meyve ağırlığının ve boyutlarının arttığı belirlenmiştir. Bu çalışmalar, elde edilen bulguları desteklemektedir.

Tablo 3. Wondeful nar çeşidinde açık tozlama ve kendileme uygulamalarının 100 dane ağırlığı, dane sayısı, dane ağırlığı, dane randımanı ve su randımanı özellikleri üzerine etkisi

Uygulamalar	100 dane ağırlığı (g)	Meyve dane sayısı (adet)	Dane ağırlığı (g)	Dane randımanı (%)	Meyve su randımanı (%)
Açık tozlama	34,89	759,34a	261,41 a	55,64 a	45,64 a
Kendileme	34,47	471,24 b	160,49 b	49,88 b	39,88 b
Ortalama	34,68	615,29	210,95	52,76	42,76
p<0,05	0,841	0,0014	0,0007	0,0243	0,0168



Şekil 2. Wonderful nar çeşidinde kendileme ve açık tozlama uygulamalarına ait meyveler



4. SONUÇ

Deneme sonucunda, kendileme uygulamasına ait nar meyvelerinin serbest tozlama uygulamasına göre daha küçük oldukları tespit edilmiştir. Kendileme uygulamasındaki meyvelerin küçük olmasının nedeninin meyve dane sayısının azalmasından kaynaklandığı belirlenmiştir.



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KAYNAKÇA

Gharaghani, A., Soloklui, A.A.G., Oraguzie, N., and Zare, D., (2017). Pollen Source Influences Fruit Quality, Aril Properties, and Seed Characteristics in Pomegranate. *International Journal of Fruit Science*, 17:3, 333-348.

Karimi, H.R., and Mirdehghan, S.H., (2015). Effects of Self, Open, and Supplementary Pollination on Growth Pattern and Characteristics of Pomegranate Fruit, *International Journal of Fruit Science*, 15:4, 382-391.

Özgüven, A.I. and Yılmaz, C., 2000. Pomegranate Growing in Turkey. *Options Mediterraneennes, Serie A: Seminaires Mediterraneennes Numero 42*: 41-48.

Özgüven, A.I., Yılmaz, C., Yılmaz, M., Dikkaya, Y.R., 2015. Nar Yetiştiriciliği. Çukurova Üniversitesi Ziraat Fakültesi Yayınları, 27 p.

Vazifeshenas, M.R., and Tehranifar, A., Davarnejad, G.H., and Nemati, H., 2015. Self and Cross-Pollination Affect Fruit Quality of Iranian Pomegranate ‘Malas-eYazdi’. *Advances in Environmental Biology*, 9(2): 1299-1301.

Yılmaz, C., 2007. Nar. Hasad Yayıncılık, Basım sayısı:1, p: 192, ISBN:978-975-8377-52-2.



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**REYHAN BİTKİSİNİN GELİŞİMİ VE VERİM UNSURLARI ÜZERİNE
VERMİKOMPOST ORANLARI VE BAKTERİ UYGULAMALARININ ETKİLERİ**

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ÖZET

Bitki kökleri veya toprak içerisinde yararlı bakterilerin bazıları bitkilerde gelişmeyi teşvik edici etkide bulunurlar. Reyhan bitkisinin gelişimi üzerine toprağa farklı vermikompost dozları (%0-%20-%40-%60-%80 ve %100) ve bakteri uygulamasının etkilerini incelemek için bir saksı çalışması yürütülmüştür. Çalışmada %16 kireç içeren bir toprak seçilmiş olup, deneme tesadüf parselleri deneme desenine göre serada 3 tekerrür olarak kurulmuştur. Bitki besin çözeltisi olarak saksılara 150 ppm N, 50 ppm P ve 100 ppm K toplamda 3 uygulama olmak üzere uygulanmıştır. Reyhan bitkisi 65 günlük yetiştirilme süresi sonunda toprak üstü aksamaları kesilerek bitki yaş ve bitki kuru ağırlıkları, kök yaş ve kök kuru ağırlıkları, bitki boyu ve kök uzunluğu ölçümleri yapılmıştır. Vermikompost dozlarının artması ve bakteri uygulamaları reyhan bitkisinin incelenen özellikler üzerine etkisi istatistiksel olarak farklı oranlarda artışlara neden olmuştur. Yetiştirme ortamına vermikompost karıştırılması sonucu kontrol koşullarında 15,34 gr olan bitki kuru ağırlığı 62,92 gr'a kadar çıkmıştır. Yine kontrol koşullarında 15,34 gr olan bitki kuru ağırlığı bakteri uygulanan kontrol şartlarında 16,56 gr olarak ölçülmüştür. Sonuç olarak yetiştirme ortamına artan dozlarda vermikompost katılması ve bakteri uygulamaları bitki biyomasi üzerine artış yaşanmasında incelenen özelliklerde farklı sonuçlar ortaya çıkmasına sebep olmuştur.

Anahtar kelime: Bakteri, Reyhan, Vermikompost, Besin Elementleri



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**THE EFFECTS OF VERMICOMPOST RATIOS AND BACTERIA APPLICATIONS
ON THE DEVELOPMENT AND PRODUCTION ELEMENTS OF BASIC PLANT**

ABSTRACT

Some of the beneficial bacteria in plant roots or soil have a growth-promoting effect on plants. A potting study was carried out to examine the effects of different vermicompost doses (0%-20%-40%-60%-80% and 100%) and bacteria application on the development of basil plant. In the study, a soil containing 16% lime was selected, and the experiment was established as 3 replications in the greenhouse according to the randomized plots trial design. As a plant nutrient solution, 150 ppm N, 50 ppm P and 100 ppm K were applied to the pots for 3 applications in total. At the end of 65 days of cultivation period of basil plant, above ground parts were cut and plant fresh and plant dry weights, root fresh and root dry weights, plant height and root length were measured. Increasing doses of vermicompost and bacterial applications caused statistically different increases in the effect of basil on the investigated properties. As a result of mixing vermicompost into the growing medium, the dry weight of the plant, which was 15.34 g under control conditions, increased to 62.92 g. Again, the dry weight of the plant, which was 15.34 g under the control conditions, was measured as 16.56 g under the bacteria-applied control conditions. As a result, adding increasing doses of vermicompost to the growing medium and bacterial applications caused different results in the investigated properties in terms of an increase in plant biomass.

Keyword: Bacteria, Basil, Vermicompost, Nutrient Elements



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1. GİRİŞ

Dünya nüfusundaki artışla birlikte tarım ürünlerine olan ihtiyaçta gün geçtikçe artmaktadır. Tarım alanlarında daha fazla ürün alabilmek için yetiştiricilerin uyguladıkları yöntemlerle araziler sürdürülebilirliğini kaybetmekte ve toprak yapısı gün geçtikçe bozulmaktadır. Bunun önüne geçebilmek için birim alandan daha fazla ürün alabilmek için daha organik yollara başvurulması gerekirken hem toprak yapısı hemde toprağın sürdürülebilirliği devamlı olsun. Bu uygulamalardan bir tanesinde vermikompost kullanımıdır.

Verimli bir toprak denildiğine akla gelen organik madde miktarı yüksek, bitki köklerinin kolaylıkla hareket edebildiği ve besin elementlerini yeterli miktarda aldığı ifadesi düşünülmektedir. Bunun içinde toprağın fiziksel, kimyasal ve biyolojik yapısını daha üst seviyeye çıkarabilecek uygulamalara ihtiyaç vardır. Bu uygulamalar toprağa vermikompost karıştırılması ve bakteri uygulaması ile gerçekleştirilebilir.

Vermikompost, organik materyallerin humusa benzer bir maddeye dönüştürülmesi ile elde edilen üründür (Garg ve ark. 2010). Buchanan (1988)'a göre, solucan gübresi (vermikest) içindeki bitki besin elementleri, bitkiye yararlılık ve konsantrasyon değeri açısından ticari saksı karışımlarından ve geleneksel yöntemlerle (termofilik kompost) üretilen kompost ürünlerinden daha üstün özelliklere sahiptir. Oksijenli parçalanmadan sonra solucanın sıvı formda aldığı besinler sindirim sisteminde daha ileri seviyede parçalandığı için; vermikest bitkiye yararlı (ileri parçalanma gerekmeden bitkinin alabildiği formda) besin elementleri açısından zengindir.

Vermikompostun yavaş salınımlı (tarımsal üretimi artıran ve besin element kayıplarını azaltan) bir özelliğe sahip olması ve kullanıldığı topraklarda fiziksel, kimyasal, biyolojik ve mikrobiyolojik iyileşmeler sağlaması sebebiyle güvenilir organik bir gübredir. Yaygın olarak bilinen faydaları arasında; toprak düzenleyicisi özelliğe sahip olması, yeterli oranda yararlı bitki besin maddelerini içermesi, bazı pestisit ve bitki hastalıklarını kontrol etmesi, toprak kalitesini yükselterek ürün verimini artırması, çevreci ve uzun vadede kullanıldığında ekonomik bir gübre olması sayılabilir (Bellitürk, 2016).

Bitki köklerinin etki alanı dışında kalan, topraktan alımı zor olan bitki besin elementlerini lifler yardımıyla bitkiye taşınmasında mikorizaların etkisi büyüktür. Mikorizaların P, Zn, Ca, Cu, Mn, Fe, Mg gibi önemli besin elementlerini arttırması, bitki köklerini patojenik organizmalara karşı koruması, ağır metal ve toksisiteye karşı direnç sağlama gibi özellikleri bilinmektedir. Bu özellikleri ile vermikompost ve mikorizanın birlikte kullanılması üzerinde çalışmalar yapılmış



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olup, bitkide verimi ve besin element alımını arttırdığı bulunmuştur. Bunun sonucunda bitkisel üretimde kullanılması faydalı görülmüştür (Küçükyumuk, 2014).

Bitkilerin gelişimi ve verimini iyileştiren bir veya birkaç bakteri formülasyonunu içeren bakteriyal biyogübreler son yıllarda artış göstermiştir. Bu bakterilerin; topraklardaki besinleri bitkilerin kullanabileceği forma dönüştürerek, bitkilerin besin maddelerine erişimini artırma yoluyla besin alımını etkilediği bildirilmiştir. Bununla birlikte, bu bakterilerin fitohormon biyosentezi, çevresel stresleri azaltma veya önleme mekanizmaları ile patojenlerin neden olduğu bitki hastalıklarının önlenmesi gibi bitki gelişimini desteklemek için farklı mekanizmalara sahip oldukları açıklanmıştır (Malua and Vassilev, 2014).

Edwards ve Burrows tarafından (1988) yapılan bir denemede, *E. Fetida* ile organik atıkların işlenmesiyle üretilen bitki büyüme ortamında 28 süs bitkisi ve sebze gelişimindeki yükselişler gözlenmiştir. Vermikompostun, piyasada bulunan bitki yetiştirme ortamlarına göre özellikle bitki besin elementi kalitesi ve alınabilirliği açısından çok daha iyi olduğu görülmüştür. Özellikle, 20:1 oranında uygun diğer materyallerle ve besince dengeli diğer ortamlarla seyreltilen vermikompostların kayda değer ölçüde süs bitkilerinin gelişimini etkilediği gözlenmiştir.

Bitki gelişimini (büyümesini) teşvik eden rizobakterilerin tarımsal gelişim platformunda önemli bir yeri bulunmaktadır (Singh, 2018). Bitki gelişimini teşvik eden bakteriler (Plant Growth Promoting Rhizobacteria=PGPR)/antagonistik bakteriler bitki köklerinin bulunduğu toprak rizosferinde yoğun olarak bulunan ve toprakta fizyokimyasal aktiviteleri gerçekleştiren mikroorganizmalardır. Bu bakteriler bitki kökleri ile yakın ilişki içerisinde ve bitkinin gelişimini olumlu yönde etkilerler. Biyolojik mücadele kapsamında kullanılan bu mikroorganizmalar kök yüzeyine kolonize olan ve kök çevresindeki toprakla yakın ilişkide bulunan bakterilerdir. Bu bakterilerin en önemli özellikleri bitki büyümesini geliştirmeleri, bitkiyi stresten korumaları ve çeşitli mekanizmaları kullanarak patojenlerin gelişimini baskılamalarıdır (İmriz ve ark., 2014). PGPR'ler çoğunlukla *Acinetobacter*, *Achromobacter*, *Aereobacter*, *Agrobacterium*, *Alcaligenes*, *Artrobacter*, *Azospirillum*, *Bacillus*, *Burkholderia*, *Enterobacter*, *Erwinia*, *Flavobacterium*, *Micrococcus*, *Pseudomonas*, *Rhizobium*, *Serratia* ve *Xanthomonas* cinslerine aittir (Çakmakçı, 2005).

Bitki gelişimini teşvik eden bakteriler atmosferdeki serbest azotu bağlaması, fosforu çözmesi, enzim ve fitohormon üretmesi gibi direk etkileri ile bitki gelişimini pozitif yönde etkilemektedir (Ferreira ve ark., 1987; James ve ark., 2002). Bitkide sistemik dayanıklılığı (ISR) artırması, yer



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ve besin yarısı ile patojen gelişimini baskılaması, ürettiği bazı sekonder metabolitler ile patojenin gelişimini inhibe etmesi gibi indirekt etki ile de bitki gelişimini desteklemektedirler (Dejordjevic ve ark., 1987). Yapılan çalışmalara bakıldığında bir bakteri türünün birden fazla PGPR özelliğini taşıyabileceği görülmektedir. Buda PGPR'lere bitkisel üretimde biyolojik gübre olma potansiyelinin yanı sıra biyolojik kontrol ajanı olma özelliği de katmaktadır.

Bu çalışma, yetiştirme ortamına artan dozlarda vermikompost katılması ve bakteri uygulamalarının bitki gelişimi üzerine olan etkisini gözlemlemek amacıyla yapılmıştır

2. MATERYAL VE METOT

Çalışmada Fitopatoloji Laboratuvarında -20°C'de Nutrient broth ve gliserol içerisinde stok kültür olarak bulunan antagonistik bakteriyel izolat *Pseudomonas putida* (ZE-12) kullanılmıştır. *P. putida*, 2016/77 nolu Bilimsel Araştırma Projesi kapsamında, Tokat ili biber üretim alanlarından izole edilmiştir, fosfatı indirgeme ve azotu bağlama özellikleri yüksek olup, MALDI-TOF tekniği ile tanısı yapılmıştır. Çalışmada bakterinin çoğaltılması için Nutrient Agar (NA) besi yeri kullanılmıştır. Çalışmada ilk olarak stok kültür olarak bulunan antagonistik bakteri izolatu *Pseudomonas putida* (ZE-12) Nutrient agar besi yerine çizilerek geliştirilmiştir. 26 °C'de 24 saat geliştirilen bakteriyel izolattan spektrofotometre kullanılarak 600 nm'de 108 hücre/ml yoğunluğunda süspansiyon hazırlanmış ve hazırlanan bu süspansiyon ile vermikompost karıştırılmıştır.

Reyhan bitkisinin gelişimi üzerine toprağa farklı vermikompost dozları (%0-%20-%40-%60-%80 ve %100) ve bakteri uygulamasının etkilerini incelemek için bir saksı çalışması yürütülmüştür. Çalışmada %16 kireç içeren bir toprak seçilmiş olup, deneme tesadüf parselleri deneme desenine göre serada 3 tekerrür olarak kurulmuştur. Bitki besin çözeltisi olarak saksılara 150 ppm N, 50 ppm P ve 100 ppm K ve toplamda 3 uygulama olmak üzere uygulanmıştır. Reyhan bitkisi çıkışı takiben 65 günlük yetiştirilme süresi sonunda toprak üstü aksamaları kesilerek bitki yaş ve bitki kuru ağırlıkları, kök yaş ve kök kuru ağırlıkları, bitki boyu ve kök uzunluğu ölçümleri yapılmıştır.



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Tablo 1. Vermikompostun fiziksel ve kimyasal analiz değerleri

Yapılan analizler	Analiz sonuçları
Organik madde %	64.19
Toplam azot %	2.60
Nem %	76.55
pH	7.70
EC ms cm ⁻¹	4.75
Toplam fosfor %	1.59
Toplam potasyum %	1.43
Toplam kalsiyum ppm	17162
Toplam magnezyum ppm	7060
Toplam demir ppm	5274
Toplam bakır ppm	76.16
Toplam çinko ppm	149.02
Toplam mangan ppm	289.02

Bitki ve kök boy uzunluğu; bitkiler hasat sırasında, her saksıdaki bitki kök boğazından kesilmiş ve kesilen bitkilerin kök ve kök üstü aksamaları ayrı ayrı metre ile ölçümü yapılarak boy uzunlukları alınmıştır.

Bitki yaş ve kuru ağırlıkları; bitkiler hasat sırasında, her saksıdaki bitki kök boğazından kesilmiş ve kesilen bitkilerin kök ve kök üstü aksamaları ayrı ayrı tartılarak bitki yaş ağırlıkları alınmıştır. Sonraki aşamada bitkiler 70 °C'ye ayarlanmış olan etüvde kurutulmuş ve kuru ağırlıkları alınmıştır.

Bitki kök yaş ve kuru ağırlıkları; bitkiler hasat sırasında, her saksıdaki bitki kök boğazından kesilmiş ve kesilen bitkilerin kök ve kök üstü aksamaları alındıktan sonra saksı içerisinde kalan kökler temizlendikten sonra ayrı ayrı tartılarak bitki kök yaş ağırlıkları alınmıştır. Sonraki aşamada bitki kökleri 70 °C'ye ayarlanmış olan etüvde kurutulmuş ve kuru ağırlıkları alınmıştır.

3. BULGULAR VE SONUÇ

Vermikompost ve bakteri uygulamalarının reyhan bitkisinin gelişimi üzerine etkileri Tablo 2'de verilmiştir. Kireç içeriği yüksek olan bir toprağa vermicompostun karıştırılması reyhan bitkisinin incelenen özellikler üzerine istatistiksel olarak % 1 önem seviyesinde etkili olmuştur. Bakteri uygulaması incelenen özellikler üzerine etkisi olmamıştır. Reyhan bitkisinin bitki kök üstü yaş ağırlığı kontrol uygulamasında bakteri uygulaması yapılmadığında 15.34 gr/bitki olarak ölçülürken, bakteri uygulamasının kontrol uygulamasında 16.56 gr/bitki olarak



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ölçülmüştür. Artan vermikompost uygulamaları ile bitki yaş ağırlıkları %100 vermikompost uygulamasında B- uygulanmadığı saksıda 62.92 gr/bitki ve B+ uygulaması yapıldığında ise 58.67 gr/bitki olarak ölçülmüştür. Bununla beraber bitki kök üstü kuru ağırlıkları yaş ağırlıklara paralel olarak olarak değişkenlik göstermiştir. Bitkinin kök yapısı bitki gelişimine paralel olarak gelişim göstermiştir (Tablo 2). En yüksek kök yaş ağırlıkları B- uygulamasında % 100 vermikompost uygulamasında 25.45 gr/bitki olarak ölçülürken en düşük kök yaş ağırlıkları B+ uygulamasında ve vermikompost uygulamasının yapılmadığı saksılarda yetişen reyhan bitkisinde 10.34 gr/bitki olarak ölçülmüştür.

Tablo 2. Vermikompost ve bakteri uygulamalarının reyhan bitkisinin bazı büyüme parametreleri üzerine etkileri

Bakteri Uygulaması	Vermikompost Uygulamaları**	Bitki kök üstü yaş ağırlık (gr/bitki)**	Bitki kök üstü kuru ağırlık (gr/bitki)**	Kök yaş ağırlık (gr/bitki)**	Kök kuru ağırlık (gr/bitki)**	Bitki boyu (cm)
B-	% 0	15.34 e	3.91 f	10.56 e	2.34 d	32
	% 20	25.45 d	4.34 e	14.34 d	2.56 d	44
	% 40	34.38 c	5.64 d	16.87 c	3.21 c	48
	% 60	44.67 b	6.67 c	17.34 b	3.56 c	48
	% 80	45.45 b	6.78 c	18.30 b	5.46 b	45
	% 100	62.92 a	8.78 a	25.45 a	7.56 a	48
	Ortalama Ö.D.	38.03	6.02	17.13	4.11	44
B+	% 0	16.56 e	3.84 f	10.34 e	2.45 d	31
	% 20	26.44 d	4.56 e	13.67 d	2.63 d	43
	% 40	32.34 c	5.71 d	16.78 c	3.41 c	45
	% 60	45.70 b	6.76 c	17.56 b	3.78 c	48
	% 80	48.65 b	7.12 c	17.87 b	4.12 c	45
	% 100	58.67 a	7.99 b	24.37 a	7.34 a	47
	Ortalama Ö.D.	38.06	5.99	17.76	3.95	43

*: değerler üç tekerrür ortalamasıdır ve her bir parametre ayrı ayrı değerlendirilmiş olup aynı harf ile gösterilen değerler arasında istatistiksel olarak fark yoktur. Her sütunda ortalamalar arasındaki farklılıklar Duncan testiyle belirlenmiştir. Ö.D: Önemli Değil; *P<0.05; **P<0,01 önemlidir.

Arancon ve ark. (2004), vermikompost uygulaması ile çilek bitkisinde kök bioamasının % 37 arttığını ve pazarlanabilir meyvede % 35 artış gerçekleştiğini bildirmişlerdir. Makode ve ark. (2015), vermikompostun dozlarının portakalda verimdeki etkisinin ilk yıl % 32 ve ikinci yıl ise % 61’lerde olduğunu bildirmişlerdir. Vermikompost malzemesi, hem bitki büyümesine katkı sağlayan hem de toprak yapısını düzenleyen bir bileşim içerir. Orozco ve ark. (1996) ve Parthasarathi (2004), yaptıkları bir çalışmalar solucan gübresinin bünyesinde bulunan bitki besin elementlerinin bitkiler tarafından doğrudan ve hızlıca alınabilecek bir formda



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bulunduğunu bildirmiştir. Ürün kalitesi bakımından vermikompost ürünleri, termofilik kompost (çiftlik gübresi) ürünlerinden fiziksel, kimyasal ve biyolojik açıdan daha üstün niteliklere ve ekonomik değere sahiptir. Vermikompostun bu denli ilgi görmesinin bir başka sebebi ise yapısında bulundurduğu humik asit bileşikleri ve bitki gelişme düzenleyici bazı aktif maddelerdir (Tomati ve ark., 1990; Parthasarathi ve ark., 2006).

SONUÇ

Vermikompost içerdiği besin elementlerinin mikatrının yüksek olması, mikroorganizma varlığını yüksek seviyelerde olması sebebiyle besin elementleri dönüşümünün yüksek olması ve humik maddeler, enzimlerce zengin olan bir organik gübredir (Lazcano ve ark., 2011). Bunun yanında su tutma kapasitesinin yüksek, yüksek porozite özelliğine sahip olası ve üretimde kullanılan organik materyalin gübre oluşum esnasında bitki besin elementlerinin bitkiler tarafın alınabilir formda olması bitki gelişimi artıran sebepler arasındadır (Dominguez, 2004). Ortamda su tutma kapasitesini artırarak bitkinin kök bölgesinde daha fazla suyun kökler tarafından alınma miktarını artırmaktadır. Bu durum bitki köklerinin daha fazla miktarda su ve topraktan besin elementini bitkinin ilgili organlara taşımalarını artırmaktadır.

Sonuç olarak, üretimde uygulanan bakteriler ve farklı dozlarda yetiştirme ortamına vermikompost uygulamaları reyhan bitkisinin incelenen özellikleri üzerine olumlu etkisi olmuştur. Bitki yeşil aksamına kök bölgesine oranla daha fazla olumlu etki etmiştir. Hemen hemen bütün uygulamalarda artan vermikompost dozlarına bağlı olarak daha yüksek sonuçlar elde edilmiştir. Bitki yaş ve kuru ağırlıkları üzerine bakteri uygulamasından ziyade artan vermikompost uygulamaları olumlu sonuçlar alınmasını sağlamıştır. Bu sonuçlara bakıldığında yetiştirme ortamına artan oranlarda vermikompost uygulaması bitki büyümesi ve gelişimi üzerine olumlu sonuçlar alınmasını sağlamıştır.



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KAYNAKÇA

Arancon N Q, Edwards CA, Bierman P, Welch C, Metzger JD. 2004. Influences of vermicompost applications to strawberries: Part 1. Effects on growth and yield. *Bioresource Technology*, 93(2):145–153.

Bellitürk, K. (2016). Sürdürülebilir tarımsal üretimde katı atık yönetimi için vermikompost teknolojisi. *Çukurova Tarım ve Gıda Bilimleri Dergisi*, 31(3), 1-5.

Buchanan, M.A., Russell, E. ve Block S.D. (1988). Chemical characterization and nitrogen earthworms in environmental and waste management In C.A. Edwards and E.F. Neuhauser (Eds.), SPB Acad. Publ., the Netherlands, 231- 239.

Çakmakçı, R. 2005. Bitki gelişiminde fosfat çözücü bakterilerin önemi. *S.Ü. Ziraat Fakültesi Dergisi*, 19 (35), 93-108.

Dejorđjevic, M.A., Gabriel, D.W., Rolfe, B.G., (1987). Rhizobium-the refined parasite of legumes. *Annu. Rev Phytopathology*, 25, 145-168.

Dominguez J. 2004. State of the Art and New Perspectives on Vermicomposting Research. In: C. A.

Edwards, C.A. and Burrows, I. (1988). The potential of earthworm composts as plant growth media. In *Earthworms in Environmental and Waste Management* Ed. C. A. Neuhauser, SPB Academic Publ. b.v. The Netherlands. 211-220.

Ferreira, M.C.B., Fernandes, M.S., and Döberner, J., (1987). Role of Azospirillum brasilense nitrate reductase in nitrate assimilation by wheat plants. *Biol. And Ferti of Soils*, 4: 47-53.

Garg, V.K., Gupta, R. ve Yadav, A. (2010). Vermicomposting technology for solid waste management. [http://www.environmental-expert.com/Files/0/articles/9047/Vermicomposting Article for the Biofertilizer People](http://www.environmental-expert.com/Files/0/articles/9047/Vermicomposting%20Article%20for%20the%20Biofertilizer%20People).

Lazcano C, Revilla P, Malvar RA, and Dominguez J. 2011. Yield and fruit quality of four sweet corn hybrids (*Zea mays* L.) under conventional and integrated fertilization with vermicompost. *J Sci Food Agric* 2011; 91: 1244–1253.

İmriz, G., Özdemir, F., Topal, İ., Ercan, B., Taş, N., Yakışır, E. ve Okur, O., (2014). Bitkisel üretimde bitki gelişimini teşvik eden rizobakteri (Pgpr)'ler ve etki mekanizmaları, *Elektronik Mikrobiyoloji Dergisi TR*, 12(2):1-19.



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James, E.K., Gyaneshwar, P., Mathan, N., Barraquio, W.L., Reddy, P.M., Iannetta, P.P.M., Olivares, F.L., ve Ladha, J.K., (2002). Infection and colonization of rice seedlings by the plant growthpromoting bacterium *Herbaspirillum seropedicae* Z67. *Molecular PlantMicrobe Interactions*, 15(9):894-906.

Küçükyumuk Z., Gültekin M. & Erdal İ. (2014). Vermikompost ve mikorizanın biber Bitkisinin gelişimi ile mineral beslenmesi üzerine etkisi. *SDU Journal of the Faculty of Agriculture/SDÜ Ziraat Fakültesi Dergisi*, 9(1).

Malua, E., and N. Vassilev, (2014) A contribution to set a legal framework for biofertilisers. *Applied Microbiology and Biotechnology*,. 98: p. 6599–6607.

Makode PM, Rathod RG, Akola M. 2015. Effect of vermicompost on the growth of Indian orange, *Citrus reticulatus* with reference to its quality and quantity. *Bioscience Biotechnology Research Communications*, 8(2): 217-220.

Orozco FH, Cegarra J, Trujillo L.M. and Roig A. 1996. Vermicomposting of coffee pulp using the earthworm *Eisenia fetida*: effects on C and N contents and the availability of nutrients. *Biology and Fertility of Soils*. 22,162-6.

Parthasarathi K. 2004. Vermicomposts produced by four species of earthworms from sugar mill wastes (pressmud). *Ind. J. Life Sci.*, 1, 41-46.

Parthasarathi K, Gunasekaran G, Ranganathan LS. 2006. Efficiency of mono and polycultured earthworms in humification of organic wastes. *J. Ann. Uni. Sci*, 42, 127-134.

Singh, I. (2018). Plant Growth Promoting Rhizobacteria (PGPR) and their various mechanisms for plant growth enhancement in stressful conditions: a review. *European Journal of Biological Research*, 8(4): 191-213.

Tomati U, Galli E, Grappelli A, Dihena G. 1990. Effect of earthworm casts on protein synthesis in radish (*Raphanus sativum*) and lettuce (*Lactuca sativa*) seedlings. *Biol. Fertil. Soils*, (9):288-299.



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**FARKLI DERECEDE ISISAL İŞLEMDEN GEÇMİŞ VERMİKOMPOSTUN
TOPRAĞA KATILDIĞINDA İNKUBASYON SONRASI BAZI TOPRAK
ÖZELLİKLERİNDEKİ DEĞİŞİMLER**

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ÖZET

Toprağa katılan içeriği zengin organik gübreler toprağın fiziksel, kimyasal ve biyolojik özelliklerine önemli katkıda bulunmaktadır. Bu organik gübreler içerisinde vermikompost (solucan gübresi) toprak organik maddesi ve canlılığını artıran en önemli organik gübrelerden bir tanesidir. Denemede vermikompost gübresinin kontrol (ısısal işlem uygulanmamış), 30, 50 ve 80 C° derecelerde etüvde ısıtıldıktan sonra saksılara ağırlık ilkesine göre her bir sıcaklık uygulamalarından % 0, 10, 20, 40 oranlarında 2 kg toprak alabilen saksılarda özelliği bilinen toprak içerisine vermikompost karıştırılarak 50 günlük inkübasyona bırakılmıştır. İnkübasyon sonrasında toprak örnekleri alınarak topraktaki pH, EC, organik madde, kireç miktarına bakılmıştır. Vermikompost dozlarının artması ile toprak organik maddesi artmıştır. Kontrol koşullarında organik madde miktarı %1,21 iken vermikompost dozlarının artması ile organik madde miktarı %6.88 seviyesine kadar çıkmıştır. İncelenen diğer özellikler üzerine vermikompost uygulamasının etkisi farklı olmuştur.

Anahtar kelimeler: Vermikompost, Isısal İşlem, Toprak Organik Madde, pH



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**CHANGES IN SOME SOIL PROPERTIES AFTER INCUBATION WHEN
DIFFERENTLY THERMAL TREATED VERMICOMPOST IS ADDED TO THE
SOIL**

ABSTRACT

Organic fertilizers with rich content added to the soil contribute significantly to the physical, chemical and biological properties of the soil. Among these organic fertilizers, vermicompost (worm manure) is one of the most important organic fertilizers that increase soil organic matter and vitality. In the experiment, after the vermicompost fertilizer was heated in an oven at 30, 50 and 80 °C, the control (heat treatment was not suitable) was applied to the pots at the rate of 0, 10, 20, 40 % from each temperature application according to the weight principle, in pots that can take 2 kg of soil, vermicompost was mixed into the soil with known properties and for 50 days. left for incubation. After incubation, soil samples were taken and pH, EC, organic matter and lime content in the soil were checked. Soil organic matter increased with the increase of vermicompost doses. While the amount of organic matter was 1.21% under control conditions, the amount of organic matter increased up to 6.88% with the increase in vermicompost doses. The effect of vermicompost application on other investigated properties was different.

Keywords: Vermicompost, Heat Treatment, Soil Organic Matter, pH



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GİRİŞ

Bitkisel üretimde verim ve kaliteyi etkileyen en önemli faktörlerden bir tanesinde toprak organik maddesidir. Toprak organik maddesi toprakların fiziksel özelliklerine etki etmenin yanı sıra topraktaki bitki besin elementleri üzerine de önemli etkiye sahiptir. Türkiye topraklarının %50'sine yakın bir bölümünde organik madde içeriği %1-2 civarında değişmektedir (Taban ve ark., 2013). Toprak organik maddesi bitkisel ve hayvansal kalıntılardan oluşan canlı yada cansız herhangi bir organik kökene sahip maddelerden oluşur. Fiziksel olarak toprağın strüktür yapısını güçlendirerek toprak erozyonun azalması üzerine, kimyasal olarak toprak katyon değişim kapasitesinin yüksek olması pH değişimlerine karşı tamponlama etkisi yapması ve biyolojik olarak toprak mikroorganizmalarına C ve enerji kaynağı olmak suretiyle toprakların fiziksel kimyasal ve biyolojik özellikleri üzerine etkiye sahiptir (İrget ve Cengiz, 2018). Toprakların organik madde miktarları üzerine uygulanan münavebe sistemleri, toprağın işleme süresi ve şekli, toprak üstü bitki örtüsünün durumu veya tahrip derecesi, bitki artıklarının yakılması veya gömülmesi ve gübreleme şekli gibi kontrol edilebilir faktörler etkili olmaktadır (Polat, 2020). Toprağa uygulanan organik gübreler topraktaki organik madde miktarını artırır. Bu gübreleme uygulamalarından bir tanesinde vermikomposttur. Vermikompost, çeşitli hayvan dışkıları, orman ürünleri atıkları, bitki hasat artıkları ve diğer birçok organik artıkların solucanlara yedirilerek kompostlaştırılması işlemine denir. Bu şekilde elde edilen ürünler tarım toprakları için iyi bir organik gübre niteliğindedir (Bellitürk, 2016).

Vermikompostun 5 farklı dozu (0, 250, 500, 750, 1000 kg/da) toprağa uygulanarak pazı bitkisinin gelişimi ve toprak özelliklerindeki değişimlerinin yürütüldüğü çalışmada vermikompost dozu arttıkça toprağın pH ve tuz miktarında değişim yaşanmazken toprak organik maddesinde dalgalı bir değişim yaşanmıştır (Köksal ve ark., 2017). Ispanakta verim ve toprak özellikleri üzerine yapılan çalışmada vermikompostun altı farklı dozu (0; 1; 2; 3; 4 ve 5 ton/da) uygulanmış toprağın pH değerlerinde istatistiksel değişim yaşanırken EC, kireç ve organik madde miktarında değişim olmamıştır (Özkan ve ar., 2016). İki farklı toprak tekstürü yapısına sahip toprağa 2, 4, 8, 16 t/da (kuru ağırlık olarak) vermikompost karıştırılarak değişimi incelenmiştir. Vermikompost, her iki toprak çeşidinde de organik madde, tuz (EC), katyon değişim kapasitesi (KDK), yarayıslı P, Mg, Cu ve Zn içeriklerini arttırmıştır (Aktaş, 2018). Yapılan bir saksı çalışmasında kontrol uygulamasında toprak organik madde miktarı %1.85 iken 450 kg/da vermikompost uygulamasında deneme sonrası toprak organik madde miktarı % 2.27 olarak ölçülmüştür (Tankuş, 2019).



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Bu çalışmanın amacı, farklı derecede ısısal işleminden geçmiş vermikompostun toprağa katıldığında inkübasyon sonrası bazı toprak özellikleri üzerine olan değişimlerin belirlenmesidir.

2. MATERYAL METOT

Çalışma Tokat Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarında 24 ile 26 °C arasında oda sıcaklığı ve %60'larda nem koşullarında inkübe edilmiştir. Vermikompost materyali kontrol (ısıtılma işlemi uygulanmamış), 30, 50 ve 80 °C derecelerde etüvde ısıtıldıktan sonra saksılara ağırlık ilkesine göre her bir sıcaklık uygulamalarından %0, 10, 20, 40 oranlarında 2 kg toprak alabilen saksılarda toprak içerisine vermikompost karıştırılarak inkübasyona bırakılmıştır. Aynı şekilde ısıtılma işlemi olmadan da vermikompost materyali aynı oranlarda saksılara karıştırılmıştır. Çalışmada 4 ısı derecesi, 4 farklı vermikompost dozu ve 4 tekerrür olacak şekilde 64 saksıda deneme yürütülmüştür. Inkübasyon çalışmaları 50 gün sürmüş ve 50 gün sonra saksılardan toprak örneği alınmış örnekler analize hazır hale getirilmiştir. Topraktaki organik madde miktarları, toplam N miktarı, kireç içeriği, pH ve EC değerleri ölçülmüştür.

Tablo 1. Deneme toprağının bazı fiziksel ve kimyasal analiz sonuçları

Kireç (%)	16.2
pH (1 : 2.5)	7.81
EC (1 : 2.5) μ S/cm	165
Organik madde (%)	1.19
Total N (%)	0.16
Yarayışlı P ₂ O ₅ (kg/da)	3.23
Tekstür	Killi tın
Demir (ppm)	1.51
Çinko (ppm)	0.41

Saksılardaki toprak örnekleri ufalandıktan sonra 2 mm'lik elekten geçirilmiştir. Topraklarda bazı fiziksel ve kimyasal özellikler aşağıda verilen yöntemler takip edilerek belirlenmiştir. Organik madde içeriği, modifiye Walkley-Black metodu (Walkley-Black, 1947); kireç ihtiyacı Scheibler kalsimetresi metoduyla (Allison ve Moodie, 1965); pH ve EC 1:2.5 toprak su karışımında pH ve EC metreyle (Jackson, 1958; Richards, 1954); toplam N Kjeldahl yöntemi (Kjeldahl, 1883) ile yapılmıştır. Çalışmada kullanılan vermikompost materyali Tokat ili Turhal



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ilçesinde vermikompost üretimi yapılan tesisten alınmıştır. Üretimi yapılan vermikompostun analiz değerleri üretici tarafından Ankara Toprak ve Gübre Araştırma Enstitüsünde analizler yaptırılmış ve değerler aşağıda Tablo 2’de verilmiştir.

Tablo 2. Vermikompostun fiziksel ve kimyasal analiz değerleri

Yapılan analizler	Analiz sonuçları
Organik madde %	64.19
Toplam azot %	2.60
Nem %	76.55
pH	7.70
EC (1 : 2.5) μ S/cm	1450
Toplam fosfor %	1.59
Toplam potasyum %	1.43
Toplam kalsiyum ppm	17162
Toplam magnezyum ppm	7060
Toplam demir ppm	5274
Toplam bakır ppm	76.16
Toplam çinko ppm	149.02
Toplam mangan ppm	289.02

3. BULGULAR VE SONUÇ

Farklı derecede ısısal işleminden geçmiş vermikompostun farklı oranlarda toprağa katıldığında inkübasyon sonrası bazı toprak özellikleri üzerine olan değişimlerine bakıldığında toprak kireç miktarını azalttığı, pH değeri üzerinde önemli bir değişikliğe sebep olmadığı, toprağın EC ve organik madde miktarlarında artışlara neden olduğu Tablo 3’de görülmüştür. Kontrol uygulamasında inkübasyon sonrası toprak organik madde başlangıç organik madde miktarına yakın olarak %1.21 olarak bulunmuştur. Toprağa katılan vermikompost miktarı arttıkça topraktaki organik madde miktarı sırasıyla %2.93, %4.67 ve %6.76 olarak bulunmuştur. Uz ve Tavalı (2014), kireç içeri yüksek ve alkalın bir toprağa farklı oranlarda vermikompostun kısa süreli toprak özelliklerine etkilerini araştırdıkları çalışmada 40 ton/ha vermikompost uygulamasının kontrol organik maddesini %1.92’den %3.0’e çıkardığını bildirmişlerdir. Aksakal ve ark. (2016), üç farklı tekstür yapısına sahip toprakta %0.5, 1, 2 ve 4 oranlarında vermikompostun ilavesinin tüm tekstür sınıflarının organik madde miktarını artırdığını bildirmişlerdir.



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Tablo 3. İnkübasyon sonucu toprak örneklerindeki bazı özelliklerdeki değişimler

Uygulamalar		**Organik madde %	pH	EC (1 : 2.5) $\mu\text{S/cm}$	Kireç %
Isı derecesi	Vermikompost Dozu %				
Kontrol (0 °C)	0	1.21 d	7.86	171 d	16.4 a
	10	2.93 c	7.67	242 c	14.2 b
	20	4.67 b	7.71	324 b	13.1 c
	40	6.76 a	7.73	435 a	12.5 d
30 °C	0	1.23 d	7.81	175 c	16.1 a
	10	2.89 c	7.71	238 b	14.3 b
	20	4.64 b	7.78	331 c	13.6 bc
	40	6.81 a	7.67	442 a	12.7 d
50 °C	0	1.23 d	7.88	168 d	16.8 a
	10	2.92 c	7.76	247 c	14.1 b
	20	4.71 b	7.67	325 b	13.4 bc
	40	6.87 a	7.59	438 a	12.3 d
80 °C	0	1.22d	7.81	174 d	16.5 a
	10	2.96 c	7.71	234 c	13.9 bc
	20	4.71 b	7.67	326 b	12.9 cd
	40	6.88 a	7.64	456 a	12.1 d
P		**	Ö.D.	**	*

Her sütunda ortalamalar arasındaki farklılıklar Duncan testiyle belirlenmiştir.

Ö.D: Önemli Değil; *P<0.05; **P<0,01 önemlidir;

Tablo 3 incelendiğinde vermicompost uygulamalarının toprak pH'sı üzerine etkili olmadığı görülmektedir. Uygulamalar arasında pH 7,64-7,88 arasında 0,24 birim değişim göstermiş bu fark istatistiksel olarak önemli bulunmamıştır. Tavalı ve ark. (2014) yapılan vermicompost uygulamasının toprak pH'sını kontrole göre istatistiksel olarak önemli oranda düşürdüğünü bildirmişlerdir. Bu düşüşü uyguladıkları organik maddenin parçalanması sonucu açığa çıkan organik asitlerin topraktaki asitliği desteklemesi ve oluşan ürünler ile mikroorganizmaların faaliyetleri neticesinde ve bitki köklerinin solunumu sonucu oluşan CO₂'in su ile birleşerek karbonik asidi oluşturması olarak izah etmişlerdir. Bazı çalışmalarda ise toprak çeşitlerinin değişkenliğine göre uygulanan vermicompost gübresinin toprak pH'sını %20 (Yuka ve ark., 2017) ve %23.76 oranında artırdığını (Setiawan ve ark., 2015) bildirmişlerdir. Toprak pH'sındaki değişkenlik toprak içerisindeki tüm özelliklerinin bir bütünü olarak ele almak gerekmektedir. Toprak kireç miktarının yüksek ve toprak pH'sının alkalın şartlarında toprak pH'sında ani yükselme ve düşmeler katılan organik veya inorganik materyalin pH içeriğine bağlıdır. Denemede toprağa uygulanan vermicompost arttıkça Elektrik iletkenlik (EC) değerinin arttığı görülmektedir (p<0,01). Kontrol uygulamasında EC 168 $\mu\text{S/cm}$ iken en yüksek vermicompost dozlarında yakın değerler çıkmış ve en yüksek 80 °C'de ısıtılmış



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vermikompostun %40 oranında toprağa katılmış uygulamasında 456 $\mu\text{S}/\text{cm}$ olarak tespit edilmiştir. Aktaş (2018), killi ve tınlı topraklarda vermikompost dozları arttıkça EC miktarının artırdığı bildirirken, Uz ve Tavalı (2014), 40 ton/ha vermikompost uygulamasının kontrole göre EC değerlerinde bir artış olduğunu ancak istatistiksel olarak bu artışın önemli olmadığını bildirmişlerdir. Topraktaki kireç miktarını yüksek düzeyde uygulanan organik gübreler bir miktar düşürebilirler. Uygulamamızda toprağa katılan organik gübre miktarı oldukça yüksektir. Bunun bir sonucu olarak başlangıç toprağının Kireç miktarı uygulama dozu arttıkça toprağın kireç miktarında önemli azalmalar meydana gelmiştir ($p<0,05$). Kireç içeriği başlangıçta %16'larda iken en yüksek vermikompost dozunda %12'lere kadar düşmüştür. Açık arazideki mikroorganizma faaliyetleri, ayrışma hızının yüksek olması ve bitki köklerinin ayrışmaya katılma oranı arttıkça organik maddenin incelen özellikler üzerine etkileri değişiklik gösterecektir.

SONUÇ

Vermikompost özellikle toprak özelliklerinin özellikle organik maddenin sürekliliği açısından son dönemlerin en önemli organik gübreleri arasındadır. Tarım topraklarında var olan yüksek kireç, düşük organik madde, yetersiz toprak profili, toprak içeriğindeki yetersiz mikroorganizma faaliyetleri, düşük nem gibi bitkisel üretimi kısıtlayıcı etkenleri vermikompost gibi organik gübreler ile çözebilme potansiyele sahibiz. Çalışmamızda organik maddenin artış göstermesi, toprak kireç içeriğinin bir miktar düşmesi ve EC'deki yüksek olmayan artış özellikle bitkinin ilk gelişim döneminde alması en gerekli olan fosforun bitkiler tarafından daha fazla alması sonucunu ortaya çıkaracaktır. Toprak organik maddesini toprağın fiziksel, kimyasal ve biyolojik özelliklerini artıracak vermikompost gibi organik gübrelerin ülkemizde üretim potansiyelinin artması ve ulaşılabilir fiyatla olması için üretici potansiyellerinin artması gerekmektedir.



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KAYNAKÇA

- Aksakal, E. L., Sari, S., Angin, I. (2016). Effects of vermicompost application on soil aggregation and certain physical properties. *Land Degrad. Develop.* 27: 983–995.
- Aktaş, T. (2018). Vermikompostun farklı tekstürlere sahip topraklarda bitki gelişimine ve toprakların fiziksel kimyasal özelliklerine etkisi, Yüksek Lisans Tezi, Tekirdağ Namık Kemal Üniversitesi, Fen Bilimleri Enstitüsü, Toprak Bilimi ve Bitki Besleme Anabilim Dalı, Tekirdağ.
- Allison, L.E., and Moodie C.D., (1965). Carbonate. In: C.A. Black et al. (ed.) *methods of Soil Analysis, Part 2. Agronomy* 9; 1379-1400. Am. Soc. Of Agron., Inc., Modison, Winsconsin, U.S.A.
- Bellitürk, K. (2016). Sürdürülebilir tarımsal üretimde katı atık yönetimi için vermicompost teknolojisi. *Çukurova Tarım ve Gıda Bilimleri Dergisi*, 31(3), 1-5.
- İrget, M. E., ve Cengiz, A. (2018). Organik maddenin toprak kalitesi ve üretime etkileri. *Çalıştay Bildiriler*, 17.
- Kjeldahl, J. (1883) A new method for the determination of nitrogen in organic matter. *Zeitschrift für Analytische Chemie*, 22, 366-382.
- Köksal, S. B., Aksu, G., Altay, H. (2017). Vermikompostun bazı toprak özellikleri ve pazı bitkisinde verim üzerine etkisi, *ÇOMÜ Zir. Fak. Derg.*, 5 (2): 123–128.
- Özkan, N., Dağlıoğlu, M., Ünser, E., Müftüoğlu, N. M., (2016). Vermikompostun ıspanak (*Spinacia oleracea* L.) verimi ve bazı toprak özellikleri üzerine etkisi. *ÇOMÜ Zir. Fak. Derg.*, (1): 1–5.
- Polat, H. (2020). Farklı toprak işleme sistemlerinin sürdürülebilir organik madde yönetimine etkileri. *Tarım Makinaları Bilimi Dergisi*, 16(1), 1-11.
- Richard, L.A. (1954). Diagnosis and improvement of saline and alkali soils. *United States Depertman of Agricultere Handbook* 60:94.
- Setiawan, I.G.P., Niswati, A., Hendarto, K. and Yusnaini, S. (2015). Pengaruh dosis vermicompos terhadap pertumbuhan tanaman pakcoy (*Brassica rapa* L.) dan perubahan beberapa sifat kimia tanah Ultisol Taman Bogo. *Jurnal Agrotek Tropika*, 3(1), 170-173
- Taban, S., Turan, M. A., ve Katkat, A. V. (2013). Tarımda organik madde ve tavuk gübresi. *Tavukçuluk Araştırma Dergisi*, 10(1), 9-13.



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Tankuř, Ö., (2019). Farklı dozlarda vermikompost uygulamalarının mısır (*Zea Mays* L.) bitkisinin gelişimine etkisi, Harran Üniversitesi, Fen Bilimleri Enstitüsü, Ziraat Fakültesi, Toprak Bilimi ve Bitki Besleme Ana Bilim Dalı, Şanlıurfa.

Tavalı, İ.E., Uz, İ., Orman, Ş., (2014). Vermikompost ve tavuk gübresinin yazlık kabağın (*Cucurbita pepo* L. cv. Sakız) verim ve kalitesi ile toprağın bazı kimyasal özellikleri üzerine etkileri. Akdeniz üniversitesi ziraat fakültesi dergisi 27(2): 119-12.

Uz, I and Tavalı, I.E. (2014). Short-term effect of vermicompost application on biological properties of an alkaline soil with high lime content from mediterranean region of Turkey. The Scientific World Journal. (6):395282. <http://dx.doi.org/10.1155/2014/395282>

Yuka, M.F., Niswati, A. and Hendarto, K. (2017). Pengaruh dosis vermikompos terhadap pertumbuhan produksi dan serapan N & P tanaman mentimun (*Cucumis sativus* L.) pada media asal dua kedalaman tanah Ultisol. Jurnal Penelitian Per-tanian Terapan, 17(2), 117-123.

Walkley, A. (1947). A Critical examination of a rapid method for determining organic carbon in soils: effect of variations in digestion conditions and of inorganic soil constituents. Soil Science, 63, 251-264.



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**HUMİK ASİT UYGULAMALARININ HODAN (*BORAGO OFFICINALIS* L.)
BİTKİSİNİN GELİŞİMİ ÜZERİNE ETKİLERİ**

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ÖZET

Humik asit bitki gelişimi, bitki büyümesi ve verimi üzerine önemli etkisi olan toprakta besin elementi alımını sağlayan organik materyaldir. Bu çalışmada %16 kireç içeren toprak ile vermikompost düzeyleri %0-%7,5-%15-%30 oranında olan tesadüf parselleri deneme desenine göre serada kontrollü şartlarda 5 tekerrür olacak şekilde toplamda 40 saksıda her saksıda bir adet hodan bitkisi olacak şekilde toplamda 40 bitki yetiştirilmiştir. Humik asit uygulaması olarak 3,5 lt toprak, 7 lt toprak, 1,75lt yaprak ve 3,5 lt yaprak şeklinde yapılmıştır. Hodan bitkisinin toplamda 50 günlük yetiştirilme süresi sonunda toprak üstü aksamı saksı üzerinden kesilerek bitki-yaş kuru ağırlık miktarlarına bakılmıştır. İncelenen özellikler doğrultusunda humik asit uygulamaları bitki yaş ve kuru ağırlıklarında %1 önem seviyesinde artış görülmesine sebep olmuştur. Sonuç olarak yetiştirme ortamına kompost katılması ve humik asit uygulamaları bitki biyomasi ve topraktan kaldırılan bitki besin elementi üzerine artış yaşanmasında incelenen özelliklerde farklı sonuçlar ortaya çıkmasına sebep olmuştur.

Anahtar kelime: Humik asit, Hodan, Vermikompost



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**THE EFFECTS OF HUMIC ACID APPLICATIONS ON THE DEVELOPMENT OF
BORAGO OFFICINALIS L. (HODAN) PLANT**

ABSTRACT

Humic acid is an organic material that provides nutrient uptake in the soil, which has a significant effect on plant development, plant growth and yield. In this study, according to the experimental design of randomized plots with soil containing 16% lime and vermicompost levels of 0%-7.5%-15%-30%, a total of 40 plants, one borage plant in each pot, in a total of 40 pots with 5 replications under controlled conditions in the greenhouse. plant was grown. As humic acid application, 3.5 lt of soil, 7 lt of soil, 1.75 lt of leaves and 3.5 lt of leaves were made. At the end of the 50-day growing period of the borage plant, the above-ground parts were cut from the pot and the plant-fresh dry weights amounts of the plant were examined. In line with the properties examined, humic acid applications caused an increase in the importance level of 1% in plant wet and dry matter. Depending on the increasing humic acid ratios, the plant provided an increase on N, P and K uptake. As a result, the addition of compost to the growing medium and humic acid applications caused different results in the investigated properties in terms of increasing the plant biomass and plant nutrients removed from the soil.

Keywords: Humic acid, Borage, Vermicompost



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1. GİRİŞ

Borago officinalis L. (Hodan) Boraginaceae familyasına dahil bir bitkidir. Bitki yüksekliği 30-60 cm, sert tüylü, açık mavi çiçekli, bir yıllık otsu bir bitkidir ve bitkinin yaprakları sebze olarak kullanılmaktadır (Baytop, 1999). Boraginaceae familyası γ -linolenik asit (GLA)'ın en önemli kaynaklarından biri olarak bilinmektedir (Samani ve ark., 2014). Hodan bitkisinin yaprakları ve çiçekleri ile en önemli şifalı bitkiler arasındadır (Zargari, 2004). Bitkinin geleneksel tıpta iltahap sökücü, öksürük ve diğer solunum problemlerini azaltıcı etkiye sahip olduğu bilinmektedir (Osborne, 1999). Her bitkide olduğu gibi tıbbi ve aromatik yada endemik bitkilerde oluşturduğu biyokimyasal özellikler iklime, yetiştirilme tekniğine, ekolojiye ve topraktaki mineral madde miktarına bağlıdır. Bu nedenle uygun bir gübreleme tıbbi bitkilerin başarı bir yetiştirilmesinde ve ürün kalitesine etki eden ana faktörlerden biridir (Carrubba ve ark., 2002).

Topraktaki organik madde ve bileşiklerin miktarının artması bitki içerisindeki uçucu yağ, enzim aktiviteleri ve organik bileşiklerin değişimi etkilemektedir. Bitki gelişimini sağlayan ve bu bileşiklerin artışı toprağa atılacak organik kökenli gübre kaynaklarından geçmektedir. Bunların başında da humik asitli sıvı veya katı gübreler gelmektedir. Hümkik asit, bitkilerin büyümesini olumlu yönde etkileyen ve bitki tarafından azot, potasyum, kalsiyum, magnezyum ve fosfor emilimini artıran en önemli organik gübrelerden biridir (Sabzevari ve ark., 2009). Humik asitin uygulanması topraktan özellikle mikro elementlerin ve N, P gibi makro elementlerin toprakta doğal şelatlaşma özelliği nedeniyle alımını artırmaktadır. Dolayısıyla bitki vegetatif gelişimin artmasına da yardımcı olmaktadır. Nitekim humik asitlerin bitki gelişimi, beslenme düzeni, meyve verimi ve kalitesini artırıcı etkisi ile ilgili çok sayıda araştırma bulguları mevcuttur (Adani ve ark., 1998; Karaman, 2003; Hafez, 2004; Salman ve ark., 2005). Ayrıca hümkik maddeler yapılarındaki C, N, S ve P gibi elementler sayesinde mikroorganizmalar için bir rezerv niteliğindedir. Bu özelliğinden ötürü, hümkik maddeler toprağın mikroflorasını zenginleştirirler (Larcher, 2003).

Bu çalışma kireç içeriği yüksek olan bir toprakta hodan bitkisinin gelişimi üzerine sıvı humik asidin topraktan ve yapraktan uygulamalarının bitkinin vegetatif gelişimi üzerine etkilerini ortaya koymak için yürütülmüştür.



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2. MATERYAL METOT

Tokat Gaziosmanpaşa Üniversitesi sera koşullarında tesadüf parselleri deneme desenine göre üç tekerrürlü olarak 2021 yaz döneminde yürütülen çalışmada, saksılara hava kurusu 5 kg deneme toprağı konulmuştur. Denemede, her saksıda ikişer adet bitki bulunacak şekilde yerel genotip Hodan bitkisi tohumu ekimi yapılmış bitkiler çıkınca bir bitki kalacak şekilde seyreltme işlemi yapılmıştır. Tesadüf parselleri deneme desenine göre serada kontrollü şartlarda 5 tekerrür olacak şekilde deneme kurulmuştur. Bitkiler çıkış yaptıktan sonra ticari sıvı humik asit uygulaması olarak toprağı kontrol (H0, humik asit uygulaması yapılmamış), 3,5 lt/da toprak (H1), 7 lt/da toprağı uygulama (H2) ve yapraktan ise 1,75lt/da (H3) (1000lt su) yaprak ve 3,5 lt/da yaprak (H4) şeklinde iki kere uygulama yapılmıştır. Deneme toprağına ait bazı fiziksel ve kimyasal özellikler Tablo 1’de verilmiştir.

Tablo 1. Deneme toprağıının bazı fiziksel ve kimyasal analiz sonuçları

Kireç (%)	16.8
pH (1 : 2.5)	7.86
Total tuz %	0.041
Organik madde (%)	1.21
Total N (%)	0.15
Yarayışlı P ₂ O ₅ (kg/da)	3.12
Tekstür	Killi tın
Demir (ppm)	1.45
Çinko (ppm)	0.38

TKİ-Humasın bileşimi; Organik Madde: %5, Humik Asit+Fulvik Asit: %12, Suda Çözünür Potasyum Oksit (K₂O-%3), pH: 11-13’dür. Her saksıya homojen olarak Hoagland çözeltisi hazırlanarak EC 1.4 mmhos/cm’e ayarlanarak her hafta uygulanmıştır. Farklı uygulamalarda humik asit uygulamalarının hodan bitkisinin biomas miktarı üzerine etkilerini incelemek için yürütülen bu çalışmada bitkiler toprak üstünden kesilerek bitki yaş, kuru ağırlıkları, boyları ve kök yaş ve kuru ağırlıkları gibi özelliklere bakılmıştır. Denemeden elde edilen veriler MSTATC istatistik programından yararlanılarak varyans analizine tabi tutulacak ve önemli çıkan ortalamalar arası farklılıklara Duncan çoklu karşılaştırma testi uygulanacaktır (Düzgüneş ve ark., 1987).



3. BULGULAR VE TARTIŞMA

Sıvı humik asit uygulamasının topraktan ve yapraktan uygulamasının yapıldığı denemede humik asit uygulamaları hodan bitkisinin bitki yaş ağırlığı, bitki kuru ağırlığı, kök yaş ve kök kuru ağırlığı ve bitki boyu üzerine etkisi istatistiksel olarak %1 önem seviyesinde etkili olmuştur. En yüksek bitki yaş ağırlığı 125.6 gr/bitki ile H2 uygulamasından elde edilirken kontrol uygulamasında bitki yaş ağırlığı 74.6 gr/bitki olarak ölçülmüştür. Yapraktan uygulamalar kontrole göre belirgin bir şekilde artış sağlamıştır. Kök yaş ağırlığında kontrol uygulamasında 34.6 gr/bitki olarak ölçülürken H2 uygulamasında 52.5 gr/bitki ve H4 uygulamasında 38.9 gr/bitki olarak ölçülmüştür. Hodan bitkisinin bitki boyu bitki vegetatif gelişimi arttıkça yüksek ölçülmüştür.

Tablo 2. Humik asit uygulamalarının hodan bitkisinin bazı özellikler üzerine etkisi

Uygulamalar	Bitki yaş ağırlığı (gr/bitki)**	Bitki kuru ağırlığı (gr/bitki)**	Kök yaş ağırlığı (gr/bitki)**	Kök kuru ağırlığı (gr/bitki)**	Bitki boyu (cm)
H0	74.6 d	14.5 d	34.6 c	8.3 e	27.3 d
H1	112.4 b	21.6 b	45.7 b	11.4 b	37.4 b
H2	125.6 a	24.3 a	52.5 a	15.4 a	39.5 a
H3	98.3 c	19.6 c	36.4 c	9.4 d	31.4 c
H4	105.6 b	21.5 b	38.9 c	10.2 c	33.7 c
Ortalamalar	103.3	20.3	41.6	10.8	33.8

Her sütunda ortalamalar arasındaki farklılıklar Duncan testiyle belirlenmiştir.

Ö.D: Önemli Değil; *P<0.05; **P<0,01 önemlidir;

Kireç içeriği yüksek ve fosfor konsantrasyonu düşük olan bir toprakta yapılan bu denemede özellikle humik asit uygulamasının bitki kök gelişimini arttırdığı ölçümler ile belirlenmiştir. Humik asit içeriğindeki besin elementlerinin bitki tarafından alınabilir formda olması bitkilerin daha fazla besin elementi almasını sağlamaktadır.

4. SONUÇ

Yapılan çalışma ve daha pek çok çalışmada humik asidin topraktan ve yapraktan uygulama yapıldığında bitki besin elementi alımını arttırdığını ve bitki gelişimini teşvik ettiğini göstermektedir. Çalışmada topraktan en yüksek dozda uygulanan humik asit bitki topraküstü aksamını ve kök aksamının gelişimini en fazla artıran uygulama olmuştur. Yapraktan uygulamalarda ise kontrole göre önemli artışlar yaşanmıştır. Yapılan çeşitli çalışmalarda



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yapraktan humik asit uygulamalarının bitkinin kuru madde içeriğini olumlu yönde etkilediği bildirilmiştir. Turp bitkisine 1200 ml ha-1 dozunda yapılan uygulama ile bitkinin kuru madde veriminde belirgin artışlar görülmüş (Albayrak ve Çarnaş, 2005). Ekmeklik buğdayda yapraktan humik asit uygulamasında bitki kuru madde miktarının arttığı bildirilmiştir (Delfine ve ark., 2005). Biber bitkisine farklı dozlarda topraktan ve yapraktan uygulanan humik asit bitkinin meyve verimi ve toplam veriminde artışlara neden olmuştur (Karkurt ve ark., 2009). Kışlık kolzada yapılan çalışmada genel olarak, humik asit dozlarından 250 ve 500 ml/da uygulamalarının ve uygulama zamanı olarak da 6-8 yapraklı ve sapa kalkma dönemlerinin incelenen özellikler bakımından daha iyi sonuçlar verdiği gözlenmiştir (Gürsoy ve ark., 2016). Toprağa katılacak yada yapraktan uygulanacak humik asitler toprak içerisindeki fiziksel, kimyasal ve biyolojik özelliklerin artırılmasında önemli organik gübrelerdir. Özellikle toprak içerisinde olumsuz özelliklerin düzeltilmesi için katı yada sıvı humik asitlerin uygun düzeylerde topraktan uygulanması bitki gelişiminde olumlu sonuçlar ortaya çıkaracaktır.



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KAYNAKLAR

Adani, F., Genevini, P., Zaccheo, P. and Zocchi, G., 1998. The effect of commercial humic acid on tomato plant growth and mineral nutrition, *Journal of Plant Nutrition*. 21:561-575.

Albayrak, S., and N. Çarnaş. 2005. Effects of different levels and application times of humic acid on root and leaf yield components of forage turnip. *Journal of Agronomy*. 4 (2): 130-133.

Baytop, T., 1999. Türkiye’de Bitkiler ile Tedavi (Geçmişte ve Bugün). Nobel Tıp Kitabevleri, Ltd. Şti. S. 480.

Carrubba, A., La Torre, R., Di Prima, A., Saiano, F. and Alonzo, G. 2002. Statistical analyses on the essential oil of Italian coriander (*Coriandrum sativum* L.) fruits of different ages and origins. *J. Essent. Oil Res.*, 14: 389-396.

Delfine, S., R. Tognetti, E. Desiderio, and A. Alvino. 2005. Effect of foliar application of N and humic acids on growth and yield of durum wheat. *Agronomy in Sustainable Development*. 25: 183-191.

Düzgüneş, O., Kesici, T., Kavuncu, O. ve Gürbüz, F., 1987, Araştırma ve Deneme Metotları (İstatistik Metotları II), Ankara Üniv, Ziraat Fak, Yay, No: 1021, 381 s, Ankara.

Gürsoy, M., Nofouzi, F., Başalma, D. 2016. Humik asit uygulama zamanı ve dozlarının kışlık kolzada verim ve verim öğelerine etkileri. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, 25 (Özel sayı-2):131-13.

Hafez, M.M., 2004. Effect of some sources of nitrogen fertilizer and concentration of humic acid on the productivity of squash plant. *Egypt. J. Appl. Sci.* 19: 293-309.

Larcher, W. 2003. *Physiological Plant Ecology: Ecophysiology and Stress Physiology of Functional Groups*, 4th. Edition, Springer, New York, 7.

Karaman, M.R., 2003. Efficiency of iron and humate application in preventing of iron chlorosis on the peach trees. *Ankara University, Journal of Agricultural Sciences*, 9 (1), pp.29-34.

Karkurt, Y., Unlu, H., Unlu, H., Padem, H. 2009. The influence of foliar and soil fertilization of humic acid on yield and quality of pepper. *Acta Agriculturae Scandinavica Section B – Soil and Plant Science*. 59: 233-237.

Osborne, B.A. and Miele, L. 1999. Notch and the immune system. *Immunity*, 1999; 11:653-663.



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Sabzevari, S., Khazaie, H.R. and Kafi, M. 2009. Effect of humic acid on root and shoot growth of two wheat cultivars (*Triticum aestivum* L.). J. Water Soil, 23: 87- 94. (In Persian).

Salman, S.R., Abou-Hussein, S.D., Abdel-Mawgoud, A.M.R. and El-Nemr, M.A., 2005. Fruit yield and quality of watermelon as affected by hybrids and humic acid application. Journal of Applied Sciences Research, 1(1):51-58.

Samani, M.A., Bahmani, M., Kopaci, M.R., 2014. The Chemical Composition, Botanical Characteristic and Biological Activities of *Borago officinalis*: a review. Asian Pacific Journal of Tropical Medicine, 7 (Suppl 1): S22-28.

Zargari, A. 2004. Medical plants. Fifth edition. University of Tehran press, :71 P.



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ÖZET

Bütün canlılar gibi bitkilerde, maksimum gelişimlerini optimum yetiştirme koşullarında gösterirler. Hareket etme yeteneğine sahip olmayan bitkiler yaşam süreçleri boyunca çevreden kaynaklı büyüme ve gelişmelerini olumsuz yönde etkileyecek birçok stres faktörü ile karşılaşır. Son yıllarda küresel ısınma sonucunda iklimlerde büyük değişiklikler meydana gelmekte, bu değişiklikler bitkisel üretimi sınırlamakta bununla beraber verimini de olumsuz etkilemektedir. Bitkiler nadiren bir tek stres faktörüne maruz kalmakla beraber genelde birden fazla stres faktörü ile karşı karşıya kalmaktadırlar. Bitkiler yaşamları boyunca karşılaşmakta oldukları stres faktörleri abiyotik (kuraklık, tuzluluk, radyasyon, yüksek sıcaklık, don vb.) ve biyotik (patogen, diğer organizmalarla rekabet vb.) olarak iki farklı grupta incelenmektedir. Abiyotik faktörler içerisinde, bitkilerdeki yaprak büyümesi, stomaların açılıp kapanması ve fotosentez gibi birçok önemli fizyolojik olayları doğrudan etkilemesi nedeniyle kuraklık stresi oldukça önem arz etmektedir. Bitkiler, bu gibi olumsuz durumlara uyum sağlamak amacıyla, stres sinyallerini algılamaya yardımcı olan ve optimum büyüme tepkisini sağlayan mekanizmalar geliştirmiştir. Bitkilerin normal gelişimini sürdürebilmesi ve bu olumsuz durumlara yanıt verebilmesinde çevresel koşullarla beraber bazı iç ve dış faktörler de rol oynamaktadır. Hormonların üretimindeki, dağılımındaki veya sinyal iletimindeki değişiklikler ile bitkiler, hayatta kalmayı teşvik etmek veya çevresel stresten kaçınmak için hem stres toleransını düzenleyebilir ve hem de büyümeyi koordine edebilirler. Doğal büyüme hormonları arasında giberellik asit (GA) bitki gelişimini teşvik etmesi bakımından özel bir yeri vardır. Giberellinler hücre bölünmesini uyararak ve hücre duvarlarındaki plastidleri artırarak büyümeyi teşvik eder, karbonhidratları şekere dönüştürür ve hücre duvarındaki basıncı azaltır. Böylece hücre içerisine su alındığından hücre uzamasını sağlar. GA'nın etkileri bakımından önemli gelişmelerden biride abiyotik strese maruz kalan bitkilere uygulandığında reaktif oksijen türlerinin (ROS) birikimini sınırlandırdığı ve dolayısıyla hücre ölümünün engellediği bilinmektedir. Gibberelik asit hormonu seviyesi ile stres toleransının kazanılması arasında, pozitif bir ilişki bulunmaktadır. Bu derlemede, kuraklık stresinin bitki büyüme, gelişme üzerine etkileri ve Gibberellik asitidin bitkilerin kuraklık stresi tepkisindeki rollerine ve iyileştirici etkilerine yönelik değerlendirmeler hakkında bilgi verilmiştir.

AnahtarKelimeler: Kuraklık Stresi, Hormon, GA, Oksidatif stres



THE IMPROVING ROLE OF GIBBERELIC ACID ON DROUGHT STRESS IN PLANTS

ABSTRACT

Like all living things, plants show their maximum development under optimal growing conditions. Plants that do not have the ability to move face many stress factors that will negatively affect their growth and development from the environment throughout their life processes. In recent years, as a result of global warming, significant changes have occurred in the climate, and these changes limit plant production and negatively affect its yield. Although plants are rarely exposed to one stress factor, they generally suffer more than one stress factor. The stress factors that plants experience throughout their life are examined in two different groups such as abiotic (drought, salinity, radiation, high temperature, frost, etc.) and biotic (pathogen, competition with other organisms, etc.). Among the abiotic factors, drought stress is very important because it directly affects many important physiological events such as leaf growth, stomata opening and closing, and photosynthesis. In order to adapt to such adverse conditions, plants have evolved mechanisms that help detect stress signals and provide an optimal growth response. In addition to environmental conditions, some internal and external factors also play a role in the normal development of plants and their ability to respond to these adverse conditions. With changes in the production, distribution, or transmission of hormones, plants can regulate stress tolerance and growth to promote survival or avoid environmental stress. Among the natural growth hormones, gibberellic acid (GA) occupies a special place in terms of promoting plant growth. Gibberellic acid promotes growth by stimulating cell division and increasing plastids in cell walls, converting carbohydrates into sugars, and reducing cell wall stress. Thus, since water enters the cell, it provides elongation of the cell. One important development in terms of the effects of GA is that when applied to plants exposed to abiotic stress, it is known to limit the accumulation of reactive oxygen species (ROS) and thus prevent cell death. There is a positive relationship between the level of the hormone gibberellic acid and the acquisition of stress tolerance. In this review, information is presented on the effects of drought stress on plant growth and development and the role of gibberellic acid in the drought stress response of plants, and evaluation of its healing effects.

Keywords: Drought Stress, Hormone, Gibberellic Acid, Oxidative Stress



1.GİRİŞ

Bitkilerin normal gelişimini sürdürebilmesi uygun iklim ve çevre koşulları ile mümkündür. İklim ve çevre koşullarında meydana gelen değişiklikler bitkilerin gelişimlerini olumsuz etkileyen strese neden olmaktadır. Kuraklık, aşırı sıcaklık, soğuk, ağır metaller veya yüksek tuzluluk gibi çevresel abiyotik stresler, dünya çapında bitki büyümesini ve üretkenliğini olumsuz etkileyerek verimde yaklaşık olarak %50 oranında düşüşe neden olmaktadır. (Wang ve ark., 2003, Grigorova ve ark., 2011). %26'lık pay ile en önemli abiyotik stres faktörü olan kuraklık stresi, bitki büyümesini ve gelişimini ciddi şekilde bozmakta, verim performansını diğer tüm çevresel faktörlerden daha fazla sınırlamaktadır (Kalefetoğlu ve Ekmekçi, 2005; Shao ve ark., 2009).

Bitkiler, biyotik ve abiyotik kökenli stres faktörlerine maruz kaldıklarında bazı savunma mekanizmaları geliştirmektedirler. Bitkiler bu olumsuz koşullara uyum sağlayarak büyüme ve gelişmelerini sürdürmeye çabalamaktadırlar. Herhangi bir stres faktörüne maruz kalan bitkiler genotipik özellikler çerçevesinde tepkiler oluşturmaktadır. Stres etkilenme durumu bazı tür ve çeşitlerde az düzeyde meydana gelirken, bazılarında ise ölümcül olmaktadır. Genetik temellere dayanan bu tip, farklı uyum yeteneklerinin yanı sıra herhangi bir bitkinin farklı gelişme dönemleri, stresin cinsi, şiddeti, süresi gibi faktörler de bitkilerin geliştirdiği savunma mekanizmaları üzerinde etkili olmaktadır (Yaşar, 2003; Yaşar ve ark., 2008 a,b; Yaşar ve ark., 2010). Kuraklık stresine maruz kalan bitkiler, birçok fizyolojik, biyokimyasal ve moleküler tepkiler geliştirmekte ve buna bağlı olarak sınırlı çevresel koşullara adapte olmayı sağlayacak tolerans mekanizmaları geliştirebilmektedirler (Arora ve ark., 2002).

Bitkinin normal gelişimini sürdürebilmesi ve bu olumsuz durumlara yanıt verebilmesinde çevresel koşullarla beraber bazı iç ve dış faktörlerin de rolü olduğu bildirilmektedir (Kumlay ve Eryiğit, 2011). Bitkilerin düzenli olarak büyüüp gelişmeleri hücreler arası iletişimle sağlanır. Bitkilerde bu iletişimi sağlayan temel araç, bilgiyi kimyasal mesaj olarak hücreden hücreye taşıyan bitki büyüme düzenleyicileridir (Öktüren ve Sönmez, 2005). Bitkilerde doğal olarak meydana gelen biyokimyasal maddelerin yanı sıra sentetik olarak elde edilen hormon etkilerine benzer etkiler oluşturan maddeler de bulunmaktadır. Bitki büyüme düzenleyicileri büyüme teşvik ediciler (Oksin, giberellinler ve sitokininler), engelleyici veya dorminler (absisik asit) ve olgunlaştırıcı (etilen) olarak gruplara ayrılmıştır (Algül ve ark., 2016).

Hormonlar, bitkilerin çevresel faktörlerdeki değişikliklerin algılanmasında, savunma sistemlerinin gelişmesini sağlamakta ve verilen tepkilerde önemli rol oynarlar (Davies, 1995). Bitkilerin streslere karşı verdiği tepkiler bitki bünyesinde bulunan hormonların birbirleriyle



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etkileşimleri ve konsantrasyonlarına göre şekillenmektedir. Büyüme ve çimlenmeyi teşvik etmesi bakımından giberellik asit doğal büyüme hormonları arasında özel bir yer vardır (Erdemli ve Kaya, 2015). GA hormonu bitki büyümesini ve gelişimini kontrol ederken aynı zamanda diğer hormonlar ve çevresel stresler arasında da karşılıklı etkileşimde olduğu uzun zamandır bilinmektedir (Alacı ve ark., 2021). GA'nın etkileri bakımından önemli gelişmelerden biride abiyotik strese maruz kalan bitkilere uygulandığında reaktif oksijen türlerinin (ROS) birikimini sınırladığı ve dolayısıyla hücre ölümlerini engellediği bilinmektedir (Achard ve ark., 2008). Gibberellik asit hormonu seviyesi ile stres toleransının kazanılması arasında, pozitif bir ilişki bulunmaktadır.

Bu derlemede, kuraklık stresinin bitki büyümesi, gelişmesi üzerindeki olumsuz etkileri ve Gibberellik asitin bitkilerin kuraklık stresi tepkisindeki rollerine ve iyileştirici etkilerine yönelik değerlendirmeler hakkında bilgi verilmiştir.

2.KURAKLIK STRESİ

Kuraklık, meteorolojik bir terimdir ve genellikle önemli yağışların olmadığı bir dönem olarak tanımlanır. Kuraklığın şiddeti, yağışların oluşumu ve dağılımı, buharlaşma hızı ve toprağın nem depolama kapasitesi gibi birçok faktöre bağlı olduğundan oldukça değişkenlik göstermektedir (Wery ve ark., 1994).

Genel olarak kuraklık stresi, topraktaki mevcut su miktarının azalmasıyla ve atmosferik koşulların terleme veya buharlaşma yoluyla sürekli su kaybına neden olmasıyla ortaya çıkar. Kuraklık stresi bitkilerin morfolojik, fizyolojik özellikleri, verim ve ürün kalitesi üzerinde etkili olmaktadır. Bu etki bitkinin cinsine, türüne hatta çeşidine, stresin derecesine, sürekliliğine ve bitkinin gelişme çağına göre değişmektedir. Kuraklık dünyada tarımsal üretimi sınırlandıran en önemli abiyotik stres kaynaklarından biri olarak karşımıza çıkmaktadır. Kuraklık stresi bitkilerde birçok metabolik olayı olumsuz yönde etkileyen ve özellikle kültür bitkilerinde ürün kalitesini ve verimini düşüren en önemli abiyotik faktördür. Kuraklık stresi fotosentez, solunum, karbonhidratların paylaşımı, iyon alımı, su potansiyeli, stoma kapanması, şeker ve besin metabolizması, antioksidan sistem ve ayrıca fitohormonlar gibi çeşitli fizyolojik ve biyokimyasal süreçleri etkileyerek bitki büyümesini etkilemektedir (Prasad ve ark., 2011). Kuraklık genel olarak su noksanlığı ve kuruma olarak iki tipe ayrılabilir. Su noksanlığı, stomaların kapanmasıyla gaz değişiminde kısıtlamaya neden olan orta düzeydeki su kaybıdır. Oransal su içeriğinin yaklaşık %70'te kaldığı hafif su noksanlığına maruz kalan bitkilerde



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stomaların kapanmasına bağlı olarak karbondioksit alımı kısıtlanmakta ve fotosentez azalmaktadır. Kuruma ise, metabolizma ve hücre yapısının tamamen bozulmasına ve sonunda enzimle katalizlenen reaksiyonların durmasına neden olabilecek potansiyele sahip olan aşırı miktardaki su kaybı olarak tanımlanmaktadır (Kuşvuran, 2010).

3. KURAKLIĞIN ETKİLERİ

Kuraklığın etkileri bitki yaşam döngüsünün bütün aşamalarında morfolojik seviyeden moleküler seviyelere kadar değişmektedir. Kuraklık stresinin etkileri aşağıda açıklanmıştır.

3.1. Kuraklık Stresinin Sitolojik Etkileri

Kuraklık stresine karşı bitkide meydana gelen en belirgin yanıt hücre büyümesindeki yavaşlamadır. Bitki hücrelerinde kuraklık stresinin etkileri “mekanik”, “metabolik” ve “oksidatif etkiler” olarak üç şekilde görülmektedir (Kalefetoğlu ve Ekmekçi, 2005).

3.1.1. Mekanik Etki

Bitki hücrelerinde, belirgin şekilde su kaybı gerçekleştiği zaman birincil tepki olarak bitkide turgor kaybı gerçekleşmektedir. Su kaybına bağlı olarak hücrede hacim azalır, hücre özsuyu konsantrasyonu artar ve protoplazmada artan bir dehidrasyona neden olur. Böylece plazma membranı hücre çeperinden ayrılarak yalnız plazmodezmler aracılığıyla ilişkisini sürdürür (plazmoliz). Gerilim altındaki plazma membranı ve tonoplastta gerçekleşen çökme, yırtılmalara yol açabilir ve zarlar üzerinde yerleşmiş olan hidrolitik enzimler serbest kalarak sitoplazmanın otolizine neden olabilir. Bu zarar, normal hücresel metabolizmayı genelde kalıcı olarak bozar. Su eksikliğinde bitkilerin büyümeyle ve özellikle de uzama büyümesiyle ilgili işlemlerde yavaşlamalar ve turgorlarında azalmalar meydana gelmektedir (Özcan ve ark., 2004).

3.1.2. Metabolik Etki

Suyun, hücre içeriğinin büyük bir kısmını oluşturması, taşıyıcı olması, hücresel reaksiyonlar ve işlevler için oldukça önemli roller bulunmaktadır. Bu fonksiyonel özelliklerinden dolayı hücrede gereğinden az olması durumunda, hücrenin normal düzeni devam edemez ve hücre metabolizması bozulur. Su kaybı sonucu gerçekleşen iyon birikimi, membran bütünlüğünün ve proteinlerin yapısının bozulmasına yol açarak hücreye zarar verebilir. Su kaybı sonucunda; proteinlerin yapısında bulunan hidrofobik ve hidrofilik amino asitlerin su ile etkileşimleri bozulur ve bu durum da protein denatürasyonlarına ve enzim inhibisyonlarına neden olur. Kuraklık stresi sırasında oluşan hasarda bir başka faktör, DNA ve RNA gibi nükleik asitlerin degradasyonu olduğu bildirilmiştir (Kalefetoğlu ve Ekmekçi, 2005).



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3.1.3.Oksidatif Etki

Kuraklık stresine maruz kalan bitki daha fazla su kaybetmemek için stomalarını kapatmaktadır. Böylece fotosentezin temel maddelerinden biri olan karbondioksitin alımı kısıtlanmakta ve CO₂ fiksasyonu azalmaktadır. Stres koşullarında, bitkilerde biyosentetik reaksiyonların gerilemesi ve ATP'ye olan gereksinimin azalması sonucunda mitokondri ve kloroplastlardaki elektron taşıma sisteminde elektron fazlalığı oluşabilmektedir (Eker, 2002). Fotosentez için absorbe edilen ışık enerjisi ve açığa çıkan elektronlar, yeterli CO₂ olmadığından ve bu nedenle CO₂ indirgenmesinde kullanılamadığından, kloroplastlarda biriktirilmekte ve moleküler O₂'nin aktivasyonunda kullanılmaktadır. Bu tür olumsuz koşullarda, fotosentetik kaynaklı elektronlar ve pigmentler tarafından absorbe edilmiş olan enerji, CO₂ yerine moleküler O₂'ye aktarılmakta ve toksik etkileri çok yüksek olan serbest oksijen radikalleri (ROS) ve türevleri oluşmaktadır. Bunlar, süperoksit molekülü (O₂⁻), singlet oksijen (*O), hidrojen peroksit (H₂O₂) ve hidroksil radikalleri (OH.) olarak adlandırılmıştır. Serbest oksijen radikalleri hücre zarlarında lipid peroksidasyonuna neden olmakta ve bu da hücre zarının tahrip olmasına yol açmaktadır. Toksik oksijen radikallerini stres koşullarında artan oranlarda sentezlenmesi, özellikle ortamdaki ışık yoğunluğunun fazla olmasıyla daha da etkin olabilmekte; bitkilerdeki klorofil ve hücre zarı hasarı şeklinde ortaya çıkan fotooksidatif zararlara neden olmaktadır. Serbest oksijen radikalleri, öncelikle hücre zarlarının fosfolipidlerini (özellikle doymamış yağ asitlerini), proteinleri, nükleik asitleri ve klorofili parçalamaktadır. Serbest oksijen radikallerinin bu olumsuz etkileri yüksek ışık yoğunluğunda daha da artmaktadır (Ölçer ve Ark., 2012).

Kuraklık stresine maruz kalan bitkiler antioksidant savunma sistemlerin bazılarının ya da tamamının aktivasyonu ile oksidatif stresin üstesinden gelebilirler. Antioksidan savunma mekanizmaları enzimatik (katalaz (CAT), peroksidaz (POD), askorbat peroksidaz (APX) ve glutatyon redüktaz (GR)) veya enzimatik olmayan (glutatyon, askorbat, tokoferoller, karotenoidler) antioksidan moleküllerden oluşmaktadır. Enzimatik olmayan antioksidanlar iki gruba ayrılır. Bunlar: Yağda çözünebilirler membranla ilişkili antioksidanlar (örneğin a tokoferol ve β-karoten) ve suda çözünebilir antioksidanlardır (örneğin, glutatyon, fenolikler ve askorbat) (Kuşvuran ve ark., 2016). Enzimatik olmayan antioksidan moleküllerin temel görevi fotosentetik membranların korunmasıdır (Farooq ve ark., 2009; Anjum ve ark., 2011).

3.2. Kuraklık Stresinin Bitki Büyümesi Ve Gelişimine Etkileri

Büyüme, hücre bölünmesi, hücre büyümesi ve farklılaşması yoluyla gerçekleştirilir ve genetik, fizyolojik, ekolojik ve morfolojik olayları ve bunların karmaşık etkileşimlerini içerir.



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Çimlenmeden olgunluğa kadar bitki gelişiminin her aşamasında su çok önemlidir. Kuraklığın etkileri morfolojik seviyeden moleküler seviyelere kadar değişir ve bitki büyüme ve gelişmesinin her aşamasını olumsuz etkilemektedir.

Bitki büyümesi ve gelişmesinin ilk aşaması olan tohum çimlenmesi, su emilimi ile başlar. Hem canlı hem de ölü tohumlar suyu emer ve şişer. Emilen su miktarı tohumun kimyasal bileşimine bağlı olarak değişmekle birlikte bazı tohumlar ağırlığının 3'te 1'i kadar su emmektedirler. Su seviyesi istenenden az ise, su emilimi tam olmaz ve çimlenme azalır veya durur (Leila, 2007). Su, çimlenmeyi uyaran ana faktör olup kuraklığın ilk ve en önemli etkisi, çimlenme oranını azaltması ve zayıf kök oluşumuna neden olmasıdır (Harris ve diğerleri 2002). Yapılmış olan birçok çalışmada kuraklık stresinin çimlenmeyi ciddi şekilde azalttığı ve fide gelişimini olumsuz etkilediğini bildirilmiştir (Kaya ve ark. 2006, Okçu ve ark. 2005). Ayrıca yoncada yapılan çalışmada su stresi ile çimlenme potansiyeli, hipokotil uzunluğu, sürgün uzunluğu ile taze ve kuru ağırlıkları azalırken, kök uzunluğunun arttığı belirtilmiştir (Zeid ve Shedeed 2006). Büyüme, hücre bölünmesi, hücre büyümesi ve farklılaşması yoluyla gerçekleşir. Hücre büyümesi, turgor basıncındaki azalmaya bağlı olarak kuraklığa en duyarlı fizyolojik süreçlerden biridir (Taiz ve Zeiger 2006). Şiddetli su eksikliği altında, yüksek bitkilerin hücre uzaması, ksilemden çevreleyen uzayan hücrelere su akışının kesilmesi ile engellenmektedir. (Nonami 1998). Bozulmuş mitoz bölünme, hücre uzaması ve genişlemesi, kuraklık altında bitki boyu, yaprak alanı ve ürün büyümesinin azalmasına neden olur. Vejetatif dönemdeki kuraklık stresinin üreme dönemindeki strese göre verim ve verim bileşenleri üzerindeki etkisi daha az önemlidir, ancak yaprak gelişimi, gövde gelişimi, fotosentez, yaprak ve birikim aşamalarındaki stresin bitkideki etkisi büyük önem taşımaktadır (Kabiri, 2010). Vejetatif dönemdeki kuraklık stresi, bitki büyümesini ve gelişimini büyük ölçüde azaltmaktadır.

Kuraklığın ayrıca bitkinin büyüme ve gelişmesinin azaltmasının yanında gelişim aşamasının erken geçişini tetikleyebilir, yani bitkinin vejetatif aşamadan generatif aşamasına erken geçmesine neden olabilir (Desclaux ve ark., 1996).

Büyüme döngüsündeki strese karşı en savunmasız aşama, üreme organlarının oluşumu, çiçeklenme, meyve verme ve tohum gelişimini içeren üreme aşamasıdır (Ruelland ve ark., 2009). Bitkilerin stresten kaçınma mekanizması ile bu süreci kısaltması ve azalan fotosentez sonucu yeterli asimilatların oluşmaması nedenleriyle çiçeklenme dönemindeki kuraklık genellikle kısırlıkla sonuçlanır (Farooq ve ark., 2009).



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3.3. Kuraklığın Bitki Su İlişkilerine Etkileri

Bağıl su içeriği, yaprak su potansiyeli, ozmotik potansiyel, basınç potansiyeli, yaprak sıcaklığı ve terleme oranı bitki su ilişkilerini etkileyen önemli özelliklerdir. Bitkilerin kuraklık stresine maruz kalması, yaprak sıcaklığındaki artışla birlikte yaprak su potansiyeli, bağıl su içeriği ve terleme oranının önemli ölçüde azalmasına neden olmaktadır.

Terleme oranı bitkide sadece yaprak sıcaklığının korunmasına yardımcı olmakla kalmaz, aynı zamanda su ve besin alımını ve stomaların açık kalması ile CO₂ girişini etkilemektedir.

3.4. Kuraklığın Besin Maddeleri Alımına Etkileri

Bitkilerde toprakta bulunan besin maddelerinin kök tarafından alınması ve bunların sürgünlere taşınması su mevcudiyeti ile gerçekleşmektedir. Kuraklık stresi besinlerin bulunabilirliğini, alımını, taşınmasını ve metabolizmasını azaltmaktadır. Yeterli su olmaması nedeniyle azalan terleme hızı, besin emilimini ve bunların kullanım verimliliğini azaltmaktadır (Farooq ve ark., 2009).

3.5 Kuraklığın Fotosenteze Etkileri

Fotosentez, kloroplastlarda ışık enerjisinin enerjice zengin organik bileşiklerde kimyasal bağ enerjisine dönüştürüldüğü fizyolojik bir prosestir (Ainsworth ve ark., 2003). Yaprak alanında (boyut ve sayı) azalma, erken yaprak yaşlanması ve stomatal kapanma, karboksilasyon enzimlerinin ve ATP sentezinin bozulmuş aktiviteleri fotosentez mekanizmasının olumsuz etkilenmesine neden olan etmenlerdir. Su stresini algılayan bitkilerde ilk olarak ortaya çıkan adaptasyon mekanizması su kaybını engellemek amacıyla stomaların daralması veya kapanmasıdır (Osakabe ve ark., 2014). Bitki fotosentez oranı, açık stomalardan bitki yaprak dokusu içerisine alınan gaz formundaki karbondioksit miktarı ile ilişkilidir. Stomaların açık olması aynı zamanda bitkinin terleme ile su kaybetmesine de yol açmaktadır. Bu nedenle, kurak koşulların oluşması durumunda bitkiler, terleme ile su kaybını en aza indirmek amacıyla stomalarını hızlı bir şekilde kısar veya kapatırlar. Buna bağlı olarak karbondioksit alımını da azaldığı için bitki fotosentez oranında bir düşüş gerçekleşir. Bitki büyümesinde kullanılan karbonhidrat molekülleri ve enerji, fotosentez ile üretildiği için, bu düşüş bitki büyüme ve gelişmesini de etkileyen bir faktördür (Öztürk, 2015). Bitkilerin büyümesini ve fotosentetik yeteneklerini engelleyen bir diğer önemli etki, reaktif oksijen türlerinin üretimi ile antioksidan savunma arasındaki dengenin bozulmasıdır. Bu da serbest oksijen radikallerinin birikmesine neden olur. Proteinlerde, zar lipidlerinde ve diğer hücresel bileşenlerde oksidatif strese neden olur (Farooq ve ark., 2009).



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4. KURAKLIK STRESİNE KARŞI GELİŞTİRİLEN UYUM MEKANİZMALARI

Kuraklık stresi bitkilerde sınırlı çevresel koşullara adapte olmayı sağlayacak birçok fizyolojik, biyokimyasal ve moleküler cevabı indüklemektedir. Kuraklık stresine karşı oluşturulan cevaplar, türe, genotipe, su kaybı şiddetine ve uzunluğuna, bitkinin gelişme durumuna, yaşına, organ ile hücre tipine bağlı olarak değişmektedir. Kurak koşullarda bitkinin hayatta kalmasını sağlayan ve vegetatif dokularda su stresine karşı streslenmeden kaçınma ve stres toleransı olmak üzere iki ana savunma mekanizması geliştirmektedir (Kuşvuran, 2010).

4.1. Kuraklıktan Kaçış

Kuraklıktan kaçış, bir bitkinin ciddi bir su açığı oluşmadan yaşam döngüsünü tamamlama yeteneği olarak tanımlanabilir.

4.2. Kuraklıktan Kaçınma

Toprak nemi eksikliğine rağmen bitkilerin nispeten yüksek doku suyu potansiyelini muhafaza etme yeteneği; su alımını iyileştirmeye, bitki hücresinde depolamaya ve su kaybını azaltmaya yönelik mekanizmalar kuraklıktan kaçınma olarak adlandırılır. Farklı bitki türlerinde, artan köklenme derinliği, verimli kök sistemi ve artan hidrolik iletkenlik yoluyla turgorun sürdürülmesi ve azaltılmış epidermal (stomatal ve lentiküler) iletkenlik yoluyla su kaybının azaltılması, yaprak tarafından radyasyonun azaltılması gibi farklı kuraklıktan kaçınma mekanizmaları bildirilmektedir.

4.3. Kuraklık Toleransı

Bitkinin düşük doku su potansiyeli ile su açığına dayanma kabiliyetine kuraklık toleransı denir. Turgorun korunması ve su kaybının azalması arasındaki denge, bitkilerin kuraklık stres koşullarından kurtulmasına yardımcı olur. Bitkiler, ozmotik ayarlama (hücrede çözünen madde birikimini indükleyen bir süreç) yoluyla turgoru sürdürerek, hücrede esneklikte artış ve protoplazmik dirençle hücre boyutunda ve kuruma toleransında azalma yoluyla kuraklık stresiyle mücadele edebilir.

4.4. Antioksidan Savunma

Kuraklık stresine maruz kalan bitkiler su kaybını en az düzeye indirebilmek için stomalarını kapatarak su kaybını azaltmaya çalışmaktadırlar. Ancak stomaların kapanması ile yeteri kadar CO₂ fiksasyonu sağlanamamaktadır. CO₂ indirgenmesinde kullanılmayan elektronlar, O₂'nin indirgenmesinde rol oynamakta ve serbest oksijen radikallerinin oluşumuna neden olmaktadır (Kuşvuran, 2010). Bitkiler, strese maruz kaldıklarında, serbest oksijen radikalleri (ROS) üretimi ile antioksidanların, ROS'ların zararlı etkilerini azaltma aktivitesi arasındaki denge



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bozulur ve genellikle oksidatif hasarla sonuçlanır. Serbert oksijen radikalleri lipidlerin, proteinlerin ve nükleik asitlerin metabolizmasını oksidatif hasar ile bozmaktadır (Kuşvuran, ve ark., 2016). Bitkiler stres koşullarında serbest oksijen radikallerine karşı savunma mekanizmaları geliştirmiştir. Bitki, ROS seviyesini kontrol etmek ve hücreleri stres koşulları altında korumak için ve dokularında ROS'un zararlı etkilerini elemine etmek için birkaç enzime sahiptir. Bitki hücresindeki antioksidan savunma sistemi hem enzimatik hem de enzimatik olmayan bileşenleri oluşturur. Enzimatik antioksidan savunmaları, kloroplastlardaki ve mitokondrideki H_2O_2 'yi temizleyen sırasıyla askorbat peroksidaz (APX) ve glutayon redüktaz (GR), H_2O_2 'yi etkili bir şekilde yok eden katalaz (CAT) ve süperoksit anyonlarını temizleyen süperoksit dismutazı (SOD) içine alır (Kuşvuran, ve ark., 2016). Enzimatik olmayan bileşenler sistein, indirgenmiş glutatyon ve askorbik asit içerir. Kuraklık stresi koşullarında antioksidan enzimlerin yüksek aktivitesi ve enzimatik olmayan bileşenlerin yüksek içeriği önemlidir (Farooq ve ark. 2009).

5. KURAKLIK STRESİNİN HORMONLARA ETKİSİ

İster doğal olsun isterse sentetik olsun hormonlar, çok düşük konsantrasyonlarda bitkilerin fizyolojik süreçlerini etkileyen maddelerdir (Morgan 1990). Bitkilerin abiyotik stres ile karşılaştığı zaman bazı endojen bitki hormonları, sinyal iletimi ve geni ifadelerinin düzenlenmesinde önemli görevler yapar (Xiong ve ark., 2002). Kuraklık altında, oksinlerin, gibberellinlerin ve sitokininin endojen içerikleri genellikle azalırken, absisik asit ve etilen içeriği artar (Nilsen ve Orcutt 1996). Bununla birlikte, hormonlar bitkilerin kuraklığa toleransında hayati rol oynarlar.

Bitki büyüme ve gelişmesini teşvik eden hormonlara stimülatör adı verilir. Bu grupta oksin, sitokinin ve gibberellin hormonları yer almaktadır. Bu grubun tersi etkilerde bulunan büyüme ve gelişmeyi gerileten, yavaşlatan etkilere sahip olan hormonlar vardır ve bunlara ise inhibitörler adı verilmektedir. Absisik asit (ABA) ve etilen hormonu bu grupta yer alır. Bitki bünyesinde gerçekleşen fizyolojik faaliyetlerin büyük bir kısmı stimülatör ve inhibitör gruplarında yer alan hormonların kontrolü ile gerçekleşmektedir (Bozcuk ve Topçuoğlu, 1982). Bitki büyüme ve gelişmesini teşvik eden hormonlarından olan gibberellinler strese karşı korumada önemli rol oynamaktadır.



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5.1. Giberellik Asit (Ga)

Bitki büyümesini ve gelişimini uyaran bir bitki hormonu olan Gibberellik asit (GA), bir tetrasiklikditerpenoid bileşigidir. İlk olarak 1926 yılında Japon bilim adamları tarafından pirinç bitkisinde çok fazla boylanmaya neden olan Gibberella fujikuroi adlı mantarda keşfedilmiş ve adını oradan almıştır. Daha sonra bu mantardan steril bir ekstrakt elde edilmiş ve gibberellik asit (GA3) olarak adlandırılmıştır (Vardar, 1970; Kılıç, 2007; Morsünbül, 2010).

Bitki gelişim düzenleyicileri arasında en yaygın olarak kullanılan giberellinler, bitkilerde gövde büyümesi, bitki boyunun uzaması, tohumlarda çimlenmenin uyarılması, çimlenme sırasında enzim aktivitesinin artırılması ile meyve tutumu, meyvenin büyümesi ile bazı bitkilerde erkek kısırlılığa neden olması şeklinde özetlenebilir. Su azlığının ya da yüksek tuzluluğun neden olduğu ozmotik stres, bitki hormonu olan absisik asitin (ABA) miktarını artırmaktadır (Roychoudhury ve ark., 2013). Kuraklık ve tuzluluk streslerinde cevap olarak oluşturulan ABA biyosentezi, stres yolunda birçok sinyal ve giberellik asit ile de etkileşim içindedir (Griffiths ve ark., 2006). Gibberellik asit (GA) genellikle bitki büyümesi ve gelişiminde görev alan tohum çimlenmesi, yaprak genişlemesi ve çiçeklenmeyi kontrol eden bitki hormonudur. Gibberellik asit biyosentezi, kontrol edilmektedir (Olszewski ve ark., 2002). Bununla birlikte, GA düzeyleri ve stres yanıtı arasında belirli bir korelasyon olduğu ve GA'nın strese karşı korumada önemli rol oynadığı bildirilmiştir (Vettakkorumakankav ve ark., 1999).

5.2. Gibberellik Asitin İyileştirici Etkileri

GA'lar, çimlenmeden ölüme kadar bitki büyümesini ve gelişimini düzenlemede ve bitkilerin stres korumasında merkezi bir rol oynar. GA'nın genellikle bitki büyümesi ve gelişiminde etkilerin yanı sıra abiyotik strese maruz kalan bitkilere uygulandığında reaktif oksijen türlerinin (ROS) birikimini sınırlandırdığı ve dolayısıyla hücre ölümlerini de engellemektedir (Achard ve ark., 2008). Marulda yapılan çalışmada GA uygulamasının ROS 'un zararlı etkilerini temizleyen enzimleri indükleyerek kuraklık stresi iyileştirilmiştir (Abdel-Kader, 2001). Kuraklık stresi altındaki Pirinç ve buğday fidelerinde, kalsiyum ve GA dozlarının uygulaması kök sürgün oranı, çözünür şeker ve prolin miktarlarının indüklendiği, ayrıca yapraklarda antioksidan enzimlerinin aktive olmasıyla MDA ve ROS seviyeleri azalmıştır (Wang et al., 2005). Pamukta, kalsiyum ve GA dozlarının uygulaması kuraklık altında tohum çimlenmesinin ve fidelerin uzunluğunun iyileşmesine sağlamıştır (Juxiang ve Guangling, 2004). Li ve ark., (2010) tarafından yapılan çalışmada, GA3 uygulaması yapılan kolza tohumlarının daha iyi çimlenme ve büyüme parametreleri göstermiştir. Ayrıca, çözünür



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şekerleri, prolin, çözünür proteinleri ve antioksidan enzim aktivitelerini arttırırken, elektrolit sızıntısını ve MDA içeriğini de azalmıştır. Kuraklık stresine maruz kalan şeker kamışlarını GA₃ uygulaması, hayatta kalma oranlarını artırmıştır (Tripathi ve ark., 2019). Akter ve ark. (2014), mısırdaki kuraklık stresinin etkisini azaltmak amacıyla yaptığı çalışmada, GA₃ ve sitokinin 50, 100 ve 150 mg/L dozlarındaki uygulamaları vejetatif gelişme döneminde (çıkıştan 49 ve 60 gün sonra) ve çiçeklenme döneminde (çıkıştan 74 ve 85 gün sonra) iki kez uygulamışlar ve 50 mg/L GA uygulaması verimin %78,8 arttığını belirtmişlerdir.

6. SONUÇ VE ÖNERİLER

Dünya nüfusundaki sürekli artışa karşın ekilebilir tarımsal alanlar gün geçtikçe azalmaktadır. Beslenme sorunlarını çözme ve yeterli besin sağlamak için birim alandan daha fazla sağlıklı ürün elde etmek gerekmektedir. Tarımsal üretimde önemli kayıplara neden olan abiyotik stres faktörlerinin başında kuraklık stresi gelmektedir. Bitkiler hayatta kalmak ve yaşam döngüsünü tamamlamak için streslere karşı tolerans mekanizmalarına sahiptirler. Bitkilerin bu olumsuz durum sinyallerinin algılaması ve verilen tepkilerin düzenlenmesi bazı hormonlar yardımıyla gerçekleşmektedir. Bitki büyüme ve gelişmesini uyaran hormonlardan olan giberellinlerde stres toleransının artırmaktadır.

Bu derlemede kuraklık stresine maruz bırakılan bitkilere Giberellik asit uygulamasının iyileştirici etkilerini incelemek üzere yapılmış çalışmalara yer verilmiştir. Giberellinlerin etki mekanizmaları diğer hormonlarla etkileşim halinde olması, bulunduğu organa, bitki yaşına ve türe bağlı olarak değişmekle beraber gen ekspresyonları ve Della proteinlerinin durumuna göre değişmektedir. Giberellik asitin etki mekanizmalarının karmaşıklığı ve kuraklık stresi üzerine etkilerini incelemek araştırılabilir önemli bir alandır.



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KAYNAKLAR

Abdel-Kader, D.Z. (2001) Drought and gibberellic acid-dependent oxidative stress: effect on antioxidant defense system in two lettuce cultivars. *Pakistan Journal of Biological Sciences*, 4(9), 1138–1143.

Achard P, Renou JP, Berthome R, Harberd NP, Genschik P. (2008). Plant DELLAs restrain growth and promote survival of adversity by reducing the levels of reactive oxygen species. *Curr. Biol.* 18:656–60

Ainsworth, E. A., Davey, P. A., Hymus, G. J., Osborne, C. P., Rogers, A., Blum, H., ..., Long, S. P. (2003). Is stimulation of leaf photosynthesis by elevated carbon dioxide concentration maintained in the long term? A test with *Lolium perenne* grown for 10 years at two nitrogen fertilization levels under Free Air CO₂ Enrichment (FACE). *Plant, Cell ve Environment*, 26(5), 705-714.

Akter, N., Islam, M.R., Karim, M.A., Hossain, T. (2014) Alleviation of drought stress in maize by exogenous application of gibberellic acid and cytokinin. *Journal of Crop Science and Biotechnology*, 17(1), 41–48.

Alacı R.B., Kaymaz Ö., Üzal Ö., Yaşar F., (2021). Drought stress in plants and its relationship with plant hormones. *Agricultural Studies On Different Subjects*, Chapter VIII 257-291

Algül B.E., Tekintaş F.E., Dalkılıç G.G. (2016). Bitki büyüme düzenleyicilerinin kullanımı ve içsel hormonların biyosentezini arttırıcı uygulamalar. *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi* 13(2): 87–95.

Anjum, S.A., Xie, X., Wang, L., Saleem, M.F., Man, C., Lei, W. (2011). Morphological, physiological and biochemical responses of plants to drought stres. *Afr. J. Agric. Res.*, 6: 2026-2032.

Arora, A., Sairam, R. K., Srivastava, G. C. (2002). Oxidative stress and antioxidative system in plants. *Current science*, vol. 82, no. 10, pp. 1227-1238.

Bozcuk, S. & Topçuoğlu, Ş.F. (1982). Variation of abscisic acid (ABA) amount in plants under different stress conditions and adaptation mechanism to stress. *Natural Science Journal*, 6(3): 157-167.

Davies, P. J. (1995). The plant hormone concept: concentration, sensitivity and transport. In *Plant hormones* (pp. 13-38). Springer, Dordrecht.



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Desclaux D, Roumet P., (1996). Impact of drought stress on the phenology of two soybean (*Glycine max* L. Merr) cultivars. *Field Crops Research* 1996; 46(1-3): 61-70. doi: 10.1016/0378-4290(95)00086-0

Eker, S., (2002). Yapraktan Azot Uygulamasının Limon ve Mandarinde Düşük Sıcaklık Stresine Etkisinin Antioksidatif Savunma Mekanizmaları Açısından Araştırılması. (doktora tezi, basılmamış). Ç. Ü. Fen Bil. Enst., Adana, 148s.

Erdemli, H., Kaya, M. D. (2015). Ayçiçeği (*Helianthus annuus* L.)'nde Giberellik Asit Dozlarının Verim ve Abiyotik Stres Koşullarında Çimlenme Üzerine Etkileri. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, 24(1), 38-46.

Farooq, M., Wahid, A., Kobayashi, N., Fujita, D. B. S. M. A., ve Basra, S. M. A. (2009). Plant drought stress: effects, mechanisms and management. *Sustainable agriculture*, 153-188.

Griffiths, J., Murase, K., Rieu, I., Zentella, R., Zhang, Z.-L., Powers, S. J., Gong, F., Phillips, A. L., Hedden, P., Sun, T.-P. et al. (2006). Genetic characterization and functional analysis of the *GID1* gibberellin receptors in *Arabidopsis*. *Plant Cell* 18, 3399-3414.

Grigorova, Bilianna. Vaseva, Irina I. Demirevska, Klimentina. Feller, Urs.(2011) "Expression of Selected Heat Shock Proteins After Individually Applied and Combined Drought and Heat Stress." *Acta Physiol Plant* 33: 2041-2049.

Harris, P.M., 1992. The potato crop. The scientific basis for improvement. Chapman and Hall. p. 909

Juxiang, T., Guangling, L. (2004) Effects of GA-Ca₂(+) mixture solution on drought hardiness of cotton seeds. *Seed*, 4, 1.

Kabiri, R. (2010). Effect of salicylic acid to reduce the oxidative stress caused by drought in the hydroponic cultivation of *Nigella sativa* (*Nigella sativa*) (Doctoral dissertation, MA thesis, Kerman University Shahid Bahonar).

Kalefetoğlu, T., Ekmekçi, Y., (2005). The Effects Of Drought On Plants And Tolerance Mechanisms, *G.Ü. Fen Bilimleri Dergisi*, 18 (4), 723-740.

Kaya, M. D., Okçu, G., Atak, M., Cıkılı, Y., Kolsarıcı, Ö. (2006). Seed treatments to overcome salt and drought stress during germination in sunflower (*Helianthus annuus* L.). *European journal of agronomy*, 24(4), 291-295.

Kılıç, Y. (2007). The Effect of Phytohormones on Morphological Characteristics of Stalked Oak (*Quercus robur* L.) 1+0 Aged Sapling. Gazi University Graduate School of Natural and Applied Sciences. Undergraduate Thesis, Ankara. pp: 74.



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Kumlay A.M., Eryiğit T., (2011) Bitkilerde Büyüme ve Gelişmeyi Düzenleyici Maddeler: Bitki Hormonları. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi 1(2): 47-56

Kuşvuran Ş., (2010). Kavunlarda kuraklık ve tuzluluğa toleransın fizyolojik mekanizmaları arasındaki bağlantılar. Doktora Tezi, Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Bahçe Bitkileri Anabilim Dalı, Adana

Kusvuran S, Kıran S., Ellialtıoğlu S.S., (2016). Antioxidant Enzyme Activities and Abiotic Stress Tolerance Relationship in Vegetable Crops. In: Shanker AK, Shanker C (editors). Abiotic and Biotic Stress in Plants- Recent Advances and Future Perspectives, Intech, pp.481-506.

Leila, R., (2007). Response of Tunisian autochthonous peral millet to drought stress induced by polyethylene glycol 6000. African Journal of Biotechnology. 6: 1102-1105.

Li, Z., Lu, G.Y., Zhang, X.K., Zou, C.S., Cheng, Y. and Zheng, P.Y., (2010). Improving drought tolerance of germinating seeds by exogenous application of gibberellic acid (GA3) in rapeseed (*Brassica napus* L.), Seed Science and Technology, 38(2): 432-440.

Morgan P.W. (1990) Effects of abiotic stresses on plant hormone systems, in: Stress Responses in plants: adaptation and acclimation mechanisms, Wiley-Liss, New York, pp. 113–146.

Morsünbül, T., Solmaz, S.K.A., Üstün, G.E., Yonar, T. (2010). Environmental effects of plant growth regulators (BGD) and solution proposals. Journal of Uludag University Faculty of Engineering and Architecture, 15(1).

Nilsen, E. T. dan Orcutt, D. M.. (1996). Physiology of plant under stress abiotic factor. Virginia USA: Virginia Polytechnic Institute and State University.

Nonami, H. (1998). Plant water relations and control of cell elongation at low water potentials. Journal of Plant Research, 111(3), 373-382.

Okçu G, Kaya MD, Atak M 2005. Effects of Salt and Drought Stresses on Germination and Seedling Growth of Pea (*Pisum sativum* L.). Turkish Journal of Agriculture and Forestry, 29(4): 237-242

Olszewski N, Sun TP, Gubler F. 2002. Gibberellin signaling: biosynthesis, catabolism, and response pathways. Plant Cell 14(Suppl.):S61–80

Osakabe Y, Osakabe K, Shinozaki K, Tran LP. 2014. Response of plants to water stress. Front. Plant Sci., 5: Article 86.



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and RURAL DEVELOPMENT
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Ölçer, H., Demiral, T., Dilsiz, N. (2012). Kuraklık Stresi Koşullarında Nitrik Oksit Uygulamalarının Yerel ve Yabani Karpuz Genotiplerinin Gelişimi Üzerine Etkisi.

Öktüren F., Sönmez S., (2005) Bitki Besin Maddeleri ve Bazı Bitki Büyüme Düzenleyicileri (Hormonlar) Arasındaki İlişkiler. Derim. Batı Akdeniz tarımsal Araştırma Enstitüsü. 22 (2) 20:32.

Özcan, S., Babaoğlu, M., Gürel, E., (2004). Bitki Biyoteknolojisi Genetik Mühendisliği ve Uygulamaları. S.Ü. Vakfı Yayınları, Konya, 289s.

Öztürk, N.Z. (2015). Bitkilerin kuraklık stresine tepkilerinde bilinenler ve yeni yaklaşımlar. Türk Tarım-Gıda Bilim ve Teknoloji Dergisi, 3(5): 307-315.

Prasad, P.V.V., Pisipati, S.R., Momčilović, I. ve Ristic, Z., (2011). Independent and combined effects of high temperature and drought stress during grain filling on plant yield and chloroplast EF-Tu expression in spring wheat. Journal of Agronomy and Crop Science, 197, 430–441.

Roychoudhury, A., Paul, S., Basu, S. (2013). Cross-talk between abscisic acid-dependent and abscisic acid-independent pathways during abiotic stress. Plant cell reports, 32(7), 985-1006.

Ruelland, E., Vaultier, M. N., Zachowski, A., Hurry, V., (2009). Cold signalling and cold acclimation in plants. Advances in botanical research, 49, 35-150.

Shao HB, Chu LY, Jaleel CA, Manivannan P, Panneerselvam R, Shao MA (2009). Understanding water deficit stress-induced changes in the basic metabolism of higher plants-biotechnologically and sustainably improving agriculture and the ecoenvironment in arid regions of the globe. Crit. Rev. Biotechnol., 29: 131-151.

Taiz, L., Zeiger, E. (2006). Plant physiology/by Lincoln Taiz and Eduardo Zeiger (No. Libro 581.1 T3 (2006).).

Tripathi, P., Chandra, A., Prakash, J. (2019) Physio-biochemical assessment and expression analysis of genes associated with drought tolerance in sugarcane (Saccharum spp. hybrids) exposed to GA3 at grand growth stage. Plant Biology, 21(1), 45–53.

Vardar, Y. (1970). Introduction to Plant Physiology. Ege Univ. Faculty of Science Books Series, İzmir.

Vettakkorumakankav NN, Falk D, Saxena P, Fletcher RA (1999) A crucial role for gibberellins in stress protection of plants. Plant Cell Physiol 40:542–548



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and RURAL DEVELOPMENT
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Wang, W., Vinocur, B., and Altman, A. (2003). Plant responses to drought, salinity and extreme temperatures: towards genetic engineering for stress tolerance. *Planta*, 218(1), 1-14.

Wang, L., Zhang, T., Yang, J., Wu, D. & Zhang, S. (2005) Effects of seed treatment with calcium and gibberellin mixture on antioxidative enzyme activity of seed embryo under drought stress. *Agricultural Research in the Arid Areas*, 23(1), 125–128.

Wery J., Silim S.N., Knights E.J., Malhotra R.S., Cousin R. (1994) Screening techniques and sources and tolerance to extremes of moisture and air temperature in cool season food legumes, *Euphytica* 73, 73–83.

Xiong L, Zhu J: Molecular and genetic aspects of plant responses to osmotic stress. *Plant Cell Environ.* 2002; 25(2): 131–9.

Yaşar, F., (2003). Tuz Stresi Altındaki Patlıcan Genotiplerinde Bazı Antioksidant Enzim Aktivitelerinin in vitro ve in vivo Olarak incelenmesi (doktora tezi, basılmamış). Y.Y.Ü. Fen Bil. Enst., Van. 139 s.

Yaşar, F., Ellialtıoğlu, Ş., Yıldız, K., (2008a)., “Effect of salt stress on antioxidant defense systems, lipid peroxidation and chlorophyll content in green bean (*Phaseolous vulgaris* L.), *Russian Journal of Plant Physiology*, 55 (6): 1-5.

Yaşar, F., Ellialtıoğlu, Ş., Özpaya, T., Üzal, Ö., (2008b). Tuz Stresinin Karpuzda (*Citrullus lanatus* (Thunb.) Mansf.) Antioksidatif Enzim (SOD, CAT, APX ve GR) Aktivitesi Üzerine Etkisi. *Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi, Tarım Bilimleri Dergisi (Journal of Agricultural Science)*, 18(1):61-65.

Yaşar, F., Uzal, Ö., Özpaya, T., (2010). Changes of the lipid peroxidation and chlorophyll amount of green bean genotypes under drought stress, *African Journal of Agricultural Research* Vol. 5(19): 2705-2709.

Zeid I.M., Shedeed Z.A. (2006) Response of alfalfa to putrescine treatment under drought stress, *Biol. Plant.* 50, 635–640.



FÖTAL CİNSİYET VE FETÜS SAYISININ MATERNAL VÜCUT KONDÜSYONU ÜZERİNE ETKİSİNİN GENELLEŞTİRİLMİŞ TAHMİN DENKLEMLERİ (GTD) KULLANILARAK KESTİRİMİ

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ÖZET

Genelleştirilmiş Tahmin Denklemleri (GTD), tekrarlı ölçümlerle elde edilmiş nicel (sürekli /kesikli) veya nitel (nominal/ordinal) sonuç değişkenlerin analizinde kullanılan esnek bir regresyon modeli olarak tanımlanır. Bağımlı yapıdaki nitel sonuç değişkenler için, ayrıca normallik ve küresellik varsayımının sağlanmadığı durumlarda bağımlı nicel sonuç değişkenler için Tekrarlı Ölçümlerde Varyans Analizi'ne alternatif olarak kullanılmaktadır. Bu çalışmada, GTD'nin gerçek bir veri seti üzerinde uygulamasının gösterilmesi amaçlanmıştır. Buna yönelik olarak, keçilerde gebeliğin 100. gününde ve doğum esnasında ölçülen vücut kondüsyon skoruna (VKS) fetal cinsiyet ve fetüs sayısının etkisi GTD ile analiz edilmiştir. Çalışmanın hayvan materyalini entansif bir süt işletmesinde yetiştirilen, 2-5 yaş aralığında, en az bir kez doğum yapmış ve üreme mevsiminde gebe kalmış 70 baş Damascus keçisi oluşturmuştur. Keçilerin gebeliği çiftleşmeden sonraki 50. günde real time ultrason ile belirlenmiştir. Keçilerin vücut kondüsyonları, Mitchell (1986) tarafından geliştirilen 4'lü skora sistemine göre değerlendirilmiştir. Fetüs sayısı, tekiz ve çoğul gebelik olarak gruplandırılmıştır. Fetal cinsiyet, tekiz gebeliklerde dişi ve erkek; çoğul gebeliklerde tüm fetüsler dişi ise cinsiyet dişi, tüm fetüsler erkek ise cinsiyet erkek, hem dişi hem erkek fetüs mevcut ise cinsiyet karma olarak sınıflandırılmıştır. VKS bağımlı değişken olmak üzere, fetüs sayısı ve fetal cinsiyet bağımsız değişkenlerinin etkisi GTD modeli ile belirlenmiştir. İstatistiksel analizler SPSS 23.0 paket programında uygulanmıştır. GTD modeline göre VKS üzerinde ölçüm gününün ana etkisi istatistiksel olarak anlamlı iken ($p < 0,001$), fetüs sayısı ve fetal cinsiyetin ana etkisi istatistiksel olarak anlamlı bulunmamıştır. Ancak modelde (ölçüm günü*fetal cinsiyet) etkileşim terimi istatistiksel olarak anlamlı sınırdan anlamlı ($p = 0,054$); (ölçüm günü*fetal cinsiyet*fetüs sayısı) etkileşim terimi de istatistiksel olarak anlamlı ($p = 0,040$) bulunmuştur. Post hoc analizler sonucunda VKS; çoğul ve erkek gebeliklerde 100. Günde doğum sırasına göre daha yüksek bulunmuştur. Ayrıca doğum esnasında ölçülen VKS, tekiz erkek gebeliklerde çoğul erkek gebeliklere göre, çoğul dişi gebeliklerde çoğul erkek gebeliklere göre daha yüksek bulunmuştur. Sonuç olarak, bu çalışma ile GTD analizinin sağladığı avantajlar ve kullanımının hangi durumlarda uygun olduğu uygulamalı olarak gösterilmiştir. Ayrıca, veri yapısına ve dağılımına uygun istatistiksel analizlerin seçilmesinin önemi vurgulanmıştır.

Anahtar Kelimeler: Genelleştirilmiş Tahmin Denklemleri (GTD), Keçi, Vücut Kondüsyon Skoru, Fetal Cinsiyet, Fetüs Sayısı



ESTIMATION OF THE EFFECTS OF FETAL GENDER AND FOETUS NUMBER ON MATERNAL BODY CONDITION USING GENERALISED ESTIMATING EQUATIONS (GEE)

ABSTRACT

Generalized Estimating Equations (GEE) is defined as a flexible regression model used for analyzing repeatedly measured quantitative (continuous/discrete) or qualitative (nominal/ordinal) outcome data. GEE is often performed to analyze dependent qualitative outcome data, also used as an alternative to Repeated Measures ANOVA to analyze dependent quantitative outcome data when normality and sphericity assumptions are violated. In this study, it was aimed to show an application of GEE on a real database. Therefore, the effects of fetal gender and foetus number on body condition score (BCS) of goats on day 100 of pregnancy and during birth were analysed. The animal material of the study was 70 Damascus goats which were bred intensively in a commercial farm, aged 2-5 years, had given at least one birth, and become pregnant during the breeding season. Pregnancies were determined by real-time ultrasound on day 50 after mating. BCS was measured by a 4-point scoring system developed by Mitchell (1986). Foetus number is grouped as single and multiple pregnancies. Fetal gender is grouped for single pregnancies as female and male. For multiple pregnancies, if all foetuses are female the fetal gender was categorized as female, if all foetuses are male the fetal gender was categorized as male and if there are both female and male foetuses, fetal gender was categorized as mix gender. GEE model was performed to determine the effects of fetal gender and foetus number by taking the BCS measurements on day 100 and during parturition as the dependent variable. Statistical analyses were conducted with SPSS 23.0. According to the GEE model, the main effect of pregnancy day was statistically significant ($p < 0.001$), but the main effects of foetus number and fetal gender were not significant. However, the interaction term of (pregnancy day*fetal gender) was marginally significant ($p = 0.054$) and another interaction term of (pregnancy day*fetal gender*foetus number) was statistically significant ($p = 0.040$) in the model. As a result of post hoc analyses, BCS was higher in multiple/male pregnancies on day 100 compared to the parturition day. In addition, BCS was higher in single/male pregnancies compared to multiple/male pregnancies and in multiple/female pregnancies compared to multiple/male pregnancies on parturition day. In conclusion, the advantages of GEE and the situations where its usage is appropriate were shown in this study. Additionally, the importance of the use of suitable statistical methods for the data structure and distribution was emphasized.

Keywords: Generalized Estimating Equations (GEE), Goat, Body Condition Score, Fetal Gender, Foetus Number



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1. GİRİŞ

Sağlık alanında yapılan bilimsel araştırmalarda bağımlı değişkenler ile bağımsız değişken veya değişken grupları arasındaki ilişkiyi açıklamak amacıyla sıklıkla regresyon analizi yöntemine başvurulmaktadır. Ancak regresyon analizinde, verilerin bağımsızlığı ve normal dağılımını gerektiren kullanımı kısıtlayıcı varsayımlar söz konusudur. Genelleştirilmiş Tahmin Denklemleri (GTD), tekrarlı ölçümlerle elde edilmiş yani bağımlı yapıdaki nicel (sürekli /kesikli) veya nitel (nominal/ordinal) sonuç değişkenlerin analizinde kullanılan esnek bir regresyon modeli olarak tanımlanır (Hubbard ve ark., 2010). Bağımlı yapıdaki nitel sonuç değişkenler için, ayrıca normallik ve küresellik varsayımının sağlanmadığı durumlarda yine bağımlı yapıdaki nicel sonuç değişkenler için Tekrarlı Ölçümlerde Varyans Analizi'ne alternatif olarak kullanılmaktadır.

GTD yöntemi ilk olarak Liang ve Zeger (1986) ile Zeger ve Liang (1986) tarafından bağımlı kesikli ve sürekli yapıdaki nicel değişkenleri analiz edebilmek üzere geliştirilmiştir. Bu yöntem daha sonra bağımlı ikili (dikotom) verilerin ve bağımlı ordinal verilerin analizinde kullanılacak şekilde genişletilmiştir (Qu ve ark., 1992, Clayton, 1992). Farklı pek çok yapıdaki verilerin analizinde kullanılabilen ve katı varsayımlar gerektirmeyen bir yöntem olması nedeniyle araştırmacılar tarafından sıklıkla tercih edilmeye başlanan bir yöntem olan GTD, yalnızca bağımlı sonuç değişkenler arasındaki korelasyon yapısının belirlenmesi esasına dayanmaktadır (Nooraee ve ark, 2014).

Vücut Kondüsyon Skoru (VKS), canlı bir hayvandaki toplam kas ve yağ kütlesini ifade eden bir belirteç olarak kullanılmaktadır. Sütçü keçilerde, vücut kondüsyonunun süt üretimi, fertilité, yem tüketimi ve genel sağlık durumu üzerinde önemli bir etkisi olduğu, ayrıca hayvanın reproduktif etkinliği ile pozitif yönde ilişkili olduğu bilinmektedir (Koyuncu ve Altınçekiç, 2013). Çok yüksek VKS gebelik toksemisi, karaciğer yağlanması, plasental retensiyon ve güç doğuma, düşük VKS ise düşük yavru sağkalımına ve düşük süt verimine neden olmaktadır.

Bu çalışmada, GTD'nin gerçek bir veri seti üzerinde uygulamasının gösterilmesi amaçlanmıştır. Buna yönelik olarak, keçilerde gebeliğin 100. gününde ve doğum esnasında ölçülen vücut kondüsyon skoruna (VKS) fetal cinsiyet ve fetüs sayısının etkisi GTD ile analiz edilmiştir.



2. GEREÇ VE YÖNTEM

Çalışmanın hayvan materyalini entansif bir süt işletmesinde yetiştirilen, 2-5 yaş aralığında, en az bir kez doğum yapmış ve üreme mevsiminde gebe kalmış 70 baş Damascus keçisi oluşturmuştur. Keçilerin gebeliği çiftleşmeden sonraki 50. günde real time ultrason ile belirlenmiştir. Çalışma sırasında çeşitli sebeplerden dolayı abort yapan 6 baş keçi çıkarıldıktan sonra, çalışma 64 baş keçi ile tamamlanmıştır. Fetüs sayısı değişkeni, tekiz ve çoğul gebelik olarak gruplandırılmıştır. Fötal cinsiyet değişkeni, tekiz gebeliklerde dişi ve erkek; çoğul gebeliklerde tüm fetüsler dişi ise cinsiyet dişi, tüm fetüsler erkek ise cinsiyet erkek, hem dişi hem erkek fetüs mevcut ise cinsiyet karma olarak sınıflandırılmıştır.

Keçilerin vücut kondüsyonları, Mitchell (1986) tarafından geliştirilen 4'lü skarlama sistemi ile ölçülmüştür. Bu skarlama, vertebranın bel bölgesindeki çıkıntıların palpasyonundaki etlilik derecesine göre en düşük 1, en yüksek 4 olacak şekilde yapılmıştır. Buna göre 1: çok zayıf, 2: zayıf, 3: orta, 4: yağlı vücut kondüsyonu olarak skorlanmaktadır.

Çalışmanın istatistiksel analizleri SPSS 23.0 paket programında GENLIN prosedürü kullanılarak yapılmıştır. Tanımlayıcı istatistikler ortalama±standart hata şeklinde gösterilmiştir. VKS bağımlı değişken olmak üzere, fetüs sayısı ve fötal cinsiyet bağımsız değişkenlerinin etkisi Genelleştirilmiş Tahmin Denklemleri (GTD) modeli ile belirlenmiştir. Ayrıca ortalama VKS değerlerinde gebeliğin 100. günü ile doğum sırasında ölçülen değişim de modelde değerlendirilmiştir.

Modelde ölçüm zamanı, fetüs sayısı ve fötal cinsiyet faktörlerinin yanı sıra, (ölçüm zamanı*fetüs sayısı), (ölçüm zamanı*fötal cinsiyet), (fetüs sayısı*fötal cinsiyet) ve (ölçüm zamanı*fetüs sayısı*fötal cinsiyet) etkileşim terimlerinin anlamlı olup olmadığı da değerlendirilmiştir. İstatistiksel anlamlılık sınırı $p < 0,05$ olarak kabul edilmiştir.

3. BULGULAR

VKS bağımlı değişken olmak üzere kurulan GTD modelinde, ölçüm günü faktörünün ana etkisi istatistiksel olarak anlamlı bulunurken ($p < 0,001$), fetüs sayısı ve fötal cinsiyet faktörlerinin ana etkileri anlamsız bulunmuştur (sırasıyla, $p = 0,213$, $p = 0,764$). Modeldeki etkileşim terimleri incelendiğinde ise (ölçüm günü*fötal cinsiyet) etkileşim terimi istatistiksel olarak sınırda anlamlı ($p = 0,054$), (gün*ikizlik*cinsiyet) teriminin istatistiksel olarak anlamlı olduğu ($p = 0,040$) görülmüştür.



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Tablo 1: Ölçüm günü, fetüs sayısı ve fotal cinsiyete göre ortalama VKS değerleri (Ortalama±Standart Hata)

	Fetüs sayısı	Fötal cinsiyet	VKS ölçüm günü	
			100. gün	Doğum sırası
VKS	Tekiz gebelik	Dişi	2,78±0,28	2,61±0,30
		Erkek	2,91±0,16	2,68±0,26 ^A
	Çoğul gebelik	Dişi	2,64±0,20	2,64±0,21 ^x
		Erkek	2,73±0,18 ^a	1,97±0,21 ^{b,y}
		Karma	2,83±0,19	2,39±0,18

a,b: Farklı harfler ölçüm günleri arasındaki istatistiksel farkı ifade etmektedir.

A,B: Farklı harfler tekiz gebelik ve çoğul gebelik arasındaki istatistiksel farkı ifade etmektedir.

x, y: Farklı harfler dişi, erkek ve karma fetüsler arasındaki istatistiksel farkı ifade etmektedir.

Gebeliğin 100. Gününde ve doğum sırasında, tekiz ve çoğul gebeliklerde ve ayrıca dişi, erkek ve karma fetüs bulunması durumunda ölçülen ortalama VKS değerleri Tablo 1 'de gösterilmiştir. Post hoc analizlere göre çoğul gebeliklerde, erkek fetüslerde gebeliğin 100. gününde ölçülen ortalama VKS, doğum sırasında ölçülen ortalama VKS'ye göre daha yüksek bulunmuştur. Erkek fetüslerde, doğum sırasında ölçülen ortalama VKS, tekiz gebeliklerde çoğul gebeliklere göre daha yüksek bulunmuştur. Son olarak çoğul gebeliklerde, doğum sırasında ölçülen ortalama VKS, fotal cinsiyet erkek olan grupta fotal cinsiyetin dişi olduğu gruba göre daha düşük bulunmuştur.

4. TARTIŞMA

Çalışma kapsamında keçilerde gebeliğin 100. Gününde ve doğum sırasında ölçülen VKS üzerine; ölçüm günü, fetüs sayısı ve fotal cinsiyetin etkisi GTD yaklaşımı ile incelenmiştir. Buna göre, tekiz gebeliklerde VKS'nin 100. Gün ölçümleri ile doğum sırası ölçümleri arasında herhangi bir fark olmadığı, ayrıca dişi fetüs taşıyan anneler ile erkek fetüs taşıyan anneler arasında da anlamlı farklılığa rastlanmadığı görülmüştür. Ek olarak 100. Gündeki VKS ölçümlerinin fetüs sayısı ve fotal cinsiyetten etkilenmediği belirlenmiştir. Buna karşın, doğum sırasındaki VKS ölçümlerinin çoğul gebelikler tek başına değerlendirildiğinde dişi fetüs taşıyan annelere göre erkek fetüs taşıyan annelerde düşüş gösterdiği, erkek fetüs taşıyan anneler tek başına değerlendirildiğinde ise tekiz gebeliklere göre çoğul gebeliklerin düşüş gösterdiği belirlenmiştir. Ayrıca tüm fetüsler erkek olduğunda çoğul gebeliklerde doğum sırası VKS'nin 100. Güne göre yine düşüş gösterdiği görülmüştür.

Genel olarak çoğul ve erkek gebeliklerin özellikle gebeliğin son trimesterinde annedeki VKS düşüşüne neden olduğu yorumu yapılmıştır. Keçilerde bu bulguyu destekleyen herhangi bir



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literature rastlanmamasına rağmen, insan çalışmalarında erkek fetüs taşıyan annelerde gebelik diyabeti riskinin yüksek olabileceğini gösteren çalışmalar mevcuttur (Retnakaran ve ark., 2015, Geng ve ark., 2017). Bu çalışmalarda, fetal cinsiyetin annedeki glukoz metabolizmasını etkileyebileceği öngörülmüştür. İnsanda gebelik diyabeti şekillenen dönem ve oluşma mekanizması göz önünde bulundurulduğunda, keçilerde gebeliğin ileri döneminde şekillenebilen hiperglisemik gebelik toksemisi ile benzer özellikler taşıdığı düşünülebilir (Marteniuk ve Herdt, 1988). Çalışmamızda gebelik toksemisi VKS'yi etkileyen parametreler arasında değerlendirilmemiştir ancak çoğul gebeliğe sahip ve erkek fetüs taşıyan annelerin VKS'indeki belirgin düşüşün nedeninin gebelik toksemisi sırasında şekillenen yağ mobilizasyonu olabileceği yorumu yapılabilir.

Çalışmada ortaya konulan fizyolojik sonuçların yanı sıra, istatistiksel olarak veri yapısına uygun yöntemin seçilmesinin de önemi de vurgulanmak istenmiştir. 1-4 puan arası skorlama sistemine sahip olan ordinal yapıdaki VKS bağımlı değişkeni hem nicel bir değişken olmaması nedeniyle regresyon analizi veya varyans analizi yöntemleri için uygun değildir. Bunun yanı sıra VKS ölçümlerinin aynı hayvandan gebeliğin 100. Gününde ve gebelik sırasında olmak üzere iki kez alınmış olması, regresyon analizinde verilerin bağımsızlığı varsayımını sağlamamaktadır. Böyle bir durumda regresyon analizi yanlış ve hatalı sonuçların elde edilmesine neden olacaktır. Bu nedenle çalışmamızda uygulandığı üzere GTD gibi varsayım gerektirmeyen esnek modellerin kullanımı sonuçların güvenilirliğini artıracaktır.



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KAYNAKLAR

Hubbard AE, Ahern J, Fleischer NL, Van der Laan M, Lippman SA, Jewell N, Bruckner T, Satariano WA. To GEE or not to GEE: comparing population average and mixed models for estimating the associations between neighborhood risk factors and health. *Epidemiology*. 2010 Jul;21(4):467-74. doi: 10.1097/EDE.0b013e3181caeb90. PMID: 20220526.

Liang, K. Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika*, 73(1), 13-22.

Zeger, S. L., & Liang, K. Y. (1986). Longitudinal data analysis for discrete and continuous outcomes. *Biometrics*, 121-130.

Qu, Y., Williams, G. W., Beck, G. J., & Medendorp, S. V. (1992). Latent variable models for clustered dichotomous data with multiple subclusters. *Biometrics*, 1095-1102.

Clayton, D. (1992). Repeated ordinal measurements: A generalised estimating equation approach. *Medical Research Council Biostatistics Unit Technical Report*. Cambridge, England.

Noorae, N., Molenberghs, G., & van den Heuvel, E. R. (2014). GEE for longitudinal ordinal data: comparing R-geepack, R-multgee, R-repolr, SAS-GENMOD, SPSS-GENLIN. *Computational Statistics & Data Analysis*, 77, 70-83.

Koyuncu, M., & Altınçekiç, Ş. Ö. (2013). Importance of body condition score in dairy goats. *Macedonian Journal of Animal Science*, 3(2).

Mitchell, T. D. (1986). Condition scoring goats. Agfact A7. 2.3. *Agriculture New South Wales: Sydney*.

Retnakaran R, Kramer CK, Ye C, Kew S, Hanley AJ, Connelly PW, Sermer M, Zinman B. Fetal sex and maternal risk of gestational diabetes mellitus: the impact of having a boy. *Diabetes Care*. 2015 May;38(5):844-51. doi: 10.2337/dc14-2551. Epub 2015 Feb 18. PMID: 25693837.

Geng X, Geng L, Zhang Y, Lu H, Shen Y, Chen R, Fang P, Tao M, Wang C, Jia W. Fetal sex influences maternal fasting plasma glucose levels and basal β -cell function in pregnant women with normal glucose tolerance. *Acta Diabetol*. 2017 Dec;54(12):1131-1138. doi: 10.1007/s00592-017-1055-1. Epub 2017 Nov 2. PMID: 29098391.

Marteniuk, J. V., & Herdt, T. H. (1988). Pregnancy toxemia and ketosis of ewes and does. *Veterinary Clinics of North America: Food Animal Practice*, 4(2), 307-315.



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**NANO-LC KROMATOĞRAFİSİ: GIDA BİLİMİ VE GIDA ANALİZİNE YENİ BİR
BAKIŞ**

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ÖZET

Minyatürize LC, ayırma bilimi ve teknolojisindeki ileri analitik kimya analizlerinde yüksek performans potansiyeli nedeniyle klasik LC tekniklerine alternatif olarak etkili ve trend bir araç haline gelmiştir. Ayırma bilimindeki hızlı gelişme, nano-sıvı kromatografisi gibi gelişmiş kromatografi çeşitleri ile sonuçlanmıştır. Sıvı kromatografisinin gelişimi, yüksek performanslı sıvı kromatografisi (HPLC), ultra yüksek performanslı sıvı kromatografisi (UHPLC), kapiler LC'nin geliştirilmesi ve son zamanlarda nano-LC'nin geliştirilmesi ile devam etmiştir. Nano-sıvı kromatografisi (nano-LC) ve kılcal elektroforez kromatografisi, çoğunlukla analitik amaçlar için kullanılan mikro akış teknikleridir. Diğer kromatografi yöntemlerine kıyasla nano-LC yöntemleri, mikro akış hızı sayesinde yeşil kimya ilkeleri doğrultusunda solvent tüketimini azaltarak hem çevresel etkiyi hem de analiz maliyetini düşürür. Az miktarda reaktif kullanımı, etkili verim, daha kısa numune hazırlama süresi ve özellikle akış ayırıcı ile akış hızı ayarı nano-LC'nin diğer önemli avantajlarıdır. Ek bir avantaj olarak, yüksek ayırma verimliliği sağladığı bilinen 3-5 µm veya daha küçük partikül boyutuna sahip ters fazlı C18 sorbentleri gibi HPLC için yaygın olarak bulunan sabit fazları kullanma fırsatıdır. Proteomik ve metabolomik karışımlar gibi örneklerdeki esansiyel moleküller, varyant proteinler, lipidler, bitki-omik ve gıdaların yanı sıra minyatür kromatografi, moleküler toksikoloji ve ilaçların tanımlanması için önemli bir metod haline gelmiştir. Nano-LC yöntemlerinin en yaygın uygulaması proteomiklerdir. Günümüzdeki geleneksel HPLC ve UHPLC ile analiz edilen tüm numune türlerinin nano-LC yöntemleriyle de analiz edilebilmesinin temel yararına rağmen, gıda analizinde nano-LC yöntemleriyle ilgili yayınların sayısı önemli ölçüde düşüktür. Bugüne kadar gıda güvenliği kontrolü amacıyla sütte antibiyotik ve veteriner ilaç kalıntıları, sebze, meyve, bebek mamaları, zeytin ve zeytinyağında pestisit analizleri; fındık ve fındık ürünlerindeki mikotoksinler; balda ve polende bulunan insektisitler ve pestisitler gibi gıda kontaminantları analizleri gerçekleştirilmiştir. Avantajları nedeniyle yakın gelecekte sadece gıda güvenliğinde değil, diğer tüm gıda analizlerinde minyatürize LC yönteminin yoğun ilgi göreceği öngörülmektedir.

Anahtar Kelimeler: Minyatürize LC, Nano-LC, Monolitik Kolon, Foodomik, Proteomik



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**NANO-LC CHROMATOGRAPHY: A NEW PERSPECTIVE OF FOODOMICS AND
FOOD ANALYSIS**

ABSTRACT

Miniaturized LC has become an effective and trend tool as an alternative to classic LC methods due to its high performance probable in their analysis in advanced analytical chemistry in separation science and technology. The rapid improving in separation science has resulted in the availability of advanced varieties of chromatography such as nano-liquid chromatography. The development of liquid chromatography has continued with high-performance liquid chromatography (HPLC), ultra-high-performance liquid chromatography (UHPLC), elaboration of capillary LC, and recent enhancement of nano-LC. Nano-liquid chromatography (nano-LC) and capillary electrophoresis chromatography are microflow techniques mostly used for analytical purposes. Compared to other chromatography methods, nano-LC methods reduce solvent consumption in line with green chemistry principles due to micro flow rate, reducing both environmental impact and analysis cost. The use of a small amount of reagent, good efficiency, shortened sample preparation time and especially flow rate adjustment with flow separator are other essential advantages of nano-LC. An additional advantage is the opportunity to use stationary phases that are commonly available for HPLC, such as reversed phase C18 sorbents with 3-5 μm or smaller particle size, which are known to enable high separation efficiency. Miniaturized chromatography has become an important basis for the identification of proteins, lipids, foods, phytoomics, molecular toxicology, and drugs. The most common application of nano-LC methods is proteomics. Despite the main benefit that all sample types currently analyzed by conventional HPLC and UHPLC can also be analyzed by nano-LC methods, the number of publications on nano-LC methods in food analysis is significantly low. Up to the present, analyses of antibiotics and veterinary drugs residues in milk, pesticides in vegetables, fruits, baby foods, olive and olive oil; mycotoxins in nuts and their products; insecticides and pesticides in honey and pollen have been carried out as a food contaminants for food safety control. It is foreseen that, because of its advantages, it will attract intensive attention the miniaturized LC method not only in food safety but also in all other food analysis in the near future.

Keywords: Miniaturized LC, Nano-LC, Monolithic column, Foodomics, Proteomics



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INTRODUCTION

The latest in technological developments in the last decade has accelerated the development of suitable conditions for working at the miniature liquid chromatography (capillary and nano-LC). Key features of miniaturized LC include superior resolution and high sensitivity, less reagent use and sample requirement, reduction in analytical column diameters over conventional LC. Recently, a lot of researches have been described fundamental sight and progresses on miniaturized LC technology related to different food analysis, food safety and foodomics.

Historical Development of Chromatography

Chromatography is essentially a physical separation and purification technique that allows compounds in a mixture to be separated by their distribution between two immiscible phases. One of these phases is the stationary phase, which is in the form of a porous bed, sheet or film is generally stationary; the other is the mobile phase flowing over this phase through the stationary phase. Chromatography is a fundamental process that enables their separation based on the dispersion balances or selective interactions between these two phases, and also performs qualitative and quantitative analyzes of these substances [1,2]. The term chromatography, which consists of the words "khramoma" (color) and "graphe" (writing), is of Greek origin and means "color writing" [3]. The chronological evolution of chromatography dates back to 1848. Wal and Thompson stated that ion exchange is possible in solids, in 1848. Between 1850 and 1900, the German chemist Runge used filter paper and a solvent for the separation of different colored dyes. This technique is known as paper chromatography, which is still applicable today. It was noted for the first time that column-assisted separations could be possible and used caloin-containing columns to separate iron-3-chloride from copper sulfate by Reed in 1892. Chromatography was first used in 1906 as a strong technique in defining and measurement of biochemical molecules since using the Russian botanicist Mikhail Tswett in the distinction of plant pigments (chlorophyll) [3,4]. Then by, after a 25-year period of recession, chromatography started to be rediscovered with the increasing interest of organic chemists in natural products [5]. In 1935, Holmes and Adams synthesized organic ion exchange resins, this was followed by Reichstein's research on elution chromatography [6]. In 1967, Huber and Hulsman laid the foundations of high-pressure liquid chromatography with advances in column technology, high-pressure pump systems, and the use of sensitive detectors [7]. In chromatography, the properties of molecules such as adsorption, dispersion and exchange play



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an active role. According to these features, chromatographic methods are grouped in different groups according to their separation mechanism, enforcement of method and phase types [8].

Liquid Chromatography

Chromatographic separation is performed between two different phases, one mobile and the other stationary. According to type of phase, if mobile phase is liquid and stationary phase is solid, method is called the liquid chromatographic method [9]. Liquid chromatography (LC) is a strong separation technique, that resolves mixtures containing numerous of similar analytes. In LC, the sample is pumped through a column containing the stationary phase and is separated between the mobile phase and the stationary phase. Analytes come in sight, as peaks with a Gaussian distribution of their concentration in the mobile phase [10]. In the first half of the 20th century, studies were carried out to develop liquid chromatography (LC), but in later periods, it showed a slower development due to technological limitations due to the high back pressure created by the small solid particles placed in the analytical column. In the next century, studies on the solution of all possible problems related to the miniaturization technique and its practical application continued and took its final form today [12].

Miniaturized Liquid Chromatography

In the 21st century, there has been a detonating development in miniaturized liquid chromatography (LC) concerning to analytical systems [13]. Microbiodegradation studies in chromatographic systems have picked speed thanks to developments in miniaturization technology such as capillary LC (cLC) and nano LC (Nano-LC) [14,17]. The same stationary phase, mobile phase and same separation mechanisms used in conventional chromatography can be applied in microflow chromatographic systems, which have similar principles with the conventional chromatography method. Nevertheless due to the use of columns with a very thin inside diameter, a special column system must be used [18]. Nano LC technology developed for this purpose is based on new approaches in the molecular analysis of a wide range of substances containing molecules of different sizes. As a new trend in analytical separation science, nano LC plays an important role in many of today's compelling issues. Capable of effectively separating very small amounts of various samples (eg <1 ng of analyte) from biological samples, nano LC also plays an important role in many of today's challenging problems. While there are different reasons why nano LC has become a more comprehensive tool for various complex molecules, miniaturization of LC systems relies on improving analysis speed and reducing the amount of sample required and reagent used [13,19].



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In conventional HPLC (4.6 mm i.d.) the flow rate is 1000–1200 $\mu\text{L}/\text{min}$, while in nano LC (75 μm i.d.) it is 0.250–0.300 $\mu\text{L}/\text{min}$. This ratio (4000 times) reflects the scale factor between 4.6 mm ID and can result in the same linear velocity for both columns. Another important consideration for tubing is the inner diameter, the tubings (20 μm) in nano LC are approximately 10 times smaller when the inner diameters are compared. Usually in capillary and micro LC, 50 and 75 μm i.d. tubing is used. The best results can be obtained when the appropriate tubing is connected correctly. In this way, assembly process can be taken without tools without the risk of dead space or capillary breakage during columns and connection. Thus, nano LC greatly facilitates downscaling in the entire analysis without sacrificing other capabilities [20].

In nano-LC, the flow rates used for analysis are fairly low (50-800 nL/min). Modified silica particles filled in capillary columns are widely used as the stationary phase, and successful results are also acquired in monolithic materials as an alternative. Thanks to these developed columns, lower back pressure and controlled porosity can be achieved. In addition, a better separation mechanism can be developed with the selection of a suitable chemical reagent. Packed capillary columns largely contain silica particles modified either by chemical reactions or by the coating process. Among them, C18, C8, CN, phenyl-hexyl, vancomycin, teicoplanin or cyclodextrin or amylose-linked silica, adsorbed cellulose derivatives etc. exists [18]. Classification of miniaturized LC variants is usually based on the range of mobile phase flow rates (μL to nL) and the internal diameter (column identity) characteristic of the chromatographic column. Three LC modes are usually considered: micro-LC, capillary LC and nano-LC[21-23]. Result of this classification, typically, the miniaturized chromatographic columns can be classified into two major groups: the filled (packed and monolithic) columns, and the open tubular (porous layer, open tubular and wall-coated open tubular) columns [24]. Table 1 shows the i.d. of the analytical column and correspondingly varying flow rates of all LC column types. Nowadays, this classification is one of the most favored in miniaturized LC [21,22].



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Table 1 Flow rates of LC chromatographs by column type [24]

Column i.d. (mm)	Flow rate (mL min ⁻¹)	Type
4.6-3.2	2.0-0.5	HPLC
3.2-1.5	0.5-0.1	Microbore LC
1.5-0.5	0.1-0.01	Micro LC
0.5-0.15	0.01-0.001	Capillary LC
0.15-0.01	0.001-0.0001	Nano LC
0.05-0.005	<0.0001	Open Tubular LC

Apart from the monolithic columns, which are most commonly used in nano-LC applications, analyzes are also performed on packaged, open tubular capillary columns. In recent years, monolithic stationary phases have been developed to be applied in micro-separation systems such as cLC, CEC and Nano-LC for analyzes at molecular scale [25–28]. There has been high interest in monolithic columns due to their unique features such as low back pressure, easy preparation, high loading capacity and fast mass transfer. Many studies have been conducted on the applications of polymer, silica and hybrid based monolithic columns [29–32]. Studies have shown that polymer-based monoliths, including polymethacrylate, polyacrylamide and polystyrene, have good biocompatibility and excellent pH stability. Among these monoliths, polymethacrylate-based monolithic columns (PMMCs) have a rapidly advancing field in the preparation of monolithic stationary phases [33]. Chiral separations, affinity chromatography for bioanalysis, and in biomolecular domains monolithic columns are used. On the other hand, despite its wide range of applications, monolithic columns have some disadvantages: swelling possibility in organic solvents, negative changes in pore structure and mechanical instability [34-37].

The advantages of nano-LC methods are numerous. Due to the reduced flow rates, consumption of solvents is decreased [38-40] in line with the green chemistry principles, reducing both the environmental impact and the cost of analysis. An additional advantage is the opportunity to use stationary phases that are commonly available for HPLC, such as reversed phase C18 sorbents with 3-5 μm or smaller particle size, which are known to enable high separation efficiency [41].



Applications of Nano- LC Technique in Foodomics

Recently, it is seen that various studies have been carried out in the literature for miniaturized systems in many different areas such as environmental, biological, food and ohmic [42-45]. In molecular biology, "omics" is used to mean the study of large-scale changes in an organism's genomics, proteomics, metabolomics, and lipidomics [13]. In the last 20 years, there have been great developments in different fields due to the development of high-efficiency omic technologies. The four main classes of omics, genomics, transcriptomics, proteomics, and metabolomics, and their various sub-disciplines of omics, epigenomics, lipidomics, interactomics, metallomics, disease science, etc. branches emerged [46]. The foodomics approach has become more popular in the last 20 years, owing to the developing miniaturized chromatography techniques (Figure 1).

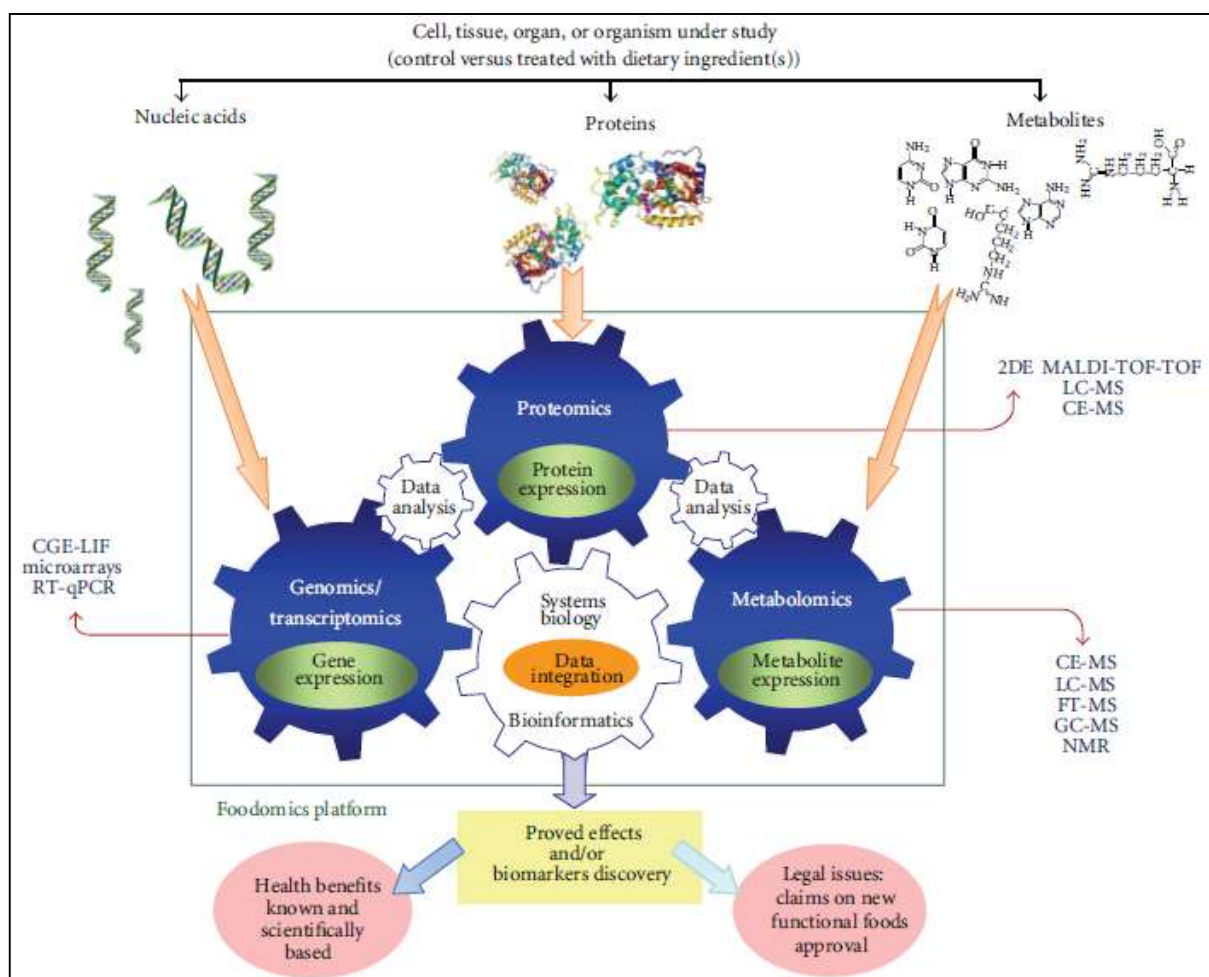


Figure 4 Scheme of an ideal foodomics platform [47]



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Foodomics can be described as a discipline that including the food and nutrition domains through the application of advanced omics technologies to improve consumer's beneficence, health, and knowledge [47-49]. As mentioned above, due to the essential advantages of Nano-LC, has become one of the most remarkable techniques of recent times in foodomics especially for food quality and safety, food traceability and food-borne pathogens. Moreover, food quality is increasingly compromised by a series of procedures aimed to obtain illegal higher profits. Among them, adulteration and artificiality are the most often used, for instance addition of seed oil to olive oil, synthetic amino acids to fruit juices, dextrose syrup to honey, addition of color agents to spices, butter and tea etc. These ingredients reduce food quality and value. Therefore, find out of these frauds gives rise to a continuous challenge in the analytical field [50].

Analytical research has always been necessary for foods that have been reported to contain so-called nutraceutical ingredients, which have recently increased in market availability. Another controversial issue related to food quality control is to verify the possible presence of genetically modified organisms (GMOs). At the same time, it is worth noting that promoting the functional food market also increases the exchange of food products. Even if in each country food industries are depended to the control of restrictive agencies, such as Codex Alimentarius Commission for European Community and Food and Drug Administration for United States, there are no global parameters to determine food quality, so that a continuous food control is necessary [51].

Today, 1000 or more compounds can be physically separated with a single operation by nano-LC columns [52-54]. Table 2 lists recent literature sources reporting the applications of miniaturized methods for the analysis of various contaminants and drug residues relevant to food safety, as well as some applications for environment sample analysis.



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Table 2 Applications of miniaturized methods on some foods

Miniaturized Analytical Technique	Sample	Compounds Class	Reference
Nano LC	Edible nuts (peanuts, pistachios, almonds)	Mycotoxins	[55]
Nano LC	Tomato	Pesticides	[56]
Capillary LC	Wine	Herbicides	[57]
Capillary LC	Cheese	Biogenic amines	[58]
Nano LC	Egg yolk	Hormones	[59]
Capillary LC	Beverages	Benzodiazepines	[60]
Nano LC	Honey	Veterinary drugs	[61]
Nano LC	Baby Food	Pesticides	[56]
Capillary LC	Vegetarian oyster sauces and soy sauces	Parabens	[62]
Capillary LC	Milk	Anthelmintics	[12]
Nano-LC	Pasteurized bovine milk	Antibiotics (sulfonamides)	[63]
Nano-LC	Olive oil	Multiclass pesticides	[64]
Nano-LC	Pollen	Insecticides and pesticides	[65]
Nano-LC	Peanut products (peanuts, peanut butter, peanut powder)	Aflatoxins	[66]

CONCLUSION

This review, intend to give recent selected foodomics applications using miniaturized LC. Food analysis constitutes one of the most important fields of study for evaluating and characterization food ingredients and demonstrating of beneficial effect of human health. A great many studies have provided encouraging results for the application of nano-LC methods in food safety and environmental sample analysis. Capillary and nano liquid chromatography have ensured substantial advances in biological, food, environmental, and other fields. Major studies have been done in miniature LC for effective separation efficiency, lower toxic solvent consumption and waste manufacture and hence green chemistry approach. Capillary and nano-LC applications emphasize their advantages and drawbacks as well as the future trends on using this approach in the analysis of complex and new ingredients, therefore foodomics hopes important outcomes related to food science and nutrition in the future.



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REFERENCES

- [1] Konak, Ü.İ., Turhan, İ., Certel, M. (2014). Proteinlerin Kromatografik Yöntemlerle Saflaştırılması. Akademik Gıda. 12(2), 79-87.
- [2] Emekdaş, G., Güngör, S., Gün, H., Kocabeyoğlu, Ö. (1990). Kromatografik Yöntemler. Gaziantep Üniversitesi Tıp Fakültesi.1, 108-118.
- [3] Eser, B.; Sepici Dincel, A. (2018). Kromatografiye Giriş, Yüksek Performanslı Sıvı Kromatografi Kullanımında Basit İpuçları. Journal of Health Services and Education. 2(2), 51-57.
- [4] Tswett, M. (1906). On a New Category of Adsorption Phenomena and Their Application to Biochemical Analysis. Ber. Deutsch. Bot. Ges. 24, 384-393.
- [5] Sezen, H. (2010). Tiyokolşikosid Tayininde Hızlı Sıvı Kromatografisi (UPLC) Yönteminin Geliştirilmesi. Uludağ Üniversitesi, Yüksek Lisans Tezi.
- [6] Fahey, J.L., Terry, E.W. (1979). Ion Exchange Chromatography and Gel Filtration. Immunochemistry. Third Edition, 8-1.
- [7] Ettre, L.S. (1971). The development of chromatography, Anal. Chem. 43, 20A-31A.
- [8] J.C. Giddings (1965). Comparison of theoretical limit of separating speed in gas and liquid chromatography, Anal. Chem. 37, 60-63.
- [9] A.J.P. Martin, Synge, R.L.M. (1941). A new form of chromatogram employing two liquid phases. Biochem. J. 35, 1358-1368.
- [10] Aydoğan, C. (2020). Liquid chromatography-high resolution mass spectrometry for the analysis of bioactive natural products. Studies in Natural Products Chemistry. 66, 331-353.
- [11] Golay, M.J.E. (1957). Vapor phase chromatography and telegrapher's equation. Anal. Chem. 29, 928-932.
- [12] Vasconcelos Soares Maciel, E., Lúcia de Toffoli, A., Sobieski, E., Eduardo Domingues Nazario, C., Mauro Lanças, F. (2020). Miniaturized liquid chromatography focusing on analytical columns and mass spectrometry: A review. Analytica Chimica Acta. 1103, 11-31.
- [13] Aydoğan, C., Rigano, F., Krčmová, L.K., Chung, D.S., Macka, M., Mondello, L. (2020). Miniaturized LC in Molecular Omics. Anal. Chem. 92, 11485–11497.
- [14] Svec, F., Peters, E. C., Sykora, D., Frechet, J. M. J., J. (2000). Chromatogr. A. 887, 3–29.



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and RURAL DEVELOPMENT
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- [15] Fanali, S., Catarcini, G., Blaschke G., Chankvetadze, B.(2001). Electrophoresis. 22, 3131–3151.
- [16] Bedair, M., El Rassi, Z., J. (2005). Chromatogr. 1079, 236–245.
- [17] Borges, J. H., Aturki, Z., Rocco, A., Fanali, S. (2007). J. Sep. Sci. 30, 1589–1610.
- [18] Fanali, S.(2017). An overview to nano-scale analytical techniques: Nano-liquid chromatography and capillary electrochromatography, Electrophoresis. 38, 1822–1829.
- [19] Zietek, B. M.; Still, K. B. M.; Jaschusch, K.; Bruyneel, B.; Ariese, F.; Brouwer, T. J. F.; Luger, M.; Limburg, R. J.; Rosier, J. C.; Iperen, D. J. v.; Casewell, N. R.; Somsen, G. W.; Kool. (2019). J. Anal. Chem. 91, 10458–10466.
- [20] Sneekes, E.J.; Laurent Rieux, L.; Swart, R. Miniaturization of Liquid Chromatography: Why Do We Do It? <https://assets.thermofisher.com/TFS-Assets/CMD/Reference-Materials/WP-70817-LC-Miniaturization-WP70817-EN.pdf>
- [21] Vissers, J. P. C., Claessens, H. A., Cramers, C. A. (1997). J. Chromatogr. 779, 1–28.
- [22] Chervet, J. P., Ursem, M., Salzmann, J. P. (1996). Anal. Chem. 68, 1507–1512.
- [23] Fanali, C., Asensio-Ramos, M., D’Orazio, G., Hernández- Borges, J., Rocco, A., Fanali, S., in: Holcapek, M., Byrdwell, W. C. (Eds.)(2017). Handbook of Advanced Chromatography/ Mass Spectrometry Techniques. Academic Press and AOCS Press, London. 309–363.
- [24] Mejía-Carmona, K., Vasconcelos Soares Maciel, E., Mauro Lanças, F. (2020). Miniaturized liquid chromatography applied to the analysis of residues and contaminants in food: A review. Electrophoresis, 0, 1–14.
- [25] Aydoğan, C., Yılmaz, F., Denizli, A. (2013). Cation exchange/hydrophobic interaction monolithic chromatography of small molecules and proteins by nano liquid chromatography. J. Sep. Sci. 36, 1685–1692.
- [26] Karenga, S., El Rassi, Z. (2011). Electrophoresis. 32, 90–104.
- [27] Aydoğan, C., Denizli, A. (2012). Chirality. 24, 606–609.
- [28] Jandera, P., Urban, J., Skerikova, V., Langmaier, P., Kubickova, R., Planeta, J.(2010). J. Chromatogr. 1217, 22–33.
- [29] Bakry, R., Huck, C. V., Bonn, G. K. (2009). J. Chromatogr. Sci. 47, 418–431.
- [30] Arrua R. D., Causon, T. J., Hilder, E. F. (2012). Analyst. 137, 5179–5189.
- [31] Rozenbrand, J., Bennekomp W. P. (2011). J. Sep. Sci. 32, 1934–1944.



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- [32] Vlach, E. G., Tennikova, T. B. (2013). *J. Sep. Sci.* 36, 1149–1167.
- [33] Svec, F., Frechet J. M. J. (1992). *Anal. Chem.* 64, 820–822.
- [34] Zuvela, P., Skoczylas, M., Jay Liu, J., Baćzek, T., Kaliszan, R., Wong, M.W., Buszewski B. (2019). Column characterization and selection systems in reverse phase high-performance liquid chromatography. *Chem. Rev.* 119, 3674-3729.
- [35] Haghighi, F., Talebpour, Z., Nezhad, A.S. (2018). Towards fully integrated liquid chromatography on a chip: evolution and evaluation. *TrAC Trends Anal. Chem.* 105, 302-337.
- [36] Gama, M.R., Rocha, F.R.P., Bottoli, C.B.G. (2019). Monoliths: synthetic routes, functionalization and innovative analytical applications. *TrAC Trends Anal. Chem.* 115, 39-51.
- [37] Maya, F., Paull, B. (2019). Recent strategies to enhance the performance of polymer monoliths for analytical separations. *J. Sep. Sci.* 42, 1564-1576.
- [38] Yandamuri, N.; Nagabattula, K. R. S.; Kurra, S. S.; Batthula, S.; Allada, L. P. S. N.; Bandam, P. (2013). Comparative Study of New Trends in HPLC: A Review. *Int. J. Pharm. Sci. Rev. Res.* 23, 167–172.
- [39] Fanali, C.; Dugo, L.; Dugo, P.; Mondello (2013). L. Capillary-Liquid Chromatography (CLC) and Nano-LC in Food Analysis. *TrAC Trends Anal. Chem.* 52, 226–238.
- [40] Yandamuri, N.; Dinakaran, S. K. (2015). Advanced Study of Nano Liquid Chromatography and Its Application-A Review. *World J. Pharm. Res.* 4, 1355–1367.
- [41] Fedorenko, D., Bartkevics, V. (2021). Recent Applications of Nano-Liquid Chromatography in Food Safety and Environmental Monitoring: A Review. *A Review, Critical Reviews in Analytical Chemistry.*
- [42] Min, H.-K., Hyung, S.-W., Shin, J.-W., Nam, H.-S., Ahn, S.-H., Jung, H.J., Lee, S.-W. (2007). Ultrahigh-pressure dual online solid phase extraction/capillary reversephase liquid chromatography/tandem mass spectrometry (DO-SPE/cRPLC/ MS/MS): a versatile separation platform for high-throughput and highly sensitive proteomic analyses. *Electrophoresis.* 28, 1012-1021.
- [43] Rinne, S., Holm, A., Lundanes, E., Greibrokk, T. (2006). Limitations of porous graphitic carbon as stationary phase material in the determination of catecholamines, *J. Chromatogr. A* 1119, 285-293.



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- [44] Pitarch, E., Hernandez, F., Hove, J. T., Meiring, H., Niesing, W., Dijkman, E., Stolker, L., Hogendoorn, E. (2004). Potential of capillary-column-switching liquid chromatography-tandem mass spectrometry for the quantitative trace analysis of small molecules: application to the on-line screening of drugs in water, *J. Chromatogr., A* 1031,1-9.
- [45] Prieto-Blanco, M.C., Moliner-Martínez, Y., Opez-Mahía, P. L., Campíns-Falco, P. (2013). Determination of carbonyl compounds in particulate matter PM_{2.5} by intube solid-phase microextraction coupled to capillary liquid chromatography/ mass spectrometry. *Talanta* 115, 876-880.
- [46] Capozzi, F., Bordoni, A. (2013). Foodomics: a new comprehensive approach to food and nutrition. *Genes Nutr.* 8, 1–4.
- [47] Cifuentes, A. (2009). Food analysis and foodomics. *Journal of Chromatography A*, 1216 (43), 7109–7110.
- [48] Herrero, M., Garc'ia-Cañas, V., Simo, C., Cifuentes, A. (2010). Recent advances in the application of capillary electromigration methods for food analysis and Foodomics. *Electrophoresis*. 31(1), 205–228.
- [49] M. Herrero, C. Sim'ó, V. Garc'ia-Cañas, E. Ib'ñez, and A. Cifuentes (2012). Foodomics: MS-based strategies in modern Food Science and Nutrition. *Mass Spectrometry Reviews*. 31, 49–69.
- [50] Perks, B. (2007). *Chem. World*, 4, 48–52.
- [51] Asensio-Ramos, M., Herna'ndez-Borges, J., Rocco, A., Fanali, S. (2009). Food analysis: A continuous challenge for miniaturized separation techniques. *J. Sep. Sci.* 32, 3764–3800.
- [52] Wilson, S.R., Vehus, T., Sjaanes, H., Lundanes, B., Lundanes, E. (2015). Nano-LC in proteomics: recent advances and approaches. *Bioanalysis*. 7(14), 1799–1815.
- [53] Vallejo-Cordoba, B., Gonz'alez-C'ordova, A. F. (2010). “Capillary electrophoresis for the analysis of contaminants in emerging food safety issues and food traceability,” *Electrophoresis*. 31,(13) 2154–2164.
- [54] Shin, G. W., Hwang, H. S., Chung, B., Jung, G. Y (2010). Recent developments in CE-based detection methods for foodborne pathogens. *Electrophoresis*. 31(13), 2137– 2153.



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- [55] Vrkoslav, V., Rumlová, B., Strmen, T., Nekvasilová, P., Sulc, M., Cvacka, J.(2018). Applicability of low-flow atmospheric pressure chemical ionization and photoionization mass spectrometry with a microfabricated nebulizer for neutral lipids, *Rapid Commun. Mass Spectrom.* 32, 639-648.
- [56] Tomasini, D., Cacciola, F., Rigano, F., Sciarrone, D., Donato, P., Beccaria, M., Caram~ao, E.B.,Dugo, P., Mondello, L.(2014). Complementary analytical liquid chromatography methods for the characterization of aqueous phase from pyrolysis of lignocellulosic biomasses. *Anal. Chem.* 86, 11255-11262.
- [57] Rigano, F., Albergamo, A., Sciarrone, D., Beccaria, M., Purcaro, G., Mondello, L. (2016). Nano liquid chromatography directly coupled to electron ionization mass spectrometry for free fatty acid elucidation in mussel, *Anal. Chem.* 88,4021-4028.
- [58] Cui, L., Lu, H., Lee, Y.H.(2018). Challenges and emergent solutions for LC-MS/MS based untargeted metabolomics in diseases. *Mass Spectrom. Rev.* 37, 772-792.
- [59] Xie, X., Tolley, L.T., Truong, T.X.,Tolley, H.D., Farnsworth, P.B., Lee, M.L.(2017). Dualwavelength light-emitting diode-based ultraviolet absorption detector for nano-flow capillary liquid chromatography. *J. Chromatogr. A* 1523, 242-247.
- [60] Trufelli, H., Famiglini, G., Termopoli, V., Cappiello, A.(2011). Profiling of non-esterified fatty acids in human plasma using liquid chromatography-electron ionization mass spectrometry. *Anal. Bioanal. Chem.* 400, 2933-2941.
- [61] Cappiello, A., Famiglini, G., Palma, P., Pierini, E., Termopoli, V., Trufelli, H.(2008). Overcoming matrix effects in liquid. *Anal. Chem.* 80, 9343-9348.
- [62] Hayes, M.J., Lankmayer, E.P., Vouros, P., Karger, B.L., McGuire, J.M. (1983). Moving belt interface with spray deposition for liquid chromatography/mass spectrometry. *Anal. Chem.* 55, 1745-1752.
- [63] D'Orazio, G., Rocchi, S., Fanali, S. (2012). Nano-Liquid Chromatography Coupled with Mass Spectrometry: Separation of Sulfonamides Employing Non-Porous Core-Shell Particles. *J. Chromatogr. A.* 1255, 277-285.
- [64] Moreno-Gonzalez, D., Perez-Ortega, P., Gilbert-Lopez, B., Molina-Diaz, A., Garcia-Reyes, J. F., Fernandez-Alba, A. R. (2017). Evaluation of Nanoflow Liquid Chromatography High Resolution Mass Spectrometry for Pesticide Residue Analysis in Food. *J. Chromatogr. A* 1512, 78-87.



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[65] Moreno-Gonzalez, D., Alcantara-Duran, J., Gilbert-Lopez, B., Beneito-Cambra, M., Cutillas, V. M., Rajska, Ł., Molina-Díaz, A., García-Reyes, J. F. (2018). Sensitive Detection of Neonicotinoid Insecticides and Other Selected Pesticides in Pollen and Nectar Using Nanoflow Liquid Chromatography Orbitrap Tandem Mass Spectrometry. *J. AOAC Int.* 101, 367–373.

[66] Liu, H.-Y., Lin, S.-L., Chan, S.-A., Lin, T.-Y., Fuh, M.-R. (2013) Microfluidic Chip-Based Nano-Liquid Chromatography Tandem Mass Spectrometry for Quantification of Aflatoxins in Peanut Products. *Talanta*, 113, 76–81.



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UÇUCU YAĞ BİLEŞENLERİNİN BELİRLENMESİ**

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ÖZET

Calamintha Mill cinsi. (İngilizce calamint), tüm Akdeniz bölgesinde iyi temsil edilen ve yaygın olan Lamiaceae familyasına ait aromatik bitkileri içermektedir. Bu familyanın çok sayıda üyesi baharat olarak kullanılmaktadır ve çeşitli geleneklerde halk hekimliğinde de kullanılmaktadır. *Calamintha* türleri, Avrupa, Doğu Akdeniz bölgesi, Orta Asya, Kuzey Afrika ve Amerika'ya dağılan sekiz türle temsil edilen, orta ila büyük boyda dik, bazen tabanda odunsu çok yıllık otsu bitkilerdir. *Calamintha* Miller (Lamiaceae) cinsi Avrupa, Doğu Akdeniz bölgesi, Orta Asya, Kuzey Afrika ve Amerika'da yayılış göstermektedir. Türkiye'de 5'i Türkiye'ye endemik olmak üzere 9 tür ve 12 takson ile temsil edilmektedir. Nane benzeri hoş kokuları nedeniyle birçok *Calamintha* türü, çeşitli mutfak tariflerinde baharat olarak kullanılmaktadır. Nane gibi halk hekimliğinde başta uyarıcı, sindirim, tonik, antiseptik vb. olarak kullanılırlar. Bu bitkiler spazm giderici, terletici, idrar söktürücü, gaz söktürücü olarak ve merkezi sinir sistemini güçlendirmede etkilidirler. Çayı gaz ve kolik tedavisinde kullanılır ve haricen lapalarda morluklar için faydalıdır. Araştırmalar, *Calamintha* türlerinin yaprak ve çiçeklerinin, uçucu yağlarının antiseptik, antispazmodik ve tonik yanı sıra antimikrobiyal ve antispazmodik aktiviteleri ile etkili olduğunu göstermiştir. Bu çalışmada; Rize'nin Çat (1900 m) yaylasından Çiçeklenme zamanında toplanan *Calamintha nepeta* (L.) savi. subsp. *glandulosa* L. bitkisinin uçucu bileşenlerinin belirlenmesi amaçlanmıştır. Tam çiçeklenme döneminde hasat edilen bitkinin uçucu yağ oranı ve uçucu yağdaki aromatik bileşenler Gaz Kromatografisi (GC-MS) cihazında SPME (Solid Phase Microextraction) yöntemi kullanılarak tespit edilmiştir. Analiz sonucunda 30'a yakın farklı bileşene rastlanırken, öne çıkan bileşenlerin önemli kısmını Pulegone (19.4%), Isovaleric acid (%16.15), Germacrene-D (%11.5), Neodene (%10.5), Carvacrol (%7.7), Cedrol (%4.1) ve α -Himachalene (%9.09) oluşturmaktadır.

Anahtar Kelimeler: *Calamintha nepeta*, Aroma Bileşenleri, GC-MS



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**DETERMINATION OF VOLATILE OIL COMPONENTS OF *Calamintha nepeta* (L.)
savi. subsp. *glandulosa* COLLECTED FROM ÇAT/RİZE**

ABSTRACT

The genus *Calamintha* Mill. (calamint in English) includes aromatic plants belonging to the Lamiaceae family, which is well represented and widespread all around the Mediterranean region. Numerous members of this family are used as spices, and are also employed in folk medicine in diverse traditions. *Calamintha* species are medium to large size erect herbaceous perennials, sometimes woody at the base, represented by eight species distributed in Europe, Eastern Mediterranean region, Central Asia, North Africa and America. The genus *Calamintha* Miller (Lamiaceae) is distributed in Europe, Eastern Mediterranean region, Central Asia, North Africa and America. In Turkey it is represented by 9 species and 12 taxa, five being endemic to Turkey. Because of their pleasant mint-like smell, many *Calamintha* species are used as spices in various culinary recipes. They are used in folk medicine like mints, mainly as stimulant, digestive, tonic, antiseptic etc. These plants are used as antispasmodic, emmenagogue, diaphoretic, diuretics, carminatives expectorant and for strengthening central nervous system. Its tea is used to help with gas and colic, and externally, it is useful in poultices for bruises. Investigations showed that leaves and flowers of *Calamintha* species are effective as an antiseptic, antispasmodic and tonic, as well as antimicrobial and antispasmodic activities of their EOs. In this study; the volatile components of *Calamintha nepeta* (L.) savi subsp *glandulosa* L. plant, collected at flowering time from Çat (1900 m) highland of Rize was determined. The essential oil content of the plant harvested during the full bloom period and the aromatic components in the essential oil were determined by using SPME (Solid Phase Microextraction) method in Gas Chromatography (GC-MS) device. As a result of the analysis, nearly 30 different components were detected, while the most prominent components were Pulegone (19.4%), Isovaleric acid (16.15%), Germacrene-D (11.5%), Neodene (10.5%), Carvacrol (7.7%), Cedrol (4.1%) and α -Himachalene (9.09%).

Keywords: *Calamintha nepeta*, Aroma Components, GC-MS



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INTRODUCTION

Central Asia, Europe, Mediterranean region, America and North Africa are the distribution areas of the *Calamintha* genus (Bonnier, 1959; Bown, 1995). *Calamintha* is distributed widely in the South, West and North Anatolia in Turkey on taxa level. Its represented by a total of 13 taxa with subspecies, 6 of which are endemic (Alan et al., 2007). One of this species *Calamintha nepeta* (L.) savi. subsp. *glandulosa* displays rich essential oil content. It has use as antiseptic, stimulant, antispasmodic and diuretic agent in traditional medicine (Şarer and Pançalı, 1998). There are several studies on the composition essential oil of *C. nepeta ssp. glandulosa*. Şarer and Parkalı (1998) reporting that Pulegone (40.5%) and Menthone (23.6%). are main components of essential oil of *C. nepeta ssp. glandulosa* collected in Northern Turkey.

Also, Baldovini et. al (2000) determined the essential oil content of the 40 samples of *Calamintha nepeta*, growing wild in Corsica. They reported that half of the samples were characterized by a Menthone/Pulegone chemotype, 13 samples present Pulegone as the major component associated with Menthone. According to a study carried out by Kitic and Jovanovic (2002) revealed that the main constituents in the essential oil of *C. nepeta ssp. glandulosa* collected from Montenegro were Pulegone (37.5%), Menthone (17,6%). The volatile components of the *C. nepeta ssp. glandulosa* collected from the Çat (1900m) plateau of Rize at the time of flowering time were investigated.

MATERIAL AND METHOD

This experiment was conducted at Faculty of Agriculture, Recep Tayyip Erdoğan University in 2021. The plant materials collected from and Çat (1900m) plateau in Rize/Turkey. *C. nepeta ssp. glandulosa* plants harvested during the full bloom period. The plants were cut at a height of 10-15 cm above the soil level and the flower parts were separated.

Dried plant samples weighed 100 g and distilled with Neo-Clevenger apparatus. The essential oil content in herb was calculated as the volume of essential oil in 100 grams of dry sample (ml/100g). In order to determine essential oil components, Shimadzu model GC-MS (2010 Plus) present in RTEU Faculty of Agriculture, Plant Analysis Laboratory was used. SPME (Solid Phase Microextraction) method was used to determine essential oil components. Analysis results were evaluated and reported using related library (Seyis et al., 2020).



RESULTS AND DISCUSSION

Nearly 30 different essential oil components were found. The main essential oil components were Pulegone (19.4%), Isovaleric acid (16.15%), Germacrene-D (11.5%), Neodene (10.5%), Carvacrol (7.7%) Cedrol (4.1%) and α -Himachalene (Figure 1.).

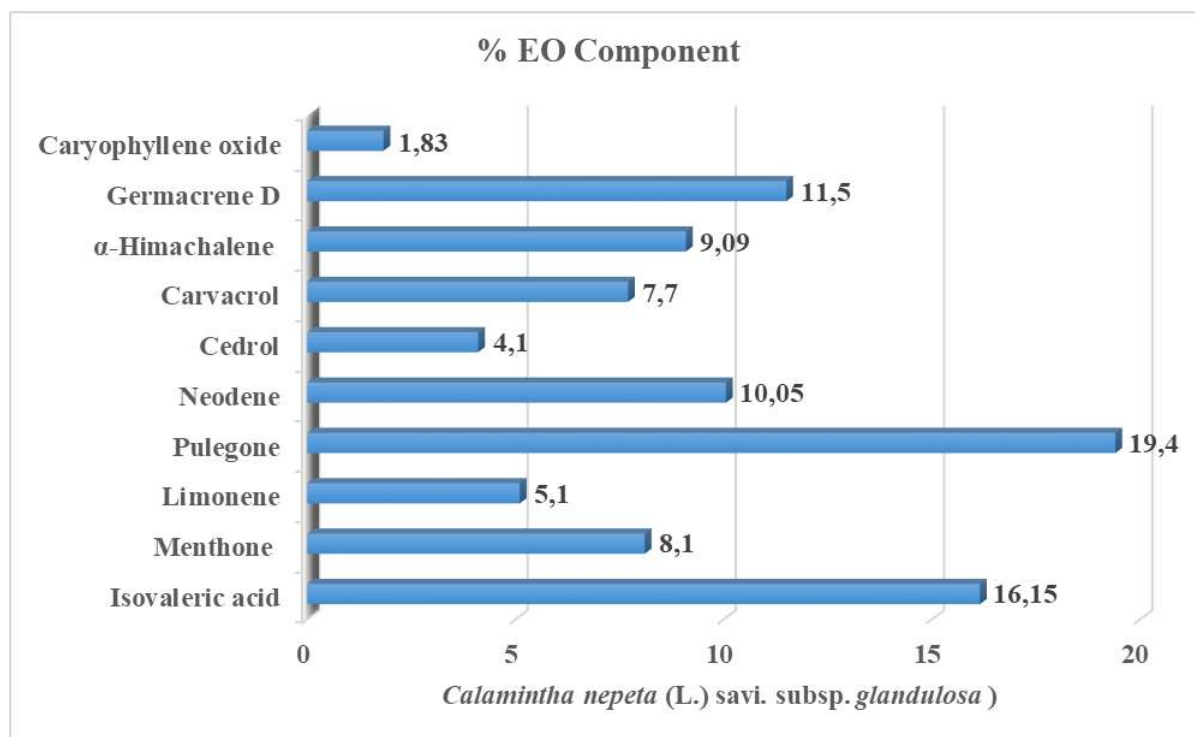


Figure 1. Essential oil components of *C. nepeta ssp. glandulosa* collected from Çat highland (1900m) Rize Province.

In our previous study (Yurteri et. al, 2021), the main essential oil components of *C. nepeta* (L) savi. subsp. *glandulosa* were Pulegone (30.3%) and Menthone (12.1%) in Amlakıt (1900m) highland and Pulegone (25.5%) and Menthone (16.7%) in Çat (1750m) highland in Rize/Turkey. This chemical differentiation within the same species can stem from varied geographic or ecological factors such as collection time, climate and genetic differentiation.

Those results are in agreement with the study conducted by Şarer and Parkalı (1998), they reported that the main components of essential oil of *C. nepeta ssp. glandulosa* collected in Northern Turkey were Pulegone (40.5%) Also, pulegone, as a main essential oil component, were reported by several studies by Kitic and Jovanovic (2002) reported as Pulegone (37.5%) and Baldovini et. al (2000) reported that essential oil content of *Calamintha nepeta* were characterized by a Menthone/Pulegone chemotype.



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There is a consensus that Pulegone is the dominant constituent, associated with different components such as Menthone and/or Isomenthone in *C. nepeta ssp. glandulosa* (Yurteri et. al 2021; Şarer and Parkalı, 1998; Kitic and Jovanovic, 2002; Baldovini et. al, 2000).



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REFERENCES

- Alan, S., Ocak, A., & Duman, H. (2007). *Calamintha pamphylica* subsp. *alanyense* (Lamiaceae), a new subspecies from South Anatolia, Turkey. *Annales Botanici Fennici*, 44(4), 309–314. <http://www.jstor.org/stable/23727804>
- Baldovini, N., Ristorcelli, D., Tomi, F., Casanova, J. (2000). Intraspecific variability of the essential oil of *Calamintha nepeta* from Corsica (France). *Flavour and Fragrance Journal*, 15, 50-54.
- Bonnier, G. (1959). Complete Illustree en Couleurs de France Suisse et Belgium, Tome 9, 114-117. Paris-Brussels, Berlin.
- Bown, D. (1995). The Herb Society of America Encyclopedia of Herbs and Their Uses, 97, 252. Dorling Kindersley, New York.
- Kitic, D., Jovanovic, T., Ristic, M., Palic, R., & Stojanovic, G. (2002). Chemical composition and antimicrobial activity of the essential oil of *Calamintha nepeta* (L.) Savi ssp. *glandulosa* (Req.) PW Ball from Montenegro. *Journal of Essential Oil Research*, 14(2), 150-152.
- Seyis, F., Yureteri, E., Özcan Aykutlu, A., & Cirak, C. (2020). Altitudinal impacts on chemical content and composition of *Hypericum perforatum*, a prominent medicinal herb. *South African Journal of Botany*, 135, 391-403.
- Şarer, E., & Solakel Pançalı, S. (1998). Composition of the essential oil from *Calamintha nepeta* (L.) Savi ssp. *glandulosa* (Req.) PW Ball. *Flavour and Fragrance Journal*, 13(1), 31-32.
- Yurteri, E., Seyis F. & Küplemez, H. (2021). Investigation of the Essential Oil Components of *Calamintha nepeta* (L.) savi. subsp. *glandulosa* Plant. 3. International Baku Scientific Research, 192-194.



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***Salvia glutinosa*' da UÇUCU YAĞ KOMPOZİSYONU**

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ÖZET

Dünyada yaklaşık 900 türü bulunan adaçayı (*Salvia* spp.) türleri en çok Amerika ve Güney-Batı Asya kıtalarında yayılış göstermektedir. Türkiye'deki *Salvia* türlerinin sayısı 97'dir. Bu türlerin 51'i endemiktir ve yüksek oranda endemizm sergilemektedir. Antibakteriyel, antispazmodik, antifungal ve antioksidan aktivite özellikleri birçok *Salvia* türüne atfedilir. Ayrıca kozmetik, parfüm ve diğer ilaç endüstrilerinde olduğu kadar aroma verici gıda olarak kullanımları da iyi bilinmektedir. Bu çalışmanın konusu olan *Salvia glutinosa* L, Güney Anadolu'nun yaprak döken orman ve fundalıklarındaki nemli yerlerde ve *Picea* ormanlarında doğal olarak yetişmektedir. Bu türler çoğunlukla Temmuz'dan Ekim'e kadar çiçek açmaktadır. Rize İli Çat (1205 m) yaylasından çiçeklenme döneminde toplanan *Salvia glutinosa*'nın (L.) uçucu yağ bileşimi araştırılmıştır. Bir Gaz Kromatografisi (GC-MS) cihazında SPME (Katı Fazlı Mikroekstraksiyon) yöntemi kullanılarak bitkinin uçucu yağ bileşimi belirlenmiştir. 28 kadar farklı bileşen tespit edilmiştir. Doğadan toplanan bitki örneklerinde uçucu bileşikler sırasıyla Germacrene-D (%17.87), Neomentil asetat (%9.2), Neodene (%9.82), Isoborneol (%6.54), α -Himachalene (%6.23), İzovalerik asit (%8.36) ve Karvakrol (%5.39) olarak belirlenirken tarladan yetiştirilen bitki örneklerinde uçucu bileşikler sırasıyla Germacrene-D (%15.87), Aromadendren (%13.85), Neomentil asetat (%8.2), α -Himachalen (%7.23), β -Burbonene (%5.88), α -Humulen (%4.91) ve γ -Kadinen (%4.22) olarak tespit edilmiştir.

Anahtar Kelimeler: *Salvia glutinosa*, Aromatik Bileşenler, Germacrene-D, Aromadendrene, GC-MS



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VOLATILE OIL COMPOSITION OF *Salvia glutinosa*

ABSTRACT

Sage (*Salvia* spp.) species, represented by about 900 species in the world are mostly distributed in the Americas and South-West Asia continents. The number of *Salvia* species in Turkey are 97. 51 of these species are endemic and are displaying a high rate of endemism. Antibacterial, antispasmodic, antifungal and antioxidant activity traits are attributed to many *Salvia* species. Furthermore, their use as flavor food as well as in cosmetics, perfumes and other pharmaceutical industries are well known. *Salvia glutinosa* L., object of the present study, grows naturally in moist locations in deciduous forest and scrub and in *Picea* forests of South Anatolia. These species flowers mainly from July to October. The volatile oil composition of the *Salvia glutinosa* (L.), collected from the ÇAT (1205 m) plateau of Rize at the time of flowering, were investigated. The proportion of volatile oils of the plant harvested during the full flowering period both in the nature and under cultivation were determined. Using the SPME (Solid Phase Microextraction) method in a Gas Chromatography (GC-MS) device the volatile oil composition of the plant were determined. Almost 28 different components were detected. The volatile compounds in the plant samples collected from the nature was found as respectively Germacrene-D (%17.87), Neomenthyl acetate (%9.2), Neodene (%9.82), Isoborneol (%6.54), α -Himachalene (%6.23), Isovaleric acid (%8.36) and Carvacrol (%5.39) while volatile compounds of the plant samples cultivated from the field was detected as Germacrene-D (%15.87), Aromadendrene (%13.85), Neomenthyl acetate (%8.2), α -Himachalene (%7.23), β -Burbanone (%5.88), α -Humulene (%4.91) and γ -Cadinene (%4.22) respectively.

Keywords: *Salvia glutinosa*, Aromatic Compounds, Germacrene-D, Aromadendrene, GC-MS



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INTRODUCTION

Besides its use in industry Lamiaceae species family have use as folk medicine. Additionally, they have use as a raw drug in the form of condiments and spices, which increases their importance even more. The genus *Salvia* L. with over 900 species is presumably the largest member of the Lamiaceae family and is found in both subtropical and other temperate parts of the world (Polunin and Huxley, 1967). Many *Salvia* species are aromatic plants and rich in essential oils and of potential economic value besides their usage as ornamental plants. Many of these species are used to flavour food as well as in pharmaceutical industries, perfumes and cosmetics (Marin et al., 1996). *Salvia glutinosa* L. is an essential oil plant which grows in moist places in deciduous forest and scrub and in *Picea* forests of north and south Anatolia and the flowering time is from July to October (Hedge, 1982). The medicinal and commercial uses of plants representing the subject of this study, are increasing day by day. Especially their essential oil content and the detection of their secondary metabolites have increased the importance of these plants. Essential oils are usually complex mixtures of natural compounds of both polar and apolar structure and consist mainly of terpenoids and their oxygenated derivatives. Essential oils, which have antioxidant and antimicrobial activities, display therapeutic properties. They are raw materials of cosmetics and are acting as natural additives in foods and food products (Fokou et al., 2020). The essential components of *Salvia glutinosa* (L.) plants collected from the Çat (1205 m) plateau at the time of flowering and cultivated in the field in Rize were investigated.

MATERIAL AND METHOD

The present study was conducted at Faculty of Agriculture, Recep Tayyip Erdoğan University in 2021. The plant materials were collected from Çat (1205 m) plateau in Rize/Turkey. The aerial parts of *Salvia glutinosa* collected at the flowering time were used as plant material. The plants were cut at a height of 10-15 cm above the soil level. Dried plant samples weighed as 100 g and distilled with Neo-Clevenger apparatus. The essential oil content in herb was calculated as the volume of essential oil in 100 grams of dry sample (ml/100g). In order to determine essential oil components, Shimadzu model GC-MS (2010) Plus) present in RTEU Faculty of Agriculture, Plant Analysis Laboratory was used. SPME (Solid Phase Microextraction) method was used to determine essential oil components. Analysis results were evaluated and reported using related library.



RESULTS AND DISCUSSION

Nearly 28 different essential oil components were found. The essential oil components in the plant samples collected from the nature was found as respectively Germacrene-D (%17.87), Neomenthyl acetate (%9.2), Neodene (%9.82), Isoborneol (%6.54), α -Himachalene (%6.23), Isovaleric acid (%8.36) and Carvacrol (%5.39) while volatile compounds of the plant samples cultivated from the field was detected as Germacrene-D (%15.87), Aromadendrene (%13.85), Neomenthyl acetate (%8.2), α -Himachalene (%7.23), β -Bourbonene (%5.88), α -Humulene (%4.91) and γ -Cadinene (%4.22) respectively (Figure 1.).

Germacrene-D content found close to each other as 17.87% in flora and 15.85% in field. Also Neomenthyl acetate contents showed same trend as 9.2% in flora and 8.2% in field samples (Figure 1.).

In our previous study (Yurteri et. al, 2021), the main essential oil components of *S. glutinosa* were respectively as Germacrene-D (15.87 %), Neomenthyl acetate (8.2 %), Neodene (7.82 %), Isoborneol (7.54 %), α -Himachalene (7.23 %), Isovaleric acid (6.36 %) and Carvacrol (5.39 %) collected from the Çat highland (1295m). Aromadendrene content (13.95%) distinguished from these results that collected from Çat highland at 1205 m altitude.

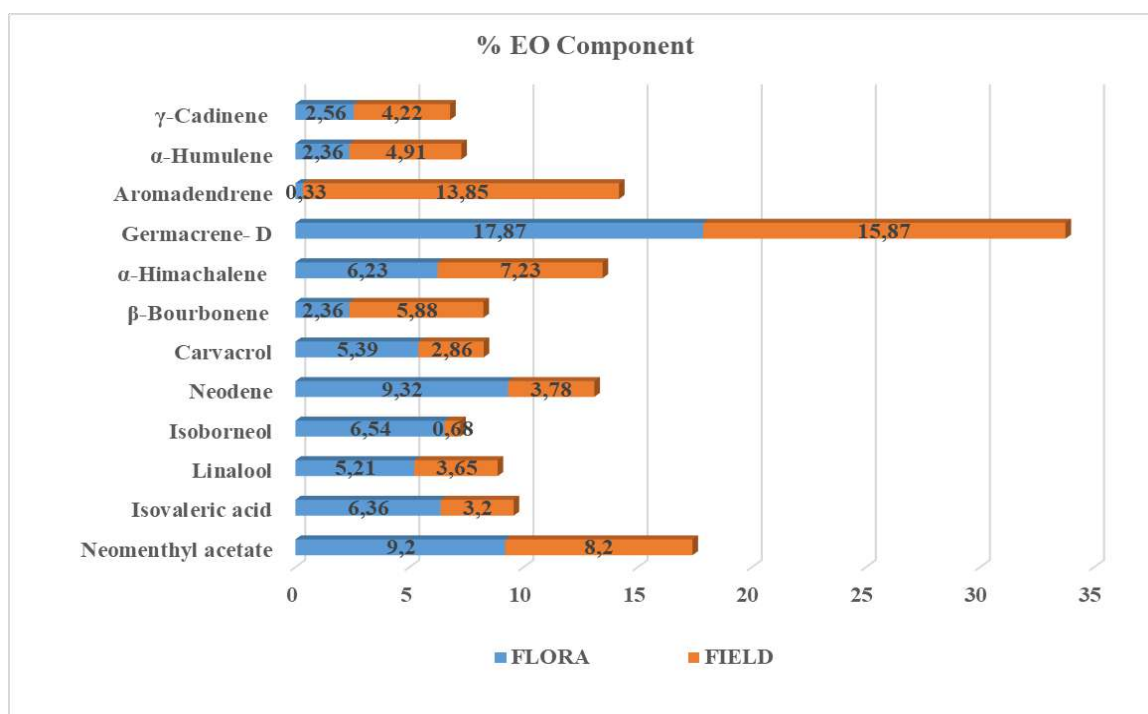


Figure 1. Essential oil components of *S. glutinosa* collected from field and cultivated type.



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Tavassoli et al. (2009) published similar results. They detected a Germacrene-D content of 18.0% in the essential oil of *S. glutinosa*. On the contrary, Pitarokili et al. (2006) reported that the most abundant component in *S. glutinosa* as Butyryl lactate (26.7%).

The essential oil composition of *Salvia glutinosa* investigated in this study contains relatively different components when compared with the results of the same species grown in different places of the World (Pitarokili et al., 2006). So to say, different climate and soil conditions are effective on the essential oil components even in the same species. Chemical differentiation within the same species can occur generally as a result of the varied ecological or geographic origin as well as the genetic differentiation, collection time, climate or method of analysis.



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REFERENCES

- Fokou, J. B. H., Dongmo, P. M. J., & Boyom, F. F. (2020). Essential Oil's Chemical Composition and Pharmacological Properties. In *Essential Oils-Oils of Nature*. IntechOpen.
- Hedge, I.C. (1982). *Salvia*. In: Davis PH (ed) *Flora of Turkey and the East Aegean Islands*, Vol. 7. Edinburgh University Press, Edinburgh, pp 400–461. ISBN 0–85224–396–0.
- Marin, P. D., Duletic, S., & Petkovic, B. (1996). Nutlet ornamentation in selected *Salvia* L. species (Lamiaceae). *Flora Mediterranea*, 6, 203-211.
- Pitarokili, D., Tzakou, O., & Loukis, A. (2006). Essential oil composition of *Salvia verticillata*, *S. verbenaca*, *S. glutinosa* and *S. candidissima* growing wild in Greece. *Flavour and Fragrance Journal*, 21(4), 670-673.
- Polunin, O., Huxley, A. (1967). *Flowers of Meditterreanean*. Chatto and Windus, London. ISBN 0–7011–2284–6.
- Tavassoli, A., Esmaili, A., Ebrahimzadeh, M. A., Safaeyan, S., Akbarzade, M., & Rustaiyan, A. (2009). Chemical Composition of Essential Oil and Antibacterial Activity of *Salvia Glutinosa* L. Growing Wild in Iran. *Journal of Applied Chemical Researches (JACR)*. Vol. 3, No. 10.
- Yurteri, E., Aykutlu Özcan A., Küplemez, H. & Seyis F. (2021). Investigation of The Volatile Oil Components of *Salvia glutinosa*. Vth International Eurasian Agriculture and Natural Sciences Congress, Abstract Book, 20.



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KAYISI REKOLTESİNİN İHRACAT MİKTARI VE FİYATLARI İLE İLİŞKİSİ

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ÖZET

Türkiye kuru meyve ihracatında 2008 yılında yaklaşık 1 milyar \$ ile toplam dünya ihracatında %11'lik paya sahip olmuştur. 2023 yılındaki hedefi ise 3 milyar \$ ile %25 oranına ulaşmaktır. Türkiye'nin ihraç ettiği kuru meyvelerden biri de kayısıdır. Kayısı hem üretimde hem de ihracatta ülkenin önde gelen ürünlerinden biridir. Örneğin 2016 yılında %18.81'lik payla üretimde dünyada birinci sırada yer almıştır. Kurutmalık veya farklı şekilde saklanabilen ürünlerde rekolte ve stoğun fiyatlarla ilişkisi öteden beri vardır. Bu çalışmada ihracata giden kuru kayısının rekoltesi ile fiyat ilişkisinin araştırılması amaçlanmıştır. Ayrıca kayısı fiyatlarında dönemsel farklılıklar olup olmadığına da bakılmıştır. Bunun için 2011-2021 yıllarına ait 11 yıllık veriler incelenmiştir. Veriler Malatya Ticaret Borsası web sitesindeki kayıtlardan alınmıştır. Dönemsel farklar içinse yıllar 3 döneme ayrılmıştır. Aralık, ocak, şubat, mart ayları birinci dönem; nisan, mayıs, haziran, temmuz ayları ikinci dönem ve ağustos, eylül, ekim, kasım ayları üçüncü dönem olarak alınmıştır. Dönemlerin bu şekilde ayrılmasında şu düşünceler etkili olmuştur. Kuru kayısının üretilip yeni sezon ürünün satışa sunulduğu ilk aylar fiyatlar üzerinde etkili olabilir. Yılbaşları ve yılsonları genel olarak ekonomi üzerindeki etkin olabilmektedir. Kuru kayısı fiyatlarında etkili olabilecek diğer bir faktör ise beklenen rekolte ile sezon sonu stok miktarları olabilir. Rekoltenin durumu stoktaki fiyatları da etkileyebilmektedir. Yapılan korelasyon analizine göre rekoltenin hem ihracat miktarı hem de ihracat fiyatları ile doğrusal ilişkisi olduğu görülmüştür. Rekoltenin ihracat miktarı ile olan ilişkisi pozitif yönlü iken ihracat fiyatları ile negatif yönlüdür. Yani rekolte arttıkça ihracat miktarı artmakta iken ihracat fiyatları azalmaktadır. İhracat miktarındaki artışın ise en fazla şekerpare türünde olduğu görülmüştür. Bu durum arz-talep dengesi kapsamında fiyatlar düşünce daha kaliteli ürüne yönelim artar şeklinde açıklanabilir. Kayısının rekoltesi ile ihracat miktarı arasında pozitif doğrusal ilişkiye göre üretimin artmasının pazarlama sorununa neden olmayacağı söylenebilir. Bu amaçla kayısıda zirai don, sulama, ilaçlama, gübreleme için yapılacak çalışmalar destek kapsamına alınabilir. Ancak üretim artışında, iyi kalite kayısı ihracatındaki artış oranının daha fazla olduğu da unutulmamalıdır. Üretim artışının sağlanması durumunda kalite ve pazarlamaya yönelik çalışmalar da yeniden gündeme alınabilir.

Anahtar kelimeler: Kayısı, ihracat, rekolte



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**THE RELATIONSHIP OF APRICOT PRODUCTION AMOUNT WITH EXPORTS
AND PRICES**

ABSTRACT

Turkey had a share of 11% in total world exports with approximately \$1 billion in dried fruit exports in 2008. Its target in 2023 is to reach 25% with 3 billion dollars. One of the dried fruits exported by Turkey is apricot. Apricot is one of the leading products of the country in terms of both production and export. For example, in 2016, it ranked first in the world in production with a share of 18.81%. For products that can be dried or stored in a different way, yield and stock have long been associated with prices. In this study, it is aimed to investigate the relationship between the harvest of dried apricots for export and the price. In addition, it has been examined whether there are seasonal differences in apricot prices. For this, 11 years of data for the years 2011-2021 were examined. The data were taken from the records on the Malatya Commodity Exchange website. For periodic differences, years are divided into 3 periods. December, January, February, March are the first term; April, May, June, July were taken as the second term and August, September, October, and November were taken as the third term. The following considerations were effective in the separation of the periods in this way. The first months when dried apricots are produced and the new season product is offered for sale may have an impact on prices. Up of the year and the end of the year can have an impact on the economy in general. Another factor that may have an impact on dried apricot prices may be the expected yield and end-of-season stocks. The situation of the harvest can also affect the prices in stock. According to the correlation analysis, it has been seen that the yield has a linear relationship with both the export quantity and export prices. While the relationship between the harvest and the export amount is positive, it is negative with the export prices. In other words, as the yield increases, the export amount increases while the export prices decrease. It was observed that the increase in the export amount was mostly in the sugar pare type. This situation can be explained as the tendency towards higher quality products increases as prices fall within the scope of supply-demand balance. According to the positive linear relationship between the apricot harvest and the export amount, it can be said that the increase in production will not cause a marketing problem. For this purpose, studies to be carried out for agricultural frost, irrigation, spraying and fertilization in apricot can be included in the scope of support. However, it should not be forgotten that the rate of increase in exports of good quality apricots is higher in production increase. In the event that an increase in production is achieved, studies on quality and marketing can be put on the agenda again.

Keywords: Apricot, export, yield



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1. GİRİŞ

İlk olarak Orta Asya ve Batı Çin'den dünyaya yayıldığı belirtilen kayısı Türkiye koşullarında da yetiştirme ortamı bulmuştur. Türkiye'de Malatya başta olmak üzere Elazığ, Erzincan, Sivas, Iğdır, Kars, Mersin illerinde kayısı yetiştiriciliği yapılmaktadır. Bunların dışında bazı illerde de farklı miktarlarda da olsa kısmen yetiştirilmektedir. Kayısı üretimi Türkiye'de ve dünyada artmaktadır. Bununla birlikte tüketimi de hızla artmakta olup arz fazlası oluşmadığı düşünülmektedir. Türkiye'de üretilen kayısının yaklaşık %80'i kuru kayısı olarak işlenmektedir (Uçar ve Engindeniz, 2018). Türkiye kuru meyve ihracatında 2008 yılında yaklaşık 1 milyar \$ ile toplam dünya ihracatında %11'lik paya sahip olmuştur. 2023 yılındaki hedefi ise 3 milyar \$ ile %25 oranına ulaşmaktır. Türkiye'nin ihraç ettiği kuru meyvelerden biri de kayısıdır. Kayısı, hem üretimde hem de ihracatta ülkenin önde gelen ürünlerinden biri olduğu gibi dünya çapında da söz sahibidir. Örneğin 2016 yılında %18.81'lik payla üretimde dünyada birinci sırada yer almıştır.

Kayısının üretimi ve son tüketiciye ulaşması uzun bir süreçtir. Çekirdekten fidan yetiştirme, sonrasında ürün elde etme, stoklama, pazarlama gibi birçok aşaması vardır. Bu nedenle de farklı alanlarda birçok çalışma yapılmıştır. Çukur ve ark. (2008) ile Çukur ve Saner (2009) kayısı üretiminde riskler; Akbulut ve Özen (2008) kayısının beslenmedeki önemi ve bazı besin ürünlerinde kullanımı; Muradoğlu ve ark. (2011) ile Kan ve Karaat (2019) bazı kayısı çeşitlerinin fizikokimyasal özellikleri, bileşik ve mineral içerikleri; Özdoğru ve ark. (2014) kayısının depolanma süreci; Asma ve ark. (2017) kayısı ıslah çalışmaları; Türkoğlu ve ark. (2020) kayısı hastalıkları; Ertürk ve ark. (2016) ile Öztürk ve Karakaş (2017) kayısı üretimi ve pazarlanması üzerinde çalışmalar yapmışlardır.

Bu çalışmada ihracata giden kuru kayısının miktarı ile ihracat fiyatlarının kayısı rekoltesi ile ilişkisi araştırılmıştır. Böylece üretimin artması durumunda pazarlama sıkıntısının olup olmayacağı tahmin edilmeye çalışılmıştır. Bu öngörü ise kayısı üretimi için yapılacak yatırımlara yön verebilir. Çünkü meyve ağaçları çok yıllık bitkiler olup yetiştiriciliği emek ve maliyet gerektirmektedir. Tek yıllık bitkilerde yapılacak hatanın sonuçları bir yıl sonra görülüp hatadan dönülebilir. Ancak meyve ağaçlarında 5-10 yıl sonraki fikir değişikliği maddi ve manevi olarak ciddi bir kayba neden olabilir. Bu nedenle meyve bahçesi yetiştiriciliğinde birçok faktör dikkate alınarak yatırım yapılmalıdır. Sadece toprak analizi gibi temel konular değil, aynı bölge içerisinde dahi farklılıklar olabilen yükseklik, rüzgar, güneşlenme miktarı gibi durumlar da iyi incelenmelidir (Uçar ve ark., 2019). Çalışmada ayrıca kayısı fiyatlarında dönemsel



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farklılıklar olup olmadığına da bakılmıştır. Yani yılın herhangi bir zamanında fiyatlarda yükselme olup olmadığı tahmin edilmeye çalışılmıştır. Böyle bir dönemin olması ülkeye giren döviz miktarının da artmasını sağlayabilir.

2. MATERYAL METOD

Çalışmada her hangi bir yılın ağustos ayının ilk günü ile bir sonraki yılın temmuz ayının son günü bir yıllık zaman dilimi olarak seçilerek 2011-2021 yıllarına ait veriler incelenmiştir. Kuru kayısının elde edilip pazarlanmaya başlandığı ay genellikle temmuz ayı sonları ağustos ayı başları olduğundan yıllık dönemler bu şekilde belirlenmiştir. Veriler Malatya Ticaret Borsası web sitesindeki kayıtlardan alınmıştır. Analizler yapılırken toplam ortalama ile çalışmak yerine şekerpare, endüstriyel ve kesilmiş olmak üzere üç sınıf olarak ihracata sunulan kuru kayısının her biri ayrı olarak değerlendirilmiştir. Böylece herhangi bir sınıfa özgü dalgalanmaların tüm sonucu etkilememesi amaçlanmıştır.

Dönemsel farklar içinse yıllar 3 döneme ayrılmıştır. Aralık, ocak, şubat, mart ayları birinci dönem; nisan, mayıs, haziran, temmuz ayları ikinci dönem ve ağustos, eylül, ekim, kasım ayları üçüncü dönem olarak alınmıştır. Dönemlerin bu şekilde ayrılmasında şu düşünceler etkili olmuştur: Kuru kayısının üretilip yeni sezon ürünün satışa sunulduğu ilk aylar fiyatlar üzerinde etkili olabilir. Yılbaşları ve sonları genel olarak ekonomi üzerinde etkin olabilmektedir. Kuru kayısı fiyatlarında etkili olabilecek diğer bir faktör ise beklenen rekolte ile sezon sonu stok miktarları olabilir. Rekoltenin durumu stoktaki fiyatları da etkileyebilmektedir. Çalışmada kullanılan veriler aşağıdaki tablolarda verilmiştir. İhraç edilen üç sınıf kayısının ihracat miktarı ve ihracat tutarları Tablo 1’de sunulmuştur.

Tablo 1. İhracat miktarı ve ihracat tutarları

	Şekerpare		Endüstriyel		Kesilmiş	
	İhracat miktarı (ton)	İhracat tutarı (\$)	İhracat miktarı (ton)	İhracat tutarı (\$)	İhracat miktarı (ton)	İhracat tutarı (\$)
2011-2012	83002	294105620	7231	12028051	5767	16946715
2012-2013	95389	272502671	11830	15820324	6203	13252110
2013-2014	93844	306362682	9943	13646503	7790	20195042
2014-2015	41731	258834955	3695	12432488	5356	26740051
2015-2016	64603	288220179	5478	9959551	6467	23907139
2016-2017	72952	242627495	6766	11608653	6538	19185593
2017-2018	79968	233878989	8063	10711271	7319	16807015
2018-2019	82334	224894278	9966	10939789	7161	15243871
2019-2020	82121	229297298	7483	8945362	6796	14419337
2020-2021	76406	267430207	3934	6970546	6781	17348685
2021(4 ay)	33097	141642011	1857	3890532	2516	8359410

Kaynak: MTB-1



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İhraç edilen kuru kayısının çeşitlerine göre bir ton fiyatları ve rekolte bilgisi Tablo 2’de sunulmuştur.

Tablo 2. Kayısı çeşitleri ton fiyatları (\$) ve rekolte

	Şekerpare	Endüstriyel	Kesilmiş	Rekolte
2011	3543,36	1663,40	2938,57	136900
2012	2856,75	1337,31	2136,40	176718
2013	3264,60	1372,47	2592,43	110345
2014	6202,46	3364,68	4992,54	8210
2015	4461,41	1818,10	3696,79	84500
2016	3325,85	1715,73	2934,47	103250
2017	2924,66	1328,45	2296,35	163735
2018	2731,49	1097,71	2128,73	89318
2019	2792,19	1195,42	2121,74	88392
2020	3500,12	1771,87	2558,43	104254
2021*(4 ay)	4279,60	2095,06	3322,50	94938

Kaynak: MTB-2 *Rekolte bilgisi yılın tamamı içindir.

Dönemlere göre ihracat miktar ve tutarları Tablo 3’de sunulmuştur.

Tablo 3. Dönemlere göre ihracat miktar ve toplam tutarları

	Birinci dönem		İkinci dönem		Üçüncü Dönem	
	İhracat miktarı (ton)	İhracat tutarı (\$)	İhracat miktarı (ton)	İhracat tutarı (\$)	İhracat miktarı (ton)	İhracat tutarı (\$)
2012			16880	50025393	44595	123605364
2013	38282	96526819	21644	58290643	47458	132054708
2014	41186	108000298	17001	71225956	20149	135161812
2015	16675	95686709	13958	67158973	31878	137802394
2016	26616	109935968	18054	74348507	34315	114117042
2017	29890	92396652	22051	66908047	41731	108618608
2018	33179	92278669	20440	60499998	39971	103486826
2019	35305	86921282	24185	62054794	39406	101793174
2020	36321	95250775	20673	55618047	34767	112013162
2021	30853	104081353	21501	75654923	37470	153891953

Yılın üç farklı dönemlerindeki kuru kayısı ton fiyatları Tablo 4’de sunulmuştur.

Tablo 4. Dönemlere göre ton fiyatları (\$)

	Birinci dönem	İkinci dönem	Üçüncü Dönem
2012		2963,59	2771,73
2013	2521,47	2693,15	2782,56
2014	2622,26	4189,52	6708,12
2015	5738,33	4811,50	4322,81
2016	4130,45	4118,12	3325,57
2017	3091,22	3034,24	2602,83
2018	2781,24	2959,88	2589,05
2019	2462,01	2565,84	2583,19
2020	2622,47	2690,37	3221,82
2021	3373,46	3518,67	4107,07



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3. BULGULAR

Bir yıllık süreler için yapılan korelasyon analizine göre rekoltenin hem ihracat miktarı hem de ihracat fiyatları ile doğrusal ilişkisi olduğu görülmüştür. Rekoltenin ihracat miktarı ile olan ilişkisi pozitif yönlü iken ihracat fiyatları ile negatif yönlüdür. Yani rekolte arttıkça ihracat miktarı artmakta iken ihracat fiyatları azalmaktadır. Fakat azaldığı söylenen bu fiyatların kilogram başına fiyat olduğu, toplam döviz tutarı olmadığı gözden kaçırılmamalıdır. Yani üretimin ve ihracatın artması kilogram başına fiyatta kısmi bir düşüşe neden olsa da ülkeye giren toplam döviz miktarı artmaktadır. İhracat miktarındaki artış ise en fazla şekerepare türündedir. Bu durum; arz-talep dengesi kapsamında fiyatlar ucuzlayınca kaliteli ürüne yönelim artar şeklinde açıklanabilir.

Dönemlerin; ihracat miktarı, toplam tutarları ve kilogram fiyatlarında dönemler arası farkı incelemek için yapılan Kruskal Wallis testine göre ihracat miktarı ve toplam tutarları değişkenleri için dönemler arasında fark olduğu ve bu farkların anlamlı olduğu görülmüştür ($p<0.00$). İhracat miktarı mean rank değerleri dönem sıralamasına göre sırasıyla 16.78 – 7.00 – 21.40'dır. İhracat tutarı mean rank değerleri ise dönem sıralamasına göre sırasıyla 15.78 – 5.50 – 23.80'dir. Buna göre ihracat miktarı ve toplam tutarı yılın üçüncü döneminde en yüksek düzeydedir. Daha sonra birinci dönem ve en sonda ikinci dönemdir. Bu iki değişkenin paralellik göstermesi normaldir. Çünkü fiyatlarda dönemler arasında ciddi bir fark olmadığı sürece satılan mal arttıkça elde edilen toplam para da artacaktır. Bu çalışmanın sonuçlarına göre dönemler arasındaki fiyat farklılıkları da anlamsız bulunmuştur ($p=0.727$). İhracat fiyatları mean rank değerleri dönem sıralamasına göre sırasıyla 13.22 – 16.30 – 15.30'dur.

Rekolte ile ihracat fiyatları arasındaki korelasyon analizine göre iki değişken arasındaki ilişki üç dönem içinde anlamsızdır. Yani rekoltenin çok veya az olması dönemler arasında ciddi bir fiyat farkı oluşturmamaktadır.

4. SONUÇ

Bu çalışmanın sonuçlarına göre kayısının rekoltesinin artması ile birlikte ihracat miktarının da artması arz talep dengesi için önemlidir. Bu durumda üretimin artmasının pazarlama sorununa neden olmayacağı, ihracat miktarının dolayısıyla da ülkeye giren döviz miktarının artacağı söylenebilir. Üretim artışı için de öncelikle yatırımların doğru yapılmasına dikkat edilmelidir. Diğer meyve türlerinde de olması gerektiği gibi kayısı bahçesi yetiştiriciliğinde de sadece toprak analizi gibi temel zirai analizler değil, aynı bölge içerisinde dahi farklılıklar olabilen



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yükseklik, rüzgar, güneşlenme miktarı gibi durumlar iyi incelenmelidir. Yetiştirilmiş bahçeler için zirai don, sulama, ilaçlama, gübreleme için yapılacak çalışmalar destek kapsamına alınabilir. Ancak üretim artışında, iyi kalite kayısı ihracatındaki artış oranının daha fazla olduğu da unutulmamalıdır. Bunun içinde işçilik, paketleme, sunum gibi hususlara dikkat etmek gerekir. Bu tür üretim artış çalışmalarının başarılı olması halinde bulgularda yer alan rekolte arttıkça ihracat fiyatlarındaki kısmi azalma için çalışmalar yapılabilir. Ürünün değerinde satışı için yeni pazar arayışlarına gidilebilir.

Çalışma sonuçlarına göre yılın üç dönemi arasında önemli bir fiyat farkının olmadığı görülmüştür. Bu durumda üreticiler veya toptancıların kayısı depolayıp fiyatların yükselmesini beklемelerinin genel olarak anlamlı olmadığı söylenebilir. Ancak bu sonuçlar ortalamalardan elde edilen istatistikler olup bazı yıllara özgü tersi durumların olması yanlış anlaşılmalıdır. Zirai don nedeni ile çok düşük rekoltenin olması dönemler veya yıllar arasında dalgalanmaya neden olabilir. Bu çalışmanın verilerinde de bu durumu gözlememek mümkündür. Örneğin tablolar incelendiğinde 2014 yılı üçüncü dönemindeki fiyat artışı birinci döneme göre %155, ikinci döneme göre %60 olmuştur. Ancak aynı yıldaki rekolte düşüklüğü de dikkat çekicidir. Bu yıldaki rekolte bir önceki yıla göre yaklaşık %93 daha azdır. Yine fiyat artışı gibi görünen bazı durumların nedeni ise döviz kurlarındaki dalgalanmalar olabilir.



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KAYNAKÇA

- Akbulut, M., Özen, G. (2008). Kayısı Lokumu Üretimi ve Beslenmedeki Önemi. Gıda Teknolojileri Elektronik Dergisi. (1) 7-11.
- Asma B.M, Karaat F. E, Çuhacı Ç, Doğan A, Karaca H (2017). Türkiye'de Kayısı Islah Çalışmaları ve Islah Edilen Yeni Çeşitler. Türk Tarım - Gıda Bilim ve Teknoloji dergisi, 5(11), 1429 - 1438.
- Çukur, F., Saner, G., Çukur, T. & Uçar, K. (2008). Malatya İlinde Kayısı Üreticilerinin Riskin Transferinde Tarım Sigortasına Bakış Açılarının Değerlendirilmesi: Doğanşehir İlçesi Polatdere Köyü Örneği . Ege Üniversitesi Ziraat Fakültesi Dergisi, 45 (2), 103-111.
- Çukur, F. & Saner, G. (2009). Malatya İli Kayısı Üretiminde Riskin Ölçülmesi ve Riske Karşı Oluşturulabilecek Stratejiler. Ege Üniversitesi Ziraat Fakültesi Dergisi, 46 (1), 33-42.
- Erturk, Y. E., Geçer, M. K. & Karadaş, K. (2016). Iğdır İlinde Kayısı Üretimi ve Pazarlaması. Meyve Bilimi, Volume: 1 Issue: 0, 44-49.
- Kan, T., Karaat, F. (2019). Farklı Rakımlarda Yetiştirilen Bazı Kayısı Çeşitleri ile Zerdali Meyvelerinde Fenolik Bileşiklerin İncelenmesi. Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi, 29 (1), 88-93.
- MTB-1, <http://www.malatyatb.org.tr/turkiye-geneli-kayisi-ihracati/turkiye-geneli-kayisi-ihracati>. (Erişim tarihi: 05/12/2021)
- MTB-2, <http://www.malatyatb.org.tr/malatya-ili-tahmini-kayisi-rekoltesi/malatya-ili-tahmini-kayisi-rekoltesi>. (Erişim tarihi: 05/12/2021)
- Muradoğlu, F., Pehlivan, M., Gündoğdu, M. & Kaya, T. (2011). Iğdır Yöresinde Yetiştirilen Bazı Kayısı Genotiplerin Fizikokimyasal Özellikleri ile Mineral İçerikleri. Journal of the Institute of Science and Technology, 1 (1) , 17-22.
- Özdoğru, B., Şen F., Acarsoy Bilgin, N., Mısırlı, A. (2014). Bazı Sofralık Kayısı Çeşitlerinin Depolanma Sürecinde Fiziksel ve Biyokimyasal Değişimlerinin Belirlenmesi. Ege Üniv. Ziraat Fak. Derg., 52 (1):23-30
- Öztürk, D. & Karakaş, G. (2017). Kayısı Üretimi Ve Pazarlama Sorunları; Malatya İli Örneği. Uluslararası Afro-Avrasya Araştırmaları Dergisi, 2 (4), 113-125.
- Uçar, K., Engindeniz, S. (2018). Malatya İlinde Kuru Kayısı Pazarlaması Üzerine Bir Araştırma. Selcuk J Agr Food Sci, 32 (3), 249-256



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Uçar, K. , Engindeniz, S. & Çiçekli, U. G. (2019). Tarımsal Yatırımların Kuruluş Yeri Seçimi: Malatya İlinde Kayısı Bahçesi Yatırımı Örneği. İzmir İktisat Dergisi, 34 (1), 95-110.

Türkoğlu, M., Hanbay, K., Saraç Sivrikaya, I. & Hanbay, D. (2020). Derin Evrışimsel Sinir Ağı Kullanılarak Kayısı Hastalıklarının Sınıflandırılması. Bitlis Eren Üniversitesi Fen Bilimleri Dergisi, 9 (1), 334-345.



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**BENZER KOŞULLARDAKİ KOLONİLERİN ANA ARI KABULÜNE ANA ARI
IRKININ ETKİSİ**

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ÖZET

Türkiye, arıcılık faaliyeti için iyi bir potansiyele sahiptir. Coğrafi konumu nedeni ile dört mevsim yaşanabilmektedir. Bu nedenle yılın her zamanında arıcılık faaliyetlerini sürdürebilecek bir bölge bulunabilmektedir. Türkiye arılı kovan sayısı ve bal üretiminde de dünyada üst sıralarda olup bazı yıllarda Çin'den sonra ikinci sırada gelmektedir. Ancak bu olumlu verilerin yanında verimliliğin düşük olduğu da belirtilmektedir. Tarım ve hayvancılıkta verimi etkileyen birçok faktör bulunmaktadır. Bunlardan biri de doğru ırk veya tohum seçimidir. Sahip olduğu coğrafi zenginlik Türkiye'de bulunan arı ırklarında da çeşitliliği sağlamıştır. Türkiye'de Anadolu, Kafkas, Suriye, Muğla, İran, Gökçeada, Bolu, Trakya gibi arı ırk ve ekotiplerinin olduğu ve arı ırklarından %20 sinin bulunduğu belirtilmektedir. Ana arı yetiştiriciliği üzerinde zaman zaman ve farklı konular üzerinde çalışmalar yapılmıştır. Ancak kolonilerin yeni bir ana arıyı kabul etmesinde ana arıların ırkının etkisine dair çalışmaların gözlemlendiği kadarıyla olmadığı söylenebilir. Ana arının koloni tarafından kabul edilmesi hatta erken kabul edilmesi oldukça önemlidir. Örneğin ilkbahar sonlarında koloninin bir an önce ana arıya kavuşması bal mevsiminin verimli geçmesine etki edebilir. Sonbahar sonlarında ise koloninin bir an önce ana arıya kavuşması ile koloninin genç işçi arı nüfusu ile kış mevsimini geçirmesi sağlanabilir. Bir ana arının yeni bir koloniye kabul ettirilmesini etkileyen birçok faktör vardır. Bu faktörlerin başlıca; ana arının nitelikleri, ana arının verileceği koloninin nitelikleri ve çevresel şartlar olduğu söylenebilir. Bu çalışmada aynı koşullarda ve benzer kolonilerin ana kabulünde ana arı ırklarındaki farklılığının etkisi incelenmiştir. Verimlilikleri ve davranış özellikleri ile arıcılıkta sıklıkla tercih edilen 5 farklı ırk ana arının koloniler tarafından kabullenilmelerinde ırkın etkisi incelenmiştir. Sonuç istatistikleri yüzde-frekans bilgisi ile verilmiştir. Sonuçlara göre ırkların erken dönemdeki yani ilk alışma döneminden sonraki kabul oranlarına göre Belfast ve Kafkas birinci sıradadır. Bunu daha sonra sırasıyla Karpas, Karniyol ve Yığılca izlemiştir. Kısa süreli alışma sonrasında kabulü en rahat gerçekleşen ırklar Belfast ve Kafkas iken en zor ırk Yığılca ırkı olmuştur. Belfast ve Kafkas ırkı ana arılar koloniler tarafından erken olarak kabul gördükleri gibi bir aylık süreçte de en az sorun yaşanan ırklar olmuşlardır. Bir aylık süre sonunda en az kabul gören ırklar ise Karniyol ve Yığılca ırkları olmuştur. Bu sonuçlara göre ana arının erken kabul edilmesi gereken durumlarda kabul oranları yüksek ırkların tercih edilmesi faydalı olabilir.

Anahtar kelimeler: Ana Arı, Kolonilerde Ana Arı Kabulü, Ana Arı Irkları



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**EFFECT OF QUEEN BREED ON ACCEPTANCE OF QUEENS IN COLONIES
WITH SIMILAR CONDITIONS**

ABSTRACT

Turkey has a good potential for the beekeeping sector. Due to its geographical location, four seasons can be experienced. For this reason, it is possible to find a region where beekeeping can continue at any time of the year. Turkey is at the top of the world in the number of beehives and honey production, and in some years it comes second after China. However, besides these positive data, it is stated that the productivity is low. There are many factors affecting productivity in agriculture and animal husbandry. One of them is the selection of the right breed or seed. Its geographical richness has also provided diversity in bee breeds in Turkey. It is stated that there are bee breed and ecotypes such as Anatolia, Caucasian, Syria, Mugla, Iran, Gökçeada, Bolu, Thrace in Turkey, and 20% of bee breed exist. Studies have been carried out on queen bee breeding from time to time and on different subjects. However, it can be said that the studies on the effect of the breed of the queen bees on the acceptance of a new queen by the colonies are not as far as observed. It is can be important that the queen bee is accepted by the colony early. For example, in late spring, the colony's meeting with the queen as soon as possible may affect the productive honey season. Or, at the end of autumn, the colony can be provided with the queen bee as soon as possible, and the colony can spend the winter season with the young worker bee population. There are many factors that affect the acceptance of a queen bee to a new colony. These factors are mainly; it can be said that the qualities of the queen bee, the qualities of the colony to which the queen will be given, and the environmental conditions. In this study, the effect of the difference in queen bee breeds on the queen acceptance of similar colonies under the same conditions was investigated. The effect of the breed on the acceptance by the colonies of 5 different breeds of queen bees, which are frequently preferred in beekeeping with their productivity and behavioral characteristics, was examined. Result statistics are given with percentage-frequency information. According to the results, Belfast and Caucasian are in the first place according to the acceptance rates of the breeds in the early period, that is, after the first acclimatization period. This was followed by Karpat, Karniyol and Yıgılca, respectively. After a short period of familiarization, the most easily accepted breeds were Belfast and Caucasian, while the most difficult breed was Yıgılca. Belfast and Caucasian queens were accepted by the colonies early and they were the races with the least problems in a month. At the end of the one-month period, the least accepted breeds were Carniolan and Yıgılca breeds. According to these results, it may be beneficial to prefer breeds with high acceptance rates in cases where the queen bee must be accepted early.

Keywords: Queen Bee, Reception of Queens in Colonies, Queen Breeds



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1. GİRİŞ

Türkiye arıcılık faaliyeti için iyi bir potansiyele sahiptir. Coğrafi konumu nedeni ile dört mevsim yaşanabilmektedir. Bu nedenle yılın her zamanında arıcılık faaliyetlerini sürdürebilecek bir bölge bulunabilmektedir. Bununla birlikte zengin bitki örtüsü ve bazı endemik türleri de üretim açısından önemlidir. Anzer balı gibi endemik türlerden elde edilen balın yanı sıra kestane balı, çam balı gibi özgün bal üretimleri de yapılmaktadır. Türkiye arılı kovan sayısı ve bal üretiminde de dünyada üst sıralarda olup bazı yıllarda Çin'den sonra ikinci sırada gelmektedir. Ancak bu olumlu verilerin yanında verimliliğin düşük olduğu da belirtilmektedir. Tarım ve hayvancılıkta verimi etkileyen birçok faktör bulunmaktadır. Bunlardan biri de doğru ırk veya tohum seçimidir (Çevrimli ve Sakarya, 2018; Malkoç ve ark., 2019).

Sahip olduğu coğrafi zenginlik Türkiye'de bulunan arı ırklarında da çeşitliliği sağlamıştır. Türkiye'de Anadolu, Kafkas, Suriye, Mugla, İran, Gökçeada, Bolu, Trakya gibi arı ırk ve ekotiplerinin olduğu ve arı ırklarından %20 sinin bulunduğu belirtilmektedir (Borum, 2017). Bal arılarının farklı iklim koşullarının birçoğuna uyum sağlamış alt türleri bulunmaktadır. Türkiye'de de fizyolojik ve davranış özellikleri ile farklılık gösteren birçok ırk vardır. Bazıları geniş bir coğrafyaya uyum sağlamışken bazıları daha küçük alanlara uyum sağlamış yerel ırklar olabilmektedir (Gençer, 2003; Gösterit ve ark., 2012).

Arıcılıkta verimi artırmanın yollarından biri de morfolojik ve fizyolojik olarak bölgeye uyum sağlamış olan ırklarla arıcılık yapmaktır. Oysa bu konuda yapılan yanlışlardan biri herhangi bir bölgede verimi yüksek ve başarılı bulunan bir ırkın farklı bir bölgeye de uyum sağlaması için ısrarcı olunmasıdır. Bunun yerine her bir bölge için uygun ırkın seçiminin yapılması veya ırkların ıslah edilmesi daha verimli olabilir (Sıralı, 2017).

Arı kolonilerinde ırk her kovanda sadece bir tane bulunan ana arının ırkına göre belirlenmektedir. Çünkü ana arı kolonideki tüm arıların anasıdır. Dolayısıyla tüm kalıtsal özelliklerin kaynağıdır. Arıların; mizaç ve davranışları, hastalıklara karşı dirençleri, bal, polen vs. arı ürünlerindeki verimlilikleri, oğul verme eğilimleri gibi tüm özellikleri ana arının ırkı ile belirlenmektedir. Bir koloninin ana arısının değişimi ile yaklaşık üç dört hafta sonra tüm özelliklerinde değişim yaşanabilmektedir (Keskin A, 2016).

Ana arı yetiştiriciliği üzerinde zaman zaman ve farklı konular üzerinde çalışmalar yapılmıştır. Zırhlioğlu ve Kara (2004) yaşam analizi yöntemi ile ana arı üretimindeki bazı parametreleri, Koç ve Karacaoğlu (2004), Arslan ve Hamgiri (2010), Öztürk (2014) ile Güneşdoğdu ve



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Şekeroğlu (2020) ana arı üretiminde kaliteyi etkileyen bazı faktörleri çalışmışlardır. Emir (2015) ana arı üretiminde Türkiye'nin durumu, Koç ve Karacaoğlu (2016) ana arıların kışlatma koşulları, Karaca ve Karaman (2018) ise ana arı üretiminde maliyet ve karlılık üzerinde çalışmalar yapmışlardır.

Ancak kolonilerin yeni bir ana arıyı kabul etmesinde ana arıların ırkının etkisine dair çalışmaların gözlemlendiği kadarıyla olmadığı söylenebilir. Bir ana arının yeni bir koloniye kabul ettirilmesini etkileyen birçok faktör vardır. Bu faktörlerin başlıca; ana arının nitelikleri, ana arının verileceği koloninin nitelikleri ve çevresel şartlar olduğu söylenebilir. Bu çalışmada farklı ırk ana arıların koloniler tarafından kabul edilme durumları incelenmiştir. Aynı koşullarda ve benzer kolonilerin ana kabulünde ana arıların ırk farklılığının etkisi incelenmiştir.

Ana arının koloni tarafından kabul edilmesi hatta erken kabul edilmesi oldukça önemlidir. Örneğin ilkbahar sonlarında koloninin bir an önce ana arıya kavuşması bal mevsiminin verimli geçmesine etki edebilir. Sonbahar sonlarında ise koloninin bir an önce ana arıya kavuşması ile koloninin genç işçi arı nüfusu ile kış mevsimini geçirmesi sağlanabilir.

2. MATERYAL METOD

Bu çalışmada verimlilikleri ve davranış özellikleri ile arıcılıkta sıklıkla tercih edilen 5 farklı ırk ana arının koloniler tarafından kabullenilmelerinde ırkın etkisi incelenmiştir. Çalışma için Kafkas, Karniyol, Karpat, Belfast ve Yığılca ırklarından ana arılar seçilmiştir. Gözlem için her bir ırktan 5'er tane alınmıştır. Çalışma, 2021 yılı temmuz ayı sonu ve ağustos ayının ilk günleri aralığında Malatya'da yapılmıştır. Yılın bu döneminde bölgede ortalama sıcaklık 27°C; ortalama güneşlenme süresi yaklaşık 12 saattir. Ortalama en yüksek sıcaklık ve ortalama en düşük sıcaklıklar ise sırasıyla yaklaşık 34 ve 20°C'dir. Ana arıların verileceği kolonilerin homojen olması için bölmeler karma olarak yapılmıştır. Ana arı ve koloninin birbirlerine alışma sürecinde kafes telleri açılmadan 3 gün bekletilmiştir. Böylece ana arının kafesten çıkış zamanının kontrol altına alınması amaçlanmıştır. Bu sürenin sonunda serbest bırakılan ana arıların koloniler tarafından kabulü incelenmiştir. Ana arıyı kabullenmeyen kolonilerde ana arılar kafese alınarak alışmaları için tekrar beklenmiştir. İstatistikler yüzde-frekans bilgisi ile verilmiştir.



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3. BULGULAR

Ana arıların erken kabul edilmesi yavru faaliyetleri için önemli olduğu gibi koloninin bir an önce düzenli çalışmaya başlaması içinde önemlidir. İlk alışma süresi sonunda kolonilerin ana arı kabul bilgileri Tablo 1’de sunulmuştur.

Tablo 1. Ana arıların ilk denemedeki kabul sayısı ve oranları

Irklar	Frekans	Yüzde (%)
Belfastırkı ana arı	5	100
Kafkas ırkı ana arı	5	100
Karpat ırkı ana arı	4	80
Karniyol ırkı ana arı	3	60
Yığılca ırkı ana arı	1	20

Tablo 1 ile verilen sonuçlar son durumdaki ana arı kabul oranları değildir. İlk alışma süresi sonunda kabul edilen oranlardır. İkinci alışma süreci sonunda kabul oranları artış göstermiş ve 1’i dışında analar kabul görmüştür. İkinci alışma süresi sonunda kolonilerin ana arı kabul bilgileri Tablo 2’de sunulmuştur.

Tablo 2. Ana arıların ikinci alışma süresi sonunda kabul sayısı ve oranları

Irklar	Frekans	Yüzde (%)
Belfastırkı ana arı	5	100
Kafkas ırkı ana arı	5	100
Karpat ırkı ana arı	5	100
Karniyol ırkı ana arı	4	80
Yığılca ırkı ana arı	5	100

Tablo 2’den de görüldüğü gibi biri dışında tüm ana arılar koloniler tarafından kabul görmüş yavru atmış hatta bu yavrular gözlerden ergin arı olarak çıkmıştır. Bu süreç artık koloninin tam uyum içinde olduğunu düşündürülebilir. Oysa alışma süreci bazen daha uzun sürebilmektedir. Bu çalışmanın yaklaşık bir ay sonraki kontrollerinde de bu durum gözlenmiştir. Bir ay sonraki kontrollerdeki ana arı kabul bilgileri Tablo 3’de verilmiştir.

Tablo 3. Ana arıların bir ay sonraki kabul oranları

Irklar	Frekans	Yüzde (%)
Belfastırkı ana arı	5	100
Kafkas ırkı ana arı	5	100
Karpat ırkı ana arı	3	60
Karniyol ırkı ana arı	2	40
Yığılca ırkı ana arı	2	40

4. SONUÇ

Öncelikle arıcılığın birçok faktörden etkilendiği gerçeği de göz önünde bulundurularak bu çalışmadan elde edilen verilerin bu çalışmaya özgü olduğu unutulmamalıdır. Benzer çalışmalarla desteklenmesi durumunda daha çok önem kazanacağı düşünülmektedir. Yine bu



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çalışmanın kapsamında olmayan farklı ırklarda daha başarılı sonuçlar da elde edilebilir. Çalışmanın başındaki yüksek kabul oranlarına rağmen ilerleyen zamanlarda bu oranın düşmesinin başka sebeplerinin olabileceği de unutulmamalıdır. Çalışmada kullanılan farklı ırk ana arılarının üretim ortamlarından kaynaklı farklılıklar da olabilir.

Bu çalışmanın sonuçlarına göre ırkların erken dönemdeki yani ilk alışma döneminden sonraki kabul oranlarına göre Belfast ve Kafkas birinci sıradadır. Bunu daha sonra sırasıyla Karpat, Karniyol ve Yığılca izlemiştir. Kısa süreli alışma sonrasında kabulü en rahat gerçekleşen ırklar Belfast ve Kafkas iken en zor ırk Yığılca ırkı olmuştur. Belfast ve Kafkas ırkı ana arılar koloniler tarafından erken olarak kabul gördükleri gibi bir aylık süreçte de en az sorun yaşanan ırklar olmuşlardır. Bir aylık süre sonunda en az kabul gören ırklar ise Karniyol ve Yığılca ırkları olmuştur. Bu sonuçlara göre ana arının erken kabul edilmesi gereken durumlarda kabul oranları yüksek ırkların tercih edilmesi faydalı olabilir.

İkinci alışma süresi sonunda kabul oranlarındaki yükselme de dikkat çekmektedir. Bu durumda kafeslerin kontrollü bir şekilde açılması ve ana arıyı kabullenmeme durumu olması halinde ana arının yeniden kafese alınması kabul oranını artırabilir.

Bu çalışmada ana arı kabulünde etkili olan ana faktörlerden ana arının verileceği koloninin nitelikleri ve çevresel koşulların benzer olduğu söylenebilir. Ancak ana arının niteliklerinde farklılıklar olduğu söylenebilir. Yani kabul oranının yüksek olduğu ırkların feromon salgı düzeyleri, irilikleri, ağırlıkları, fizyolojik özellikleri gibi durumları ayrıca araştırılabilir.



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KAYNAKÇA

Arslan ve Hamgir. Ana Arı Üretiminde Farklı Koloni Populasyonuna Sahip Analı ve Anasız Başlatma Kolonileri İle Üretim Mevsiminin Ana Arı Kalitesi ve Yetiştiricilik Parametreleri Üzerine Etkileri. GOÜ, Ziraat Fakültesi Dergisi, 2010, 27(2), 81-88.

Borum AE. Güney Marmara Bölgesi'nde arıcılık anket çalışması. Uludağ Bee J 2017; 17(1): 24-34.

,Çevrimli, MB., Sakarya, E. 2018. Türkiye Arıcılık Sektöründe Mevcut Durum, Sorunlar ve Çözüm Önerileri. Erciyes Üniv Vet Fak Derg 15(1), 58-67.

Emir, M. (2015). Türkiye'de Ana Arı Üretiminin Değerlendirilmesi . Uluslararası Tarım ve Yaban Hayatı Bilimleri Dergisi, 1 (2), 104-107.

Gösterit, A. , Kekeçoğlu, M. & Çıkılı, Y. (2012). Yığılca Yerel Bal Arısının Bazı Performans Özellikleri Bakımından Kafkas ve Anadolu Bal Arısı Irkı Melezleri ile Karşılaştırılması. Ziraat Fakültesi Dergisi, 7 (1), 107-114.

Karaca, Ü. & Karaman, S. (2018). Türkiye Ana Arı Üretim Maliyeti ve Karlılık Analizi. ANADOLU Ege Tarımsal Araştırma Enstitüsü Dergisi, 28 (2), 17-28.

Keskin A. Balarısı (*apis mellifera l.*) kolonilerinin ana arı kabulünde, genotip, koloni ve mevsimin etkileri üzerinde bir araştırma, Yüksek Lisans tezi, Adnan Menderes Üniv Fen Bil Ens, Aydın 2016.

Koç, A. U. ve Karacaoğlu, M., 2004. Ege Bölgesi Kosullarında Ana Arı (*Apis mellifera L.*) Yetistirme Mevsiminin Ana Arı Niteliklerine Etkileri. *Mellifera*, 4: 2-5.

Koç, A.U. ve Karacaoğlu, M. (2016). Bal Arısı *Apis mellifera* Ana Arılarının Ege Bölgesi Koşullarında Farklı Yöntemlerle Kışlatılması. *Journal of Agricultural Sciences*, 22(2), 229-236.

Malkoç, M., Çakır, H., Kara, Y., Can, Z., Kolaylı, S. (2019). Phenolic composition and antioxidant properties of Anzer honey from black sea region of Turkey. *Uludağ Arıcılık Dergisi*, 19 (2), 143-151.

Öztürk, A. İ. (2014). Ana Arıda Kalite Kavramı ve Ana Arı Kalitesini Etkileyen Faktörler. ANADOLU Ege Tarımsal Araştırma Enstitüsü Dergisi, 24 (1), 53-59.

Sıralı, R. (2017). Ordu arıcılığının başlıca sorunları ve çözüm yolları. *Uludağ Arıcılık Dergisi*, 17 (1), 35-43.



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Zırhlioğlu G., Kara, K. Yaşam Analizi Yöntemleri Kullanılarak Ana Arı Yetiştiriciliği İle İlgili Bazı Parametrelerin Tahmin. Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi, Tarım Bilimleri Dergisi, 2004, 14(1): 7-15

Güneşdoğdu M,Şekeroğlu A (2020). Kraliçe (Ana) Arı Kalitesini Etkileyen Faktörler. Türk Tarım - Gıda Bilim ve Teknoloji dergisi, 8(SP1), 197 - 202.



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KÜÇÜKBAŞ HAYVANLARDA VAJİNAL ÇEVRENİN ÖNEMİ

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ÖZET

Koyun ve keçilerde başarılı bir üreme performansı için sağlıklı bir vajinal çevre şarttır. Vajinal pH, mukus özellikleri, vajinal elektriksel direnç ve vajina ekosistemi gibi bileşenlerin hassas bir denge içinde oluşturduğu vajinal çevre; östrojen konsantrasyonu, hastalıklar, uygulanan tedaviler ve immunolojik koşullar gibi endojen ve ekzojen pek çok faktörün etkisi altında değişkenlik gösterir. Vajina pH'ı, patojen mikroorganizmalara karşı bir bariyer görevi görür. Mukus, spermin taşınması ve hayatta kalması için kritik öneme sahiptir. Vajinal flora ise sürekli değişime uğrayan dinamik bir ekosistemdir. Mukus hacminin ve iyonik içeriğinin değişmesi ve vajinal florada meydana gelen farklılıklar vajinanın elektriksel direncine yansımaktadır. Vajinal çevreyi oluşturan parametrelerde meydana gelen değişiklikler, sperm hareketliliğini ve dölleme oranını etkileyerek hayvanların üreme performanslarını belirler. Çiftlik hayvanlarında döl verimi düşüklüğü verimliliği azaltmakta, üretim maliyetini artırmakta ve işletmenin sürdürülebilirliğini sınırlandırmaktadır. Bu çalışmada vajinal çevre parametrelerinde değişime sebep olan faktörler ve döl verimi üzerine etkileri ele alınmıştır.

Anahtar Kelimeler: Koyun, Keçi, Vajinal pH, Vajinal Ekosistem, Vajinal Elektrik Direnci, Servikal Mukus



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**THE IMPORTANCE OF THE VAGINAL ENVIRONMENT IN SMALL
RUMINANTS**

ABSTRACT

A healthy vaginal environment is essential for successful reproductive performance in sheep and goats. The vaginal environment created in a delicate balance by components such as vaginal pH, mucus properties, vaginal resistance, and vaginal ecosystem varies under the influence of many endogenous and exogenous factors such as estrogen concentration, diseases, treatments, and immunological conditions. The pH of the vagina acts as a barrier against pathogenic microorganisms. Mucus is critical for the transport and survival of sperm. Vaginal flora, on the other hand, is a dynamic ecosystem that is constantly changing. Changes in mucus volume and ionic content and differences in vaginal flora are reflected in the electrical resistance of the vagina. Changes in the parameters of the vaginal environment determine the reproductive performance of animals by affecting sperm motility and fertilization rate. Low fertility in farm animals reduces productivity, increases production costs, and limits the farm's sustainability. This study discusses the factors that cause changes in and vaginal environment parameters and their effects on fertility.

Keywords: Ewe, Doe, Vaginal pH, Vaginal Ecosystem, Vaginal Electric Resistance, Servical Mucus



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GİRİŞ

Vajinal çevrenin kimyasal sinyalleri doğrudan etkilediğinden hayvanların sosyal hayatını ve fizyolojik davranışlarını özellikle de üreme davranışlarını etkileyerek türdeşler arasında algılanamaz iletişim araçları sağladığı bilinmektedir (Ezenwa ve Williams 2014). Bireye özgü vajinal çevre, koku bezinden gelen uçucu yağ asidi profillerini değiştirerek kimyasal iletişimi etkileyen cinsiyete özgü kokular üretir. Bu kokular hayvanların bireysel kimliği, grup üyeliği ve cinsel statüsüne hizmet ederler (Archie ve Theis 2011; Leclaire ve ark. 2014). Kokuya dayalı bu sinyaller, hayvanlar arası iletişimde anahtar bileşenlerdir. Erkekleri çiftleşme için çeken bu semiokimyasal maddeler hayvanların üremesinde önemli bir rol oynarlar (Kustritz 2006). Nishimura ve ark. (1991) kızgın olan düvelerden topladıkları mukusu aynı hayvanın ve sürüdeki diğer hayvanların but bölgesine diöstrusta iken sürmüşler ve hayvanların davranışlarını gözlemlemişlerdir. Kendi vaginal mukusu but bölgesine sürülen hayvanın diğer sürü arkadaşları tarafından aşılmaya çalışıldığını ancak diğer hayvanların butlarındaki aynı mukusun hayvanlar üzerinde aynı etkiyi yapmadığını belirlemişlerdir. Bu durum vajinal mukusun sadece kızgınlıkla ilgili feromonları değil, aynı zamanda bireysel ayırt edici kokuları da içerdiğini göstermektedir. Va'zquez ve Orihuela (2001), 5 aylık yaştaki erkek kuzuların ağızlarına kızgın koyunların vajinal mukusun bulaşmasından sonraki 2 saat içinde testosteron seviyelerinin arttığını bildirmiştir. Feromon sinyalleri yardımcı koku alma organı olan vomeronazal organdan hipotalamusa aktarılır ve cinsel davranışların gerçekleşmesini uyaran hipofiz ön lobunu aktive eder (Savic ve ark. 2005). Bu duyu organı koç ve tekelerde flehmen tepkisinde rol oynamaktadır. Koyun ve keçilerde normal vajinal çevrenin cinsel çekiciliği artırdığı kabul edilmektedir. Herhangi bir sebeple normal vaginal çevrenin yapısı bozulduğunda kimyasal uyarıcılarda meydana gelen değişimler sonucu dişi hayvanlar erkek hayvanlar için çekiciliğini yitirmekte bu da döl veriminde kayıplara sebep olmaktadır (Ungerfeld ve Silva 2005).

Küçükbaş hayvanlarda kızgınlık mevsime bağlı olduğundan yılın sadece belli zamanlarında çiftleşme isteği gösterirler (Kaymakçı 2016). Bu nedenle çiftleşme mevsiminin dışında kızgınlıkların oluşturulması ya da çiftleşme mevsiminde daha fazla döl alınması amacıyla çeşitli uygulamalar yapılmaktadır (Abecia ve ark. 2012). Üremenin denetlenmesinde ışık uygulaması, koç/teke etkisi, flushing gibi doğal yöntemlerin yanı sıra progestagen, PGF_{2α} ve analogları, gebe kısarak serum gonadotropini (eCG/PMSG), gonadotropin salgılatıcı hormon (GnRH), insan koryonik gonadotropini (hCG) ve melatonin gibi hormonlar tek başına ya da



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kombinasyonlar şeklinde uygulanmaktadır (Karaca ve Kılboz 2010; Özyurtlu ve ark. 2010). Küçükbaşlarda kızgınlığı senkronize etmek için yaygın olarak progestagen emdirilmiş poliüretan süngerler veya progesteron içeren sert medikal silikonlar olan CIDR'lar vajinaya yerleştirilir (Vinoles ve ark. 2001; Uçar ve ark. 2002; Özyurtlu ve Bademkiran 2010; Abecia ve ark. 2012; Gebrekidan ve ark. 2014; Öziş Altınçekiç ve Koyuncu 2017). Ancak kullanılan vaginal aparatlar, vajinadaki ekosistemin hem tür hem de sayıca değişmesine yol açarak vajinal çevrenin dengesini bozmaktadır (Padula ve Macmillan 2006). Vajinal çevredeki değişim, mukus birikimini ve vajinadaki bakteriyel yükün artmasını tetikleyerek iltihabi reaksiyon meydana getirmektedir. Bunun sonucu vajinal araçların çıkarılması esnasında itihaplı kötü kokulu akıntı görülmektedir. Ayrıca bu olumsuzluklar fırsatçı ikincil patojenlerin üreme organlarında vajinite neden olarak hayvanın döl tutma yeteneğinin azalmasına yol açmaktadır (Martins ve ark. 2009). Vajinal aparatlar vajinada sebep oldukları tahrişin yanı sıra, yapılarındaki progesteron hormonu nedeniyle lenfositleri ve PGF_{2α} üretimini azaltarak hayvanın enfeksiyonları önleme veya başa çıkma kapasitesini de zayıflatmaktadır (Manes ve ark. 2010). Bununla birlikte gram-negatif *Enterobacteriaceae* varlığında önemli bir artış olmasına yol açarak vajina ekosisteminin bozulmasına neden olurlar. Vajinal çevredeki bu değişiklikler hayvanların sonraki doğurganlığı ve dolayısıyla üreme performansını etkilemektedir (Manes ve ark. 2010). Spermin işlevselliği ve canlılığı, kızgınlık senkronizasyon protokollerinde progestagen emdirilmiş vajinal sünger kullanılan koyunların servikal mukusundan olumsuz etkilenmektedir. Kızgınlıkları vajinal süngerle senkronize edilen koyunların mukusları ile sperm karşılaştığında hareketliliğe sahip sperm yüzdesi düşük, akrozom hasarı olan sperm yüzdeleri ise yüksek olmaktadır ve dolayısıyla gebelik oranı düşmektedir (Manes ve ark. 2016). Anormal servikal mukus, yapay tohumlama uygulanan koyunlarda yüksek oranda döllenenmemiş yumurta varlığı ile ilişkilendirilmiş ve bu durum düşük gebelik oranı ve embriyo gelişimi ile sonuçlanmıştır (Scudamore 1988). Servikal mukusun elektrik direncindeki değişiklikler kızgınlığın ve yapay tohumlama için en uygun zamanın belirlenmesinde yarar sağlamanın yanı sıra foliküler kistler ve endometrit gibi genital organların patolojik durumları hakkında da bilgi edinilmesine olanak sağlamaktadır (Leidl ve Stolla 1976).

Bu derlemede vajinal çevreyi oluşturan parametreler olarak vajinal pH, mukus özellikleri, vajinal elektriksel direnç ve vajina ekosistemi ele alınmış, bu parametreleri etkileyen faktörler ve döl verimi üzerine etkileri incelenmiştir.



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Vajinal pH

Kızgınlık döngüsünün farklı aşamaları sırasında, vajinal mukus pH değerleri steroid hormon seviyesinden etkilenir. Koyunlarda normal vajinal pH 5.6 ila 7.1 arasında değişerek nötre yakın değerler göstermektedir (Swartz ve ark. 2014). Manes ve ark. (2013) da koyunlarda vajinal pH değerinin normalde 7.0-7.6 arasında değiştiğini, vajinal sünger uygulamasından sonra düştüğünü (6.8) bildirmişlerdir. Gaafar ve ark. (2005) pH değerindeki azalmanın vajinada sodyum, hidrojen, klorür gibi iyonların birikimine bağlı olduğunu bunun yanı sıra glikojen ve protein birikiminin de azalmaya katkı sağladığını bildirmişlerdir. Mahmoud (2013), progesteron emdirilmiş vajinal sünger uygulanan koyunlarda östrusta vaginal pH değerinin 6.7, sünger uygulanmayan koyunlarda ise 6.8 olduğunu belirtmiştir. Kendiliğinden kızgınlık gösteren keçilerde kızgınlıkta vajinal pH değerinin 7.17, metöstrus döneminde 6.17, diöstrus döneminde 5.79 ve proöstrus döneminde 5.92 olduğu bildirilmiştir (Sitaresmi ve ark. 2018). Aynı araştırmacılar vajinal pH değerinin yüksek olduğu kızgınlık döneminde meydana gelen en düşük progesteron seviyesini tespit etmişler ve bunun tohumlama için en uygun zamanın belirlenmesinde temel olarak kullanılabileceğini belirtmişlerdir. Kızgınlıkları CIDR ile senkronize edilen keçilerde ise vaginal pH östrusta 8.55 olarak tespit edilmiştir (Widayati ve ark. 2010). Widayati ve ark. (2018) keçilerde kızgınlıkta vajinal pH değerinin (10.26) arttığını sonraki fazlarda hızla azaldığını (7.97, 7.74, 7.69) ve bunun yumurtlamanın göstergesi olduğunu ve bunun kızgınlığı belirlemede yararlı bir parametre olarak kullanılabileceğini bildirmişlerdir. Dogra ve ark. (2016) progesteron implantı uygulanan keçilerde vaginal pH değerini 6.8-7.0 olarak saptamıştır. Kızgınlık esnasında pH değerinin luteal döneme göre daha yüksek olmasının vajinayı bu dönemde enfeksiyonlara karşı daha dayanıklı duruma getirdiği, bu nedenle mikroorganizmaların kolayca yerleşemedikleri ifade edilmiştir (Doğaneli ve ark. 1978). Suarez ve Pacey (2006)'ın Roberts (1986)'dan alıntısına göre seminal plazmanın pH değeri, evcil türlerde 6.7 ila 7.4 arasında değişmektedir ve vajinal asidi nötralize etme potansiyeline sahiptir. Fox ve ark. (1973) fertilite yeteneğine sahip bir insan çiftinin çiftleşme sırasında vajinal pH değerinin, spermanın gelişinden 8 saniye sonra 4.3'ten 7.2'ye yükseldiğini bildirmişlerdir.

Servikal mucus

Ruminantlarda çiftleşme zamanında sperma vajina boşluğuna bırakıldığı için servikal mukus, spermatozoaların genital organların ileri kısımlarına doğru taşınmalarında karşılaştığı ilk fizyolojik sıvıdır. Servikal mukus kompleks bir bileşime sahip biyolojik bir üründür. Vajinal



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havuzda biriken servikal mukus endometriyal, oviduktal, foliküler ve peritoneal sıvıların yanı sıra lökositler ile uterus, servikal ve vajinal dokulardan gelen hücresel artıklar içerebilir. Servikal mukusun fiziksel ve kimyasal özellikleri hormonal etkilerle değişiklikler gösterir. Servikal mukus, su (%90-98) ve üç boyutlu bir ağ oluşturan üç veya daha fazla birimden oluşan bir yarı katı hidrojelidir. (Hafez, 1993). Mukus düşük ve yüksek moleküler ağırlıklı iki tip bileşenin varlığından dolayı heterojen yapıdadır. Düşük moleküler ağırlıklı bileşikler arasında serbest basit şekerler ve amino asitler bulunur. Mukus ayrıca proteinler, eser elementler ve enzimler içerir (Tsiliogianni ve ark. 2001, 2003; Rutlant ve ark. 2005; Pluta ve ark. 2011). Servikal mukus viskozite, akış esnekliği ve yapışkanlık gibi reolojik özelliklere sahiptir. Mukusun kızgınlık sırasındaki viskozitesi esas olarak salgılanan yüksek moleküler ağırlığa sahip olan müsinlerin yüksek miktarlarda olmasına ve bunların glikozilasyon seviyelerine bağlıdır. Yumurtlama sırasında glikozilasyondaki belirgin değişiklikler gibi müsinlerdeki biyokimyasal değişimler müsinlerin hidrasyonuna katkıda bulunur ve değişen sialik asit içeriği sperm penetrasyonunu ve hayatta kalmasını teşvik eder (Ma ve ark. 2016). Mukus özellikleri koyun ırkları arasında farklı yapıdadır. Mukusların farklı glikozilasyon seviyeleri daha yüksek bağışıklık tepkimesine ve daha düşük fertilitateye yol açabilmektedir. Örneğin Suffolk ve Belclare koyunlarında mukustaki müsinlerin glikozilasyonu birbirinden farklı bulunmuştur. Yüksek fertilitateye sahip Belclare ırkından önemli ölçüde daha fazla sialik asit içeren düşük fertilitateye sahip Suffolk ırkında *in vitro* olarak spermatozoaya sialik asit eklenmesi mukus penetrasyonunu artırmıştır (Richardson ve ark. 2019). Başka bir ifadeyle, sialik asit uterusun bağışıklık tepkimesine karşı spermatozoanın bağışıklık geliştirmesine aracılık etmiştir. Normal koşullarda kızgınlık döneminde servikal mukus spermatozoaların taşınmasında, beslenmesinde ve vajinanın asidik ortamından korunmasında rol oynamasının yanı sıra zayıf morfoloji ve motilitateye sahip ya da ölü ve anormal yapıdaki spermatozoaların elimine edilmesi için doğal bir filtre görevi yapmaktadır (Bianchi ve ark. 2004). Mukus tarafından spermatozoaların ilerleme yeteneklerine göre seçilme süreci spermatozoanın dölleme kapasitesi ile güçlü bir şekilde ilişkilidir ve sperm yeteneği mukus penetrasyon testi ile değerlendirilebilir. Spermatozoanın mukusa *in vitro* penetrasyonu, sperm fonksiyonunun güvenilir bir göstergesi olarak kullanılabilir (Aitken ve ark. 1992).

Küçükbaş hayvanlarda servikal mukus hidrasyon seviyeleri foliküler fazda zirve yapar ve foliküler fazda daha az proteinli viskoelastik mukus üretilir. Bu durum normal hareketlilik ve morfolojiye sahip spermilerin ilerlemesi için gereklidir (Maddison ve ark. 2016). Spermilerin



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taşınmasında mukusun viskoelastik özellikleri tek başına viskoziteden daha etkilidir (Tung ve ark. 2017). Spermin vajinadan yumurta kanallarına nakli mukus miktarı, viskozite ve hidrasyon dahil olmak üzere spermatozoayı taşıyacak mukusun özelliklerine bağlıdır ve bunların tümü yumurtalık steroidleri tarafından düzenlenir. Mukus üretimi sürekli ve üretimi östrojen etkisi altındadır, progesteron ise modifiye edici bir etkisi yapar. Bu nedenle mukus bileşimi kızgınlık döngüsü boyunca değişir. Moriyama ve ark. (1999)'un alıntıladığına göre Moghissi ve Syner (1976) insanlarda luteal faz sırasında günde yaklaşık 20-60 mg mukus üretildiğini, yumurtlama döneminde ise günde 700 mg'a kadar çıkararak 10-20 kat arttığını bildirmiştir. Koyunlarda da kızgınlık sırasında mukus üretiminde benzer artışlar olduğu bildirilmiştir (Maddison ve ark. 2016). Mukus üretimi ve bileşimindeki bu doğal varyasyon, foliküler faz sırasında (östrojen baskın) sperm taşınmasını kolaylaştırırken, luteal faz sırasında (progesteron baskın) bir antimikrobiyal bariyer görevi görür ve dişi üreme kanalını gebeliğe hazırlar. Mukus proteomu (protein seti), kızgınlık döngüsü boyunca salgılardaki proteinlerin miktarının belirlenmesi, mukusun mekanik özellikleri ve onunla sperm etkileşimi arasındaki ilişkiyi anlamak için anahtar niteliğindedir. Mukusta 900'den fazla protein tanımlanmıştır (Soleilhavoup ve ark. 2016). Döngü boyunca sıvılardaki bu protein bolluğu, salgılanmanın endokrin ve bağışıklık sistemleri tarafından düzenlenmesinin bir sonucudur (Lee ve ark. 2015). Dişilerin üreme kanalında beş müsin tanımlanmıştır ve bunlardan biri olan MUC 5B, mukusun viskoelastik özelliklerinden sorumlu ana jel oluşturunca müsinidir (Portal ve ark. 2017). Müsin koyunlarda foliküler faz sırasında toplanan mukusta luteal fazda olduğundan daha fazla seviyede bulunmuştur. Ayrıca kızgın koyunların mukuslarında bulunan ancak luteal fazda bulunmayan sialidazın (NEU1) mukusun viskoelastik özelliklerinde bir azalmaya yol açan enzimatik bir etki yaptığı ortaya konulmuştur (Maddison ve ark. 2017). Sonuçta koyunlarda servikovajinal mukus proteomunun, kızgınlık döngüsü boyunca doğal varyasyona uğradığını ve progesteron senkronizasyonu ve süperovulasyon uygulamaları tarafından önemli ölçüde değiştirildiğini, meydana gelen değişikliklerin gebelik oranı üzerinde etkileri olabileceğini ileri sürmüşlerdir. Küçükbaş hayvanlarda kızgınlığın dışsal belirtileri çok belirgin olarak sergilenmediğinden belirlenmesi zordur. Servikal mukusun yapısı kızgınlık ve yumurtlama zamanı konusunda yol gösterici olabilmektedir. Koyunlarda kızgınlık başlangıcında servikal mukus şeffaftır, kızgınlık ilerledikçe bulanıklaşır, kızgınlığın sonunda yani yumurtlamaya yakın zamanda ise peynirimsi bir yapıya bürünür (Souza ve ark. 2011). Fonseca ve ark. (2017) tarafından şeffaf servikal mukuslu keçilerin, peynirimsi servikal mukus tiplerine sahip keçilere kıyasla daha büyük antral



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foliküllere sahip oldukları bildirilmiştir. Bu, küçükbaş hayvanlarda yumurtlama öncesi foliküllerin çapındaki azalma tipik olarak folikül yırtılmasından (yani yumurtlamadan) hemen önce meydana geldiğinden, yumurtlamaların çoğunun peynirimsi mukus salgılanması sırasında meydana geldiğini göstermektedir (Oliveira ve ark. 2016). Kızgınlık başlangıcından 22-24 saat sonra keçilerin %72.7'sinde mukus bulanık/peynirimsi görünümde iken tohumlandıklarında gebelik oranı %62.5 ile sonuçlanmıştır (Fonseca ve ark. 2017). Siqueira ve ark. (2009) keçilerde mukusun bulanık ve bol miktarda olduğu zaman tohumlama için en uygun dönemde olduklarını ve bu dönemin yaklaşık kızgınlık başlangıcından 12-18 saat sonraya denk geldiğini ifade etmişlerdir. Siqueira ve ark. (2009) tarafından alıntılanan Bonfert (1964), mukusun şeffaf görüntüde olduğu zaman tohumlama uygulandığında birinci tohumlamadan 12 ila 14 saat sonra ikinci bir tohumlama yapılmasını önermektedir. Aisen ve ark. (1994) tarafından bildirildiğine göre koyunlarda servikal mukus şeffaf, bulanık ve peynirimsi olarak sınıflandırıldığı sırada taze sperma ile tohumlandıklarında gebelik oranları sırasıyla %80, 60 ve 25 olarak gerçekleşmektedir (Fonseca ve ark. 2017). Özmen ve Cirit (2020) progesteron içeren süngerlerle kızgınlıkları senkronize edilen koyunlarda servikal mukus miktarını yok, az ve bol olarak sınıflandırdıktan hemen sonra taze sperma ile yapay tohumlama uygulamışlar ve gebelik oranlarını sırasıyla % 36.4, 50.6 ve 45.1 olarak saptamışlardır. Sonuçta koyunların gebelik oranları arasında kayda değer sayısal farklılığın olması nedeniyle servikal mukus miktarının fertilitiyi etkileme potansiyelinin olduğunu belirtmişlerdir.

Vajinal ekosistem

Sağlıklı hayvanların vücudunda var olan ve zarar vermeden hatta bazen fayda sağlayan ve organizmayla birlikte yaşayan mikroorganizma topluluklarına, vücudun “normal ekosistemi” denir. Normal ekosistem üyeleri genellikle bulundukları bölgede ekolojik dengeyi sağlayarak patojen mikroorganizmaların yerleşimini önlerler ve hastalık oluşumuna karşı vücudun direncini arttırırlar. Ancak immun sistem bozulduğunda buralardaki bakteriler fırsatçı enfeksiyonlara yol açabilirler (Levinson ve Javetz 1996). Başka bir ifadeyle yerleşik mikrobiyaya genelde zararsız olmakla birlikte, travma ya da enfeksiyon varlığında bu organizmaların bazıları potansiyel patojenler haline gelerek bireyin sağlığını tehdit edebilmektedir (Martins ve ark. 2009). Sağlıklı hayvanlarda vajinal ekosistem aerobik, fakültatif anaerobik ve zorunlu anaerobik bakterilerin dengeli ve dinamik bir bileşimi tarafından kolonize edilir. Komensal mikrobiyoya, rekabet etkisi ile genital sistemin patojenik mikroplardan korunmasında anahtar rol oynar (Srinivasan ve ark. 2021). Süt sığırlarında doğum



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sonrası dönemde tespit edilen mikrobiyal populasyonun değişken olduğu, yem alımı ve enerji metabolizmasından etkilendiği ve bunun mikrobiyal yan ürünleri ve hayvan kokusunu etkilediği bildirilmiştir (Esposito ve ark. 2020). Genital mikroflora başta vajina, rumen, deri, dışkı ve çevre olmak üzere farklı kaynakların bileşenlerinden oluşur. Mikroorganizmanın kökeni ne olursa olsun vajina, genital yola giden ana giriştir (Piersanti ve Bromfield 2019). Vajinal ekosistem, mikropları yakalayan ve onların spesifik antikorlarına bağlanmalarını kolaylaştıran müsinler yoluyla ekzojen patojene karşı koruma sağlayan mikroflora tarafından kolonize edilmiş epitel ve mukus oluşur (Otero ve ark. 2006). Servikal mukus uterusun istilacı patojenlerine karşı mekanik bir bariyer görevi görmektedir (Rutllant ve ark. 2005). Fırsatçı bakteriler uygun ortamı bulduklarında genital organlarda vaginit ve enfeksiyonların gelişiminde rol oynarlar. *Staphylococcus aureus*, vaginit koyunlardan izole edilen en yaygın mikroorganizmadır (Donders ve ark. 2002). *Escherichia coli*, bakteriyel vaginit için fırsatçı ikincil bir ajan olarak bilinmektedir (Sargison ve ark. 2007).

Vajinal ekosistem yaş, kızgınlık döngüsü ve vajinal pH değerinden etkilenen ve yaşam döngüsü boyunca oldukça dinamik bir süreçtir. Yüksek östrojen veya düşük progesteron seviyeleri, kızgınlık döngüsünün farklı fazları sırasında değişen bakteri topluluğunun yoğunluğunu etkiler (Otero ve ark. 1999). Diğer bir ifadeyle vajinal flora populasyonundaki dalgalanmalar dolaşımdaki steroid hormonlarına bağlıdır (Srinivasan ve ark. 2021). Progesteron, uterusun savunma mekanizmasını engelleyerek mikroorganizmalara karşı koyma gücünü azaltmakta ve bunun sonucu luteal dönemde hayvanların uterusunda östrus dönemine göre çok daha fazla sayıda canlı mikroorganizma ve daha fazla yangısal aktivite görülmektedir (Lewis 2003). Östrojen, vajinal ekosistem için değerli bir besin kaynağı olan vajinal epitel dokusunda glikojen birikimini uyarır (Eschenbach ve ark. 2000). Klinik olarak sağlıklı koyun ve keçilerin vajinasında en yaygın bakteri türü *Staphylococcus spp.*'dir (Penna ve ark. 2013; Oliveira ve ark. (2013). Swartz ve ark. (2014) koyunlardan vajinal pH değerinin alkali olması nedeniyle *Lactobacillus spp.* türlerinin seyrek görüldüğünü, en çok *Aggregatibacter spp.* ve *Streptobacillus spp.* türlerinin bulunduğunu ifade etmişlerdir. Keçilerde ise progesteron emdirilmiş süngerler çıkarıldığında gram-pozitif *Streptococcus*, koagülaz-negatif *Staphylococcus* ve koagülaz-pozitif *Staphylococcus* en sık izole edilen bakteriler olarak bildirilmiştir (Penna ve ark. 2013). Manes ve ark. (2010) koyunlarda, *Bacillus spp.*, *Corynebacterium spp.*, *Escherichia spp.*, *Staphylococcus spp.* ve *Streptococcus spp.* türlerinin de sık izole edildiğini bildirmişlerdir. Bu bakteri türlerinin, kızgınlık döngüsü ve gebelik



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sırasında immünolojik engeller olarak mikrobiyal ortamı stabilize etmek için mukusa yapıştığı ve biofilmler oluşturduğu bildirilmiştir (Swartz ve ark. 2014). Biofilmler canlı veya cansız yüzeylere tutunarak, koruyucu bir ekstra sellüler polimerize madde matriks içinde yapılanmış bakteri topluluklarıdır. Mikroorganizmaların biofilm oluşturması olumsuz çevre koşullarında yaşamalarına olanak sağlamaktadır (Willke Topçu 2018). Vajinal aparatlar çıkarıldıktan sonra hayvan kızgınlık gösterene kadar bakteri sayısı bazal değerlere dönse de vajinal ekosistem normale dönmez (Martins ve ark. 2009). *Escherichia coli* vajinal aparatların çıkarılmasından sonra en yaygın görülen bakteridir (Manes ve ark. 2010) ve bu bakteri aglütinasyon yoluyla spermilerin hareketliliğini ve yumurtayı dölleyebilme yeteneğini azaltmaktadır (Schulz ve ark. 2010). Yániz ve ark. (2010) erkek genital sistem enfeksiyonu sırasında koç spermının enterobakteriyel türlerle kontaminasyonunun sperm kalite parametrelerini azalttığını gözlemlenmiştir. Bu nedenle, progestagen emdirilmiş vajinal sünger kullanımından sonra görülen vajinit nedeniyle mukus özelliğindeki değişiklikler sonucu vajinal ortamda bakteri ürünlerinin birikmesi apoptotik sperm sayısını artırarak spermilerin canlılığını tehlikeye atmakta ve tüm bu faktörlerin bir sonucu olarak döl verimi olumsuz etkilenmektedir. Kızgınlık sırasında antibiyotik tedavisi gören dişiler, erkekler tarafından antibiyotik uygulanmayan dişilere göre daha az çekici gelmektedir (Dzieciol ve ark. 2013). Bunun nedeni, erkekleri uyarmak ve çiftleşmeyi teşvik etmek için gerekli olan semiokimyasal sinyal emisyonunu etkileyecek olan vajinal bakteri flora kompozisyonunun ortadan kaldırılması veya değiştirilmesidir. Vasconcelos ve ark. (2016), sahada vaginal araçlar uygulanırken dışkı kaynaklı gram negatif bakterilerin vaginaya girişini önlemek için hijyene dikkat edilmesinin ve araçların vaginada tutulma sürelerinin kısaltılmasının kontaminasyonu en aza indirmede fayda sağlayacağını belirtmişlerdir.

Vajinal elektriksel direnç

Vajinal direnç ölçümü kızgınlık, yumurtlama zamanı, kızgınlık döngüsünün aşamaları gibi üreme olaylarının belirlenmesinde kullanılabilecek ucuz ve pratik bir yöntemdir. Dişi hayvanların kızgınlık göstermeleri yumurtalıklardaki foliküler gelişim tarafından kontrol edilir. Foliküler büyüme, bu organın elektriksel özelliklerindeki değişikliklerin eşlik ettiği histolojik ve histokimyasal değişikliklerle ilişkilidir. Yumurtalıkların endokrin aktivitesi tarafından uyarılan genital sistemdeki histolojik ve biyokimyasal değişiklikler, bu dokuya dışarıdan uygulanan alternatif bir düşük elektrik akımına direnme yeteneği ölçülerek izlenebilir (Yamauchi ve ark. 2009). Kızgınlık döngüsünün evrelerinde vajinal elektriksel direnç



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değerlerindeki değişiklikler östrojen ve progesteronun etkisi altındadır ve bu nedenle kızgınlık döngüsünün aşamalarının belirlenmesinde kullanılabilir (Rezac 2008). Yumurtalık döngüsünün foliküler fazı sırasında yüksek östrojen seviyesi, vajinal dokunun hidrasyonunu indükler, bu da vajinal mukus ve epitelin elektrik iletkenliğini artırır (Ezov ve ark. 1990). Vajinal mukoza zarının en düşük elektriksel direnci östrojen konsantrasyonu zirveye ulaştığında meydana geldiğinden, en düşük direnç değeri, kızgınlık tespiti ve yapay tohumlama zamanının belirlenmesi için yararlı bir araçtır (Yamauchi ve ark. 2009). Benzer şekilde Leidl ve Stolla (1976) tarafından koyunlarda vajinal elektriksel direncinin koçun kabul edilmesinden 24 saat önce keskin bir şekilde düştüğü ve en düşük değerine kızgınlığın başlamasından sonraki ilk 12 saat içinde ulaştığı bildirilmiştir. Aynı şekilde Bartlewski ve ark. (1999) da koyunların kızgın olduklarında düşük vajinal elektriksel direnç değerlerine sahip olduklarını gözlemlemişlerdir. Koyunlarda vajinal mukusun en düşük direnç değerinin kızgınlıktan önce meydana geldiğini ve sonraki 24-48 saat boyunca düşük kaldığını bildirmişlerdir. Ancak kızgınlık senkronizasyonu için progesteron emdirilmiş vajinal sünger kullanıldığında, fizyolojik servikal mukusun karakteristik dalgalanmaları ciddi şekilde bozulmakta ve bunun sonucunda servikal mukus hacmi ve kristalizasyon artmaktadır. Talukder ve ark. (2018) koyunlarda vajinal elektriksel direnç değerleri ile foliküler çap arasında negatif korelasyon olduğunu, büyük çaplı folikül varlığında ölçüm değerlerinde azalma gözlendiğini ortaya koymuşlardır. Düşük vajinal elektriksel direnç değerleri ile tohumlanan dişiler, vajinal elektriksel direnç değerleri yüksek olup tohumlanan dişilere göre daha yüksek gebelik oranına sahip olmuştur (Tasal ve ark. 2005; Ahmed ve ark. 2017). Theodosiadou ve Tsiligianni (2015) koyunlarda hem kızgınlık hem de anöstrus dönemlerinde vajinal elektriksel direnç değerleri ile kan serumu progesteron konsantrasyonları arasında pozitif bir ilişki olduğunu ortaya koymuştur. Keçilerde ise vajinal direnç değerlerinin, kızgınlık öncesinden kızgınlığın başlangıcına kadar kademeli bir düşüş gösterdiği ve kızgınlık sırasında ise arttığı gözlenmiştir (Řezáč ve ark. 2001; Křivanek 2008). Ayrıca Křivanek (2008) prob yerleştirme derinliğinin, östrus döngüsü sırasında vajinal direnç değişikliklerini etkilediğini bildirmiştir. Rezac ve ark. (2009) dişilerde kızgınlık öncesi vajinal elektriksel direncin sütten kesimden sonraki kızgınlık gösterme aralığından, kızgınlık süresinden, pariteden ve laktasyon süresinden etkilendiğini tespit etmişlerdir. Bu nedenle vajinal elektriksel direnç ölçümünün, kızgınlık süresinin tahmini için, sütten kesimden sonra kızgınlığa dönüşte ve kızgınlık süresinin değişmesiyle ilgili mekanizmaların incelenmesi için potansiyel bir araç olarak kullanılmasını önermişlerdir. McCaughey ve Patterson (1981) vajinal



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mukozanın elektrik direnci ölçümlerinin progesteron testi veya davranışsal gözlemler tarafından belirlenen yumurtalık değişiklikleriyle yakından ilişkili olduğunu ve bu testin rutin progesteron testine bir alternatif olarak kullanılabileceğini ifade etmişlerdir. Bu nedenle, vajinal mukozanın elektriksel direnç değerleri, erken gebeliğin belirlenmesi, gebe hayvanlarda doğum zamanının tahmini için de kullanılabilir. Bununla birlikte, vajinal elektriksel direnç değerleri bakımından kısmen ölçüm teknikleri ve kısmen de genital reaksiyonlar nedeniyle döngüsel değişikliklere ek olarak dişi hayvanlar arasında önemli farklılıklar görülmektedir (Yılma ve Sobiraj 2012). Hayvanlar arasında gözlenen bu varyasyonu azaltmak amacıyla McCaughey ve Patterson (1981)'in alıntılacağına göre Podany and Muzikant (1970) vajinanın serviks yakın ön kısmındaki bölgenin vajinal elektriksel direnç ölçümü için daha uygun olduğunu çünkü vulvada sık görülen idrar kontaminasyonunun vulva mukus direncini kısa süreliğine de olsa azaltabileceğine dikkat çekmiştir. Talukder ve ark. (2018) vajinal elektriksel direnç değerleri bakımından aynı koyunda farklı döngülerde aynı aşamada bile belirgin varyasyonlar olduğunu, bu nedenle kızgınlık dönemini saptamak için koyunların direnç ölçümlerinin düzenli olarak yapılarak bireysel eğri profilinin çıkarılması gerektiğini bildirmişlerdir.

Sonuç olarak, koyun ve keçilerin sağlıklı bir şekilde gebe kalmaları ve doğum yapmaları ancak sağlıklı bir vaginal çevreye sahip olmaları ile mümkündür. Çiftleşme veya yapay tohumlama ile spermier dişi genital kanala aktarıldıktan sonra sayılarında ve fonksiyonlarında değişikliğe neden olacak bir dizi faktörün etkisine maruz kalmaktadırlar. Genel olarak spermatozoalar için dişi genital kanalda mekanik, fiziko-kimyasal ve immunolojik engeller bulunmaktadır. Bu engeller kızgınlık döngüsünün fazlarına göre değişen hormonal etkinin kontrolü altındadır. Servikal mukus muayenesinin kolaylıkla gerçekleştirilebilmesi, onu yapay tohumlama prosedürlerinin optimal zamanını belirlemek için son derece faydalı bir yöntem haline getirir. Vajinal elektriksel direnç, dişi çiftlik hayvanlarında kızgınlık döngüsü ile ilgili genital sistem değişiklikleri, gebelik, doğum ve doğum sonrası kızgınlık döngüsünün yeniden başlaması gibi üreme aktivitelerinin izlenmesi için uygulanabilecek faydalı tekniklerden biridir. Vajinal ekosistem, vajinal mukus içeriklerinin ürünlerini metabolize ve fermente ederek feromon üretimini etkiler. Dolayısıyla vajinal çevre herhangi bir nedenle tahrip olduğunda veya dengesi bozulduğunda hayvanın üreme performansı açısından tehdit oluşturmaktadır. Kızgınlık döngüsünün farklı aşamalarında vajinal çevredeki değişiklikler ve bunun foliküler dinamikler ve steroid profili ile ilişkisi üzerine gelecekte yapılacak çalışmalar, koyun ve keçilerde üreme yönetimine değerli bilgiler sağlayacaktır.



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KAYNAKLAR

- Abecia JA, Forcada F, González-Bulnes A. 2012. Hormonal control of reproduction in small ruminants. *Anim Reprod Sci.*, 130 (3-4): 173-179.
- Ahmed M, Chowdhury MK, Rahman MM, Bhattacharjee J, Bhuiyan MMU. 2017. Relationship of electrical resistance of vaginal mucus during oestrus with post – AI pregnancy in cows. *Bangl. J. Vet. Med.*, 15: 113-117.
- Aitken RJ, Bowie H, Buckingham D, Harkiss D, Richardson DW, West KM. 1992. Sperm penetration into hyaluronic acid polymer as a means of monitoring functional competence. *J Androl.*, 13: 44-54.
- Archie EA, Theis KR. 2011. Animal behaviour meets microbial ecology. *Anim. Behav.*, 82: 425-436.
- Bartlewski PM, Beard AP, Rawlings NC. 1999. The relationship between vaginal mucous impedance and serum concentrations of estradiol and progesterone throughout the sheep estrous cycle. *Theriogenology*, 51(4): 813-827.
- Bianchi PG, De Agostini A, Fournier J, Guidetti C, Tarozzi N, Bizzaro D, Manicardi GC. 2004. Human cervical mucus can act in vitro as a selective barrier against spermatozoa carrying fragmented DNA and chromatin structural abnormalities. *J. Assist. Reprod. Genet.*, 21: 97-102.
- Dzieciol M, Nizanski W, Stanczyk E, Kozdrowski R, Najder-Kozdrowska L, Twardon J. 2013. The influence of antibiotic treatment of bitches in oestrus on their attractiveness to males during mating. *Pol. J. Vet. Sci.*, 16: 509-516.
- Dogra P, Dhaliwal GS, Kaswan S. 2016. Estrous behaviour, physio-chemical properties and vaginal cytology of cervical mucus in Beetal goats during induced estrus. *Indian J. Anim. Reprod.*, 38(1): 41-44.
- Doğaneli MZ, Aydın N, Alaçam E. 1978. Koyunlarda östrus siklusunun çeşitli dönemlerinde uterusun enfeksiyonlara karşı koyma gücü üzerine araştırma. TÜBİTAK, Proje No: VHAG-359, 20s.
- Donders GGG, Vereecken A, Bosmans E, Dekeersmaecker A, Salembier G, Spitz B. 2002. Definition of a type of abnormal vagina flora that is distinct from bacterial vaginosis, aerobic vaginitis. *Br. J. Obstet. Gynaecol.*, 109: 34-43.



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Eschenbach DA, Thwin SS, Patton DL, Hooton TM, Stapleton AE, Agnew K, Winter C, Meier A, Stamm WE. 2000. Influence of the normal menstrual cycle on vaginal tissue, discharge, and microflora. *Clin. Infect. Dis.*, 30: 901-907.

Esposito G, Raffrenato E, Lukamba SD, Adnane M, Irons PC, Cormican P, Tasara T, Chapwanya A. 2020. Characterization of metabolic and inflammatory profiles of transition dairy cows fed an energy-restricted diet. *J. Anim. Sci.*, 98(1): 1-15.

Ezenwa VO, Williams AE. 2014. Microbes and animal olfactory communication: where do we go from here? *Bioessays*, 36: 847-854.

Ezov NE, Maltz R, Yarom GS, Lewis D, Schindler M, Ron E, Aizinbud E, Lehrer AR. 1990. Cell density, fluid volume and electrolyte content of bovine vulvar tissue during oestrus and dioestrus. *Anim. Reprod. Sci.*, 22: 281-288.

Fonsecaa JF, Souza-Fabjan JMG., Oliveira MEF, Cruz RC, Esteves LV, Matos de Paiva MP, Brandão FZ, Mancio AB. 2017. Evaluation of cervical mucus and reproductive efficiency of seasonally anovular dairy goats after short-term progestagen-based estrous induction protocols with different gonadotropins. *Reprod. Biol.*, 17: 363-369.

Gaafar KM, Gabr MK, Teleb DF. 2005. The hormonal profile during the estrous cycle and gestation in Damascus goats. *Small Rumin. Res.*, 57(1): 85-93.

Gebrekidan B, Gebremeskel G, Weldegebrial B, Asfaw YT. 2014. Efficacy of GnRH-PGF2 α treatment in synchronization of estrus in Ethiopian local sheep breed. *Int. J. Livest. Res.*, 4(7): 40-48.

Hafez ESE. 1993. *Reproduction in farm animals*. 6th edition. Lea and Febiger, Philadelphia, 573p.

Karaca F, Kılboz Eİ. 2010. Üreme mevsimi dışında genç keçilerde flugeston asetat vaginal sünger ve norgestomet kulak implantı uygulamalarıyla östrüslerin uyarılması. *Y.Y.U. Vet. Fak. Derg.*, 21: 1-6.

Kaymakçı M. 2016. İleri koyun yetiştiriciliği kitabı, genişletilmiş 3. Baskı. Meta Basım Matbaacılık, Bornova, İzmir. ISBN: 9944-5334-0-8.

Křivanek I. 2008. Impedance pattern of vaginal and vestibular mucosa in cyclic goats. *Acta Univ. Agric. et Silv. Mendel. Brun.*, 4: 109-114.

Kustritz MV. 2006. Collection of tissue and culture samples from the canine reproductive tract. *Theriogenology*, 66: 567-574.



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Leclaire S, Nielsen JF, Drea CM. 2014. Bacterial communities in meerkat anal scent secretions vary with host sex, age, and group membership. *Behav. Ecol.*, 25: 996-1004.

Lee SK, Kim CJ, Kim DJ, Kang JH. 2015. Immune cells in the female reproductive tract. *Immune Netw.*, 15(1): 16-26.

Leidl W, Stolla R. 1976. Measurement of electric resistance of the vaginal mucus as an aid for heat detection. *Theriogenology*, 6(2-3): 237-249.

Levinson W, Javetz E. 1996. *Medikal mikrobiyoloji ve İmmünoloji*. Lange Medical Book, İstanbul, Barış Kitabevi, 20-25.

Lewis GS. 2003. Steroidal regulation of uterine resistance to bacterial infection in livestock. *Reprod. Biol. Endocrinol.*, 1(117): 1-8.

Ma X, Pan Q, Feng Y, Choudhury BP, Ma Q, Gagneux P, Ma F. 2016. Sialylation facilitates the maturation of mammalian sperm and affects its survival in female uterus. *Bio. Reprod.*, 94: 123.

Maddison JW, Rickard JP, Mooney E, Bernecic NC, Soleilhavoup C, Tsikis G, Druart X, Leahy T, de Graaf SP. 2016. Oestrus synchronisation and superovulation alter the production and biochemical constituents of ovine cervicovaginal mucus. *Anim. Reprod. Sci.*, 172: 114-122.

Maddison JW, Rickard JP, Bernecic NC, Tsikis G, Soleilhavoup C, Labas V, Combes-Soia L, Harichaux G, Druart X, Leahy T, de Graaf SP. 2017. Oestrus synchronisation and superovulation alter the cervicovaginal mucus proteome of the ewe. *J. Proteomics*, 155: 1-10.

Mahmoud B. 2013. Physical and chemical properties of ewes cervical mucus during normal estrus and estrus induced by intravaginal sponges. *Egyptian J. Anim. Prod.* 50(1):7-12.

Manes J, Fiorentino MA, Kaiser G, Hozbor F, Alberio R, Sanchez E, Paolicchi F. 2010. Changes in the aerobic vaginal flora after treatment with different intravaginal devices in ewes. *Small Rumin. Res.*, 94: 201-204.

Manes J, Fiorentino MA, Hozbor F, Paolicchi F, Alberio R, Ungerfeld R. 2013. Changes in the aerobic vaginal bacteria load and antimicrobial susceptibility after different oestrous synchronisation treatments in goats. *Anim. Prod. Sci.*, 53: 555-559.

Manes J, Ríos G, Fiorentino MA, Ungerfeld R. 2016. Vaginal mucus from ewes treated with progestogen sponges affects quality of ram spermatozoa. *Theriogenology*, 85: 856-861.



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Martins G, Figueira L, Penna B, Brandão F, Varges R, Vasconcelos C, Lilenbaum W. 2009. Prevalence and antimicrobial susceptibility of vaginal bacteria from ewes treated with progestin-impregnated intravaginal sponges. *Small Rumin. Res.* 81: 182-184.

McCaughey WJ, Patterson AD. 1981. Vaginal electrical resistance in cows: 2. Relationship to milk progesterone concentrations during the reproductive cycle. *Vet. Res. Commun.*, 5: 77-84.

Moriyama A, Shimoya K, Ogata I, Kimura T, Nakamura T, Wada H, Ohashi K, Azuma C, Saji F, Murata Y. 1999. Secretory leukocyte protease inhibitor (SLPI) concentrations in cervical mucus of women with normal menstrual cycle. *Mol. Hum. Reprod.*, 5(7): 656-661.

Nishimura K, Utsumi K, Okano T, Iritani A. 1991. Separation of mounting-inducing pheromones of vaginal mucus from estrual heifers. *J. Anim. Sci.*, 69: 3343-3347.

Oliveira JK, Martins G, Esteves LV, Penna P, Hamond C, Fonseca JF, Rodrigues AL, Brandao FZ, Lilenbaum W. 2013. Changes in the vaginal flora of goats following a short-term protocol of oestrus induction and synchronisation with intravaginal sponges as well as their antimicrobial sensitivity. *Small Rumin. Res.*, 113: 162-166.

Oliveira MEF, Ayres H, Oliveira LG, Barros FFPC, Oba E, Bicudo SD, Bartlewski PM, Fonseca JF, Vicente WRR. 2016. Effects of season and ovarian status on the outcome of long-term progesterone-based estrus synchronization protocols and ovulatory follicle development in Santa Inês ewes under subtropical conditions. *Theriogenology*, 85: 452-460.

Otero C, de Ruiz CS, Ibanez R, Wilde OR, Holgado AAPD, Nader-Macias ME. 1999. Lactobacilli and enterococci isolated from the bovine vagina during the estrous cycle. *Anaerobe*, 5: 305-307.

Otero MC, Morelli L, Nader-Macias ME. 2006. Probiotic properties of vaginal lactic acid bacteria to prevent metritis in cattle. *Lett. Appl. Microbiol.*, 43: 91-97.

Öziş Altınçekiç Ş, Koyuncu M. 2017. Anöstrustaki kıvrıcık ırkı koyunlarda CIDR ve prostaglandin uygulamalarının üreme performansı üzerine etkilerinin karşılaştırılması. *J. Tekirdag Agric. Fac.*, 14(01): 9-15.

Özmen MF, Cirit Ü. 2020. İvesi koyunlarında servikal mukus miktarı ile fertilité arasındaki ilişki. *Dicle Üniv. Vet. Fak. Derg.*, 13(2): 83-86.



**ISPEC 8th INTERNATIONAL CONFERENCE
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Özyurtlu N, Küçükaslan İ, Çetin Y. 2010. Characterization of oestrous induction response, oestrous duration, fecundity and fertility in Awassi ewes during the non-breeding season utilizing both CIDR and intravaginal sponge treatment. *Reprod. Dom. Anim.*, 45: 464-467.

Özyurtlu N, Bademkiran S. 2010. Koyunlarda östrus senkronizasyonu ve östrusu uyarma yöntemleri. *Dicle Üniv Vet Fak Derg* 3: 17-22.

Padula AM, Macmillan KL. 2006. Effect of treatment with two intravaginal inserts on the uterine and vaginal microflora of early postpartum beef cows. *Aust. Vet. J.*, 84: 204-208.

Penna B, Libonati H, Director A, Sarzedas AC, Martins G, Brandão FZ, Fonseca J, Lilenbaum W. 2013. Progestin-impregnated intravaginal sponges for estrus induction and synchronization influences on goats vaginal flora and antimicrobial susceptibility. *Anim. Reprod. Sci.*, 142: 71- 74.

Piersanti RL, Bromfield JJ. 2019. The consequence of postpartum uterine disease on dairy cow fertility. *EDIS 2019*. <https://edis.ifas.ufl.edu/pdf/AN/AN35400.pdf>

Pluta K, Irwin JA, Dolphin C, Richardson L, Fitzpatrick E, Gallagher ME, Reid CJ, Crowe MA, Roche JF, Lonergan P, Carrington SD. 2011. Glycoproteins and glycosidases of the cervix during the periestrous period in cattle. *J. Anim. Sci.* 89: 4032–4042.

Portal C, Gouyer V, Magnien M, Plet S, Gottrand F, Desseyn JL. 2017. In vivo imaging of the Muc5b gel-forming mucin. *Sci. Rep.*, 7(44591): 1-9.

Rezac P, Vasicková D, Pöschl M. 2001. Changes of vaginal and vestibular impedance in dairy goats during the estrous cycle. *Small Rumim Res.*, 42: 185-190.

Rezac P. 2008. Potential applications of electrical impedance techniques in female mammalian reproduction. *Theriogenology*, 70: 1-14.

Rezac P, Krivánek I, Urban T, Borkovcová M, Pöschl M. 2009. Relationship of vaginal impedance with speed of return to oestrus after weaning, oestrous behaviour, parity and lactation length in cyclic sows. *Anim. Reprod. Sci.*, 114: 238-248.

Richardson L, Hanrahan JP, Tharmalingam T, Carrington S, Lonergan P, Evans ACO, Fair S. 2019. Cervical mucus sialic acid content determines the progression of thawed ram sperm through the cervix. *Reproduction*, 157: 259-271.

Rutlant J, López-Béjar M, López-Gatius F. 2005. Ultrastructural and rheological properties of bovine vaginal fluid and its relation to sperm motility and fertilization: A Review. *Reprod. Domest. Anim.*, 40: 79-96.



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Sargison ND, Howie F, Mearns R, Penny CD, Foster G. 2007. Shiga toxin-producing *Escherichia coli* as a perennial cause of abortion in a closed flock of Suffolk ewes. *Vet Rec*, 160: 875-876.

Savic I, Berglund H, Lindstrom P. 2005. Brain response to putative pheromones in homosexual men. *Proc. Natl. Acad. Sci.*, 102(20): 7356-7361.

Schulz M, Sánchez R, Soto L, Risopatrón J, Villegas J. 2010. Effect of *Escherichia coli* and its soluble factors on mitochondrial membrane potential, phosphatidylserine translocation, viability, and motility of human spermatozoa. *Fertil. Steril.*, 94: 619-623.

Scudamore CL. 1988. Intravaginal sponges insertion technique. *Vet. Rec.*, 123(21): 554.

Siqueira AP, Fonseca JF, Silva Filho JM, Bruschi JH, Viana JHM, Palhares MS, Bruschi MCM, Peixoto MP. 2009. Reproductive parameters of Toggenburg goats inseminated with cooled semen diluted in egg yolk extender. *Arq. Bras. Med. Vet. Zootec.*, 61(2): 299-305.

Sitairesmi PI, Astuti PK, Widyobroto BP, Bintara S, Widayati DT. 2018. Exfoliative vaginal cytology and vaginal acidity profile in Ettawa-Saanen grade does. *Int. J. Pure Appl. Math.*, 118(24): 1-16.

Souza JMG, Torre CAA, ALRS Maia, Brandão FZ, Bruschi JH, Viana JH, Oba E, Fonseca JF. 2011. Autoclaved, previously used intravaginal progesterone devices induces estrus and ovulation in anestrous Toggenburg goats. *Anim. Reprod. Sci.*, 129(1-2): 50-55.

Srinivasan M, Adnane M, Archunan G. 2021. Significance of cervico-vaginal microbes in bovine reproduction and pheromone production – A hypothetical review. *Res. Vet. Sci.*, 135: 66-71.

Suárez SS, Pacey AA. 2006. Sperm transport in the female reproductive tract. *Hum. Reprod. Update*, 12: 23-37.

Swartz JD, Lachman M, Westveer K, O'Neill T, Geary T, Kott RW, Berardinelli JG, Hatfield PG, Thomson JM, Roberts A, Yeoman CJ. 2014. Characterization of the vaginal microbiota of ewes and cows reveals a unique microbiota with low levels of lactobacilli and near-neutral pH. *Front. Vet. Sci.*, 1(19): 1-10.

Talukder MRI, Hasan M, Rosy TA, Bari FY, Juyena NS. 2018. Monitoring vaginal electrical resistance, follicular waves and hormonal profile during oestrous cycle in the transition period in Bangladeshi sheep. *J. Vet. Res.*, 62: 571-579.



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Tasal I, Ataman MB, Aksoy M, Kaya A, Karaca F, Tekeli T. 2005. Estimation of early pregnancy by electrical resistance values of vaginal mucosa in cows and heifers. *Revue Méd. Vét.*, 156: 91-94.

Theodosiadou E, Tsiligianni T. 2015. Determination of the proper time for mating after oestrous synchronisation during anoestrous or oestrous. *Vet. Med.*, 60(2): 87-93.

Tsiligianni T, Karagiannidis A, Brikas P, Saratsis P. 2001. Chemical properties of bovine cervical mucus during normal estrus and estrus induced by progesterone and/or PGF2 α . *Theriogenology*, 56(1): 41-50.

Tsiligianni T, Karagiannidis A, Saratsis P, Brikas P. 2003. Enzyme activity in bovine cervical mucus during spontaneous and induced estrus. *Can. J. Vet. Res.*, 67(3): 189-193.

Tung CK, Lin C, Harvey B, Fiore AG, Ardon F, Wu M, Suarez SS. 2017. Fluid viscoelasticity promotes collective swimming of sperm. *Sci. Rep.*, 7(3152): 1-9.

Uçar M, Gündoğan M, Özdemir M, Tekerli M, Eryavuz A, Saban E, Özenç E. 2002. Değişik ırk koyunlarda Progesteron+eCG ile östrusların senkronize edilmesi ve hayvanlarda kolesterol ile progesteron seviyelerinin araştırılması. *Vet. Bil. Derg.*, 18: 79-85.

Ungerfeld R, Silva L. 2005. The presence of normal vaginal flora is necessary for normal sexual attractiveness of estrous ewes. *Appl. Anim. Behav. Sci.*, 93: 245-250.

Vasconcelos COP, Brandão FZ, Martins G, Penna B, Souza-Fabjan JMG, Lilenbaum W. 2016. Qualitative and quantitative analysis of bacteria from vaginitis associated with intravaginal implants in ewes following estrus synchronization. *Ciência Rural*, Santa Maria, 46(4): 632-636.

Vazquez R, Orihuela A. 2001. Effect of vaginal mucus and urine from ewes in estrus on plasma testosterone levels and weight gain of feedlot rams. *Small Rum. Res.*, 42: 173-177.

Vinoles C, Forsberg M, Banchero G, Rubianes E. 2001. Effect of long-term and short-term Progestagen treatment on follicular development and pregnancy rate in cyclic ewes. *Theriogenology* 55: 993-1004.

Widayati DT, Junaidi A, Suharto K, Oktaviani A, Wahyuningsih W. 2010. Reproduction performance of Etawah crossbred goats in estrus synchronization by controlled internal drug release implant and PGF2 α continued by artificial insemination. *World Academy of Science, Engineering and Technology, International Science Index 41, International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering*, 4(5): 393-395.



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Widayati DT, Sitaesmi PI, Bintara S, Widyobroto BP. 2018. Estrus detection through vaginal pH in Saanen Etawah crossbreed goats. Pak. J. Biol. Sci., 383-386.

Willke Topçu A. 2018. Biyofilm Nedir? Biyofilm Enfeksiyonları. 1. Baskı. Ankara: Türkiye Klinikleri, 1-3, 2018.

Yamauchi S, Nakamura S, Yoshimoto T, Nakada T, Ashizawa K, Tatemoto H. 2009. Prediction of estrous cycle and optimal insemination time by monitoring vaginal electrical resistance (VER) in order to improve the reproductive efficiency of the Okinawan native Agu pig. Anim. Reprod. Sci., 113: 311-316.

Yániz JL, Marco Aguado MA, Mateos JA, Santolaria P. 2010. Bacterial contamination of ram semen, antibiotic sensitivities, and effect on sperm quality during storage at 15oC. Anim. Reprod. Sci., 122: 142-149.

Yilma T, Sobiraj A. 2012. Relationships between intra-vaginal electrical impedance, estrus behavior, plasma levels of ovarian steroids and the preovulatory luteinizing hormone surge in the prediction of the optimal insemination time in normal cycling pigs. Indian J. Anim. Res., 46: 114-120.



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**TÜRKİYE’DE PAMUK TARIMININ BAŞLICA SORUNLARI VE ÇÖZÜM
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ÖZET

Ülkemizde birçok farklı sanayi dalında değerlendirilebilen stratejik öneme sahip bir lif bitkisi olan pamuk, özellikle dünyada rekabetçi konumda olduğumuz tekstil ve konfeksiyon sektörümüzün temel hammaddesini oluşturan endüstriyel bir üründür. Bu çalışmada ülkemizde Ege bölgesi, Güneydoğu Anadolu bölgesi, Adana ve Antalya yörelerinde tarımının yoğun olarak yapıldığı pamuk bitkisinin tarımına yönelik yaşanan başlıca sorunları ve bu sorunların çözümüne bağlı olarak bazı çözüm önerilerine değinilecektir. Bu çalışmada literatür taraması, ürün raporları, bültenler ve istatistikler materyal olarak kullanılmış ve saha deneyimlerine dayanarak yoruma gidilmiştir. Ülkemizde 2019/2020 yılı pamuk üretim sezonunda 478 bin ha alanda 2.200 bin ton kütlü üretimi, 814 bin ton lif üretimi yapılmış olup dekara kütlü verimi ise 460 kg/da olarak kaydedilmiştir. 2018/19 sezonunda 519 bin ha’a çıkan pamuk ekim alanları 2019/20’de %14 azalarak 478 bin ha’a gerilemiştir. 2020/21 sezonunda bu gerileme artarak sürmü ve pamuk alanları % 40 azalma ile 353 bin ha seviyesine düşmüştür. Türkiye pamuk tüketimi 2019/20 sezonunda, son yılların en büyüğü olan 1 milyon 17 bin tona yükselmiş olup söz konusu tüketim lif pamuk ithalatlarıyla kapanmıştır; bu durum, Dünya’da kayda değer bir öneme sahip olan tekstil sektörümüzün hammadde ihtiyacını önemli ölçüde karşılayamadığımızı açıkça gözler önüne sermekte ve gelişmekte olan ülkemizin, tekstil sektörünün hammadde ihtiyacının yerli üretimle karşılanabilmesi yönünden pamuk verim ve üretiminin artırılmasına yönelik çalışmaları zorunlu kılmaktadır. Bu sorunların yanı sıra tarlada hasat olgunluğuna gelen pamuğun toplanması sırasındaki kayıpların, hasat makinalarının ve çırçırılama işletmelerinin yetersizliklerinin, depolama ve standardizasyon sistemindeki denetim yetersizliğinin, üretim ve pazarlamadan kaynaklı sorunların çözülmesi, hem ithalatımızı azaltarak dışa bağımlılığımızı azaltacak, hem de pamuk üreticinin emeğinin kaybolmasının önüne geçilecektir.

.,Anahtar Kelimeler: Pamuk, Lif, Çırçırılama, Pamuk Sorunları



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MAIN PROBLEMS AND SOLUTIONS OF COTTON AGRICULTURE IN TURKEY

ABSTRACT

Cotton, which is a strategically important fiber plant that can be evaluated in many different industries in our country, is an industrial product that constitutes the basic raw material of our textile and apparel industry, where we are in a competitive position in the world. In our country, in the cotton production season of 2019/2020, 2.200 thousand tons of seed production and 814 thousand tons of fiber were produced on an area of 478 thousand hectares, and the seed yield per decare was recorded as 460 kg/da. The cotton cultivation areas, which increased to 519 thousand hectares in the 2018/19 season, decreased by 14% to 478 thousand hectares in 2019/20. In the 2020/21 season, this decline continued and cotton areas decreased by 40% to 353 thousand ha. Turkey's cotton consumption increased to 1 million 17 thousand tons, which is the largest of recent years, in the 2019/20 season, and this consumption was closed with fiber cotton imports; this situation clearly reveals that we cannot meet the raw material needs of our textile industry, which has a significant importance in the world. This situation necessitates studies to increase cotton yield and production in order to meet the raw material needs of the textile sector of our developing country with domestic production. In addition to these problems, the inadequacy of the harvesting machines in the field, the inadequacy of the harvesting machines, the malfunctions and unconscious mistakes in the ginning system, the decreases in the quality of the seed due to the inability to improve the storage conditions, and the fact that we lag behind the cotton prices in the world market due to these factors reduces our chance of competition among the producer countries. In addition to these problems, solving the losses during the collection of the cotton that has reached the harvest maturity in the field, the inadequacy of the harvesting machines and ginning enterprises, the inadequacy of the control in the storage and standardization system, the problems arising from production and marketing will both reduce our imports and reduce our foreign dependency, and also prevent the loss of cotton producers labor.

Keywords: Cotton, fiber, ginning system, cotton problems



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1. GİRİŞ

Pamuk ülkemizin tarımsal yapısında büyük öneme sahip olan stratejik bir üründür. Yaygın ve çeşitli kullanım alanları ile hem insanlık açısından hem de üretici ülkeler açısından büyük ekonomik öneme sahiptir. Dünya genelinde giderek artan nüfus gıda sektörünü olduğu gibi diğer pek çok sektörü de etkilemiştir. Yaşam standartlarının değişmesine bağlı olarak sürekli bir şekilde artan ihtiyaçlar tekstil sektörüne olan ilginin artmasına da neden olmuştur. Dünyada olduğu gibi ülkemizde de tekstil sektörünün temel hammaddesinin pamuk olması söz konusu bitkinin önemini her geçen gün arttırmaktadır. Özellikle son yıllarda, polyester ve suni elyafların doğada parçalanamadan daha uzun süre kalması nedeniyle suni elyaf kirliliği ve çevreye verilen zararın daha fazla farkına varıldıkça, en büyük doğal elyaf kaynağı olan pamuğa olan talep, pamuğun pazar payının yeniden yükselmesine sebep olmuştur.

Dünya genelinde *Gossypium hirsutum* ve *Gossypium barbadence* türüne bağlı özellikle dört pamuk türünün yetiştiriciliği yapılmaktadır. Upland pamukları (*Gossypium hirsutum* L.), verim potansiyelleri yüksek, vejetasyon süresi orta-uzun, çırcır randımanları $>39\%$ civarındadır. Dünyada yetiştirilen pamukların 80% 'inden fazlasını ülkemizde yetiştirilen pamukların ise hemen hemen 99% 'nu *Gossypium hirsutum* L. türüne bağlı çeşitler oluşturur (Gürel ark. 2000). Ülkemizde pamuk özellikle iklim faktörlerinin belirleyici etkisi ile Güneydoğu Anadolu Bölgesi, Ege Bölgesi, Adana ve Antalya yörelerinde yoğun olarak yetiştirilmektedir.

Pamuk lifinin yanı sıra tohum, tohumundan yağ çıkarıldıktan sonra elde edilen küspesi ve linteri gibi yan ürünleri ile bitkisel yağ ve yem başta olmak üzere birçok farklı sanayi dalına hammadde oluşturarak ülke ekonomisine olan katkısını giderek arttırmaktadır. Ülkemizin pamuk tarımına uygun bir iklime sahip olması ve pamuğun tarımsal üretim değerinin yüksek olması gibi nedenler söz konusu bitkinin tarımının yapılmasına olanak sağlamıştır. Bu bağlamda tekstil ve konfeksiyon sanayilerimiz de hızla gelişerek hammaddenin işlenip özellikle hazır giyim sektöründe kullanılması ile pamuk tarımının sürdürülebilirliğine katkı sağlamıştır. Pamuk, üretim ve tüketim açısından dünya genelinde birçok ülkenin ilgi alanında olan bir endüstri bitkisidir. Dünya pamuk üretimi açısından ülkemiz 10 büyük pamuk üreticisi ülke içerisinde 6. Sırada yer almaktadır. Dünya pamuk tüketim verilerine göre ise ülkemiz Çin, Hindistan ve Pakistan' dan sonra 4. Sırada yer almaktadır. Her ne kadar ülkemiz üretici ülkeler içerisinde ilk sıralarda yer alsa Dünya pamuk ithalatında da Çin, Vietnam ve Bangladeş ' ten sonra 4. Sırada yer almaktadır. Ülkemizde 2019/2020 yılı pamuk üretim sezonunda 478 bin ha alanda 2.200 bin ton kütlü üretimi, 814 bin ton lif üretimi yapılmış olup hektara kütlü verimi



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ise 1.700 kg/ha olarak kaydedilmiştir. 2018/19 sezonunda 519 bin ha'a çıkan pamuk ekim alanları 2019/20'de %14 azalarak 478 bin ha'a gerilemiştir. 2020/21 sezonunda bu gerileme artarak sürmüştür ve pamuk alanları % 40 azalma ile 353 bin ha seviyesine düşmüştür. Türkiye pamuk tüketimi 2019/20 sezonunda, son yılların en büyüğü olan 1 milyon 17 bin tona yükselmiş olup söz konusu tüketim lif pamuk ithalatlarıyla kapanmıştır (Ulusal Pamuk Raporu 2020). Türkiye'de TÜİK II. tahminine göre Kütlü pamuk üretiminin 2021 yılında 2,25 milyon ton olacağı tahmin edilmektedir (Tarım ve Orman Bakanlığı 2021).

Çizelge 1. Türkiye Lif Pamuk Verileri (bin ton)

	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Alan (1000 ha)	434	416	502	519	478
Verim (kg/ha)	1.700	1.820	1.760	1.880	1.700
Üretim	738	756	882	977	814
Tüketim	1.490	1.445	1.596	1.583	1.474
İhracat	50	73	71	105	78
İthalat	918	801	876	762	996

Kaynak: Türkiye İstatistik Kurumu (TÜİK), 2019-2020

Türkiye'de pamuk lif üretimi 2019/2020 üretim sezonunda 814 bin ton ile ülke ihtiyacının ancak %54'ünü karşılamıştır. Türkiye lif ihtiyacını karşılamak için 996 bin ton lif ithal etmiş ve bu bakımından ithalatçı konumdadır. Türkiye, dünya pamuk tüketiminde Çin, Hindistan, Pakistan ve Bangladeş'ten sonra 5. sırada yer almaktadır.

Ülkemizde 2020 yılında 26,8 milyar \$'lık tekstil ve hazır giyim ihracatı gerçekleştirmiştir. 2021 Ocak-Eylül döneminde Türkiye hazır giyim ve konfeksiyon ihracatı 2020 yılının aynı dönemine kıyasla %22,3 artarak 14,8 milyar \$ olmuştur. 2021 Ocak-Eylül döneminde Türkiye tekstil ve hammaddeleri ihracatı 2020 yılının aynı dönemine kıyasla %39,5 artarak 9,4 milyar \$ olmuştur (Tarım ve Orman Bakanlığı 2021).

2. ÜLKEMİZDE PAMUK TARIMININ BAŞLICA SORUNLARI

Tarım sektörünün ekonomik ve sosyal açıdan taşıdığı önem yanında, karşılaşılan riskler ve beraberinde meydana gelen sorunlar ülkemizin tarım potansiyeli açısından büyük önem arz etmektedir. Öte taraftan, üretim sürecinin uzun, parasal geri dönüşüm hızının düşük, sermaye



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birikiminin yetersiz ve yatırımların az olması da tarım sektörünü etkileyen etmenlerdir (Yeni ve Sağlam, 2002).

Türkiye önemli bir pamuk geçmişi olan ve bunu geleceğe de taşıyacak potansiyele sahip önemli pamuk üreticisi ülkelerden biridir. Son yıllarda yapılan çalışmalar incelendiğinde ülkemizin dekara pamuk üretiminde ve verimde dünya genelinde ilk sıralarda yer aldığı görülmektedir (Balsuyu 2016). Ne yazık ki ülkemizde giderek sanayisinin geliştiği stratejik öneme sahip bu ürünün tekstil sektörüne paralel olarak gelişmesi gerekirken halen istenilen seviyelere ulaşamamıştır. Bundan dolayı ülkemiz ihtiyacı olan pamuğun önemli bir kısmını her yıl ithal ederek karşılamaktadır. Bu durum ülkemiz istihdamı ve ihracatında ön sıralarda olduğumuz tekstil sektörümüzün geleceğini tehdit etmektedir. Tekstil sektörünün yapılanmasında önemli yeri olan pamuk üretimini etkileyen pek çok sorun bulunmaktadır. Pamuk tarımında girdi maliyetlerinin yüksek olması, tarımında çeşit, tohumluk ve üretim tekniğinden kaynaklanan sorunlar, Pamuk standardizasyon sistemindeki sorunlar, hasat ve hasat sonrası çırçırılama sisteminde meydana gelen aksaklıklar bu sorunların başında gelmektedir.

2.1. Çırçırılama Kaynaklı Sorunlar

Kütlü pamukta kalite, lifteki renk, parlaklık, uzunluk, mukavemet, incelik gibi parametreler ile değerlendirilmektedir. Çırçırılama öncesi lif kalitesini, doğru hasat uygulamaları, kalibrasyonu iyi yapılmış hasat makineler ve hasadın zamanında yapılması belirler. Tarladaki pamuğun hasadı için uygun zamanlama ve nem kontrolü çok önemlidir. Hasat özellikle lifteki nemin % 5-6 civarında olduğu dönemde yapılmalıdır. Çırçırılama sırasında özellikle yağmurdan dolayı nemli olan pamuğun çırçırılması hem çırçırılmayı zorlaştırır hem de lifin kalitesini olumsuz etkileyerek renk değerlerini bozmaktadır. Bu durumda liflerin çırçırılma öncesi kurutulması ve nemin düşürülmesi gerekmektedir. Çırçırılama esnasında life karışan tohum kabuğu kırıntıları, bitki parçacıkları ve neps (dügüm) oranının yüksek olması da lifin değerini düşüren etmenlerdendir (Evcim, 2016). Ülkemizde çırçır teknolojileri henüz istenilen seviyede gelişmemiştir. Halı hazırda bulunan çok sayıda ve küçük çırçır tesisleri ağır rekabet koşulları nedeniyle teknolojik gelişmelerin gerisinde kalmıştır. Çırçırılama öncesi pamuğun ön temizlenmesi ve kurutma sistemi işletmelerin enerji maliyetlerinin yüksek olmasından dolayı en az seviyede yapılmaktadır, bu durum işletmelerin verimliliğini düşürerek pamukta kalite kayıplarına neden olmaktadır.

Pamukta hasat ve çırçırılama sırasında meydana gelebilecek kalite ve verim kayıplarını asgari seviyeye indirmek için; özellikle makinalı hasat teşvik edilerek makinelerin ayar dengesi ve



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bakımları iyi yapılmalıdır. Kütlü pamuk temiz bir şekilde toplanmalı eğer pamuk nemli ise nem seviyesinin düşmesi beklenmeli ve uygun ambalajlarla fabrikaya getirilmelidir. Çırçır makinalarının bakımları düzenli olarak yapılmalı özellikle lifte kopma, tohum kabuğunu kırma, lif dolanmaları gibi istenmeyen durumlar önlenmeli ve bu bağlamda işletmelerde çalışan işçilerin eğitilmesine olanak verilmelidir. Çırçırılan pamuk lifleri uygun şekilde balyalanmalı ve tek balya sistemi ile lif özelliklerine göre sınıflandırılmalıdır.

2.2. Kontaminasyon (Kirlenme) İle İlgili Sorunlar

Pamukta kontaminasyon; kütlü pamukların toplanması, taşınması, muhafazası, çırçırılması, balyalanması, ve depolanması esnasında yabancı maddelerin life karışması ve lif kalitesinin düşmesi, özellikle dokuma ve boyama aşamalarında fire ve üretim kayıplarına neden olması olarak tanımlanabilir. Bunun yanı sıra, pamuk lifinin kalitesini, uzunluk, mukavemet, incelik, parlaklık, renk, yeknesaklık gibi parametreler ve lifin içerisinde bulunan yabancı maddeler (tohum kabuğu parçaları, bitki artıkları, toz ve toprak, plastik parçaları, kağıt parçaları) önemli ölçüde etkilemektedir. Pamuk lifinde bu nedenlerden dolayı meydana gelen kirlilik, çırçır işletmelerini, iplik fabrikalarını ve tekstil endüstrisini ekonomik olarak olumsuz etkilemekte tekstil sektörümüzün hammaddesi olan pamuğun iç ve dış piyasa değerini düşürerek ithal pamukların tercih edilmesine neden olmaktadır. Bu durum ulusal bağlamda önemli bir sorun olarak karşımıza çıkmaktadır. Life bulaşan ve karışan yabancı maddeler kumaşın ve buna bağlı olarak işlenen giysilerin kalitesinde düşüslere neden olarak pazar değerini düşürmektedir. İşleme sırasında kontaminant maddelerinin yoğunluğu elyaf kalitesini olumsuz etkilemesinin yanı sıra işleme ekipmanlarının da zarar görmesine neden olmaktadır. Bu şekilde meydana gelen olumsuzluklar sadece pamuk üreticilerini değil, çırçırıcılar, tüccarlar, tekstil ve giyim üreticilerini de etkilemektedir (Sluijs and Hunter, 2018). Uluslararası Tekstil Üreticileri Federasyonunun (ITMF) raporuna göre kirliliğe neden olan yabancı madde karışımı pamuk satışlarının toplam pamuk satışının % 1.4 ile % 3.2' sini oluşturmaktadır. Yine aynı rapora göre dünya çapında kontaminasyon sonucu meydana gelen lif kayıplarının 200 milyon dolar olduğu bildirilmiştir (Potter, 2015)



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Çizelge.2. Uluslararası Tekstil Üreticileri Federasyonuna Göre Pamukta Kontaminasyona Neden Olan

Kaynaklar

İmalat Ürünleri	Kumaş parçaları, Plastik atıklar, Jüt, Kendir, Dokuma Ürünler, Naylon iplik ve çuval kalıntıları
Organik Maddeler	Bitkiye ait dal, yaprak, sap parçacıkları, kıl, tüy ve hastalık etmenleri
İnorganik Maddeler	Metal maddeler, çivi, tel, kum, toz
Yağ ve Kimyasal Maddeler	Makine yağı, yaprak döktürücüler, kimyasal ilaç kalıntıları, boya, mürekkep

Kaynak: Uluslararası Tekstil Üreticileri Federasyonu (ITMF), 2017.

Ticaret Bakanlığının 2019 yılı pamuk raporunda ülkemiz pamuklarında kirliliğin önemli bir sorun teşkil ettiği ve bu durumun pamuklarımızın piyasa değerini düşürdüğü bildirilmiştir.

Ekonomi Bakanlığı “Pamukların Standardizasyonuna İlişkin Tebliğ (Ürün Güvenliği Ve Denetimi: 2012/27) kapsamında, üretilen pamuklar ve linter pamukları ile çırçırılama ve iplik imalatı sırasında meydana gelen pamuk lifi döküntülerinin derece (grade), elyaf uzunluğu (stapel) ve karakter özellikleri bakımından sınıf ve tiplere ayrılmasını güvence altına almıştır. Ancak denetimlerin yetersizliği ve çırçır fabrikalarının farklı kalite değerlerine sahip pamuk çeşitlerinin birlikte işlenmesinden dolayı da iplik sanayinde fire ve kalite düşüklüğüne neden olması da kontaminasyon içerisinde değerlendirilebilir. Bu durum, pamuk üreticisinin ve çırçır fabrikalarının sözleşmeli üretim ile bölgeye uygun ve aynı döl ve sınıf kademesindeki sertifikalı tohum kullanımıyla çözülebileceği düşünülmektedir.

Ülkemiz pamuk tarımında ve üretiminde önemli sorun teşkil eden kontaminasyon problemine çözüm için, çırçır işletmelerinin devlet tarafından denetlenmesi ve bu kapsamda tedbirler alınması gerekmektedir. Çırçır işletmelerinde çırçırılama sırasında yabancı madde tayini yapan cihazlar kullanılmalıdır. Makinalı hasat yaygınlaştırılmalı özellikle hasat sırasında naylon ip ve çuval gibi kirlenmeye neden olacak malzemeler kullanılmamalıdır. Kütlü pamuğun temiz bir şekilde hasadı yapılmalı, hasat sırasında hava nemi ve tohum nemine dikkat edilmeli eğer kütlü nemli olarak toplanmışsa kurutulup depolanmalıdır. Homojen bir üretimin yapılabilmesi için yetiştiriciliği yapılan tohum çeşitlerine belirli bir standart verilmeli (Çopur 2016) bölge ekolojik



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yapısına uygun çeşitler kullanılmalı ve bir bölgede belirli standartlara göre çeşit tercihi yapılmalıdır (İyiuyarlar 2016).

2.3. Üretim Ve Pazarlama İle İlgili Sorunlar

Ülkemiz, tekstil ve konfeksiyon sektöründe başta AB ülkeleri olmak üzere birçok ülkenin hazır giyim tedarikçisidir. 2019/2020 TUIK verilerine göre ülkemizde 478 bin ha alanda pamuk tarımı yapılmış olup kütlü verimi ortalaması 460 kg/da, lif verimi ise 170 kg/da'dır (Ulusal pamuk raporu 2020). Pamuk üretiminde yeterli ve kaliteli hammaddenin yurt içerisinde temin edilemeyişi, pamuk üretim girdilerinde dışa bağımlılık nedeniyle maliyetin yüksekliği pamuk üretimini ve küresel bazda pazarlama kapasitesini olumsuz etkilemektedir.

Ülkemiz pamuk tarımında girdi fiyatlarının yüksek olması, işçilik giderlerinin fazla olması, küçük ve dağınık şekilde yapılanmış işletmelerden kaynaklanan sorunlar pamuk üretimine yönelik sürdürülebilirliği de azaltmaktadır. Ülkemizde pamuğa önemli ölçüde destekleme primi verilmesine rağmen yukarıda da belirtildiği gibi girdi (tohum, ilaç, gübre vb.) fiyatlarında maliyetlerin fazla olması pamuk üretimini karlı hale getirme ve artırma konusunda rakip ülkelerin gerisinde kalmaktadır. Ülkemiz için son derece kıymetli olan pamuğun; üretim, pazarlama ve küresel rekabet açısından sürdürülebilirlik potansiyelini artırmak için; Tekstil sektörünün ihtiyacı olan hammaddeyi karşılayabilecek şekilde üretimi artırmaya yönelik çalışmalar yapılmalıdır. Pamuk destekleme primlerinde girdi maliyetleri göz önüne alınmalı ve dünya genelinde verilen fiyatlarla mukayese edilerek ülkemiz pamuğunun rekabetçi ülkeler içerisinde ön plana çıkılması sağlanmalıdır. Pamukta lisanslı depoculuk sistemi yaygınlaştırılmalı ve pamuk üretim-pazarlama yapısı güçlendirilmelidir. Ülkemiz pamukçuluğunun dünya piyasalarında gereken önemi görmesi ve etkin bir pazarlama sistemine sahip olması için önemli kriterlerden biri de tek balya sistemidir. Pamukta tek balya sisteminin benimsenerek lif kalite kriterlerine göre sınıflandırılması gerekmektedir.

3. SONUÇ

Ülkemizin pamuk üretiminde yurtiçi talebi karşılayamaması ve ihtiyacı olan pamuğun büyük bir oranını ithalatla karşılamak zorunda kalması çözülmesi gereken önemli problemlerden biridir. Büyük bir pamuk üretim potansiyeline sahip olan coğrafyamızda yurt içi tüketimi karşılayacak oranda üretim yapılabilmesi için birim alandan alınan verim artırılmalı, pamuk ekimine uygun olan arazilerde ekim alanı genişletilmeli ve üretim altyapısındaki yetersizlikler iyileştirilmelidir. Stratejik bir ürün olan pamuk üretiminde sürdürülebilirliğin sağlanabilmesi için tekstil ve konfeksiyon sanayi ile birlikte pamuğa dayalı diğer sanayi dallarımızı



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geliştirmeye yönelik politikalar benimsenmeli ve bu bağlamda hem üretici hem de sanayici desteklenmelidir. Pamuk tarımında girdi maliyetlerinin mümkün olduğunda düşürülmelidir. Tarlada hasat olgunluğuna gelen kütlü pamuğun hasat ve hasat sonrası işlemlerde mevcut kalitesini koruyarak gerek çırçır işletmelerinin gelişmiş sistemlere geçilmesi gerekse elde edilen ürünün muhafazasında lisanslı depoculuk faaliyetlerinden yararlanılması gerekmektedir. Kütlü pamuk tarladan temiz bir şekilde hasat edilmeli pamuğun daha temiz bir şekilde toplanabilmesi için makinalı hasat yaygınlaştırılmalı hasat kayıplarının en aza düşürülmesi açısından hasattan önce yaprak döktürücüler zamanında uygulanmalıdır.

Pamukların Standardizasyonuna İlişkin Tebliğ (Ürün Güvenliği ve Denetimi: 2012/27) kapsamında denetimler artırılması ve çırçır işletmelerinin donanım olarak modern tesisler haline getirilmesi sağlanmalıdır. Bu konuda Tarım ve Orman Bakanlığı çırçır işletmelerinin modernizasyonu kapsamında daha fazla destek ayırmalıdır.

Sonuç olarak ülkemizin tarımsal yapısında iç ve dış ticaret açısından geçmişten günümüze önemini koruyan pamuğun ülke ekonomisine olan katkısı her geçen artmaktadır. Bu nedenlerden dolayı ülkemizde önemli bir istihdam yaratan ve çeşitli sanayi dallarına hammadde sağlayan pamuğun tarımına yönelik mevcut sorunlar çözülmeli ve üretiminin artırılmasına yönelik politikalar izlenerek tarımında sürdürülebilirliğin sağlanması stratejik bir hedef olarak benimsenmelidir.



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KAYNAKLAR

Anonymous, 1996-2003. Cotton: Review of the World Situation. International Cotton Advisory Committee.

Balsuyu, A.D., 2016. Pamuk Tarımının Sorunları ve Çözüm Önerileri. Pamuk Çalıştay ve Pamukta Kontaminasyonun Önlenmesi AR-GE Proje Pazarı. Bildiri ve Proje Özetleri Kitabı, s. 5-6.

B. Potter, Farm J. 2015. Cotton contamination conference. p.1.

Çopur, O., 2016. Güneydoğu Anadolu Bölgesi Açısından Pamuk Üretimini Değerlendirilmesi. Pamuk Çalıştay ve Pamukta Kontaminasyonun Önlenmesi AR-GE Proje Pazarı. Bildiri ve Proje Özetleri Kitabı, s. 53-55. Kahramanmaraş.

Ekonomi Bakanlıđından, 2021. Pamukların Standardizasyonuna İlişkin Tebliğ (Ürün Güvenliğı Ve Denetimi: 2012/27). 14 Ağustos 2021 tarih ve 28384 sayılı resmi gazete. Ankara.

Evcim, Ü., 2016. Hasat ve Çırcırlamada Lif Kalitesinin Korunması. Pamuk Çalıştay Bildiri ve Proje Özetleri Kitabı. S. 65-66. Kahramanmaraş.

Gençer, O., Özüdoğru, T., Kaynak, M. A., Yılmaz, A., & Ören, N. (2005). Türkiye’de Pamuk Üretimi Ve Sorunları.

Gençer, O., Özmeriç, H., ve Moore, J., 1999. Türkiye Ürün Pazarları Geliştirme Projesi. Türkiye’deki Pamuk Standardları ve Tasnif Sisteminin Durum Tespiti ve Geliştirme Önerileri. Nisan 1999, Ankara.

Gürel, A., H. Akdemir, Ş.H. Emiroğlu, H. Kadioğlu, H.B. Karadayı, 2000. Türkiye Lif Bitkileri (Pamuk Tarımı ve Teknolojisine Genel Bakış ve Diğer Lif Bitkileri). Türkiye Ziraat Mühendisliğı V. Teknik Kongresi. 17-21 Ocak, Ankara.

Güneş A. Cevheri C.İ. Beyyavaş V. Yılmaz A. 2005. GAP Bölgesinde Pamuk (*Gossypium hirsutum* L.) Tarımı, Sorunları ve Çözüm Önerileri. Türkiye VI. Tarla Bitkileri Kongresi, 5-9 Eylül 2005, Antalya. Derleme Sunusu Cilt I, Sayfa 309-314.

H.M. Strolz, ITMF cotton contamination survey 1997, in International Cotton Conference. Bremen, Germany, 1998, p.21–25.

İyiuyarlar, Ş., 2016. Kontaminasyon. Bildiri ve Proje Özetleri Kitabı, s. 47. Kahramanmaraş.

M.K. Sharma, 2014. Contamination, trash and moisture control in ginning & pressing factories, in Cotton India Nagpur.



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Özüdoğru, T., 2002. Pamuk Durum ve Tahmin 2002-2003. Tarım ve Koyisleri Bakanlığı, Tarımsal Ekonomi Araştırma Enstitüsü, Ankara.

Özüdoğru, H., 2003. Türkiye’de Pamuk Pazarlamasında Kooperatiflerin Rolü. Türkiye 6. Pamuk, Tekstil ve Konfeksiyon Sempozyumu Bildirileri.

Sluijs, M.H.J. Van der., Hunter, L. 2018. Cotton Contamination Textile Progress. Page: 138-145.

Şengül, H., and Ören, M.N., 2001. The Cotton and Cotton Yarn Sectors in Turkey: Policies and Cost Structure. The Inter-Regional Cooperative Research on Cotton. A Joint Workshop and Meeting of the All Working Groups. WG-10 Economy. Adana-Turkey, P. 316-320.

Tarım ve Bakanlığı, Bitkisel Üretim Genel Müdürlüğü, 2021. Pamuk Bülteni. Sayı:18, Erişim linki: <https://www.tarimorman.gov.tr/BUGEM/Duyuru/119/Urun-Masalari-Ekim-Ayi-Bultenleri-Yayimlandi-Ekim-2021>, Ankara.

Ticaret Bakanlığı Esnaf, Sanatkarlar ve Kooperatifçilik Genel Müdürlüğü, 2018. Pamuk Raporu. s. 9-15.

Uluslararası Tekstil Üreticileri Federasyonu, 2017. Pamukta kontaminasyona neden olan faktörler.

Ulusal Pamuk Konseyi, Pamuk Sektör Raporu 2020.

G. Blomquist, 1997. We can stop contamination this is how to do it, in Beltwide Cotton Conference, New Orleans, LN, p.688–689.

Yeni, R., & Sağlam, D. (2002). Tarımsal destekleme politikaları ve pamuk prim sistemi. Türkiye V. Pamuk, Teksil ve Konfeksiyon Sempozyumu Bildirileri, 28-29.



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**ERKEK BILDİRCİN RASYONLARINA LAVANTA ESANSİYEL YAĞI
İLAVESİNİN PERFORMANS, ET RENGİ VE SERUM PARAMETRELERİNE
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ÖZET

Bu çalışma 3-6 haftalık erkek bıldırcın rasyonlarına ilave edilen artan düzeylerinde lavanta esansiyel yağının performans, göğüs ve but et rengi ve serum biyokimya değerlerine etkisinin incelenmesi için gerçekleştirilmiştir. Bu amaçla, 48 adet 3 haftalık erkek bıldırcın 3 denene grubuna dört tekerrür olacak şekilde rastgele ayrılmıştır. Bu çalışmada, bıldırcınlar 0 (K), 300 (LY3) ve 600 mg/kg (LY6) düzeylerinde lavanta esansiyel yağı ilave edilen deneme rasyonları ile 3-6 haftalık dönem arasında beslenmişlerdir. Canlı ağırlık artışı LY3 grubunda artarken, LY6 grubunda azalmıştır ($P<0.05$). Göğüs eti b renk değeri (45 dakika ve 24 saat) rasyonlarına lavanta esansiyel yağı ilave edilen tüm gruplarda ($P<0.01$); but eti L (45 dakika; $P<0.05$) ile a (24 saat; $P<0.01$) renk değerleri ise LY6 grubunda önemli düzeyde artmıştır. Rasyona ilave edilen lavanta esansiyel yağı ile birlikte kan trigliserit düzeyi K grubuna göre önemli düzeyde yükselmiştir ($P<0.05$). Bu sonuçlar doğrultusunda, erkek bıldırcın rasyonlarına ilave edilen lavanta esansiyel yağının et renk ve serum trigliserit değerlerini arttırırken, 300 mg/kg düzeyinde ilave edilen lavanta esansiyel yağının canlı ağırlık artışını geliştirmiştir.

Anahtar Kelimeler: Bıldırcın, Et Kalitesi, Lavanta Esansiyel Yağı, Performans, Serum



EFFECT OF ADDITION OF LAVENDER ESSENTIAL OIL TO THE DIET ON PERFORMANCE, MEAT COLOUR AND SERUM PARAMETERS IN MALE QUAILS

ABSTRACT

This study was carried out to examine the effects of the addition of lavender essential oil at the increasing levels in the diet of male quails at aged 3-6 weeks on performance, breast and drumstick meat colour and serum biochemical parameters. For this purpose, a total of 48 male quails, 3-week-olds, were randomly allocated to 3 treatment groups with four replications. In the experiment, birds were fed with treatment diets with the addition of lavender essential oil at 0 (K), 300 (LY3) and 600 mg/kg (LY6) levels during the 3-6 weeks period. Live weight gain increased in LY3 but decreased in LY6 group ($P<0.05$). Breast meat b colour value (45 minutes and 24 hours) was significantly increased with lavender essential oil in the diet ($P<0.01$), drumstick meat L (45 minutes; $P<0.05$) and a (24 hours; $P<0.01$) colour values increased significantly in LY6 group. With the addition of lavender oil to the diet, serum triglyceride level increased significantly compared to the K group ($P<0.05$). According to these results, the addition of lavender essential oil to the diet of male quails increased the meat colour and serum triglyceride level, while the addition of lavender essential oil at the level of 300 mg/kg was effective in improving live weight gain.

Keywords: Quail, Lavender Essential Oil, Performance, Meat Quality, Serum



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1. INTRODUCTION

Essential oils are natural additives added to diets in order to regulate the physiology and digestive functions of poultry and thus increase performance. Lavender is a flowering plant in the Lamiaceae family. Lavender oil is rich in linalool and linalyl acetate and contains beta-cimene, cineol, camphor, caryophyllene epoxide, rosmarinic acid and coumarin (Adaszynska-Skwirzynska and Szczerbinska, 2019).

It is known that the addition of lavender essential oil to the diet improves digestive microflora, antioxidant capacity, intestinal morphology, performance and carcass quality (Küçükyılmaz et al. 2017; Salarmoini et al. 2018; Adaszynska-Skwirzynska and Szczerbinska, 2019).

The aim of this study was to determine the effect of adding lavender essential oil to male Japanese quail diet on performance, meat quality and serum biochemistry parameters in the 3–6-week-old period.

2. MATERIAL AND METHODS

Table 1. Ingredients and nutrient composition of the basal diet

Ingredients (%)	
Barley	10.00
Vegetable Oil	0.50
Maize	49.27
Corn gluten meal	1.72
Soybean meal	35.28
Dicalcium phosphate	0.73
DL-Methionine	0.15
Coccidiostat	0.08
L-Lysine hydrochloride	0.15
Marble powder	1.37
Sodium bicarbonate	0.10
Salt	0.40
Vitamin and Mineral Premix*	0.25
TOTAL	100.00
Calculated composition	
Dry Matters, (%)	88.74
Crude Protein, (%)	23.60
Crude Fat, (%)	6.00
Crude Ash, (%)	7.11
Crude Fiber, (%)	3.09
Sodium, (%)	0.23
Calcium, (%)	0.85
Phosphorus, (%)	0.31
Lysine, (%)	1.34
Total Met + Sis, %	0.93
ME (kcal/kg)	2,920

*1 Kg Vitamin-Mineral Premix contains; 8,800 IU vitamin A, 2,200 IU vitamin D3, 11 mg vitamin E, 44 mg nicotinic acid, 8.8 mg Calcium D-Pantothenate, 4.4 mg riboflavin, 2.5 mg thiamin, 6.6 mg vitamin B12, 1 mg folic acid, 0.11 mg D-biotin, 220 mg choline, 80 mg manganese, 60 mg iron, 5 mg copper, 60 mg zinc, 0.20 mg cobalt, 1 mg iodine, 0.15 mg selenium.



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In this study, a total of 48 male Japanese quails at the age of 3 weeks have been randomly distributed among three treatment groups and has lasted 6 weeks. In each treatment group, there have been four replicates, each with four quail. For 3 weeks, the quails were fed three experimental diets supplementing three levels (0, 300 and 600 mg/kg) of lavender essential oil. The experimental diets were balanced to meet or exceed the nutrient requirements of the Japanese quail (NRC 1994). During the experiment, water and feed were given as ad libitum. Initial body weights of the quails were recorded at the beginning of the study. Body weight and feed intake were measured weekly, for each pen, and then body weight gain per pen was calculated. Feed conversion ratio was also calculated as a three-week period as g of feed intake per g of body weight gain.

At the end of the trial (6th week), 3 ml of blood was taken from one quail selected at random from each subgroup (12 in total) to determine serum parameters. Blood was centrifuged at 5000 rpm for 10 minutes. The serum was stored at -20°C until analysis. Glucose, triglyceride, cholesterol, creatinine, total protein, albumin, globulin, calcium, and phosphorus levels were determined in an autoanalyzer using commercial kits (DDS® Spectrophotometric Kits, Diasis Diagnostic Systems Co., İstanbul, Turkey).

Data were analysed by a one-way analysis of variance for the level of supplemental lavender essential oil in the diet (Minitab Reference Manual, Release 10.1). Those response variables resulting in a significant F value were further analysed using Duncan's multiple range test.

3. RESULTS AND DISCUSSION

The supplementation of 0, 300 and 600 mg/kg levels of lavender essential oil to the diet did not affect the body weight, feed intake and feed conversion ratio in male quails ($P>0.05$). Addition of 300 mg/kg lavender essential oil to male quail diets significantly increased body weight gain compared to 600 mg/kg lavender oil essential supplemented ($P<0.05$), but there was no difference in body weight between the control group and lavender essential oil supplemented groups. These results were similar Küçükyılmaz et al. (2017) 24 and 48 mg/kg and Salarmoini et al. (2018) reported that the addition of 400 mg/kg lavender essential oil to the diet had a positive effect on the body weight of broilers, while Mokhtari et al. (2018) found that the addition of lavender essential oil to the diet had no effect on body weight, Barbarestini et al. (2020) reported that the addition of 600 mg/kg lavender essential oil to the diet did not affects the body weight in broilers.



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Table 2. Effect of addition of lavender essential oil to the diets on performance in male quails aged 3-6 weeks

Parameters	Lavender Essential Oil, mg/kg			SEM	P
	0	300	600		
Initial body weight, g	121.3	119.2	122.0	2.84	0.803
Final body weight,	183.1	186.8	181.7	3.20	0.575
Body weight gain, g	61.75 ^{ab}	67.63 ^a	59.69 ^b	1.939	0.049
Feed intake, g/quail/period	292.1	296.1	288.3	4.38	0.501
Feed conversion ratio, g feed/g BWG	4.77	4.39	4.84	0.183	0.277

^{a, b} Values within a row that do not share the same superscript are different at $P < 0.05$

The addition of lavender essential oil to male quail diets had a statistically insignificant effect on the 45th minute and 24th hour L and a colour values of breast meat and the 45th minute a and b colour of drumstick meat and 24th hour L and b values ($P > 0.05$). The addition of lavender essential oil (300 and 600 mg/kg) to the diet increased significantly ($P < 0.01$) at both measurement times. The addition of 600 mg/kg lavender essential oil to the diet significantly increased the 45th minute L colour ($P < 0.05$) and 24th hour a colour values ($P < 0.01$) of drumstick meat compared to the other groups. There is a study examining the effect of lavender essential oil and wind oil on meat colour, and Küçükyılmaz et al. (2017) The results of the study, which reported that the addition of lavender essential oil at 24 and 48 mg/kg levels did not affect the colour parameters of drumstick meat L, a and b, and breast a and b colour parameters, but increased the value of breast meat colour L in broilers. These results of the current study are partially similar.

Table 3. Effect of addition of lavender essential oil on the meat colour parameters in male quails aged 3-6 weeks

Parameters		Lavender Essential Oil, mg/kg			SEM	P
		0	300	600		
Breast						
45. minutes	L	38.65	37.55	37.86	0.630	0.498
	a	5.15	5.59	5.20	0.186	0.307
	b	2.03 ^B	5.70 ^A	5.05 ^A	0.654	0.009
24 hours	L	46.99	47.17	49.53	0.987	0.319
	a	5.20	5.78	6.13	0.387	0.363
	b	4.75 ^B	7.02 ^A	7.65 ^A	0.469	0.007
Drumstick						
45. minutes	L	42.06 ^b	42.14 ^b	46.48 ^a	1.088	0.032
	a	5.49	6.11	5.45	1.027	0.394
	b	2.15	2.90	6.12	1.003	0.051
24 hours	L	46.15	43.70	42.61	0.987	0.134
	a	4.27 ^B	4.82 ^B	7.33 ^A	0.385	0.001
	b	1.62	2.28	4.85	0.753	0.055

^{A, B} Values within a row that do not share the same superscript are different at $P < 0.01$

^{a, b} Values within a row that do not share the same superscript are different at $P < 0.05$



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Table 4. Effect of addition of lavender essential oil on the meat colour parameters in male quails aged 3-6 weeks

Parameters	Lavender Essential Oil, mg/kg			SEM	P
	0	300	600		
Glucose, mg/dL	354	339	358	7.9	0.289
Triglyceride, mg/dL	180 ^b	249 ^a	238 ^a	17.8	0.049
Cholesterol, mg/dL	199	192	199	16.6	0.940
Creatinine, mg/dL	0.250	0.245	0.268	0.0166	0.626
Total protein, g/dL	2.80	2.58	2.90	0.189	0.518
Albumin, g/dL	1.13	1.08	1.13	0.058	0.814
Globulin, g/dL	1.68	1.50	1.78	0.134	0.404
Calcium, mg/dL	9.58	9.58	9.55	0.219	0.996
Phosphorus, mg/dL	6.85	6.95	6.80	1.589	0.957

^{A, B} Values within a row that do not share the same superscript are different at $P < 0.01$

^{a, b} Values within a row that do not share the same superscript are different at $P < 0.05$

The addition of lavender essential oil to the diet caused a significant increase in serum triglyceride levels in male quails ($P < 0.05$), while other serum biochemistry parameters were not affected by the addition of lavender essential oil to the diets ($P > 0.05$). Contrary to currently study, it has been reported that the addition of lavender essential oil at levels of from 24-800 mg/kg in poultry diet did not affect serum triglyceride levels in previous years (Torki et al. 2021; Mokhtari et al. 2018; Adaszynska-Skwirzynskov and Szczerbinska 2019; Barbarestini et al. 2020).

4. CONCLUSION

According to the results obtained from this study, it can be said that the addition of lavender essential oil at the level of 300 mg/kg to the diet is sufficient to increase body weight gain in male quails and its addition to the diet is also effective in affecting meat quality.



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5. LITERATURE

Adaszyńska-Skwirzyńska, M., Szczerbińska, D., 2019, The effect of lavender (*Lavandula angustifolia*) essential oil as a drinking water supplement on the production performance, blood biochemical parameters, and ileal microflora in broiler chickens, *Poultry Science*, 98(1), 358-365.

Barbarestani, S.Y., Jazi, V., Mohebodini, H., Ashayerizadeh, A., Shabani, A., Toghyani, M., 2020, Effects of dietary lavender essential oil on growth performance, intestinal function, and antioxidant status of broiler chickens, *Livestock Science*, 233, 103958.

Küçükyılmaz, K., Kiyma, Z., Akdağ, A., Çetinkaya, M., Atalay, H., Ateş, A., Gürsel FE, Bozkurt, M., 2017, Effect of lavender (*Lavandula Stoechas*) essential oil on growth performance, carcass characteristics, meat quality and antioxidant status of broilers, *South African Journal of Animal Science*, 47(2), 178-188.

Mokhtari, S., Rahati, M., Seidavi, A., Haq, Q. M. I., Kadim, I., Laudadio, V., Tufarelli, V., 2018, Effects of feed supplementation with lavender (*Lavandula angustifolia*) essence on growth performance, carcass traits, blood constituents and caecal microbiota of broiler chickens, *European Poultry Science*, 82. (özet).

NRC, (1994). *Nutrient Requirements of Poultry*. 9th revised Edition. National Academy Press. Washington, DC.

Salarmoini, M., Salajegheh, A., Salajegheh, M.H., Afsharmanesh, M., 2019, The effect of lavender (*lavandula angustifolia*) extract in comparison to antibiotic on growth performance, intestinal morphology, ileal microflora, antioxidant status and meat quality of broilers. *Iranian Journal of Applied Animal Science*, 9(4), 717-725.

Torki, M., Mohebbifar, A., Mohammadi, H. (2021). Effects of supplementing hen diet with *Lavandula angustifolia* and/or *Mentha spicata* essential oils on production performance, egg quality and blood variables of laying hens. *Veterinary Medicine and Science*, 7(1), 184-193.



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ALTERNATİF BİR SILAJ BITKİSİ: AYÇİÇEĞİ (*Heliantus annus* L.)

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ÖZET

Hayvan beslemede ihtiyaç duyulan yeşil yem yıl içerisinde belli sürelerde çayır-meralardan karşılanmaktadır. Çayır-meralardan yararlanma süreleri bölgelere göre değişmekle birlikte genellikle 150 ile 200 gün civarında olmaktadır. Hayvanların bu dönemlerde yüksek olan verim ve kaliteleri, diğer dönemlerde düşüşe geçmektedir. Muş ilinin de içinde bulunduğu Doğu Anadolu Bölgesi'nde uzun ve zorlu geçen kış ayları hayvanların barınaklarda beslenme zorunluluğunu doğurmaktadır. Tarla arazilerinde yetiştirilen yem bitkileri ve çayır-meralardan elde edile ot kış beslemesi için yeterli olmadığından hayvanların kaliteli kaba yem ihtiyaçları tam olarak karşılanamamaktadır. Bu sebeple de yem değeri çok düşük olan sap, saman, bahçe atıkları beslemede kullanılmaktadır. Bu durumları önlemenin en etkili yolu silajı ve silajla hayvan beslemenin yaygınlaştırılması ve ülkemiz ekolojisine uygun silaj yapım tekniklerinin geliştirilmesidir. Nitekim taze yem bulmanın güç olduğu kış aylarında silajla besleme çok büyük önem taşımaktadır. Alternatif silaj bitkilerinden birisi olan Ayçiçeğinin (*Helianthus annus* L.) Doğu Anadolu Bölgesinin en kısa vejetasyon süresine sahip yerlerinde dahi yetiştirilebileceği bildirilmektedir. Kurağa dayanıklı olan ayçiçeği, kıraç alanlarda sulanmadan yetiştirilebilme imkanına da sahiptir. Ayrıca sonbaharın ilk donlarına daha dayanıklı olduğundan soğuk zararı riski de daha düşüktür. Bu nedenle ayçiçeğinin alternatif bir silaj bitkisi olarak incelenmesinde büyük yararlar bulunmaktadır. Bu çalışma ayçiçeğinin silajlık olarak kullanılabilme potansiyelinin araştırılmasına yönelik literatür derlemelerinden oluşmaktadır.

Anahtar Kelimeler: Kuraklık, kısıtlı sulama, silaj, ayçiçeği



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AN ALTERNATIVE SILAGE PLANT: SUNFLOWER (*Helianthus annus* L.)

ABSTRACT

The green forage needed for feeding of animals is obtained from meadow and pastures at certain times of year. Although the duration of utilisation of meadow and pastures varies according to the regions, it is usually around 150 to 200 days. The long and difficult winter months of the Eastern Anatolia Region, which includes the province of Muş, cause the animals to be fed in barns. Forage crops grown in field lands and hay obtained from meadows and pastures are insufficient in winter nutrition, so the quality roughage needs of animals cannot be fully supply. Therefore, stalk, straw and yard waste, which have very low feed value, are used for feeding. The most effective way to prevent these situations is to expand silage and animal feeding with silage and to develop silage production techniques suitable for our country's ecology. As a matter of fact, silage feeding is of great importance in the winter months when it is difficult to find fresh forage. It is reported that sunflower (*Helianthus annus* L.), one of the alternative silage plants, can be grown even in the areas with the shortest vegetation period in the Eastern Anatolia Region. Sunflower, which is drought resistant, has the opportunity to be cultivation in arid areas without irrigation. In addition, the risk of cold damage is lower as it is more resistant to the first frosts of autumn. Therefore, there are great benefits in investigation sunflower as an alternative silage plant. This study consists of literature reviews to investigate the potential of using sunflower as silage.

Keywords: Drought, restricted irrigation, silage, sunflower



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GİRİŞ

Hızla artan nüfus ile beraberinde iklim değişiklikleri dünyanın en önde gelen iki sorunu olarak nitelendirilmektedir. Dünya nüfusunun hızla artmayı sürdüreceği ve 2025 yılına gelindiğinde yaklaşık 8.5 milyar olabileceği varsayılmakta olup, FAO'nun tahminlerine göre 2050 yılında ise 9.6 milyara ulaşması beklenmektedir (Anonymous, 2021). Dünya nüfusunun bu kadar hızlı artması da gıda güvenliğinin önemini daha da artırmaktadır. Hızla artan insan nüfusunun gıda gereksinimlerine ilaveten, sayıları hızla artan ve yüksek miktarda yem tüketen kültür ırkı hayvanların da yem ihtiyaçlarının karşılanabilmesi gerekmektedir (Vinnari and Tapio, 2009). İklim değişimleri ve küresel ısınma ile birlikte sürdürülebilir tarım ilkesine bağlı kalarak insanların beslenme ihtiyaçlarını güvenli şekilde karşılamaya yönelik pek çok araştırma bulunmaktadır. Diğer yandan, tarım yapılan arazilerin giderek küçülmesi bitkisel üretim kadar hayvansal üretimin de sıkıntıya girmesine sebep olmaktadır. Özellikle hayvansal üretimin en önemli basamaklarından birisi olan hayvanların beslenme ihtiyaçlarını çayır ve meralardan karşılanması gün geçtikçe zorlaşmaktadır (Dumanoglu ve ark. 2021). Türkiye'de hayvansal üretimde karşılaşılan sorunların en başında maliyetlerin yüksek oluşu gelmektedir. Maliyetlerin bu denli yüksek oluşu da kaliteli kaba yem üretiminin yetersizliğinden kaynaklanmaktadır. Hayvan beslemede ihtiyaç duyulan yeşil yem yıl içerisindeki belli sürelerde çayır-meralardan karşılanmaktadır. Çayır-meralardan yararlanma süreleri bölgelere göre değişmekle birlikte genellikle 150 ile 200 gün civarında olmaktadır. İldeki geniş otlak alanları, otlatmanın sona ermesi gereken 1 Mayıs-10 Ekim tarihleri dışında kaliteli kaba yem ihtiyacını ortaya çıkarmakta (Tan, 2017), uzun ve zorlu geçen kış ayları hayvanların barınaklarda beslenme zorunluluğunu doğurmaktadır. Tarım arazilerinin giderek azalması ve artık yem bitkileri ekim alanlarının da son on yılda artışı çok stabil kalmıştır. Nitekim 2012 yılında 1.84 bin ha ekim alanına sahip yem bitkileri 2020 yılında da neredeyse aynı kalmış ve 1.85 bin ha olmuştur. Bu veriler yem bitkileri ekim alanlarının tarımsal desteklemeler de olsa artık son seviyelerine geldiğinin bir göstergesidir (Anonim, 2021). Bu durum da tarla arazilerinde yetiştirilen yem bitkilerinden elde edilen otun kış beslemesi için yeterli olmamasının ve neticesinde de hayvanların kaliteli kaba yem ihtiyaçları tam olarak karşılanamamasının bir nedenidir. Bu ihtiyacı karşılamak için de yem değeri çok düşük olan sap, saman, bahçe artıkları beslemede kullanılmaktadır (Serin ve Tan, 1998). Burdan hareketle yıl boyunca yem zincirinin devamlılığı ve kaliteli beslemenin yapılabilmesi açısından yeşil yemlerin önemi ortaya çıkmaktadır (Sakal, 1973; Özen ve ark., 1993). Yeşil yemlerin de depolanmasında en ucuz, kolay ve etkili yol ise silaj yapımıdır.



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Nitekim taze yem bulmanın güç olduğu kış aylarında silajla besleme çok büyük önem taşımaktadır.

Silaj

Kaba yapıllı bitkilerin yeşil dönemdeyken kıyılıp parçalanması ve havasız ortamda fermente edilmesiyle elde edilen bir yem çeşididir. Ayrıca silaj taze yem bulunmayan zamanlarda işletmeler için ucuz ve tatminkar bir kaba yem kaynağı olarak tanımlanmaktadır (McDonald ve ark., 1991; Filya, 2001; Alagöz ve Türk, 2020). Her türlü bitkiden ve taze materyalden silaj yapılmakla birlikte bazı bitkiler kolaylıkla silolanarak fermente olabilmektedir. Silaj yapılacak materyalin kuru madde oranı (% 25-35), pH (3.8-4.2) ve çözünebilir karbonhidrat (% 2.5 ve üzeri) içeriğinin sağlanması şartıyla hemen hemen tüm bitkilerin silajı yapılabilir (Yıldırım, 2015; Kaiser et al., 2004). Yeşil yemlerin doğal yollarla saklanmasından ziyade silaj yapılarak kullanılmasının, olumsuz hava şartlarından fazla etkilenmemesi, makineli tarıma uygun olması, başarılı bir şekilde yapıldığında uzun süre dayanabilmesi, hayvanlar tarafından sevilerek büyük bir iştahla tüketilmesi gibi birçok önemli avantajları bulunmaktadır (Kılıç, 1986). Bazı araştırmacılar tarafından silaj yapmak suretiyle otlardaki nitrat zehirlenmesi ve şişme gibi besleme problemlerinin hafifletilebileceği de bildirilmiştir (Kılıç 1986; Piltz ve Burns, 2006). Ayrıca yeşil yemleri kurutarak saklama yerine silaj yapılarak değerlendirilmesinin daha az besin maddesi kaybı sağlayacağı bildirilmektedir (Filya, 2001). Nitekim kuru ot olarak saklanan kaba yemlerde kuru madde kaybı % 15–30, sindirilebilir protein kaybı % 25–35 düzeyinde iken, her iki kayıp oranı silo yeminde % 5'e, kadar düşmektedir. Nişasta değerinde ise kuru otta % 50'ye yakın kayıp olurken, silo yemlerinde en fazla % 10 kayıp görüldüğü bildirilmiştir (Bingöl vd., 2008: 61-66). Başarılı bir silolama tekniği ile elde edilen kaliteli silaj bozulmadan yıllarca saklanabilmektedir.

Mısır (*Zea mays* L.)

Tüm dünyada silaj denildiğinde akla ilk gelen bitki Güney Amerika kökenli, tek yıllık bir sıcak mevsim bitkisi olan mısırdır. Mısır, tane olarak hayvan beslemedeki kullanımının yanı sıra, mükemmel bir silaj bitkisi olarak da öne çıkmaktadır. Mısır eriyebilir karbonhidratlarca zengin olduğundan katkı maddesine gerek duyulmadan silolanabilen, birim alan verimi oldukça fazla olup, yüksek enerji içeriğine sahip olan, besleme değeri yüksek olan, uzun süre depolanabilen ve kış mevsiminde taze sulu bir yem sağlayan ideal bir bitkidir (Turan ve Yılmaz, 2000). Yapılan çalışmaların çoğunda mısır silajının besin değeri bakımından standart ve/veya referans olarak alındığı görülmektedir (Miller 2000; Rodrigues et al. 2001). Son yıllarda ülkemizde silaj



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yapımı hızla artmakta ve toplam silajın yaklaşık %80'den fazlasını mısır silajı oluşturmaktadır (Alçiçek ve Karaayvaz 2003). Nitekim 2011 yılında üretilen silaj miktarı 13.2 milyon ton iken 2020 yılında ise bu miktar iki katından fazla artarak 27.1 milyon ton olmuştur. Bu da mısırın yem bitkilerinin aksine iyi bir artış gösterdiğinin ve ilerleyen zamanlarda da göstereceğinin göstergesidir. Yukarıda sayılan avantajları nedeniyle kaliteli kaba yem açığının kapatılmasında ve kışın gerekli duyulan kaliteli kaba yemin silaj olarak kapatılmasında önemli bir rol üstlenecektir.

Mısır tarımında uygun büyüme sıcaklığı 25-30 °C arasındaki sıcaklıklar olup, vejetasyon süresi boyunca toplam sıcaklık isteği bölge ve çeşitlere göre değişmekle birlikte 2000-4000°C arasında olmaktadır (Kırtok, 1998). Çimlenmesi için en az 8-10 °C'lik toprak sıcaklığına ihtiyaç duymaktadır. Düşük sıcaklıklardan zarar gören mısır yetiştirildiği bölgede en az 3 aylık don olmayan güvenli bir periyoda ihtiyaç duymaktadır. Kurağa da dayanıklı olmayan mısır yetiştirildiği yerde yağışın yeterli olmasını veya sulama yapılmasını gerektirmektedir.

Muş ilinde yükseltinin fazla olması, vejetasyon süresinin kısa olması ve sıcaklıkların düşük seyretmesi bir sıcak mevsim bitkisi olan mısır tarımına çok uygun olmamaktadır. Bunun en önemli nedenlerinden birisi de ilde bulunan ve Türkiye'nin üçüncü büyük ovası olan Muş ovasının taban suyu miktarının fazla olmasından dolayı ovada suların çekilmesi sonrası araziye girmek zor olmakta ve bu da vejetasyonun kısalması neticesinde ilde yetiştirilecek olan bitki çeşitliliğini sınırlandırmaktadır. Bununla birlikte fazla miktarda kar yağması ve karın erimesinin zaman alması yanında yazın kısa ve kurak gitmesi de üretimi sınırlandıran başka bir etken olarak göze çarpmaktadır (Bilmez Özçınar 2021). İlde mısır tarımı için gerekli olan en az 90 günlük don olmayan güvenli periyodu yakalamak oldukça zor olmaktadır. Önemli bir sorunun yaşanmadığı yıllarda erkenci çeşitlerden 8-10 ton/da silajlık hasıl verimi elde edilebildiği bildirilmektedir (Serin ve Tan 2004). Ancak yine de iklimden kaynaklanan riskler devam etmektedir. Çünkü bu bölgede ilkbaharın son donları ile sonbaharın ilk donları silajlık mısır tarımını zorlaştırmaktadır. Tüm bu sorunlar ilde silajın yaygınlaştırılması için bölgede yapılan çalışmalarda önemli bir handikap oluşturmakta, üreticilerin silajlık mısır yetiştiriciliğine daha dikkatli yaklaşımlarına sebep olmaktadır (Serin ve Tan, 1998).

Mısır; birim alana yüksek verimi ve silaj yapımına son derece uygun kimyasal kompozisyonu ile harika bir silaj bitkisidir. Bu nedenle silaj yapımında mısırdan vazgeçmek mümkün olmamaktadır. Ancak bir yandan bölgeye uygun daha erkenci mısır çeşitlerinin belirlenmesi



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için çalışmalar devam ederken diğer yandan da alternatif silaj bitkileri konusunda çalışmalar yapılması gerekmektedir.

1. 2. Silaj Bitkisi Olarak Ayçiçeği (*Heliantus annus* L.)

Ayçiçeği tek yıllık, kazık köklü, 1-2.5 m boylanabilen bir bitkidir. Ayçiçeği, yağlık ve çerezlik olarak kullanımlarının yanı sıra başarılı bir silaj bitkisi olarak da yetiştirilmektedir (Miller, 2000). Ayçiçeği tahıl baklagil karışımlarına dahil edilerek veya mısır, soya, börülce gibi bitkilerle karışık ekilerek kaba yem amaçlı (McKenzie ve Spaner, 2002), kullanımlarının dışında en yaygın yemlik kullanımı silaj yapılmasıdır. Doğu Anadolu Bölgesinin yüksek kesimlerinde mısır yetiştiriciliği riskli olmaktadır. Bölgede ilkbahar son donları ile sonbaharın son donları silajlık mısır tarımını zorlaştırmaktadır. Bu gerekçe ile bu gibi yerlerde ayçiçeği mısıra göre güvenli bir silaj bitkisi olarak göze çarpmaktadır (Güney, 2006).

Mısıra göre tarımı daha kolay olan ayçiçeği kurağa ve soğuğa dayanıklı olup sulanmayan yerlerde mısıra alternatif olarak silajlık yetiştiriciliğe uygun olmaktadır (Arıoğlu, 2000). Nitekim Tan ve Tümer (1996), yaptıkları bir çalışmada ayçiçeğinin kurağa tolerans gösterme özelliği ile sulama suyunun sınırlayıcı bir faktör olduğu yerlerde hem birinci hem de ikinci ürün üretim devrelerinde silaj yapımında alternatif bir bitki olabileceğini tespit etmişlerdir. Aynı zamanda derin kök sistemi sayesinde derinliği yaklaşık olarak 2 m olan yer altı suyunun %92'sini kullanabilme özelliği ile yağışın veya suyun az olduğu dönemlerde ve yerlerde silajlık yem bitkisi olarak mısıra alternatif olabileceği ileri sürülmektedir (Bremner et al. 1986; Evangelista ve Lima, 2001). Nitekim bu da Muş ovası gibi taban suyu oldukça yüksek yerlerde kurak zamanları daha az zararlı atlatılabileceğinin bir göstergesidir. Toprak istekleri açısından, ayçiçeğinin mısır bitkisine göre daha geniş toleransa sahip bir bitki olduğu ve genç bitkilerin ilkbaharın geç donları ile sonbaharın erken donlarına karşı hassas olmadığı belirtilmektedir (Miller, 2000). Mısıra göre daha düşük sıcaklıklara dayanıklı olan ayçiçeği yetiştirme periyodu boyunca da mısırdan daha az toplam sıcaklığa (2600-2850°C civarında) ihtiyaç duymaktadır (Arıoğlu 2000). Ayrıca geç yapılan ekimlerde hızlı bir şekilde gelişme göstermesi sayesinde de taban suyunun çekilmesinin beklenmesinden kaynaklanan vejetasyonun kısalmasının da bir nebze önüne geçilebilecek olması önemli bir avantajdır. Ayrıca ayçiçeği bitkisinin hasat olgunluğuna kadar olan vejetasyon süresi oldukça kısadır (14-15 hafta) (Kılıç 1986). Ana ürün hasadından sonra ikinci ürün olarak da yetiştiriciliği yapılabilmektedir. Vejetasyon süresinin kısa olduğu Doğu Anadolu Bölgesi'nde ayçiçeğinin tahıl hasadından sonra silajlık olarak yetiştirilebileceği bildirilmektedir (Anonim 2008). Heuze ve ark., 2012 tarafından yapılan bir



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çalışmada ayçiçeğinin 60-70 gün içerisinde yaklaşık 7500 kg/da hasıl ürettiğini belirlemişlerdir. Yıldız ve Erdoğan (2018), Van ekolojik şartlarında mısır silajına alternatif olarak ayçiçeğinin silajlık amaçlı yetiştirilebileceğini uygun bulmuştur. Arvas ve ark., 2009 yaptıkları bir araştırmada, ayçiçeğinin silajlık amaçla yetiştirilebileceği belirlenmiş olup daha güvenilir sonuçların elde edilmesi için bu ve benzeri araştırmaların uzun yıllar tekrarlanmasının yararlı olacağını bildirmişlerdir.

Ayçiçeği, silajlık olarak ülkemizde pek fazla kullanım alanı bulamamış olmakla birlikte yabancı ülkelerde çok fazla kullanılmaktadır. Nitekim ABD'nin yüksek rakıma sahip olan Montana gibi bölgelerinde ayçiçeği silajlık olarak yetiştirilmiş, mısırın 2-3 katı yeşil yem elde edilmiştir (Ray, 1919). New York'ta yapılan bir çalışmada ayçiçeğinin silajlık veriminin, mısıra göre %30-37 daha yüksek olduğu bulunmuştur (Wiggans 1926). Valdez ve ark.(1988), üç haftalık bir süreyle mısır, mısır-ayçiçeği ve ayçiçeği ile besledikleri süt ineklerinden en yüksek süt verimini mısır-ayçiçeği ile ayçiçeği silajından elde etmişlerdir. Dahası Güney Amerika ülkelerinde silajlık ayçiçeği çeşitleri dahi geliştirilmiştir (Tomich et al. 2003).

Ülkemizde silajlık ayçiçeği çeşidi bulunmamaktadır. Ancak silaj amaçlı çerezlik olarak kullanılan yerel çeşitlerin yağlık amaçla yetiştirilen melez çeşitlerden daha uygun olduğu bildirilmiştir (Güney ve ark., 2012). Bunun sebebi olarak yerel çeşitlerin uzun boylu ve daha fazla dallanma özelliğine sahip olmasıdır (Güney, 2006). Silaj amacıyla yetiştirilecek olan ayçiçeği, saplarda lignin birikimini azaltıp verimi artırmak amacıyla daha sık ekilmesi gerekmektedir. Yemlik çeşitlerin 40-50 cm sıra aralığı, 15-20 cm sıra üzeri mesafede daha sık ekilmesi gerektiği önerilmektedir (Ray, 1919). Ülkemizde çerezlik amacıyla yetiştirilen çok sayıda yerel genotip olduğu düşünülerek, bu genotiplerin silajlık olarak incelenmesinin ileride silajlık çeşitlerin geliştirilmesine fayda sağlayacağı düşünülmektedir.

Ayçiçeğinin verim ve besleme değeri bakımından mısıra göre bazı eksiklikleri bulunmaktadır. Erzurum'da yapılan bir çalışmada silajlık mısırın verimi 6880 kg/da olarak bulunurken, ayçiçeğinin verimi 5140 kg/da olarak bulunmuştur. Aynı çalışmada ayçiçeğinin ham protein, ADF ve NDF oranlarının mısırdan daha yüksek olduğu tespit edilmiştir (Güney ve ark., 2012). Ayçiçeğinin mısıra göre karbonhidrat içeriğinin düşük ve mayalanma süresinin de uzun olduğu bildirilmiştir (Mello ve Nörnberg, 2004). Besleme değerinin mısır silajının %80-85'i oranında olduğu ve lezzetinin de mısır silajına göre daha düşük seviyede olduğu bildirilmiştir (Wiggans 1926; Wheeler 1950; Hoppe 1997; Gregoire 1999). Ayçiçeği silajının besin madde içeriğinin genel olarak kurudaki sığırların ve düşük verimli süt sığırlarının ihtiyaçları için yeterli



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olabileceği ileri sürülmüştür (Filya, 2002 ; Lary ve Anderson, 2003). Ayçiçeği silajı mısıra göre daha fazla ham protein ve kalsiyum (Ca) ihtiva ederken, daha az sindirilebilir besin maddesi ve daha fazla lignin içermektedir (Putnam et al. 1990). Yapılan bir çalışmada ayçiçeği silajının %10-13 protein, %10 yağ içeriğine sahip olduğu tespit edilirken (Anon., 2004), bu içerikler mısırdaki sırasıyla %8-9, %2-3 civarında olmaktadır. Provitamin A içeriği de fazla olan ayçiçeği silajının ile beslenen hayvanlarda süt verimi %8 azalırken, süt yağının %12 oranında artış gösterdiği belirlenmiştir (Kılıç, 1986; Garcia, 2006). Nitakim silo yemi olarak kullanıldığında süt yağında önemli bir yükselme olacağı saptanmıştır (Kılıç 1986).

Silajlık ayçiçeğinin en mühim sorunu silaj kalitesinin düşük olmasıdır. Çiçeklenme dönemindeki lezzetlilik oranının, ilerleyen dönemlerde düşüşe geçtiği bildirilmektedir (Odland and Henderson 1926; Henderson and Gifford 1927). Bu nedenle ayçiçeğinde silaj kalitesinin yükseltilmesi için uygun devrede hasat edilmesi gerekmektedir. Genel olarak yapılan çalışmalar ayçiçeğinin silaj yapımı için çiçeklenmenin sonuna doğru, tanelerin sütlendiği dönemde hasat yapılmasını önermektedir (Tan ve Tümer, 1996; Demirel ve ark., 2006a; Makafher ve ark., 2010; Toruk ve ark., 2010). Ancak, Dumlu Gül (2014) ayçiçeğinin silajlık verim, kuru madde verimi ve ham protein verimi yönünden meyve dolum döneminde biçilmesinin daha uygun olduğunu saptamıştır. Ayçiçeği silajının besleme değerinin artırılması için yapılacak diğer bir işlemde farklı bitkilerle karıştırmak veya katkı maddesi kullanmaktır. Ayçiçeği silo yeminin tadının daha da iyileştirilmesi için %30-50 oranında üçgül, yonca, mısır, sorgum veya şeker pancarı yaprağının katılabileceği bildirilmektedir (Demirel ve ark., 2006b). Dumlu Gül ve ark., 2014 ayçiçeği silajına %50 oranında yonca veya mısır karıştırılarak yapılmasını önermişlerdir. Dahası kolay bulunabilecek melas veya arpa kırması gibi katkılarında kullanılabileceği söylenmiştir (Dumlu Gül, 2014).

Ayçiçeği silajı 45-60 günde kullanıma hazır duruma gelmektedir. Silajının yağ içeriği yüksek olduğu için kendine has bir kokuya sahiptir. Hayvanlar ilk başta ayçiçeği silajını severek yemeseler de sonraları severek tüketmektedirler. Ayçiçeği silajı besi sığırları ve süt ineklerine günde 20-25 kg verilebilmektedir.

SONUÇ

Muş ve çevredeki iller hayvancılığın önemli ölçüde yapıldığı yerlerdir. Uzun ve zorlu geçen kış aylarında artan kaliteli kaba yem ihtiyacını karşılayabilmek için en uygun materyal hiç kuşkusuz silajdır. Silaj denilince ilk akla gelen bitki mısır olmakla birlikte Doğu Anadolu



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Bölgesinde mısır yetiştiriciliğinde iklimden kaynaklanan bazı riskler ve sorunlar bulunmaktadır. Birim alana yüksek verimli ve silaj yapımına son derece uygun kimyasal kompozisyonu ile harika bir silaj bitkisi olan mısırdan vazgeçmenin mümkün olmayacağından hareketle bir yandan bölgeye uygun erkenci ve verimli mısır çeşitlerinin belirlenmesi için çalışmaları sürdürürken diğer yandan da alternatif silaj bitkileri konusunda araştırmalara hız verilmesi gerektiği düşünülmektedir. Ülkemizin de içinde bulunduğu coğrafyada yağış ile birlikte yağışlı gün sayısının da azalacağına dair tahminler yapılmaktadır. Bunun bir sonucu olarak topraktaki nem miktarının da olumsuz etkileneceği aşıkardır. Yapılan tahminler doğrultusunda daha uzun ve kurak dönemler öngörülmektedir (Brunetti Maugeri and Nanni 2006). Artık tarımın, ekstrem koşullarda yapılacak olması bitkilerin büyüme ve gelişme dönemlerinde bozukluklarla beraber, ürünün miktarı ve kalitesiyle ilgilide birçok olumsuzluklara sebebiyet verecektir. Gelecekte üretim desenlerinde ekstrem çevre koşullarına uygun bitkilerin daha fazla yer alması gerekecektir. Bu nedenle soğuk, sıcak ve kuraklık gibi iklim streslerine daha dayanıklı olması ile birim alandan daha fazla yeşil aksam alınması, kolay silolanması, yüksek kuru madde verimi gibi özellikleri nedeniyle son yıllarda ayçiçeği alternatif silajlık yem bitkisi olarak düşünülmekte ve güncel çalışmaların yapılmasına ihtiyaç duyulacağı düşünülmektedir.



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KAYNAKLAR

- Anonymous, 2021 https://www.gidamo.org.tr/genel/bizden_detay.php?kod=10945&tipi=2&sube=0.
- Anonim, 2021. Türkiye İstatistik Kurumu. <https://data.tuik.gov.tr/Kategori/GetKategori?p=tarim-111&dil=1>.
- Vinnari, M., Tapio, P. 2009. Future images of meat consumption in 2030, Futures 41 (2009) 269–278.
- Tan, M., 2016. Silaj Bitkileri. Atatürk Üniversitesi Ziraat Fakültesi Ders Yayınları, No:254, Erzurum.
- Serin, Y., Tan, M., 1998. Doğu Anadolu Bölgesi'nde kaba yem üretimi, ihtiyacı ve yem bitkileri tarımının geliştirilmesi. Doğu Anadolu Tarım Kongresi. 14-18 Eylül 1998, Erzurum, 407-418..
- Sakal, S., 1973. Süt sığırcılığı ve besicilikte silo yemlerinin önemi. Ege Bölgesi 1. Hayvancılık Semineri. Birlik Matbaası, Bornova İzmir
- Özen, N., Çakır, A., Haşımoğlu, S., Aksoy, A., 1993. Yemler Bilgisi ve Yem Teknolojisi. Atatürk Üniversitesi Ziraat Fakültesi Ders Kitabı, No: 50, Erzurum. 254.
- Filya, İ., 2001, Silaj Teknolojisi. Hakan Ofset, İzmir.
- McDonald, P., Henderson A.R. and Heron S.J.E., 1991. The Biochemistry of Silage, 2nd Edition, Chalcombe Publications, Printed in Great Britain by Cambrian Printers Ltd, Aberystwyth, ISBN: 0-948617-22-5, 327p.
- Yıldırım, B. 2015. Türkiye'deki silaj çalışmaları. Iğdır Üni. Fen Bilimleri Enst. Der. 2005-2014, 5(2): 79-88.
- Kaiser, A. G., Piltz, J. W., Burns, H. M. ve Griffiths, N. W. 2004. Successful silage. The State of South Wales. Department of Primary Industries and Dairy Australia.
- Kılıç, A. 1986. Silo Yemi. Bilgehan Basımevi. Bornova, İzmir.
- Piltz, J. W. ve Burns, H. M. 2006. Making Quality Silage and Hay From Pastures Containing Weeds. The Grassland Society of NSW Inc. 21th Annual Conference, Wagga, p: 71-75.
- Bingöl N.T., Karşlı M.A., Bolat D. & Akca İ. (2008). Vejetasyonun Farklı Dönemlerinde Hasat Edilen Korungaya İlave Edilen Melas Ve Formik Asit' İn Silaj Kalitesi Ve İn Vitro Kuru Madde Sindirilebilirliği Üzerine Etkileri. YYU Vet. Fak. Derg., 2, 61-66



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Turan, N. & Yılmaz, İ., (2000). Van koşullarında I. ve II. ürün olarak yetiştirilen bazı silajlık mısır çeşitlerinin hasıl verim ve bazı verim unsurlarının belirlenmesi. Atatürk Üniversitesi Ziraat Fakültesi Dergisi, 31, 63-71.

Miller, C., 2000. Sunflower: a cash-value crop and high quality silage for livestock. Countryside and Small Stock Journal, Vol.84 No.4 July/August.

Rodrigues, M.A.M., Cone J.W.i, Sequeiro C.A. and Mascarenhas-Ferreira A., 2001. Effect of the addition of cell wall degrading enzymes on fermentation kinetics of perennial ryegrasssilage. J. Agric. Sci. Cambridge., 136: 443-449.

Alçiçek, A. ve Karaayvaz K., 2003. Sığır besisinde mısır silajı kullanımı. Animalia, 203: 68-76.

Kırtok, Y., 1998. Mısır Üretimi ve Kullanımı, Kocaoluk Basın ve Yayınevi, İstanbul.

Serin, Y. ve Tan M., 2004. Erzurum merkez ve Köprüköy ilçelerinde tohumluk yonca ve silajlık mısır tarımının geliştirilmesi projesi. Atatürk Üniversitesi-DAKAP, Erzurum.

McKenzie, D.B., D. Spaner, 2002. Sunflower (*Helianthus annus L.*) seeding rate additions to frage oat-legume mixtures in Newfoundland. Acta Agriculturae Scandinavica, Section B, Soil and Plant Science, 52:52-56.

Güney, E., 2006. Erzurum Şartlarında Yetiştirilebilecek Bazı Silajlık Bitkilerin Adaptasyonu Üzerinde Bir Araştırma. Yüksek Lisans Tezi, Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı, Erzurum.

Tan, A.Ş. ve Tümer S., 1996. Ayçiçeğinin silajlık değerinin saptanması üzerine bir araştırma. Ege Tarımsal Araştırma Enstitüsü, Menemen, İzmir

Arıoğlu, H., 2000. Yağ Bitkileri Yetiştirme ve Islahı. Çukurova Üniv. Ziraat Fak. Yay No: 220, Ders Kitapları Yay. No: A-70, Adana, 204 s.

Bremner, P.M., Preston G.K. and Groth C.F., 1986. A field comparison of sunflower (*Helianthus annuus L.*) and sorghum (*Sorghum bicolor*) in long srying cycle. I. Water extraction. Australian J. Of Agric. Res., 37(5):483-493.

Evengalista, A.R., Lima, J.A., 2001. Utilização de Silagem de Girassol na Alimentação Animal. Simpósio Sobre Produção e Utilização de Forragens Conservadas, p. 177-217

Anonim, 2008. Silajlık yem bitkileri ve silaj. <http://www.cukurovataem.gov.tr/Silajweb.htm>.

Heuze V., G., Tran, P. Hassoun, F. Lebas, 2012. Sunflower forage and crop residues. <http://www.trc.zootechnie.fr/node/143>.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
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Yıldız, S., & Erdoğan, S. (2018). Van Koşullarında Yetiştirilen Silajlık Mısır (*Zea mays* L.) ve Ayçiçeği (*Helianthus annuus* L.)'nin Verim Parametreleri ve Besin Madde Kompozisyonuna Ait Kalite Özellikleri. *Türkiye Tarımsal Araştırmalar Dergisi*, 5(3), 280-285.

Arvas Ö., Yılmaz İ.H., Ekin Z. ve Hosafloğlu İ., 2009. Van koşullarında yetiştirilen bazı ayçiçeği çeşitlerinin silajlık özelliklerinin belirlenmesi. *Türkiye VIII. Tarla Bitkileri Kongresi*, s: 19-22 Ekim 2009, Hatay.

Ray, G.S., 1919. Sunflower for silage. Colorado Agricultural College Extension Service, Extension Bulletin Series I. No:158 A.

Wiggans, 1926

Valdez, F.R., J.H. Harrison and S.C. Fransen, 1988. Effect of Feeding Corn-Sunflower Silage on Milk Production, Milk Composition and Rumen Fermentation of Lactating Dairy Cows. *J. Dairy Sci.* 71:2462- 2469.

Tomich, T.R., Rodrigues J.A.S., Gonçalves L.C., Tomich R.G.P. and Carvalho A.U., 2003. Forage potential of sunflower cultivars produced in double-cropping system for silage. *Arq. Bras. Med. Vet. Zootec*, 55 (6): 756-762.

Güney, E., Tan M. and Yolcu H., 2012. Yield and quality characteristics of sunflower silages in highlands. *Türkish Journal of Field Crops*, 17(1), 31-34.

Güney, E., 2006. Erzurum Şartlarında Yetiştirilebilecek Bazı Silajlık Bitkilerin Adaptasyonu Üzerinde Bir Araştırma. Yüksek Lisans Tezi, Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı, Erzurum.

Mello, R. and Nörnberg J.L., 2004. Fractionation of carbohydrate and protein of corn, sorghum and sunflower silages. *Grasslands and Forage Abst.*, 75(1): 30, 160.

Wheeler 1950

Hoppe, K., 1997. Midge-damaged sunflowers make good silage. (Online). North Dakota State Univ. Agric. Communication. Available at <http://www.ext.nodak.edu/extnews/newsrelease/back-is-sues/000198.txt> (accessed 9 Mar. 1999, verified 25 Apr. 2003). NDSU Carrington Research Extension Center, Carrington, ND.

Gregoire, T., 1999. Sunflower silage. (Online). Available at <http://www.ag.ndsu.nodak.edu/aginfo/procrop/sun/sunsil09.htm> (verified 25 Apr.2003). North Dakota State Univ. Cooperative Extension, Fargo, ND.

Lardy, G. and Anderson V., 2003. Alternative feeds for ruminants. North Dakota State Univ. Extension Service, May 2003.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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Putnam, D.H, Oplinger E.S, Hicks D.R., Durgan B.R., Noetzel D.M., Meronuck R.A., Doll J.D. and Schulte E.E., 1990. Sunflower. Alternative field crops manual. Universty of Wisconsin-Extension.

Anonymus, 2004. Sunflower Silage. North Dakota State University Extension Service.

Garcia, A., 2006. Alternative forages for dairy cattle: Soybeans and flowers. <http://agbiopubs.sdstate.edu/articles/ExEx4023.pdf>.

Odland, T.E. and Henderson H.C., 1926. Cultural experiments with sunflowers and their relative value as a silage crop. Bull. 204. West Virginia Univ. Agric. Exp. Stn., Morgantown.

Henderson, H.O. and Gifford W., 1927. Sunflower silage vs. corn silage form ilk production. Bull. 210. West Virginia Univ. Agric. Exp. Stn., Morgantown, WV. Hill, J.A.G., Flemming J.S., Montanhini R.N., Carmargo H. and Flemming D.F., 2003.

Tan, A.Ş. ve Tümer S., 1996. Ayçiçeğinin silajlık değerinin saptanması üzerine bir araştırma. Ege Tarımsal Araştırma Enstitüsü, Menemen, İzmir

Demirel, M., Bolat D., Çelik S., Bakıcı Y. and Çelik S., 2006. Quality silages from sunflower harvested at different vegetational stages. J. Appl. Anim. Res., 30, 161-165.

Mafakher, E., Meskarbashee M., Hassibi P. and Mashayekhi M.R., 2010a. Evaluation of sunflower silage in different developmental stages. Asian Journal of Crop Science, 2(1), 20-24.

Toruk, F., Gonulol E., Kayısoğlu B. and Koç F., 2010. Effects of compaction and maturutiy stages on sunflower silage quality. African Journal of Agriculture Research Vol. 5(1), 55-59.

Dumlu Gül, Z., 2014. Farklı ayçiçeği populasyonlarının silaj performansı üzerine hasat dönemi ve katkı maddelerinin etkisi. Doktora tezi, Atatürk Üniversitesi Fen Bilimleri Enstitüsü, Erzurum.

Dumlu Gul, Z., Yolcu, M. Tan, 2014. Quality characteristics of sunflower silages (*Helianthus annus* L.) enriched with corn (*Zea mays* L.) and lucerne (*Medicago sativa* L.) at different stages. Agrocienca, 48(2).

Brunetti, M., Maugeri, M., Nanni, T. 2006. Trends of the daily intensity of precipitation in Italy and teleconnections. Nuovo Cimento Della Societa Italiana Di Fisica C-Geophysics and Space Physics 29, 105-116.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



Dumanoglu, Z. , Çačan, E. & Kökten, K. 2021. Macar fiğı (*Vicia pannonica* Crantz) Tohumlarının Bazı Fiziksel ve Fizyolojik Özelliklerinin Belirlenmesi Üzerine Bir Araştırma . Journal of Advanced Research in Natural and Applied Sciences , 7 (4) , 504-511 . DOI: 10.28979/jarnas.910045.

Özçınar Bilmez, A., Yaşar, M., 2021. Muş İlinin Tarımsal Ekosistemine Makro Bakış In: Entegre Tarım Sistemleri ve Çiftçiliğin Geleceği. 2021. Ankara. Turkey. 143-177.

ALAGÖZ, M. A., Türk, M., 2020. Bazı Silajlık Mısır Çeşitlerinin Verim ve Kalite Özelliklerinin Belirlenmesi. Ziraat Fakültesi Dergisi, 15(2), 186-191.



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**BİYOLOJİK METODLA MUAMELE EDİLEN MISIR SAMANININ İN-VİTRO GAZ
ÜRETİM TEKNİĞİ İLE SİNDİRİLEBİLİRLİĞİNİN İNCELENMESİ**

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ÖZET

Biyolojik metotlarla muamele edilerek düşük kaliteli kaba yemlerin sindirilebilirliğinin artırılması hayvancılık sektörüne büyük ekonomik katkılar sağlayabilir. Beyaz çürükçül mantarlar selüloz, ksilanaz gibi hidrolitik enzimlerle polisakkaritleri, ve lignin peroksidaz, mangan peroksidaz ve lakkaz gibi oksidatif ligninolitik enzimlerle lignini parçalayarak sindirilebilirliği artırır. İn-vitro gaz üretim tekniğinde; yem örnekleri, rumen sıvısı ve yapay tükürükten oluşmuş bir fermentörde inkübe edilmektedir. Fermantasyon sonucunda oluşan gazlar zamana bağlı olarak ölçülmekte ve bu gaz değerleri kullanılarak yeme ait sindirim derecesi ve metabolize edilebilir enerji gibi parametreler hesaplanmaktadır. Bu çalışmada, mısır samanının *Pleurotus ostreatus*, *Pleurotus eryngii* ve *Lentinula edodes* miselleri ile muamele edilerek sindirilebilirliklerinin in-vitro gaz üretim fermentasyon tekniğiyle incelenmesi amaçlanmıştır. Beyaz çürükçül mantarlar ile 10, 20, 30 ve 40 günlük inkübasyonları sonrası elde edilen fermente mısır samanının 0, 3, 6, 12, 24, 48, 72 ve 96. saatlerdeki gaz üretim miktarları ANKOMRF gaz üretim sistemi ile basınç (psi) değeri üzerinden kaydedilmiştir. Psi değerleri mL gaz üretimine (GÜ) çevrilmiştir. Üç farklı mantarla fermente edilen mısır samanların 10, 20, 30 ve 40 günlük inkübasyonlarında organik madde sindirilebilirlikleri(OMS), OMS sindirimi üzerinden metabolize edilebilir enerjileri(MEOMS) ve in-vitro paçalanma kinetiği parametreleri hesaplanmıştır. Fermente mısır samanının organik madde sindirilebilirliği ve metabolik enerji sonuçlarına göre en yüksek OMS ve MEOMS değerleri *Pleurotus ostreatus* ile 40 gün fermente edilen (PO40)'ta belirlenmiştir. Değerlendirme in-vitro gaz üretim metodu ile hesaplanan ME sonuçlarına göre yapıldığında ise en yüksek MEGÜ değeri PO40 için bulunmuştur. Sonuç olarak beyaz çürükçül mantar olan *Pleurotus ostreatus* ile fermente edilerek mısır samanının sindirilebilirliğinin %17 artırılması kaba yem sıkıntısı içinde olan Türkiye ekonomisine çok büyük katkılar sağlayabilir.

Anahtar Kelimeler: Biyolojik muamele, *Pleurotus ostreatus*, *Lentinula edodes*, *Pleurotus eryngii*, Sindirilebilirlik



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**INVESTIGATION OF THE DIGESTIBILITY OF CORN STRAW TREATED WITH
BIOLOGICAL METHODS BY IN-VITRO GAS PRODUCTION TECHNIQUE**

ABSTRACT

Increasing the digestibility of low quality roughage by treating with biological methods can provide economic benefits to the livestock sector. White rot fungi increase digestibility by breaking down polysaccharides with hydrolytic enzymes such as cellulase, xylanase, and oxidative ligninolytic enzymes such as lignin peroxidase, manganese peroxidase and laccase. In in-vitro gas production technique; The feed samples are incubated in a fermenter made of rumen fluid and artificial saliva. In this study, it was aimed to investigate the digestibility of maize straw with *Pleurotus ostreatus*, *Pleurotus eryngii* and *Lentinula edodes* micelles using in-vitro gas production fermentation technique. Gas production amounts at 0, 3, 6, 12, 24, 48, 72 and 96th hours of fermented corn straw obtained after 10, 20, 30 and 40 days incubation with white rot fungi are based on the pressure (psi) value with ANKOMRF gas production system has been recorded. Psi values are converted to mL gas production (GP). Organic matter digestibility (OMD), metabolizable energies (MEOMD) estimated over OMD digestion and in-vitro degradation kinetic parameters were calculated for 10, 20, 30 and 40 days incubation periods of corn straws fermented with three different fungi. According to the organic matter digestibility and metabolic energy results of fermented corn straw, the highest OMS and MEOMS values were determined in *Pleurotus ostreatus* fermented for 40 days (PO40). When the evaluation was made according to the ME results calculated with the in-vitro gas production method, the highest MEGP value was found for PO40. As a result, increasing the digestibility of corn straw by 17% by fermenting it with *Pleurotus ostreatus*, can make a great contribution to the Turkish economy, which is in roughage shortage.

Keywords: Biological treatment, *Pleurotus ostreatus*, *Lentinula edodes*, *Pleurotus eryngii*, Digestibility



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1. GİRİŞ

İyi kalitede kaba yemlerin hem maliyetlerinin yüksek olması hem de kaba yem kaynaklarının sınırlı olması ruminant beslemecileri düşük kalitedeki saman kullanımına yöneltmektedir. Samanların hücre duvarında bulunan lignoselüloz kompleksini parçalamak, selüloz ve hemiselüloz gibi hücre duvarı unsurlarının yararlanılabilirliğini artırmak için yüzyıllardır araştırmalar yapılmaktadır. Son yıllarda dünyanın atıklarla kirlenmesini önlemek ve daha ekonomik bir yarar sağlayabilmek için biyolojik metodlar uygulanmaktadır (Han, 2001). Lignoselülozik materyalleri en iyi parçalayabilen mikroorganizmalar mantarlardır. Mantarlar beyaz, kahverengi ve yumuşak çürüme olamk üzere 3 tür çürüme oluştururlar (FAO, 2011). Kahverengi çürükçül mantarlar tercihen selüloz ve hemiselüloza saldırır, ancak lignine dokunmaz. Bu nedenle parçalanma kalıntıları kahverengiye dönüşür. Kahverengi çürükçül mantarlar ligninde sınırlı değişiklik yaparak nem oranını artırır. Ligninin aromatik halkasını etkili olarak parçalayamaz halka açılabilir bile ligninin yapısında önemli bir dekompozisyona sebep olamazlar (Mahesh ve Mohini, 2013). Beyaz çürükçül mantarlar selüloz ve hemiselüloza etki etmeden lignini parçalayarak oluşan ürünleri beyaza dönüştür, buda materyalin sindirilebilir hale geldiğinin göstergesidir. Beyaz çürükçül mantarlar lignin polimerine saldırarak lignol bağları ve aromatik halkayı parçalarlar. Bunun sonucu olarak ta in-vitro sindirilebilirlik artar. Beyaz çürükçül mantarlar selülaz, ksilanaz gibi hidrolitik enzimlerle polisakkaritleri, ve lignin peroksidaz (LiP), mangan peroksidaz (MnP) ve lakkaz gibi oksidatif ligninolitik enzimlerle lignini parçalarlar (Mahesh ve Mohini, 2013). Yemlerin sindirim derecesi ve yem tüketimi klasik in-vivo sindirim deneme yöntemleri ile belirlenmektedir. Klasik in-vivo sindirim denemesi bir yemin gerçek sindirim derecesini belirlemede en güvenilir metot olmasına rağmen pahalı bir metottur. İn-vivo yöntemlere alternatif olarak kolay uygulanabilir in-vitro ve in-situ yöntemler geliştirilmiştir. Bu metotlar iki aşamalı sindirim yöntemi (Tilley ve Terry, 1963), naylon kese (Mehrez ve Orskov, 1977; Orskov ve Mcdonald, 1979), gaz üretimi (Menke ve ark, 1979; Menke ve Steingass, 1988) ve suni rumen (Czerkawski ve Breckenridge, 1977) tekniğidir. Menke ve ark. (1979) ve Menke ve Steingass (1988) gaz üretim tekniğini yemlerin in vitro parçalanma hızı, miktarı, metabolik enerji ve organik madde sindirim derecesini belirlemek için kullanmışlardır. Gaz üretim tekniği yemlerin fermantasyonu sonucu açığa çıkan CO₂ gazı ölçümüne dayanan indirekt bir yöntemdir. Üretilen CO₂ gazı kullanılarak bu metotla birçok parametreler hesaplanmaktadır. Gaz üretim tekniğinde elde edilen parametreler ile hayvanların performansı, yem tüketimi (Blummel ve Ørskov, 1993),



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mikrobal protein sindirimi ve yemlerin in vivo sindirim derecesi (Khazaal ve ark, 1993) arasında önemli ve yüksek bir korelasyon bulunmuştur. Bu çalışmada son zamanlarda yoğun bir şekilde kullanım alanı bulan in-vitro gaz üretim tekniği kullanılmış ve mısır samanının beyaz çürükçül mantarlardan olan *Pleurotus ostreatus*, *Pleurotus eryngii* ve *Lentinula edodes* miselleri ile muamele edilerek sindirilebilirliklerinin in-vitro gaz üretim tekniğiyle incelenerek en etkin lignilolitik beyaz çürükçül mantarın ve inkübasyon süresinin seçilmesi amaçlanmıştır.

2. MATERYAL METOD

2.1. MATERYAL

Çalışmada kullanılan rumen içeriği Florya Entegre Et Sanayi Tesisinde kesilen 400-500 kg canlı ağırlık, 2-3 yaşlı, kapalı besi yapılmış, karma yem (mısır kırması, arpa, buğday kepeği,fiğ)ve mısır samanı kullanılarak ad-libitum olarak beslenmiş büyükbaş hayvanlardan sağlandı. Kesimden hemen sonra bıçakla açılan rumenden özellikle alt kısımlardan rumen içeriği alındı, 39°C'ye getirilmiş ve içine karbondioksit basılmış termosaya konarak 10 dakika içinde OMÜ Veteriner Fakültesi Hayvan Besleme ve Beslenme Hastalıkları Anabilim Dalı Ruminant Yem Değerlendirme ve Araştırma Ünitesi'ne transfer edildi. Rumen içeriği dört katlı tülbent kullanılarak 39°C'de CO₂'li ortamda süzülür ve elde edilen rumen sıvısı taze olarak denemelerde kullanıldı. Mısır samanı (MS)Samsun, Bafra Doğanca Mahallesi mısır yetiştiricilerinden temin edildi. Mısır koçanı alınmış ve kurutulmuş sap ve yapraklar 2.0 -3.0 cm boyutlarında bahçe makası ile parçalanarak biyolojik muamelede kullanıldı.

2.2. METOD

2.2.1. Mısır Samanının Biyolojik Muamelesi

Hazırlanan mısır samanına 1300 g samana yaklaşık 3 litre su (% 23)konulup karıştırma kazanında iyice ezildi, arada bir karıştırılarak samanın suyu iyice emmesi sağlandı. Daha sonra 100'er g örnekler tartılarak 250 mL'liklerlenerek konuldu ve kalın bagetle bastırılarak sıkıştırıldı. Mantar miselleri ile muamele edebilmek için pens ile ortalarına delikler açıldı. Ardından hava ile temasını önlemek için erlenlerin ağızı pamukla kapatıldı ve dışına 2 kat folyo sarıldı. Hazırlanan örnekler 1 atm basınçta 121°C'de 1 saat otoklavda steril edildi. Mantar inokülasyonu OMÜ Ziraat Fakültesi Bahçe Bitkileri Anabilim Dalı Laboratuvarlarında yapıldı. Aşı makası OMÜ Ziraat Fakültesi Bahçe Bitkileri Anabilim Dalı'ndan temin edilen *Pleurotus ostreatus* (PO), *Pleurotus eryngii* (PE) ve *Lentinula edodes* (LE) mantar miselleri erlenlerin ortasında önceden açılmış olan deliklerden içeri konuldu. 26°C'de 10, 20, 30 ve 40 gün süre ile



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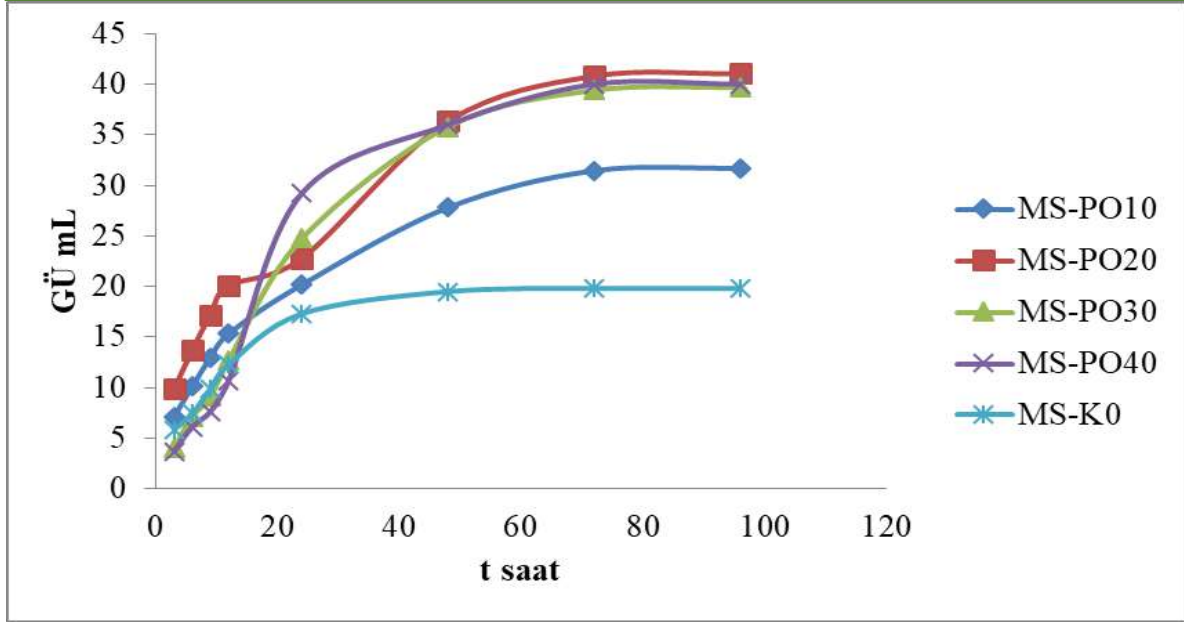
inkübasyona bırakıldı. İlk 10 günlük sürede inkübasyon OMÜ Ziraat Fakültesi Bahçe Bitkileri Anabilim Dalı Laboratuvarlarında takip edildi. 10.günden sonra OMÜ Veteriner Fakültesi Hayvan Besleme ve Beslenme Hastalıkları laboratuvarında inkübatöre konularak takip edilmeye başlandı. Her 10 günlük periyottan sonra inkübatörden alınan muamele edilmiş mısır samanları MS-PO, MS-PE, ve MS-LE kurutma fırınında 65°C’de 24 saat kurutuldu. Daha sonra cam kavonozlara konularak analiz edilinceye kadar buzdolabında saklandı. Mantar ile muamele edilen örnekler analizler için 1mm elek çapına sahip değirmenden geçirilerek küçük, ağzı kapaklı plastik kaplara konuldu.

2.2.2. Biyolojik Muamele Yapılmış Mısır Samanının İn-Vitro Gaz Üretiminin Belirlenmesi

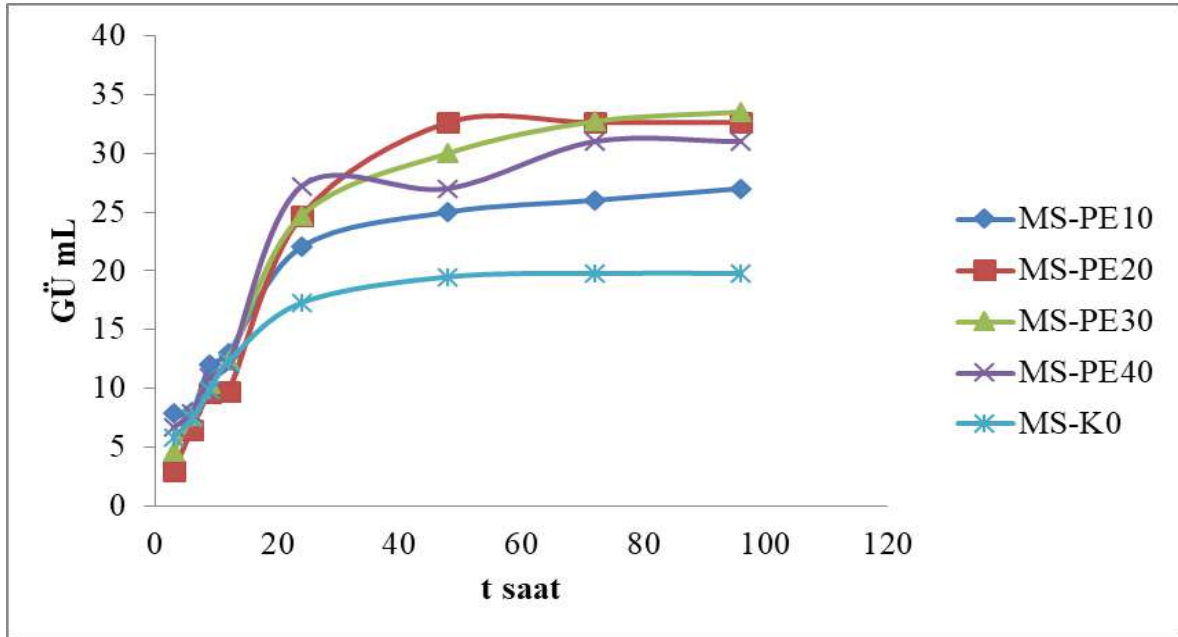
Yem ham maddelerinin in-vitro koşullarda sindirilebilirlik özelliklerinin değerlendirilmesinde Menke ve Steingass (1988) tarafından bildirilen gaz üretim metodunu esas alan ANKOMRF gaz üretim sistemi kullanıldı. Gaz üretiminin mL olarak hesaplanmasında 39 0C’de ölçülen gaz basıncı (Ppsi) kullanıldı. Ölçülen gaz basınçları aşağıda verilen ideal gaz kanunu eşitliği kullanılarak mol’ e çevrildi ve avagadro kanunu eşitliği kullanılarak mL olarak üretilen gaz hacmi (GÜ) hesaplandı.

3. BULGULAR

MS-K0, MS-PO, MS-PE ve MS-LE’nin 10, 20, 30 ve 40 günlük inkübasyonları sonrası elde edilen fermente mısır samanının 0, 3, 6, 12, 24, 48, 72 ve 96. saatlerdeki gaz üretim miktarları ANKOMRF gaz üretim sistemi ile basınç (psi) değeri üzerinden kaydedildi ve mL cinsinden hesaplanan ortalama GÜ değerleri belirlendi. Her birinin mL GÜ değeri 0, 3, 6, 12, 24, 48, 72 ve 96 saat inkübasyon zamanlarına göre grafiğe geçirilerek Şekil 1, 2 ve 3’te gösterilmiştir.



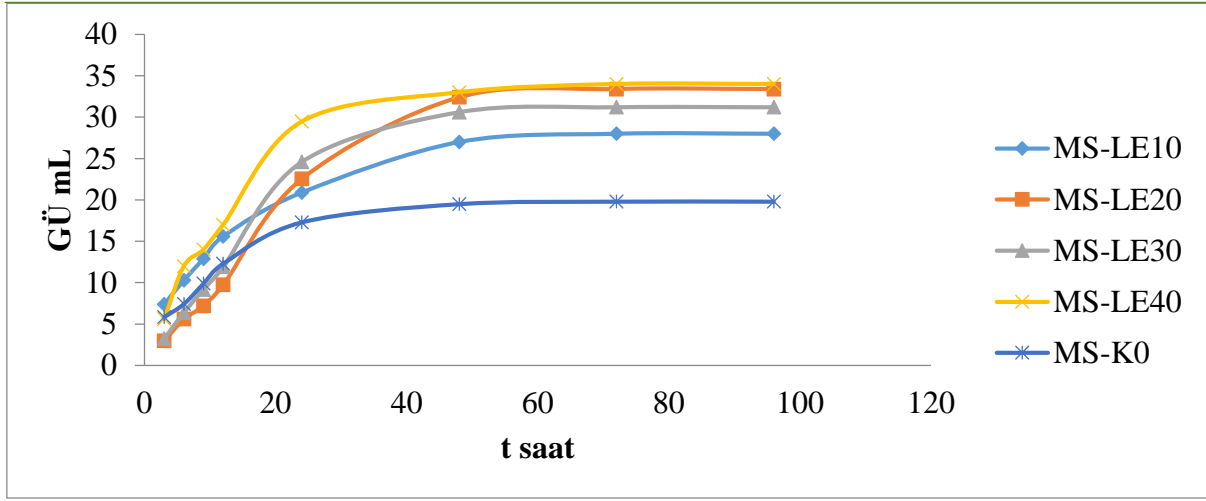
Şekil 1. Muamele edilmemiş kontrol grubu mısır samanı (MS-K0) ve *Pleurotusostreatus* mantar miselleri ile muamele edilmiş (MS-PO) fermente mısır samanının 10 ,20, 30 ve 40 günlük inkübasyonları sonrası 3, 6, 12, 24, 48, 72 ve 96. saatlerine göre mL gaz üretim (GÜ mL) değişimleri.



Şekil 2. Muamele edilmemiş kontrol grubu mısır samanı (MS-K0) ve *Pleurotuseryngii* mantar miselleri ile muamele edilmiş (MS-PE) fermente mısır samanının 10 ,20, 30 ve 40 günlük inkübasyonları sonrası 3, 6, 12, 24, 48, 72 ve 96. saatlerine göre mL gaz üretim (GÜ mL) değişimleri.



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Şekil 3. Muamele edilmemiş kontrol grubu mısır samanı (MS-K₀) ve *Lentinula edodes* mantar miselleri ile muamele edilmiş (MS-LE) fermente mısır samanının 10, 20, 30 ve 40 günlük inkübasyonları sonrası 3, 6, 12, 24, 48, 72 ve 96. saatlerine göre mL gaz üretim (GÜ mL) değişimleri.

MS-K, MS-PO10, MS-PO20, MS-PO30 ve MS-PO40'nun GÜml ve OMS değerleri arasında istatistiksel olarak önemli farklılıklar bulunmuştur ($p < 0,01$). Aynı örneklerin 10, 20 ve 30 günlük inkübasyonlarının MEOMS değerleri arasında fark yokken kontrol ve 40 günlük inkübasyonlar arasında fark istatistiksel olarak önemli bulunmuştur ($p < 0,01$). MS-K, MS-PO10, MS-PO20, MS-PO30 ve MS-PO40'nun MEGÜ değerlerine incelendiğinde 20 ve 30 günlük inkübasyonlarda değerler benzer diğerleri arasında istatistiksel farklılıklar önemli bulunmuştur ($p < 0,01$).

MS-K, MS-PE10, MS-PE20, MS-PE30 ve MS-PE40'nun GÜmldeğerleri arasında 20 ve 30 günlük inkübasyon değerleri aynı diğerleri arasındaki farklılıklar önemli bulunmuştur ($p < 0,01$). Aynı örneklerin 10 ve 20 günlük inkübasyonlarının OMS değerleri arasında fark yokken diğerleri arasında fark istatistiksel olarak önemli bulunmuştur ($p < 0,01$). MS-K, MS-PO10, MS-PO20, MS-PO30 ve MS-PO40'nun MEOMSdeğerlerine bakıldığında 10, 20 ve 30 günlük inkübasyonlarda değerler benzer diğerleri arasında istatistiksel farklılıklar önemli bulunmuştur ($p < 0,01$). Fermente mısır samanının 10 ve 20 günlük ME GÜdeğerleri aynı ve de 30 ve 40 günlük ME GÜ değerleri de aynı bulunurken kontrole göre farklılıkları istatistiksel olarak önemli bulunmuştur ($p < 0,01$).

Lentinula edodes mantar miselleri ile muamele edilen mısır samanının 10, 20, 30 ve 40 günlük inkübasyonları sonunda 24 saatlik gaz üretimi organik madde sindirilebilirliği ve metabolik enerji değerlendirildi. Bulunan sonuçlara göre MS-K, MS-LE10, MS-LE20, MS-LE30 ve MS-LE40'nin GÜml değerleri arasında 10 ve 20 günlük inkübasyon değerleri aynı diğerleri



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arasındaki farklılıklar önemli bulunmuştur($p<0,01$).OMS ve MEGÜ değerlerine bakıldığında 20 ve 30 günlük aynı bulunurken diğerleri arasındaki farklılıklar önemli bulunmuştur($p<0,01$).Aynı örneklerin 10 ,20 ve 30 günlük inkübasyonlarının MEOMS değerleri arasında fark yokken kontrol ve 40 günlük inkübasyonlar arasında fark istatistiksel olarak önemli bulunmuştur ($p< 0,01$).

4. TARTIŞMA VE SONUÇ

PO, PE ve LE mantar miselleri ile 10, 20, 30 ve 40 gün süre ile inkübasyona bırakılan mısır samanının 24 saatlik in-vitro gaz üretim sonuçlarına göre (Şekil.1-3) değerlendirme yapıldığında en yüksek GÜml değeri LE40 (29,47mL) da bulunmuş, diğer mantar türlerinin aynı günlük inkübasyonlarında bu sonuç PO40 29,20 mL ve PE40 27,24 mL olarak bulunmuştur. PO, PE ve LE mantar miselleri ile 10, 20, 30 ve 40 gün süre ile inkübasyona bırakılan mısır samanının in-vitro gaz üretim metabolik enerji sonuçlarına göre değerlendirme yapıldığında en yüksek MEGÜ değeri PO40 (17,40MJ/Kg KM) da bulunmuş, diğer mantar türlerinin aynı günlük inkübasyonlarında ise bu sonuç PE40 15,40 ve LE40 15,98 MJ/Kg KM olarak bulunmuştur. MEGÜd egeri PO30 da ise 16,37MJ/Kg KM olarak bulunmuş ve PE ve LE ‘ye göre de yüksek olduğu saptanmıştır. Karunanandaa ve Varga (1996)’nın yaptıkları bir çalışmada pirinç samanının mantar ile muamele edilmiş ve hiçbir muameleye maruz bırakılmamış örneklerinin rumende azot metabolizması, yapısal olmayan karbonhidratlar, asit deterjan fiber, nötral deterjan fiber ve ham protein üzerinde etkilerine bakılmış. Sonuç olarak selülozun sindirilebilirliği artırılmıştır. Tuyen ve ark. (2013) mısır koçanının beyaz çürükçül mantarlardan *Ceriporiopsis subvermisporea*, *Lentinula edodes*, *Pleurotus eryngii*,ve *Pleurotus ostreatus* ile muamele edip 0-42 gün inkübasyon aralığında in-vitro gaz üretim metodu ile hesapladıkları organik madde sidirilebilirliğini ruminant yemi olarak kullanılacak ölçüde iyileştirmedigini ortaya koymuşlardır.

Sonuç olarak Fermente mısır samanının organik madde sindirilebilirliği ve metabolik enerji sonuçlarına göre en yüksek OMS ve MEOMS değerleri *Pleurotus ostreatus* ile 40 gün fermente edilen (PO40)’ta belirlenmiştir. Değerlendirme in-vitro gaz üretim metodu ile hesaplanan ME sonuçlarına göre yapıldığında ise en yüksek MEGÜ değeri PO40 için bulunmuştur. Sonuç olarak beyaz çürükçül mantar olan *Pleurotus ostreatus* ile fermente edilerek mısır samanının sindirilebilirliğinin %17 artırılması kaba yem sıkıntısı içinde olan Türkiye ekonomisine çok büyük katkılar sağlayabilir.



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KAYNAKÇA

FAO. Successes and failures with animal nutrition practices and technologies in developing countries. Proceedings of the FAO Electronic Conference, 1-30 September 2010, Rome, Italy. Edited by Harinder PS Makkar. FAO Animal Production and Health Proceedings.2011. No. 11. Rome, Italy.

Blummel, M, Ørskov. ER. Comparison of in vitro gas production and nylon bag degradability of roughages in predicting of food intake in cattle. Animl Feed Sci and Technol 1993;40:109-119.

Czerkawski JW, Breckenridge G. Design and development of long-term rumen simulation technique (RUSITEC). Br J Nutr 1977;38:271–384.

Han, YW. Microbial utilization of straw (a review). Advances in Appl Microbiol 2001;23: 119–153.

Karunanandaa K, Varga, GA, Colonization of ricestrawbywhite-rot fungi (Cyathusstercoreus): Effect on ruminal fermentation pattern, nitrogen metabolism, and fiber utilization during continuous culture. Anim Feed Sci and Technol 1996; 61:1–16.

Khazaal, K, Markantonatos, X, Nastis, A, Orskov, ER. Changes with maturity in fibre composition and levels of extractable polyphenols in Greek browse: effect on in-vitro gas production and in sacco dry matter degradation. J Sci Food and Agric 1993; 63:237-244.

Mahesh MS, Mohini M. Biological treatment of crop residues for ruminant feeding: A review Afr J Biotechnol 2013;12(27):4221-4231.

Mehrez AZ, Orskov, ER. A study of artificial fibre bag technique for determining the digestibility of feeds in the rumen. J Agric Sci1977;88:645-650.

Menke KH, Raab L, Salewski A, Steingass, H, Fritz, D, Schneider, W. The estimation of the digestibility and metabolisable energy content of ruminant feedingstuffs from the gas production when they are incubated with rumen liquor. J Agric Sci 1979;93:217-222.

Menke KH, Steingass H. Estimation of the energetic feed value obtained from chemical analysis and in-vitro gas production using rumen fluid. Anim Res Dev1988;28:7-55.

Orskov ER, McDonald I. The Estimation of Protein Degradability in The Rumen from Incubation Measurement Weighed according to Rate of Passage. J Agric Sci 1979;92: 49.9-503.



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Tilley JMA, Terry RA. A two stage method for the in vitro digestion of forage crops. J Brit Grassl Soc 1963;18:104-111.

Tuyen DV, Phuonga HN, Conea JW, Baarsb JJP, Sonnenbergb ASM, Hendriks WH. Effect of fungal treatments of fibrous agricultural by-products on chemical composition and in-vitro rumen fermentation and methane production. Bioresource Technol 2013;129:256–263.



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**BİNGÖL İLİ KIRSAL KALKINMA ALANINDA YAPILAN TARIMSAL
DESTEKLEMELERİN DEĞERLENDİRİLMESİ**

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ÖZET

Bingöl ili Doğu Anadolu Bölgesinde yer alan küçük bir ilimizdir. Coğrafi yapısı gereği tarımsal üretime çok uygun olmazken, özellikle hayvancılık açısından önemli olan mera varlığı bakımından çok şanslıdır. Zengin mera varlığı hayvancılık açısından gelişmesine olanak sağlayabilme potansiyeline sahiptir. İl genelinde 720 bin küçükbaş ve 144 bin büyükbaş hayvan varlığı bulunmaktadır. 1990'lı yıllarda başlayan tarımsal destekler farklı şekil ve içerikler ile günümüze kadar gelmiştir. Yapılan desteklemeler ile Tarım ve Orman Bakanlığı tarafından başlatılan kırsal kalkınma yatırımları ve tarımsal desteklemelerle birlikte tarımsal üretim artmayı amaçlamıştır. Bingöl'de Kırsal Kalkınma yatırımları kapsamında 2007-2014 yılları arasında yatırım değeri 4 Milyon TL'nin üzerinde olan 522 makine-ekipmana %50 hibe desteği verilmiş, 792 Bin TL yatırım tutarlı 59 adet basınçlı sulama projesine %50 hibe desteği verilerek 1.128 dekar alan basınçlı sulamaya kavuşturulmuştur. Tarımsal ürünlerin işlenmesi, paketlenmesi ve depolanması, modern hayvancılık tesisleri, çelik silo ve soğuk hava depoları, kırsal turizm tesisleri, çiftlik altyapısının güçlendirilmesi, tarımsal alet-ekipman ve el sanatlarının geliştirilmesi gibi farklı konularda toplam yatırım tutarı 137 Milyon TL'nin üzerinde olan 123 proje %50 hibe desteği ile desteklenerek hayata geçirilmiştir. Ayrıca "Genç Çiftçi Projesi" kapsamında 604 projeye 18 Milyon TL doğrudan kaynak aktarılırken, Tarım ve Orman Bakanlığı GAP, DAP, KOP ve DOKAP illerindeki Hayvancılık Yatırımlarının Desteklenmesi kapsamında toplam yatırım tutarı 64 Milyon TL nin üzerinde destekleme yapılmıştır. DAP Bölge Kalkınma İdaresi, Fırat Kalkınma Ajansı, Bingöl İl Özel İdaresi gibi kuruluşlar tarafından desteklenen projelerin yanında, mazot-gübre, yem bitkisi, sertifikalı fidan-fide ve tohum kullanımı, fark/prim ödemeleri, çatak projesi, organik tarım ve küçük aile işletmesi desteği gibi çeşitli konularda toplam 81,65 Milyon TL bitkisel üretim desteği verilmiştir. Hayvancılığın geliştirilmesi için ise 252,7 Milyon TL destekleme ödemesi yapılmıştır. Tüm bu yatırım ve desteklemeler neticesinde Bingöl tarımında önemli gelişmeler kaydedilmiş, verilen sürü büyütme, anaç koyun-keçi, halk elinde ıslah projesi, göçer hayvancılık ve çoban desteği gibi destekler ve mera ıslah ve amenajman projeleri gibi projeler neticesinde 2003 yılında, 647 Bin olan küçükbaş hayvan sayısı 2020 yılında 720 bine, buzağı, çiğ süt ve kırmızı et, arı işletme desteği gibi destekler ile hibe desteğiyle kurulan modern hayvancılık tesisleri neticesinde 63 bin olan büyükbaş hayvan sayısı 144 bine, arılı kovan, organik arıcılık ve ana arı desteği gibi destekler ve arıcılık alet-ekipman projeleri neticesinde 43 bin olan arılı kovan sayısı ise 148 bine yükselmiştir. Bu gelişmeler neticesinde 2004 yılında 297 Milyon TL olan Bingöl İli tarımsal üretim değeri 2020 yılında 2,64 Milyar TL ye ulaşmıştır.

Anahtar Kelimeler: Bingöl tarımı, Kırsal kalkınma, Tarımsal desteklemeler, Hayvancılık, Tarım üretim değeri, Bingöl tarımsal yatırımları



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**EVALUATION OF AGRICULTURAL SUPPORT
IN RURAL DEVELOPMENT AREA IN BINGOL PROVINCE**

ABSTRACT

Bingöl is a small province located in the Eastern Anatolia Region. While it is not very suitable for agricultural production due to its geographical structure, it is very lucky (rich) in terms of pasture, which is especially important for animal husbandry. The presence of rich pasture enables the development of livestock. There are 720.000 ovine and 144.000 bovine animals throughout the province. Agricultural supports, which started in the 1990s, have reached today in different forms and contents. It is aimed to increase agricultural production with the supports made, with the rural development investments initiated by the Ministry of Agriculture and Forestry and with agricultural supports. Within the scope of Rural Development investments in Bingöl, 50% grant support was given to 522 machinery-equipment with an investment value of more than 4 million TL between 2007 and 2014. 50% grant support was given to 59 pressurized irrigation projects with an investment value of 792 thousand TL. As a result of these grants an area of 1.128 decares has got the opportunity of irrigation. 123 projects with a total investment amount of over 137 million TL in different areas such as processing, packaging and storage of agricultural products, modern livestock facilities, steel silos and cold storages, rural tourism facilities, strengthening farm infrastructure, development of agricultural tools-equipment and handicrafts have been implemented with the support of 50% grant. In addition, within the scope of the “Young Farmer Project”, 18 million TL was transferred directly to 604 projects. A total investment amount of over 64 million TL was provided within the scope of the Ministry of Agriculture and Forestry Supporting Livestock Investments in GAP, DAP, KOP and DOKAP Provinces. In addition to projects supported by organizations such as DAP Regional Development Administration, Fırat Development Agency, Bingöl Special Provincial Administration, a total of 81.65 million TL of plant production support was given on various subjects such as diesel-fertilizer, fodder crops, certified sapling-seedling and seed use, difference/premium payments, ÇATAK project, organic agriculture and small family business support. A support payment of 252.7 million TL was made for the development of animal husbandry. As a result of all these investments and supports, significant developments have been made in Bingöl agriculture. The number of sheep and goats, which was 647 thousand in 2003, increased to 720 thousand in 2020, as a result of the supports such as herd breeding, broodstock sheep-goat, breeding project in the hands of the folk, nomadic livestock and shepherd support, and projects such as pasture improvement and management projects. As a result of supports such as calves, raw milk and red meat, disease-free enterprise support and with modern livestock facilities established with grant support, the number of cattle increased from 63 thousand to 144 thousand. In consequence of supports such as beehives, organic beekeeping and queen bee support and beekeeping tool-equipment projects, the number of bee hives increased from 43 thousand to 148 thousand. In the wake of these developments, the agricultural production value of Bingöl Province, which was 297 Million TL in 2004, reached 2.64 Billion TL in 2020.

Keywords: Bingol agriculture, Rural development, Agricultural supports, Livestock, Agricultural production value, Bingol agricultural investments



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GİRİŞ

Doğu Anadolu Bölgesi'nin Yukarı Fırat bölümünde yer alan Bingöl ili $41^{\circ}20'-39^{\circ}56'$ doğu boylamları ile $39^{\circ}31'-38^{\circ}28'$ kuzey enlemleri arasında yer almaktadır. Bingöl ili doğuda Muş, kuzeyde Erzincan ve Erzurum, batıda Tunceli ve Elazığ, güneyde ise Diyarbakır ile komşudur. İlin Merkez ilçe dâhil Adaklı, Genç, Karlıova, Kiğı, Solhan, Yayladere ve Yedisu olmak üzere 8 İlçesi bulunmaktadır. İl Merkezinin deniz seviyesinden yüksekliği 1151 metre olup, arazi yapısı dağlık ve engebelidir [1].

Bitkisel üretim olanakları kısıtlı olan Bingöl'ün zengin mera varlığı, hayvancılık açısından büyük bir potansiyel oluşturmaktadır. Toplam yüzölçümü 825.300 hektar olan ilin mera varlığı 350.234 hektar (% 42,44), tarım arazisi varlığı 141.129 hektar (% 17,1), orman varlığı 264.934 Hektar (%32,1), yerleşim alanları ve diğer alanların varlığı ise 69.003 Hektar (% 8,36) dır [2]. TÜİK 2020 verilerine göre ilde 144.550 büyükbaş, 720.852 küçükbaş, 148.563 arılı kovan, 132.850 adet kanatlı (köy tipi), 672.000 adet (dönemlik) ise broiler etlik piliç bulunmaktadır [3].

İlin bitkisel üretiminin %90,41'ini tarla bitkileri yetiştiriciliği oluşturmaktadır. 407.053 ton olan tarla bitkileri yetiştiriciliğinin %93,64'ünü (381.171 ton) yem bitkisi yetiştiriciliği oluşturmaktadır. Yem bitkisi üretimi içerisinde yonca üretimi 310.252 ton ile ilk sırada yer alırken 53.882 ton ile silajlık mısır üretimi ikinci sırada yer almaktadır. İlin toplam sebze üretimi 24.253 ton olup bitkisel üretim içerisindeki payı %5,39'dur. Bu üretimin 8.621 tonu domates, 6.141 tonu karpuz, 3.327 tonu hıyar (örtü altı dahil), 2.286 tonu biber ve 1.071 taze fasulye üretiminden oluşmaktadır. Bu 5 ürün toplam sebze üretiminin %88,43'ünü oluşturmaktadır. İlin toplam meyve üretimi ise 18.903 ton olup bu rakam toplam bitkisel üretimin %4,2'sine tekabül etmektedir. Toplam meyve üretiminin %59,48'i elma(11.243 ton), %11,73'ü ceviz (2.217 ton), %8,97'si armut (1.696 ton), %4,49'u dut (848 ton) ve %3,39'u üzüm (640 ton) üretiminden oluşmaktadır. Bu 5 ürünün toplam meyve üretimi içerisindeki payı %88,05'tir [3].

Hayvansal üretimde ilin en önemli üretimi çiğ süt, kırmızı et ve bal üretimidir. İlin 2019 yılı çiğ süt üretimi 165.490 tondur. 2020 yılı kırmızı et üretimi 10.547 ton, bal üretimi 1.836 tondur [3]. Bu ürünlerin dışında ilde üretilen ancak il dışındaki kesimhanelerde kesilen kanatlılardan elde edilen 3.604 ton beyaz et, 47,95 ton bal mumu, 854 ton yapağı, 94 ton keçi kılı, 1.146 ton deri, 9.285.000 adet yumurta, 1,1 ton polen, 3 kg arı sütü ve 60 kg yaş koza üretimi mevcuttur [2].



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TARIMSAL DESTEKLEMELER VE PROJELER

Bingöl ilinin bitkisel ve hayvansal üretimi 1990'lı yıllardan sonra artan terör olayları, kırsaldan kente olan göç, işsizlik vb. nedenlerden dolayı giderek azalmaya başlamıştır. Tarım ve Orman bakanlığının 2000'li yıllardan sonra giderek artırdığı tarımsal desteklemeler, kırsal alanda istihdamı artırmaya yönelik hibe programları ve projeler neticesinde bitkisel ve hayvansal üretimde önemli gelişmeler yaşanmıştır. 2000'li yıllardan sonra Bingöl ilinde yapılan tarımsal yatırım ve desteklemeler şu şekilde sıralanabilir.

- 2006 yılında başlatılan KKYDP (Kırsal Kalkınma Yatırımlarının Desteklenmesi Programı) Ekonomik Yatırımların Desteklenmesi ve Ekonomik Altyapı Yatırımları Projeleri kapsamında 2006-2020 yılları arasında 33 adet hayvansal ürün işleme, paketleme ve depolama tesisi, 33 adet bitkisel ürün işleme, paketleme ve depolama tesisi, 15 adet büyükbaş, 6 adet küçükbaş ve 19 adet kanatlı tesisi olmak üzere toplam 40 adet hayvancılık işletmesi, 1 adet çelik silo ve 5 adet soğuk hava deposu, 3 adet toplu basınçlı sulama sistemi projesi, 5 adet kırsal turizm tesisi, 2 adet balya makinesi ile 1 adet el sanatlarının geliştirilmesi projesi olmak üzere toplam yatırım tutarı 137.099.091,40 TL olan toplam 123 tesise %50 hibe desteği verilmiştir [4].
- KKYDP Makine-Ekipman Alımlarının Desteklenmesi Projesi kapsamında 2006-2014 yılları arasında Bingöl Merkez ve İlçelerindeki çiftçilere toplam yatırım tutarı 4.219.849,00 TL olan 522 adet tarımsal makine-ekipman %50 hibeli olarak verilmiştir [4].
- KKYDP'nin bir diğer programı olan Bireysel Sulama Sistemleri ve Ekipmanlarının Desteklenmesi Projesi kapsamında 2010-2020 yılları arasında toplam yatırım tutarı 792.280,71 TL olan 59 adet basınçlı sulama projesine %50 hibe desteği verilerek 1.128 dekar alan basınçlı sulamaya kavuşturulmuştur [4].
- Genç Çiftçi Projesi kapsamında 2016-2018 yılları arasında 3 etapta toplam yatırım tutarı 18.120.000,00 TL olan 604 projeye doğrudan kaynak aktararak %100 hibe desteği verilmiştir [4].
- 2002 yılında Doğu Güneydoğu Anadolu Bölgesi Acil Eylem Planı çerçevesinde 1 Tarımsal kalkınma Kooperatifine 89.672,00 TL tutarında aralı kovan desteği verilmiştir. Yine 2002-2014 yılları arasında KASDP (Kırsal Alanda Sosyal Destek Projesi) kapsamında Bingöl'de 19 kooperatife 26.163.179,15 TL sıfır faizli, iki yıl geri ödemesiz ve takip eden 6 yılda 6 eşit taksitle geri ödemeli tarımsal kredi kullandırılarak, ahır, makine-ekipman ve canlı hayvan alımları desteklenmiştir [4].



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- Doğu Anadolu Projesi Kapsamındaki İllerde Etçi ve Kombine Irklarla Kurulacak Damızlık Sığır İşletmesi Yatırımlarının Desteklenmesi Projesi kapsamında 2011-2013 yılları arasında toplam yatırım tutarı 7.428.985,00 TL olan 8 adet damızlık sığır işletmesi kurulmuş ve bu işletmelerin canlı hayvan alımları ile çiftlik makine-ekipmanları (süt sağım sistemi, süt soğutma tankı vb.) alımlarına %40, ahır inşaatı yapımına %30 oranında hibe desteği verilmiştir [4].
- Tarım ve Orman Bakanlığı tarafından uygulanan GAP, DAP, DOKAP ve KOP Kapsamındaki İllerde Hayvancılık Yatırımlarının Desteklenmesi Projesi kapsamında 2015-2020 yılları arasında toplam yatırım değeri 48.598.560,94 TL olan 188 ahır ve 30 ağılın yapımına %50 hibe desteği verilmiştir. Yine aynı projede 2015-2016 yıllarında toplam yatırım tutarı 5.325.654,00 TL olan 448 baş boğa, 717 baş koç ve 146 baş teke olmak üzere toplam 1.311 baş damızlık erkek hayvan %80 hibe desteğiyle yetiştiricilere verilmiştir [4].
- 2019 yılında Türkiye’de 2.si Tokat ilinden sonra Bingöl’de kurulan ve toplam yatırım tutarı 570.291,00 TL olan, Damızlık Koç ve Teke Üretim Merkezinin yapımına %50 hibe desteği verilmiştir [4].
- 2020-2021 yıllarında Damızlık Koç ve Teke Üretim Merkezinde yetiştirilen ve toplam yatırım tutarı 3.502.600,00 TL olan 1.323 baş koç ve 12 baş teke olmak üzere toplam 1.335 baş damızlık erkek hayvanın alımında yetiştiricilere %50 hibe desteği verilmiştir [4].
- Arıcılık, İpekböcekçiliği, Kaz ve Hindi Yetiştiriciliği Yatırımlarının Desteklenmesi Projesi kapsamında 2018-2021 yılları arasında toplam yatırım tutarı 1.300.981,37 TL olan 2 adet ipek böceği üretim tesisi ile kapama dut bahçesi, 1 adet hindi kümesi ve 78 arıcıya verilen arıcılık alet-ekipmanlarına %50 ila %100 arasında değişen oranlarda hibe desteği verilmiştir [4].
- 2016 yılında Bingöl Ovasında yer alan 16 köyde uygulanan arazi toplulaştırması ve tarla içi hizmetlerin geliştirilmesi projesine 74.000.000,00 TL ödenek aktarılmıştır. Proje tümüyle Tarım ve Orman Bakanlığı tarafından finanse edilmiştir [4].
- Tarım ve Orman Bakanlığı dışında DAP Bölge Kalkınma İdaresi, Fırat Kalkınma Ajansı, Bingöl İl Özel İdaresi, bölgesel, ulusal ve uluslararası finans kuruluşlarının destekleriyle gerçekleştirilen projelere 2002-2021 yılları arasında toplamda 43.698.777,57 TL hibe desteği verilmiştir [4].
- Tarım ve Orman Bakanlığı tarafından 2002-2021 yılları arasında Bingöl’de;



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- Bitkisel üretim faaliyetlerine, yem bitkileri desteği, doğrudan gelir ve mazot-gübre desteği, katı organik-organomineral gübre desteği, sertifikalı fidan-fide ve tohum kullanımı desteği, çevre amaçlı tarım arazilerinin korunması projesi (çatak) desteği, fark/prim desteği, organik tarım desteği, küçük aile işletmesi desteği gibi çeşitli kalemlerde toplam 81.653.923,76 TL destekleme ödemesi yapılmıştır [4].
- Hayvansal üretim faaliyetlerine, anaç koyun-keçi desteği, halk elinde ülkesel küçükbaş hayvan ıslahı projesi desteği, çoban-sürü yöneticisi desteği, sürü büyütme ve yenileme desteği, küçükbaş işletmelerine yem desteği, küçükbaş göçer hayvan desteği, arılı kovan desteği, organik arıcılık desteği, damızlık/ana arı desteği, süzme bal desteği, anaç manda desteği, buzağı ve malak desteği, besilik erkek sığır (kırmızı et) desteği, çiğ süt desteği, büyükbaş işletmelerine yem desteği, anaç sığır desteği, suni tohumlama desteği, aşı desteği, hastalıktan ari işletme desteği, hayvan hastalıkları tazminatı desteği, atık (abort) desteği, su ürünleri desteği, ipek böceği (yaş koza) desteği gibi çok çeşitli kalemlerde toplam 252.286.780,06 TL destekleme ödemesi yapılmıştır [4].

Tüm bu yatırım ve desteklemelerle birlikte 2002-2021 yılları arasında Bingöl'de tarıma 592.453.422,39 TL lik kısmı hibe olmak üzere 706.598.972,18 TL yatırım ve destekleme yapılmıştır [4].

SONUÇ ve DEĞERLENDİRME

Tüm bu yatırım ve desteklemeler neticesinde Bingöl tarımında önemli gelişmeler kaydedilmiş, verilen sürü büyütme, anaç koyun-keçi, halk elinde ıslah projesi, göçer hayvancılık ve çoban desteği gibi destekler ve mera ıslah ve amenajman projeleri gibi projeler neticesinde 2003 yılında, 647 Bin olan küçükbaş hayvan sayısı 2020 yılında 720 bine, buzağı, çiğ süt ve kırmızı et, ari işletme desteği gibi destekler ile hibe desteğiyle kurulan modern hayvancılık tesisleri neticesinde 63 bin olan büyükbaş hayvan sayısı 144 bine, arılı kovan, organik arıcılık ve ana arı desteği gibi destekler ve arıcılık alet-ekipman projeleri neticesinde 43 bin olan arılı kovan sayısı ise 148 bine yükselmiştir [3]. Verilen destekler ve yatırımlar neticesinde hayvan varlığının yanında hayvansal ürünlerde de önemli artışlar yaşanmıştır. 2003 yılında 1.579 ton olan kırmızı et üretimi 2020 yılında 10.547 tona, 2003 yılında 83.910 ton olan çiğ süt üretimi



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2019¹ yılında 165.490 tona, 2003 yılında 775 ton olan bal üretimi ise 2020 yılında 1.836 tona yükselmiştir [3].

Yine hayvan varlığı ve hayvansal üretimin yanında bitkisel üretimde, özellikle de hayvancılıkta elde edilen artışlarla doğru orantılı olarak yem bitkisi üretiminde de ciddi artışlar elde edilmiştir. Bu artışlarda yem bitkisi üretimi yaygınlaştırmak amacıyla dağıtılan tohumlar ile yem bitkisi üretiminde kullanılacak makine-ekipmanların alınması projelerinin de büyük etkisi olmuştur. Bu gelişmelere bağlı olarak 2004 yılında 180 ton olan silajlık mısır üretimi 2020 yılında 53.882 tona, 29.411 ton olan yonca üretimi 310.252 tona, 2.839 ton olan korunga üretimi 3.911 tona, 2007 yılında 1.207 ton olan fiğ üretimi de 2020 yılında 10.014 tona yükselmiştir [3]. Daha önce üretimi olmayan silajlık buğday, Triticale ve yem bezelyesi gibi ürünlerin üretimi başlamıştır. Meyvecilikte de özellikle dağıtımı yapılan 240 binin üzerinde sertifikalı ceviz fidanı ve kurulan 292 kapama ceviz bahçesiyle 2004 yılında 1.178 ton olan ceviz üretimi 2020 yılında 2.217 tona yükseltilmiştir. Yine son yıllarda kapama çilek bahçeleri kurularak çilek üretimi 327 tona kadar çıkarılmıştır [4].

Tüm bu gelişmeler neticesinde Bingöl İlinin 2004 yılında 46,75 Milyon TL olan bitkisel üretim değeri, 2020 yılında 141,5 Milyon TL'ye, 73,61 Milyon TL olan hayvansal üretim değeri 524,58 Milyon TL'ye, 176,67 Milyon TL olan canlı hayvanlar değeri ise 1 Milyar 978,94 Milyon TL'ye ulaşmıştır. Bingöl ilinin 2004 yılında 297 Milyon TL olan toplam tarımsal üretim değeri 2020 yılında 2,64 Milyar TL ye ulaşmıştır [3].

¹ 2020 yılı çiğ süt üretimi TÜİK tarafından açıklanmadığı için 2019 yılı verisi kullanılmıştır.



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KAYNAKLAR

- [1] ÖZBAY, N., ERGUN, M., OSMANOĞLU, A., ÇAKIR, A., 2015. Bingöl’de Bitkisel Üretimin Durumu, Sorunları ve Çözüm Önerileri. Türk Doğa ve Fen Dergisi (Tr. J. Nature Sci). 2015, Vol. 4 No. 1
- [2] Anonim. Bingöl İli 2002-2020 Genişletilmiş İl Brifingi, T.C. Tarım ve Orman Bakanlığı Bingöl İl Müdürlüğü, Aralık, 2021.
- [3] TÜİK. Türkiye İstatistik Kurumu, www.tuik.gov.tr (erişim tarihi (12.12.2021)).
- [4] Anonim. Bingöl İli 2002-2021 Yılı Tarımsal Yatırım ve Desteklemeleri, T.C. Tarım ve Orman Bakanlığı Bingöl İl Müdürlüğü, Aralık, 2021.



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**DOĞU ANADOLU BÖLGESİ HAYVANCILIĞININ TEKNİK VE EKONOMİK
SORUNLARI İLE ÇÖZÜM ÖNERİLERİ**

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ÖZET

Ülkemiz sahip olduğu coğrafik konum nedeniyle hayvancılık yapılmasına oldukça uygundur. Son yıllarda mera varlığında gözle görülür şekilde azalış olmasına rağmen hayvan sayısında belirgin şekilde artışlar olmuştur. Özellikle Doğu Anadolu Bölgesi yapısal özellikleri bakımından hem küçükbaş ve hem de büyükbaş hayvancılık için çok uygun yapıdadır. Bölge Türkiye’de var olan küçükbaş hayvancılığının %23,5’ini, büyükbaş hayvancılığın ise 20,5’ini yetiştirmektedir. Büyük baş hayvan sayısı bakımından Erzurum ve Kars illeri ilk sırada yer alırken, küçükbaş hayvan sayısında Van ve Ağrı illeri öne çıkmıştır. Ülke genelinde var olan 14 617 000 hektar toplam mera alanı içinde 4 198 046 hektarlık mera alanı ile ilk sırada yer almaktadır. Bölgede Erzurum 1 448 446 da ile en yüksek mera varlığına sahip olan ilimizdir. Yine ülke genelinde 19 930 911 da alanda yem bitkileri ekimi yapılırken, bunun 6 744 058 da’lık alanı Doğu Anadolu Bölgesinde yetiştirilmektedir. Toplam ekim alanının %33,84’lük alana sahipken, toplan kuru ot üretiminin %21,41’ine sahiptir. Bölge hayvancılık açısından sahip olduğu bu avantajları yeterince kullanamadığı görülmektedir. Bunun en önemli nedeni hayvancılık işletmelerinin bazı teknik ve ekonomik sorunları bulunmaktadır. İşletmelerin ekonomik büyüklükte olmamaları, yetiştiricilerin gerekli ve yeterli seviyede hayvancılık yetiştirme bilgisine sahip olmaması, kaba ve kesif yem fiyatlarının yüksek olması, tarımsal desteklemelerden beklenen seviyede yararlanamamaları, genç girişimcilerin işletme kurma konusunda sıkıntı yaşamaları, hayvansal üretimde pazarlama sorunlarının çözilememiş olması, mera yönetim ve kullanımı konusunda ki belirsizlikler, veteriner hizmetlerindeki yetersizlikler, hayvan barınaklarının yetersizliği ve damızlık materyal temini konusunda yetersizliklerin yaşanması gibi sorunlar üreticilerin yaşadıkları sorunlardır. Bu çalışma bu sorunların nasıl aşılması gerektiği konusunda yol haritası çizilmiş ve uygulanabilirliği tartışılmıştır.

Anahtar Kelimeler: Hayvancılık, teknik ve ekonomik sorunlar, mera yönetimi, Doğu Anadolu Bölgesi, küçük ve küçükbaş hayvancılık



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**TECHNICAL AND ECONOMIC PROBLEMS AND SOLUTION SUGGESTIONS OF
LIVESTOCK IN THE EASTERN ANATOLIA REGION**

ABSTRACT

Our country is very suitable for animal husbandry due to its geographical location. Although there has been a noticeable decrease in pasture availability in recent years, there has been a significant increase in the number of animals. Especially the Eastern Anatolia Region is very suitable for both sheep and cattle breeding in terms of its structural features. 23.5% of the ovine livestock and 20.5 % of the cattle are bred in this region in Turkey. Erzurum and Kars provinces ranked first in terms of cattle numbers, while Van and Ağrı provinces stood out in terms of sheep and goat numbers. 14 617 000 hectares of pasture area covers the country and Eastern Anatolia Region ranks first with a pasture area of 4 198 046 hectares. In the region, Erzurum has the largest rangeland with 1 448 446 hectares. Forage crops are cultivated on an area of 19 930 911 hectares throughout the country, 6 744 058 hectares of this cultivation area is in the Eastern Anatolia Region. While it has 33.84% of the total cultivation area, it has 21.41% of the total hay production. It is seen that the region cannot sufficiently use this advantages it has in terms of animal husbandry. The most important reason for this is that livestock enterprises have some technical and economic problems. The fact that the enterprises are not in economic size, the breeders do not have the necessary and enough livestock breeding knowledge, the prices of roughage and concentrate feed are high, they cannot benefit from agricultural supports at desired level, the young entrepreneurs have difficulties in establishing an agribusiness, the marketing problems in animal products have not been solved. Uncertainties in handling and managing pastures, inadequacies in veterinary services, inadequacy of animal shelters and insufficiencies in the supply of breeding materials are the problems faced by producers. In this study, a roadmap was drawn on how to overcome these problems and its applicability was discussed.

Keywords: Livestock, technical and economic problems, rangeland management, Eastern Anatolia Region, cattle and sheep farming



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1.GİRİŞ

Ülkemizin sahip olduğu coğrafi koşullar hayvancılık için son derece elverişlidir. Özellikle geniş meraların varlığı hayvancılığı destekler niteliktedir. Doğu Anadolu Bölgesi hayvancılığın en yoğun şekilde yapıldığı bölgemizdir. Doğu Anadolu Bölgesi'nin coğrafi özellikleri hayvancılık için oldukça uygun bir yapıya sahip olup, Ülkemizdeki büyükbaş hayvan varlığının yaklaşık % 20,46'sına ve küçükbaş varlığının ise % 23,55'ine sahiptir (Anonim, 2017). Ülkemizin sahip olduğu coğrafi potansiyel, ülke genelinde hayvancılığı önemli bir geçim kaynağına dönüştürmüştür. Doğu Anadolu Bölgesi'nde de nüfusun önemli bir kısmı geçimini hayvancılıktan sağlamaktadır.

Dünya Bankası verilerine göre, %1,2 nüfus artış hızı ile Dünya ortalamasının üzerinde olan Türkiye, artan nüfusun ve küresel ısınmanın da etkisiyle yıldan yıla büyüyen bir ülkedir. Bu nüfus artışı ülkemizin yeterli ve dengeli beslenme sorunu ile karşı karşıya kalmasına sebep olmaktadır. İnsan beslenmesinde günlük protein gereksiniminin karşılanmasında hayvansal proteinler özel bir önem taşımakta ve günlük 70 gram olan protein gereksiniminin en az 33 gramının hayvansal kökenli olması gerekmesine rağmen, bu değer Ülkemizde ancak 13-17 gram kadardır (Cevheri ve Polat, 2009). Türkiye'de ana besin kaynağımız karbonhidratlar olup, kişi başına hayvansal protein tüketimiz ise çağdaş ülkelerle kıyaslanamayacak bir seviyededir. Yeterli ve dengeli beslenme ile ilgili sorunlarımız temel olarak hayvancılığımız ve hayvansal ürün üretimimize ilişkin sorunlardan kaynaklanmaktadır. Geçmişten beri hayvancılığımızın en önemli sorunlarından birini “Yem Üretimi” konusu oluşturmakta, hayvancılığımızda görülen ve beslenmemizde büyük bir protein açığı oluşturan verim düşüklüğün kısmen hayvanlarımızın yerli ırklar olması, sağlık ve barınma olanaklarının elverişsiz bulunması yanında büyük oranda yem yetersizliği ve kalitesizliğine bağlamak olası bulunmaktadır (Soya ve ark., 2004). Ülkemizde hayvan beslenmesi büyük ölçüde doğal çayır-meralara, bitki artıkları ve anızlar ile saman gibi düşük kaliteli yemlere bağlı olarak yapılmaktadır. Oysa yem bitkileri tarımı, yem temin etmenin en etkin ve ekonomik yoludur (Kuşvuran ve ark., 2011).

Otobur çiftlik hayvanlarının yaşamlarını sürdürebilmeleri ve istenen ürünleri verebilmeleri için bünyelerine almak zorunda oldukları besin maddelerini yapılarında bulunduran ve belirli sınırlar içinde yedirildiklerinde hayvan sağlığına ve hayvansal ürünlere zararlı olmayan, doğada kendiliğinden yetişen veya kültürü yapılan bitkiler olarak tanımlanabilen “yem bitkileri”; çayır, mera ve tarla gibi çeşitli alanlarda yetişmektedir. (Soya ve ark., 2004). Tarla tarımı içerisinde yetiştirilen yem bitkileri ve doğal çayır-meralar, hayvanlara kaliteli, ucuz ve bol kaba yem



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sağlamada önemli yem kaynakları durumundadır. Ayrıca, bu bitkilerin hayvansal üretimde en önemli girdi olan yemi sağlamanın yanı sıra yetiştirildikleri toprakların fiziksel ve kimyasal özelliklerini ve kendisini takip eden kültür bitkilerinin verim ve kalitesini olumlu yönde etkilemeleri de söz konusudur (Sağlamtimur ve ark., 1998; Açıkgöz ve ark., 2005).

Bu çalışmada, Türkiye İstatistik Kurumu (TÜİK) tarafından hazırlanan 2017 yılı Türkiye geneli ve Doğu Anadolu Bölgesi çayır-mera alanları, tarla tarımı içerisindeki yem bitkileri ekim alanları ve üretim miktarları ile mevcut hayvan varlığımız ele alınarak, yem bitkileri üretimi ve hayvancılığımızın durumunun değerlendirilmesi amaçlanmıştır.

2. Türkiye ve Doğu Anadolu Bölgesi Ekilebilen Arazi Varlığı

Ülkemiz 814.578 kilometrekare yüzölçümüne sahiptir. Türkiye İstatistik Kurumu 2017 yılı verilerine göre Türkiye'de 233.850.926 da toplam ekilebilen alan mevcut olup, tahıllar ve diğer bitkisel ürünlerin ekilen alanı 155.363.201 da (%66.44), sebze bahçeleri alanı 7.982.650 da (%3.41), meyve bahçeleri, içecek ve baharat bitkilerinin alanı 3.3481.004 da (%14.32), süs bitkileri alanı 49.934 da (%0.02) ve nadas alanı 36.974.137 da (%15.81) olarak kullanıldığı görülmektedir (Çizelge 1.).

Çizelge 1. Türkiye’de ekilebilen arazi varlığı ve dağılımı (da) (TÜİK, 2017).

Bölgeler	Toplam Alan	Tahıllar ve Diğer Bitkisel Ürünlerin Ekim Alanı	Nadas Alanı	Sebze Bahçeleri Alanı	Meyve Bahçeleri, İçecek ve Baharat Bitkilerinin Alanı	Süs Bitkileri Alanı
Akdeniz	22.735.906	14.361.565	1.699.356	1.718.605	4.948.156	8.224
Doğu Anadolu	25.523.859	18.084.388	5.619.135	317.958	1.502.148	230
Ege	27.575.972	16.071.720	2.039.346	1.352.000	8.095.609	17.297
G. Doğu Anadolu	29.666.365	22.107.386	1.311.111	680.990	5.566.853	25
İç Anadolu	70.201.712	47.678.264	18.902.558	1.615.647	2.004.088	1.156
Karadeniz	26.828.015	14.564.401	4.442.359	954.849	6.865.219	1.186
Marmara	31.319.097	22.495.477	2.960.272	1.342.601	4.498.931	21.816
Toplam	233.850.926	155.363.201	36.974.137	7.982.650	33.481.004	49.934
%	100,00	66,44	15,81	3,41	14,32	15,81
D. Anadolu (%)	9,12	9,59	11,40	3,58	4,49	0,46



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Çizelge 2. Doğu Anadolu Bölgesi'nde ekilebilen arazi varlığı ve dağılımı (da) (TÜİK, 2017).

İller	Toplam Alan	Tahıllar ve Diğer Bitkisel Ürünlerin Ekim Alanı	Nadas Alanı	Sebze Bahçeleri Alanı	Meyve Bahçeleri, İçecek ve Baharat Bitkilerinin Alanı	Süs Bitkileri Alanı
Ağrı	3.544.172	2.350.382	1.187.657	5.482	651	0
Ardahan	360.805	270.929	89.124	160	592	0
Bayburt	925.140	722.685	200.084	1.953	418	0
Bingöl	300.395	183.997	69.122	11.817	35.459	0
Bitlis	1.214.846	1.012.985	114.000	31.040	56.821	0
Elazığ	1.760.128	1.049.521	375.846	68.088	266.518	155
Erzincan	1.239.063	889.996	286.500	29.169	33.398	0
Erzurum	3.409.119	2.381.944	1.000.415	9.407	17.336	17
Hakkari	410.482	354.527	12.000	17.706	26.249	0
Iğdır	1.047.286	750.255	204.769	34.079	58.183	0
Kars	2.410.513	2.383.914	15.997	20	10.582	0
Malatya	2.774.474	1.055.919	768.606	44.131	905.760	58
Muş	2.473.958	2.169.094	256.154	37.745	10.965	0
Tunceli	502.281	288.971	186.151	4.573	22.586	0
Van	3.151.197	2.219.269	852.710	22.588	56.630	0
Toplam	25.523.859	18.084.388	5.619.135	317.958	1.502.148	230
%	100,000	70,853	22,015	1,246	5,88	0,001

Doğu Anadolu Bölgesi'nde toplam ekilebilen arazi varlığı 25.523.859 da'dır. Bu arazi varlığı, Türkiye toplam ekilebilen arazi varlığının %9.12'sini oluşturmaktadır. Bölgede toplam ekilebilir arazi varlığının, tahıllar ve diğer bitkisel ürünleri için 18.084.388 da, (%70,853), sebze bahçeleri için 317.958 da (%1,246), meyve bahçeleri, içecek ve baharat bitkileri için 1.502.148 da (%5,88), süs bitkileri için 230 da (%0,001) ve nadas alanlar için de 5.619.135 da (%22,015) olarak ayrıldığı görülmektedir (Çizelge 2.).



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3. Türkiye Geneli Mera Alanları

İnsanlığın geleceği ve biyoçeşitliliğin devamı açısından büyük önem taşıyan mera alanları “büyük bir bölümü otsu bitkilerden oluşan bir örtü ile kaplı bulunan doğa parçası veya kaliteli kaba yemi, bol ve en ucuz bir şekilde üreterek hayvanların yararlanmasına sunan doğal kaynaklar” olarak tanımlanmaktadır (Avcıoğlu ve ark., 1998). Türkiye İstatistik Kurumu (önceki adıyla Devlet İstatistik Enstitüsü) 2001 yılı Tarım Sayımı verilerine göre ülkemizde 14.616.687 ha mera alanı bulunmaktadır (Çizelge 3.). Mera alanları yönünden Doğu Anadolu Bölgesi, %37,53’lik mera oranı ile toplam mera alanlarımızın da 1/3’ünden fazlasına sahip bulunmaktadır. Toplam mera alanı verileri ele alındığında Doğu Anadolu Bölgesi %37.53’lük pay ile ilk sırayı alırken, bunu %31.27 ile İç Anadolu ve %10.49 ile Karadeniz Bölgeleri takip etmektedir (Çizelge 3.).

Çizelge 3. Türkiye’de mera alanlarının yıllara göre değişimi (ha) (Anonim, 2017).

Bölgeler	1970 Köy Hizmetleri	1991 Tarım Sayımı	2001 TÜİK Sayımı	1998-2017
	Alan (ha)	Alan (ha)	Alan (ha)	Alan (ha)
Akdeniz	1.002.400	434.300	659.334	540.956
Doğu Anadolu	9.162.100	4.573.400	5.485.449	4.198.046
Ege	1.027.900	615.900	802.879	394.429
G. Doğu Anadolu	2.165.100	743.600	1.012.576	556.281
İç Anadolu	5.884.200	3.890.300	4.570.182	3.939.337
Karadeniz	1.993.100	1.556.000	1.533.605	1.069.505
Marmara	463.600	564.100	552.662	286.012
Toplam	21.698.400	12.377.600	14.616.687	10.984.566

* Hesaplama Türkiye yüz ölçümü 78.000.000 hektar olarak alınmıştır.

Ülke hayvancılığının bel kemiği olan doğal çayır ve meralarımız, 1940’lı yıllarda 44 milyon hektarla ülke topraklarımızın yarısından fazlasını kaplarken, günümüzde yaklaşık 14 milyon hektarlara gerilemiştir. Doğal yem alanlarımız üzerinde uzun yıllardır süren plansız, aşırı ve erken otlatmalar nedeniyle bitki örtüsü bozulmuş ve erozyona açık alanlar haline gelmiştir. 1940 yılında bir hayvan birimi (HB) başına 3.38 ha mera alanı düşerken, son yıllarda bu değer 1.18 ha’a kadar gerilediği ve birim alanda otlayan hayvan sayısında 3 misli artış olduğu görülmektedir (Kuşvuran ve ark., 2011).



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Çizelge 4. Türkiye’de mera alanlarından elde edilen kuru ot miktarı (ton) (Anonim, 2017).

Bölgeler	Tespiti Tamamlanan Mera Alanı (ha)	Kuru Ot Verimi (kg/ha)	Kuru Ot Üretimi (ton)
Akdeniz	540.956	500	270.478,00
Doğu Anadolu	4.198.046	900	3.778.241,00
Ege	394.429	600	236.657,40
G. Doğu Anadolu	556.281	450	250.326,50
İç Anadolu	3.939.337	450	1.772.702,00
Karadeniz	1.069.505	1.000	1.069.505,00
Marmara	286.012	600	171.607,20
Toplam	10.984.566		7.549.517,10

Türkiye geneli 1998-2017 Yılları arasında tespit işlemleri tamamlanan mera alanlarından elde edilen yıllık kuru ot miktarı 7.549.517,10 ton olup, Doğu Anadolu Bölgesindeki meralardan elde edilen yıllık kuru ot miktarı 3.778.241,00 ton’dur (Çizelge 4.). Türkiye geneli çayır alanlarından elde edilen yıllık kuru ot miktarı Çizelge 5.’te verilmiştir.

Çizelge 5. Türkiye’de çayır alanlarından elde edilen kuru ot miktarı (ton) (Anonim, 2011).

Bölgeler	Çayır Alanı (ha)	Kuru Ot Verimi (kg/ha)	Kuru Ot Üretimi (ton)
Akdeniz	44.951	3.000	134.853
Doğu Anadolu	823.160	3.000	2.469.480
Ege	52.827	3.000	158.481
G. Doğu Anadolu	47.881	3.000	143.643
İç Anadolu	181.905	3.000	545.715
Karadeniz	247.458	3.000	742.374
Marmara	51.131	3.000	153.393
Toplam	1.449.313		4.347.939

*Çayır alanlarının kuru ot verimi 3000 kg/ha olarak hesaplanmıştır (Anonim, 2002).

Ülkemizde 1998 yılında yasalaşan 4342 sayılı Mera Kanunu ve bu kapsamda çıkarılan yönetmelik ile mevcut mera alanlarının ıslah edilmesi amacıyla kiralanmasına olanak tanınmaktadır. Bu amaçla, her ilimizde Mera Kanunu kapsamında oluşturulan mera komisyonları başkanlığında ülkemiz mera varlığının tespit, tahdit, tahsis ve ıslah çalışmalarının



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hızla devam ettiği bilinmektedir. Türkiye genelinde tespit, tahdit ve tahsis yapılan meralara ait bilgiler Çizelge 6.'da verilmiştir.

Çizelge 6. Türkiye Geneli Mera Tespit, Tahdit ve Tahsis Çalışmaları (1998-2017) (Anonim, 2017).

Bölge	Toplam Tespit (ha)	Toplam Tahdit (ha)	Toplam Tahsis (ha)
Akdeniz	540.956	302.459	157.812
Doğu Anadolu	4.198.046	2.307.186	1.248.601
Ege	394.429	261.413	147.614
G. Doğu Anadolu	556.281	315.220	83.097
İç Anadolu	3.939.337	2.798.949	1.746.946
Karadeniz	1.069.505	571.107	99.347
Marmara	286.012	256.436	177.218
Toplam	10.984.566	6.812.771	3.660.635

4. Doğu Anadolu Bölgesi Mera Alanları

Bölgede 5.596.158 ha olan toplam mera alanı bulunmaktadır (Çizelge 7.). Mera alanları bakımından bölge illerinden Erzurum'un 1.448.466 da ile ilk sırada yer aldığı görülmekte, bu ilimizi 542.731 da ile Ağrı, 532.862 da ile Van ve 449.432 da ile Erzincan izlemektedir.

Çizelge 7. Doğu Anadolu Bölgesi Mera Tespit, Tahdit ve Tahsis Çalışmaları (1998-2017) (Anonim, 2017)

İller	Mera Varlığı	Toplam Tespit (ha)	Toplam Tahdit (ha)	Toplam Tahsis (ha)
Ağrı	542.731	97.801	69.837	-
Ardahan	245.823	147.721	32.129	-
Bayburt	110.708	135.797	104.734	-
Bingöl	313.771	203.004	199.481	150.000
Bitlis	219.840	144.451	89.687	35.008
Elazığ	268.912	226.128	55.631	45.014
Erzincan	449.432	434.471	111.443	-
Erzurum	1.448.466	826.379	760.820	646.052
Hakkari	166.559	37.341	28.447	-
Iğdır	122.331	106.061	55.311	8.324
Kars	312.898	277.883	248.240	13.687
Malatya	363.449	230.222	95.038	33.844
Muş	371.635	295.937	52.764	22.171
Tunceli	126.741	126.987	75.955	-
Van	532.862	907.857	327.676	294.501
Toplam	5.596.158	4.198.046	2.307.186	1.248.601



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Bu dört ilin, Doğu Anadolu Bölgesi toplam mera alanının yaklaşık %53'üne sahip olduğu görülmektedir. Bölge meralarının önemli bir bölümüne sahip olan bu dört ildeki mera varlığının uygun amenajman yöntemleri ile ıslah edilmesi ve verimliliklerinin artırılması ile en azından bölgenin kaba yem ihtiyacının karşılanabileceği göz önüne alınmalıdır.

5. Türkiye ve Doğu Anadolu Bölgesi Yem Bitkileri Üretimi

Türkiye İstatistik Kurumu 2017 yılı verilerine göre düzenlenen Çizelge 8. incelendiğinde, ülkemizde toplam 19.930.911 da alanda yem bitkileri ekimi yapılmakta ve 51.265.649 ton yeşil ot karşılığı yem üretimi yapıldığı görülmektedir. Gelişmiş dünya ülkelerinde tarla tarımı içerisinde yem bitkileri üretimi yaygın olarak yapılmaktadır. Bu veriler göz önüne alındığında, son yıllarda Tarım ve Orman Bakanlığı tarafından yapılan desteklemelere bağlı olarak ülkemizdeki yem bitkileri ekim alanlarının toplam ekilebilen arazi varlığı içerisindeki oranının artış gösterdiği anlaşılmaya rağmen, halen gelişmiş ülkeler seviyesine ulaşamadığı görülmektedir. Örneğin, ekilebilen arazi varlığı içerisindeki yem bitkileri ekim alanlarının oranının Almanya'da %37, Hollanda'da %31, İtalya'da %30, Fransa ile İngiltere'de %25 ve ABD'de %23 düzeyinde olduğu bilinmektedir. Ülkemizde ise bu oran, toplam ekilebilen arazi varlığı içerisinde yaklaşık %8 civarında kalmaktadır (Topçu ve Özkan, 2017).

Çizelge 8. Türkiye geneli bölgeler bazında 2017 yılı yem bitkileri ekim alanları, üretim miktarları ve toplam alan içindeki ekim oranları (TÜİK, 2017).

Bölgeler	Ekim Alanı (da)	Yeşil Ot Üretimi (ton)	Yeşil Ot Verimi (ton/da)	Kuru Ot Üretimi (ton)	Kuru Ot Verimi (ton/da)	Ekim Alanı Oranı (%)	Kuru Ot Üretimi Oranı (%)
Akdeniz	1.310.546	3.144.421	2.399	786.105	600	6,58	6,13
Doğu Anadolu	6.744.058	10.975.692	1.627	2.743.923	407	33,84	21,41
Ege	2.966.988	10.649.677	3.589	2.662.419	897	14,89	20,77
G. Doğu Anadolu	547.963	1.767.236	3.225	441.809	806	2,75	3,45
İç Anadolu	2.965.461	8.966.399	3.024	2.241.600	756	14,88	17,49
Karadeniz	2.185.146	5.017.416	2.296	1.254.354	574	10,96	9,79
Marmara	3.210.747	10.744.808	3.347	2.686.202	837	16,11	20,96
Toplam	19.930.911	51.265.649	2.787	12.816.412	697	100,00	100,00

Yem bitkileri tarımı yapılan ekim alanları bölgeler bazında incelendiğinde hayvancılık faaliyetlerinin yoğun olarak gerçekleştirildiği Doğu Anadolu Bölgesi, 6.744.058 da (%33.84) ile ilk sırayı alırken, bunu 3.210.747 da (%16.11) ile Marmara Bölgesi ve 2.966.988 da



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(%14.89) ile Ege Bölgesi izlemektedir. Yem bitkileri yeşil ot üretim miktarları bölgeler bazında incelendiği zaman ise 6.744.058 da yem bitkileri ekim alanına sahip Doğu Anadolu Bölgesi 10.975.692 ton (%21.41) ile ilk sırayı alırken, bunu 10.744.808 ton (%20.96) ile Marmara Bölgesi ve 10.649.677 ton (%20.77) ile Ege Bölgesi izlemektedir. Yem bitkileri ekim alanları ve yeşil ot üretim miktarları incelendiğinde, Türkiye sıralamasında yeşil ot verimi açısından Ege Bölgesi'nin 3.589 kg/da ile ilk sırada, karasal iklim koşulları hâkim olan, kışların uzun ve sert, yazların kısa ve serin geçmesiyle oldukça kısa bir vejetasyon süresine sahip Doğu Anadolu Bölgesi'nin ise 1.627 kg/da ile son sırada yer aldığı görülmektedir (Çizelge 8.).

Çizelge 9. Türkiye geneli 2017 yılı yem bitkileri ekim alanları (da) ve üretim miktarları (ton) (TUIK, 2017).

Ürünler	Ekim Alanı (da)	Yeşil Ot Üretimi (ton)	Yeşil Ot Verimi (kg/da)
Korunga	1.961.808	2.001.379	1.020
Burçak	29.273	17.327	592
Mısır (Silajlık)	4.862.296	23.373.725	4.807
Hayvan Pancarı	20.620	98.537	4.779
Yem Şalgamı	69.823	370.729	5.310
Buğday (Yeşil Ot)	302.033	375.585	1.244
Arpa (Yeşil Ot)	149.419	281.063	1.881
Çavdar (Yeşil Ot)	14.810	24.124	1.629
Bezelye (Yemlik) (Yeşil Ot)	69.595	139.366	2.003
Fiğ	4.456.256	4.597.600	1.032
Üçgül	4.000	2.280	570
Yonca	6.594.319	17.561.190	2.663
Yulaf (Yeşil Ot)	1.063.555	1.755.323	1.650
Sorgum (Yeşil Ot)	17.929	65.523	3.655
Tritikale (Yeşil Ot)	95.258	150.823	1.583
Mürdümük (Yeşil Ot)	142.649	103.029	722
İtalyan Çimi (Ryegrass)	77.268	348.046	4.504
Toplam	19.930.911	51.265.649	

Türkiye geneli yem bitkileri ekim alanları tür bazında incelendiğinde, 6.594.319 da ile yonca ilk sırayı alırken, bunu 4.862.296 da ile silajlık mısır ve 4.456.256 da ile fiğ izlemektedir. Türkiye geneli üretim miktarları tür bazında incelendiğinde ise, 23.373.725 ton ile silajlık mısır ilk sırayı alırken, bunu 17.561.190 ton ile yonca ve 4.597.600 ton ile fiğ türleri izlemektedir (Çizelge 9.).

Doğu Anadolu Bölgesi'nde ise 3.776.408 da ekim alanı ile yonca ilk sırayı alırken, bunu 1.244.891 da ekim alanı ile korunga ve 1.242.475 da ekim alanı ile fiğ izlemektedir. Bölgede



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üretim miktarı açısından 6.905.969 ton ile yonca ilk sırayı alırken, bunu 1.383.991 ton ile korunga ve 898.118 ton ile fiğ izlemektedir (Çizelge 10.).

Yonca bitkisi; yüksek adaptasyon yeteneği, uzun ömürlü olması, verim ve besin değerinin kalitesi ile bazı çeşitlerinin otlatılmaya uygunluğundan dolayı tarla tarımı içerisinde en fazla yetiştiriciliği yapılan değerli bir yem bitkisidir. Birim alandan alınan verim ve sindirilme oranı oldukça yüksek olan mısır ise ülkemizde özellikle silo yemi olarak önemli miktarda yetiştirilmektedir (Topçu ve Özkan, 2017).

Çizelge 10. Doğu Anadolu Bölgesi 2017 yılı yem bitkileri ekim alanları ve üretim miktarları (TUIK, 2017).

Ürünler	Ekim Alanı (da)	Yeşil Ot Üretimi (ton)	Yeşil Ot Verimi (kg/da)
Korunga	1.244.891	1.383.991	1.112
Burçak	2.455	1.313	535
Mısır (Silajlık)	187.365	860.222	4.591
Hayvan Pancarı	-	-	-
Yem Şalgamı	122	574	4.705
Buğday (Yeşil Ot)	-	-	-
Arpa (Yeşil Ot)	-	-	-
Çavdar (Yeşil Ot)	260	90	346
Bezelye (Yemlik) (Yeşil Ot)	301	482	1.601
Fiğ	1.242.475	898.118	723
Üçgül	4.050	2.378	587
Yonca	3.776.408	6.905.969	1.829
Yulaf (Yeşil Ot)	44.237	77.632	1.755
Sorgum (Yeşil Ot)	38	135	3.553
Tritikale (Yeşil Ot)	2.780	7.553	2.717
Mürdümük (Yeşil Ot)	58.835	37.272	634
İtalyan Çimi (Ryegrass)	-	-	-
Toplam	6.564.217	10.175.729	



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6. Türkiye Geneli Hayvan Varlığı

Türkiye İstatistik Kurumu 2017 yılı verilerine göre hazırlanan Çizelge 11. incelendiğinde, ülkemiz genelinde 16.105.025 adet büyükbaş (%25,45) ve 47.166.432 adet küçük baş (%74,55) olmak üzere toplam 63.271.457 adet hayvan varlığı olduğu görülmektedir. Bölgeler bazında incelendiğinde en yüksek hayvan varlığının toplam 14.405.265 adet ile Doğu Anadolu Bölgesi'nde, en düşük hayvan varlığının ise toplam 4.328.029 adet ile Karadeniz Bölgesi'nde olduğu görülmektedir. Yoğun hayvancılık faaliyetlerinin gerçekleştirildiği Doğu Anadolu Bölgesi, hayvan türleri bakımından hep ilk sırada yer almakta ve Türkiye toplam hayvan varlığının %22,77'sini oluşturmaktadır.

Çizelge 11. Türkiye geneli bölgeler bazında 2017 yılı hayvan sayısı ve HB değeri (TÜİK, 2017).

Bölgeler	Büyük Baş		Küçük Baş		Toplam	
	Hayvan Sayısı	BBHB Değeri	Hayvan Sayısı	BBHB Değeri	Hayvan Sayısı	BBHB Değeri
Akdeniz	1.307.146	1.160.578	8.265.517	712.385	9.572.663	1.872.963
Doğu Anadolu	3.295.354	2.542.613	11.109.911	1.080.733	14.405.265	3.623.347
Ege	2.513.054	2.317.867	4.920.126	467.019	7.433.180	2.784.886
G. Doğu Anadolu	1.464.441	1.112.889	8.843.986	831.006	10.308.427	1.943.895
İç Anadolu	3.042.117	2.691.221	7.403.878	719.123	10.445.995	3.410.344
Karadeniz	2.340.072	1.890.495	1.987.957	191.225	4.328.029	2.081.720
Marmara	2.142.841	1.937.736	4.635.057	445.377	6.777.898	2.383.113
Toplam	16.105.025	13.653.400	47.166.432	4.446.867	63.271.457	18.100.268
%	25,45	75,43	74,55	24,57	100,00	20,02
Doğu Anadolu (%)	20,46	18,62	23,55	24,30	22,77	

4342 sayılı Mera Kanunu ve Mera Yönetmeliğinde yer alan otlatma hakkı ve otlatma kapasitesinin hesaplanmasında hayvan miktarı dikkate alınmakta ve hesaplamalarda ise BBHB kullanılmaktadır. Büyük Baş Hayvan Birimi (BBHB); hayvan sayısının, bir büyükbaş hayvan birimi olan 500 kg canlı ağırlığına çevrilme şeklini ifade etmekte ve meraları değerlendiren değişik ırk ve cinslere ait hayvanların sayılarını belirlemede yaşanan sıkıntıları ortadan kaldırmak için, uluslararası alanda kullanılan BBHB'ne çevirme katsayılarının kullanılması hesaplamalarda kolaylıklar sağlamaktadır (Gökkuş ve ark., 1995). Bu kapsamda 1 kültür ırk



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sığır 1.00 BBHB, 1 melez ırk sığır 0.75 BBHB, 1 yerli ırk sığır 0.50 BBHB, 1 manda 0.90 BBHB, 1 koyun 0.10 BBHB, 1 keçi 0.08 BBHB olarak hesaplanarak çevrilmektedir.

Türkiye İstatistik Kurumu 2017 yılı verilerine göre büyükbaş ve küçükbaş hayvan varlığımız ve uluslararası BBHB çevirme katsayıları göz önüne alınarak hesaplanan Hayvan Birimi (HB) sayıları Çizelge 10.'da düzenlenmiştir. Buna göre, Türkiye genelinde 13.653.400 BBHB'ye eşdeğer büyükbaş (%75,43) ve 4.446.867 BBHB'ye eşdeğer küçükbaş (%24,57) olmak üzere toplam 18.100.268 HB değeri hayvan varlığı olduğu görülmektedir. Bölgeler bazında incelendiğinde ise en yüksek hayvan varlığının 3.623.347 HB ile Doğu Anadolu Bölgesi'nde, en düşük hayvan varlığının ise 1.872.963 HB ile Akdeniz Bölgesi'nde olduğu görülmektedir. Temel geçim kaynağını hayvancılığın oluşturduğu Doğu Anadolu Bölgesi, hayvan türleri bakımından hep ilk sırada yer almakta ve ülkemiz BBHB olarak hayvan varlığının %20,02'sini oluşturmaktadır.

7. Doğu Anadolu Bölgesi Hayvan Varlığı

Türkiye İstatistik Kurumu 2017 yılı verilerine göre hazırlanan Çizelge 12. incelendiğinde, Doğu Anadolu Bölgesi'nde 3.295.354 adet büyükbaş (%22,88) ve 11.109.911 adet küçükbaş (%77,12) olmak üzere toplam 14.405.265 adet hayvan varlığı olduğu görülmektedir. Yine aynı çizelgeden, bölge genelinde 2.542.613 BBHB'ye eşdeğer büyükbaş (%70,17) ve 1.080.733 BBHB'ye eşdeğer küçükbaş (%29,83) olmak üzere toplam 3.623.347 BBHB değeri hayvan varlığı olduğu görülmektedir.

İller bazında incelendiğinde ise, en yüksek hayvan varlığının 642.172 BBHB ile Erzurum İlinde, en düşük hayvan varlığının ise toplam 54.422 BBHB ile Tunceli ilinde olduğu görülmektedir. Büyükbaş hayvan sayıları bakımından sırasıyla Erzurum, Kars ve Ağrı illeri ve küçükbaş hayvan sayıları bakımından sırasıyla Van, Ağrı ve Muş illeri ön plana çıkmaktadır.



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Çizelge 12. Doğu Anadolu Bölgesi İllerinin 2017 yılı hayvan sayısı ve BBHB değeri (TÜİK, 2017).

İller	Büyük Baş		Küçük Baş		Toplam	
	Hayvan Sayısı	BBHB Değeri	Hayvan Sayısı	BBHB Değeri	Hayvan Sayısı	BBHB Değeri
Ağrı	352.864	236.789	1.494.584	147.793	1.847.448	384.582
Ardahan	289.815	217.619	60.914	6.057	350.729	223.677
Bayburt	78.931	62.133	45.317	4.394	124.248	66.527
Bingöl	137.512	110.174	504.732	47.350	642.244	157.523
Bitlis	80.504	64.031	594.752	55.131	675.256	119.162
Elazığ	159.135	133.350	603.377	58.455	762.512	191.805
Erzincan	114.204	98.497	464.999	45.574	579.203	144.071
Erzurum	731.282	572.744	714.229	69.429	1.445.511	642.172
Hakkari	44.208	30.625	706.351	67.486	750.559	98.110
Iğdır	146.451	121.737	974.861	96.599	1.121.312	218.336
Kars	467.362	367.584	481.869	47.480	949.231	415.065
Malatya	171.963	145.295	339.987	32.585	511.950	177.880
Muş	306.508	221.825	1.049.367	100.752	1.355.875	322.577
Tunceli	28.516	22.281	336.518	32.141	365.034	54.422
Van	186.099	137.930	2.738.054	269.508	2.924.153	407.438
Toplam	3.295.354	2.542.613	11.109.911	1.080.733	14.405.265	3.623.347
%	22,88	70,17	77,12	29,83	100,00	100,00

8. Türkiye Geneli Yem Üretimi ve Kaliteli Yem İhtiyacı

Hayvan beslemede çiftlik hayvanlarına her gün canlı ağırlığının %10'una eşdeğer miktarda yeşil ot veya %2,5'i kadar kuru ot verilmesi önerilmektedir. Dolayısıyla, 500 kg canlı ağırlığındaki bir hayvanın (1.00 BBHB) yaşama payı besin madde ihtiyacını karşılamak için yaklaşık 12,5 kg/gün kaliteli kuru ot tüketmesi gerekmektedir (Gökkuş ve ark., 1995).

Buna göre, Ülkemizde bulunan 18.100.268 BBHB'ne eşdeğer hayvan varlığının yaşama payı ihtiyaçlarının karşılanması için, yıllık 82.582.473 ton kaliteli kaba yem gereksinimi bulunmaktadır. Hayvanlarımızın kaliteli kaba yem gereksinimleri iki ana kaynaktan temin edilmektedir. Bu kaynaklardan biri; meralardan biçilen veya otlanan otlar, diğeri ise tarım alanlarında yetiştirilen yem bitkilerinden elde edilen kaba yemlerdir. Ancak, ülkemizde üretilen toplam kuru ot miktarının, yem bitkileri tarımından 12.816.412,00 ton ve çayır-mera



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alanlarından ise 11.897.456 ton olmak üzere 24.713.868 ton düzeyinde kaldığı görülmektedir. Bu durumda ortaya çıkan kaba yem açığı miktarının 57.868.605 ton olduğu anlaşılmaktadır (Çizelge 13.).

Günümüzde bu yem açığının; saman, sap ve kavuz gibi yem değeri düşük kaba yemlerle veya yoğun/karma yem kaynaklarından karşılanmaya çalışıldığı bilinmektedir. Yoğun yem kaynaklarının pahalı olması ve bu kaynakların maliyetlerinin et ve süt gibi hayvansal ürünlerin fiyatlarını arttırmasından dolayı, sorunun çözümünün yoğun yem kaynaklarından ziyade, kaba yem kaynaklarımızda aranması gerekmektedir. Tarımsal kaynaklarımız ele alındığında, üretim kaynakları içinde hayvan yemi olarak meralarımızın çok büyük önem taşıdığı, dolayısıyla hayvancılığımızın esas itibarıyla doğal meralara dayalı bir hayvancılık olması gerektiği ortaya çıkmaktadır (Karadağ ve ark., 2016).

Hayvanların yeteri kadar kaliteli kaba yemle beslenememesi sonucu; et, süt vb. hayvansal ürün miktarlarındaki düşüşün yanında, stres ve beslenmeye bağlı hastalıklar gibi problemler de ortaya çıkmaktadır. Bu nedenlerden dolayı hayvancılık işletmelerinde yem bitkileri üretiminin artırılması gerekmektedir (Mut ve ark., 2016).

Çizelge 13. Türkiye geneli 2017 yılı yem üretimi ve kaliteli yem ihtiyacı (TÜİK, 2017).

Bölgeler	Hayvan Varlığı (BBHB)	Kaba Yem İhtiyacı (Kuru Ot) (ton) *	Üretilen Kuru Ot Miktarı (ton)	Çayır ve Meralarda Üretilen Kuru Ot Miktarı (ton)	Toplam Üretilen Kuru Ot Miktarı (ton)	Kaba Yem İhtiyacı Karşılama Oranı (%)	Kaliteli Kaba Yem Açığı (ton)
Akdeniz	1.872.963	8.545.394	786.105	405.331	1.191.436	13,94	7.353.958
Doğu Anadolu	3.623.347	16.531.521	2.743.923	6.247.721	8.991.644	54,39	7.539.877
Ege	2.784.886	12.706.042	2.662.419	395.138	3.057.557	24,06	9.648.485
G. Doğu Anadolu	1.943.895	8.869.021	441.809	393.970	835.779	9,42	8.033.242
İç Anadolu	3.410.344	15.559.695	2.241.600	2.318.417	4.560.017	29,31	10.999.678
Karadeniz	2.081.720	9.497.848	1.254.354	1.811.879	3.066.233	32,28	6.431.615
Marmara	2.383.113	10.872.953	2.686.202	325.000	3.011.202	27,69	7.861.751
Toplam	18.100.268	82.582.473	12.816.412	11.897.456	24.713.868	29,93	57.868.605
Doğu Anadolu (%)	20,02	20,02	20,77	52,51	36,38		

* 500 kg canlı ağırlığındaki (1.00 BBHB) bir hayvanın günlük ihtiyacı 12,5 kg kuru ot olarak hesaplanmıştır.



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Ülkemizde kaliteli kaba yem üretiminin, hayvan varlığımızın ancak yaklaşık % 29,93'üne yeter miktarda olduğu açıkça görülmektedir. Bu açığın kapatılması için öncelikle mera alanlarındaki işgal, tecavüz ve kontrolsüz otlatma vb. baskıların azaltılması, sonrasında ise gerekli ıslah çalışmaları ile bu alanların verimliliklerinin artırılarak gerçek potansiyellerinin ortaya çıkarılması ve kontrollü otlatma ile ulaşılacak verim düzeylerinin korunması temel hedef olmalıdır. Bu nedenle, aynı anda idari mekanizmanın da işletilmesi gerektiği unutulmamalıdır. Ayrıca, yem bitkileri kültürünün gelişmiş ülkelere yakın düzeylere çıkarılması amacıyla; her biri birbirinden farklı ekolojik özelliklere sahip yörelerimiz için uygun yem bitkisi türleri belirlenerek ıslah çalışmaları ile bu bitkilerin verim ve kalite özelliklerinin artırılması sağlanmalıdır (Topçu ve Özkan, 2017).

Tarla tarımı içerisindeki yem bitkileri üretimi payının daha üst düzeylere çıkarılabilmesi için, mevcut uygulamalara ek olarak yeni düzenlemeler devreye alınmalıdır. Ekim nöbeti içerisinde özel bir yere sahip olan yem bitkilerinin önemi, yayım çalışmaları ile üreticilere aktararak ekim alanlarının yaygınlaşması sağlanmalıdır. Destekleme programlarında yem bitkisi üretimi ve buna bağlı hayvansal üretim destekleri artırılmalıdır (Acar ve ark., 2015). Yem bitkileri tarımı daha kazançlı hale getirilmeli ve hayvancılıkla uğraşan işletmelerin de kaliteli kaba yem üretmesi özendirilmelidir. Ayrıca, üretimi yapılan ürünlerin ekonomik değerinin artırılması amacıyla ot borsalarının kurulması ve yeni desteklemelerin borsalara da katkı sağlayacak şekilde yeniden düzenlenmesinin daha yararlı olabileceği düşünülmektedir (Topçu ve Özkan, 2017).

9. Türkiye'deki Yem İşletmeleri

Ülkemizdeki yem işletmeleri ile ilgili bilgiler Çizelge 14.'de verilmiştir.



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Çizelge 14. Türkiye Yem İşletmeleri (GKGM; 2017).

	Yem İşletme Tipi	İşletme Sayısı (adet)
Onay	Karma Yem Üreten İşletmeler	433
	Premiks Üreten İşletmeler	125
	Yem Katkı Üreten İşletmeler	24
	Kedi ve Köpek Maması Üreten İşletmeler	34
	Hayvansal Yan Ürün Üreten İşletmeler	78
	Yem Katkı ve Premiks Satış Yerleri	1.165
	Toplam	1.859
Kayıt	Karma Yem Üreten İşletmeler	907
	Blok Mineral Yem (Yalama Taşı) Üreten İşletmeler	23
	Perakende Depolama ve Satış Arz Yerleri	12003
	Toplam	12.933
	Genel Toplam	14.792

10. Türkiye Karma Yem Üretimi

Ülkemizde son on yılda üretilen karma yem miktarları Çizelge 15.'de verilmiştir.

Çizelge 21. Türkiye Karma Yem Üretim Miktarı (ton/yıl) (GKGM; 2017).

Yıllar	Sığır Besi Yemi	Sığır Süt Yemi	Etlik Piliç Yemi	Yumurta Yemi	Diğer Karma Yemler*	Genel Toplam
2007	2.083.731	2.759.042	1.071.894	147.991	3.089.774	9.152.432
2008	1.883.970	2.948.616	2.886.173	695.373	1.149.169	9.563.301
2009	1.760.430	2.679.020	2.923.299	673.389	1.383.058	9.419.196
2010	2.169.487	3.466.422	3.453.846	820.753	1.257.022	11.167.530
2011	2.686.728	3.875.836	4.141.768	953.819	1.504.190	13.162.340
2012	2.881.354	4.365.168	4.224.111	1.058.733	1.959.173	14.488.539
2013	2.846.217	5.163.788	4.083.687	1.602.364	2.265.811	15.961.867
2014	3.386.565	5.621.664	3.979.945	2.480.547	2.534.895	18.003.616
2015	3.320.221	5.384.586	4.779.916	3.417.209	3.203.051	20.104.983
2016	3.827.073	5.840.262	4.566.237	2.958.232	3.210.048	20.401.852
2017	4.594.552	6.171.275	4.753.989	3.369.665	3.528.862	22.418.333

* Diğer Yemler: Küçükbaş yemleri, balık yemleri, at yemi, ev ve süs hayvanları yemleri, arı keki vb.



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11. Sorunlar ve Çözüm Önerileri

Sorun 1: Hayvancılık İşletmelerinin Kapasitelerinin Ekonomik Büyüklükte Olmaması;

Ülkemizdeki hayvan yetiştiricilerinin çoğunluğu sahip oldukları sermaye ile işletme kapasitesini arttıracak ekonomik güce sahip olmayan küçük aile işletmeleridir. Hali hazırda yaşlılık, engelli maaşı, evde bakım ücreti, genel sağlık sigortası primi, Sosyal Dayanışma ve Yardımlaşma Vakfının yardımları ve Devlet tarafından verilen diğer sosyal desteklerde hayvan başına gelir hesaplamaları esas alınmaktadır. Yetiştiriciler sosyal haklardan ve yardımlardan mahrum kalmamak için hayvanlarını sigortalı veya Devlet Memuru kardeşleri ve/veya üçüncü kişilerin üzerine kaydetmek gibi yöntemlere başvurmaktadır. Bu durum işletmelerin yapısını bozarak, işletmelerin bölünmesine sebep olmakta ve gerçek işletme büyüklüklerinin tespitini zorlaştırmaktadır. Aynı zamanda birçok hayvancılık işletmesinin büyümesinin önünde de çok ciddi bir engel teşkil etmektedir. Hibe ve desteklerin belli bir işletme kapasitesi şartına bağlanması, işletmeler arası hayvan hareketlerine neden olmaktadır.

Sorun 2: Yetiştiricilerin Temel Eğitim Seviyesinin Düşük Olması ve Hayvancılık

Konusunda Eğitim Yetersizliği;

Büyükbaş ve küçükbaş hayvan yetiştiricilerinin önemli bir bölümü ilkökul ve altı eğitim seviyesine sahiptir. Bu durum yetiştiricilerin kaynak kitaplar, sosyal, görsel ve yazılı medya araçlarını kullanımını kısıtlamaktadır. Büyük ve küçükbaş hayvan yetiştiricilerinin büyük bir kısmı genellikle kendi faaliyet alanları ile ilgili herhangi bir eğitime katılmamışlardır. Eğitim ve bilgi seviyelerinin düşüklüğü önemli gelir kayıplarına neden olmakta ve yetiştirici kazançlarını düşürmektedir. Hayvan yetiştiricilerine yönelik teorik ve uygulamalı eğitim ve yayım çalışmalarına mutlak ağırlık verilmelidir. Ancak Çiftçinin eğitim seviyesinin yetersiz ve yaş ortalamasının fazla olması, eğitim yayım çalışmalarına katılım ve bu faaliyetler neticesinde verilen sertifika, katılım belgesi vb. belgelerin destekleme ve projelerde ilave destek veya ekstra puan alma gibi katkılarının bulunmaması, bazı projelerde var olmasına karşın yetersiz kalması, bu nedenle çiftçilerin eğitim-yayım çalışmalarına ilginin düşük olması, çiftçi eğitim yayım çalışmalarının önündeki en büyük engeli oluşturmaktadır. Bu nedenle çiftçi eğitim-yayım çalışmaları neticesinde verilen katılım belgesi, kurs bitirme belgesi, sertifika vb. belgelerin ilave destekleme ödemesi veya hibe programları kapsamındaki projelerde önemli bir ilave puan getirisinin olması gerekmektedir. Ayrıca hayvancılıkla ilgili destek, hastalık, hayvan hareketleri, hayvan refahı konularında kamu spotları hazırlanarak ulusal görsel ve yazılı medya organlarında yayınlanmalıdır.



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Sorun 3: Kaba ve Kesif Yem Fiyatlarının Yüksek Olması;

Hayvancılık işletmelerindeki maliyetlerin yaklaşık %70'ini yem giderleri oluşturmaktadır. Özellikle kaba yemlerini üretmeyen hayvancılık işletmelerinin sektörden para kazanmaları ve sürdürülebilir olmaları neredeyse imkânsızdır. Kaba yemini kendisi üretmeyen hayvancılık işletmeleri ağırlıklı olarak buğday ve arpa samanı gibi besin değeri düşük kaba yemler kullanmaktadır. Ayrıca kaba yemi kendisi üreten işletmelerde silajlık mısır gibi besin maddesi değeri yüksek, maliyeti düşük kaba yemlerin üretimi oldukça olması da önemli bir sorundur. Hayvanlarının kaba ihtiyacını İl dışından karşılayan üreticilerin işletme girdilerine nakliye ücretleri de eklenerek ayrıca bir külfet oluşturmaktadır. Özellikle kış aylarında üreticilerin büyük bir çoğunluğu kaba yemi ücreti mukabilinde bile temin edememektedir. Hayvancılık işletmelerinde yem bitkileri üretim desteği, hayvancılık yapan işletmelerin lehine hayvan sayılarını göz önünde bulundurarak ve hayvan sayılarını arttırmayı teşvik edecek şekilde yeniden düzenlenebilir. Büyük ve küçükbaş hayvan yetiştiricileri birlikleri, ziraat odaları ve yerel kamu kurumları ortaklığında kaba yem üretim ve satış destek ofisleri kurulmalıdır. Bu ofisler aracılığıyla sözleşmeli yem bitkileri üretim modeli geliştirilerek, yem bitkileri üreticileri ve hayvan yetiştiricileri arasında bu yöntemle alım satım ağı kurulmalıdır. Hazinesinin mülkiyetindeki tarım arazileri belirlenerek belli bir kapasitenin üzerindeki hayvan varlığına sahip yetiştiricilere uzun süreli kiralama veya düşük fiyatla satışı yapılmalıdır.

Sorun 4: Tarım Arazilerinde Büyük Oranda Mülkiyet Sorunları Olması;

Tarım arazilerinde büyük oranda mülkiyet sorunları yaşanmaktadır. Arazilerin büyük bir kısmı müşterek mülkiyet yapısındadır. Bu durum her geçen gün müştereklerin artmasına bağlı olarak daha da kötü hale gelmektedir. Müşterek yapıdaki tarım arazileri kullanan çiftçi ve yetiştiriciler çoğu zaman müşterekleri ile anlaşamadıkları veya kendilerinden muvafakatname, vekâletname gibi kanuni izinleri alamadıkları için tarımsal desteklemeler ve hibe projelerden yararlanamamaktadır. Bunun yanında bazı kırsal alanlarda kadastro çalışmalarının halen tamamlanamamış olması, mevcut kadastrosu yapılan alanlarda kayma yaşanması, ölçüm hataları bulunması, kadastro nedeniyle kamu ile gerçek ve tüzel kişilerin veya kişiler arasında davalar bulunması ve bu davaların uzun sürmesi gibi nedenler de tarımsal desteklemeler ve hibe projelerden faydalanma oranını düşürmektedir. Bu durumlar hayvancılığı da doğrudan olumsuz yönde etkilemektedir.

Hayvancılık sektörünün ayakta kalabilmesi ve gelişebilmesi için özellikle yem bitkisi ekilebilir alanlar başta olmak üzere tüm tarım arazileri korunması ve tarımsal desteklerden faydalanması



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sağlanmalıdır. Bunun için kadastro sorunlarının çözümünün hızlandırılması, kadastro yapılmayan alanlarının kadastro işlemlerinin tamamlanması, müşterek mülkiyetli tarım arazilerinde kullanan kişilerin belirlenmesi yoluyla tarımsal desteklemelerden faydalanmalarının sağlanması, müşterek yapıda tarım arazilerinde birlikte üretim yapan yetiştiricilere ilave destekler verilmesi tarımsal üretimin ve hayvancılığın gelişmesine büyük bir katkı sunacaktır. Bunun yanında büyükbaş hayvancılık işletmelerinde en az 25 baş anaç hayvan, küçükbaş hayvancılık işletmelerinde en az 350 baş anaç hayvan kapasitesine sahip işletmeler veya bu kapasiteye tamamlayanların Sosyal Güvenlik Kurumu Tarım (Çiftçi) BAĞKUR'u kapsamına alınarak, primleri kamu bütçesinden ödenmesi, İŞKUR, Sosyal yardımlaşma destekleri gibi sosyal destek ve istihdam programlarında hayvancılık yapanların faaliyetlerine devam etmesi ve işletmesini büyütmesi şartıyla bu yardım ve desteklerden faydalandırılması gibi uygulamalar ile kırsaldan kente olan göçün azalmasına ve tarımsal üretimin devamlılığına katkı sağlanabilir.

Sorun 5: Genç Yetiştiricilerin Yeni Kuracakları Hayvancılık İşletmelerinin Tesisi İçin Mülkiyetlerinin Bulunmaması;

Son yıllarda genç nüfus kırsal bölgeleri hızla terk etmektedir. Küçükbaş hayvancılık işletmelerinin sadece %23,9'u 18-35 yaş aralığında olup, bu oran büyükbaş hayvancılık işletmelerinde sadece %12'dir. Tarım arazilerinin yıllardır bölünerek intikal ettirilmesinden dolayı gençlerin birçoğu ekonomik büyüklükteki arazi varlığına sahip olamamaktadır. Bu durum gençlerin yeni hayvancılık işletmeleri kurmalarının ve yem bitkileri yetiştiriciliği yapmalarının önündeki en büyük engellerden biridir. Türkiye İş Kurumu tarafından yürütülen “Toplum Yararına Çalışma Programı” son yıllarda önemli bir istihdam alanı olarak ön plana çıkmıştır. Bu iş programı için yeni bir model geliştirilerek hayvancılık sektörüne katkı sağlanmalıdır. Bu amaçla geliştirilecek yeni modelle “Toplum Yararına Çalışma Programı” kapsamında istihdamın %50'si hayvancılık sektörüne kaydırılmalıdır. Büyükbaş hayvancılıkta 25 baş anaç, küçükbaş hayvancılıkta 350 baş anaç ve üzeri kapasiteye sahip işletmelere bu program kapsamında çoban bakıcı ve/veya sağım elemanı istihdam edilmeli ve en az 5 yıl süre ile bu program kapsamında çalışmaları sağlanmalıdır. Bu sayede hem işletmelerin kapasitelerinin artırılması teşvik edilmiş olacak, hem de gençlerin kırsalda kalmaları sağlanmış olacaktır. Böylece gençlerin hayvancılık sektöründe deneyim kazanmalarına imkân tanınmış olacak ve aynı zamanda çoban, bakıcı, sağım elemanı gibi işgücü sorunu da çözülmüş olacaktır.



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Sorun 6: Hayvansal Ürünlerde Pazarlama;

Büyükbaş ve küçükbaş hayvancılık işletmelerinde özellikle süt ve süt ürünleri satışında önemli sorunlar yaşanmaktadır. Yetiştiricilerin büyük bir çoğunluğu mevcut süt fiyatlarının çok düşük olduğunu düşünmektedir. Özellikle küçükbaş hayvancılık işletmelerinde süt satış dönemlerinde komisyoncu ve aracılardan süt ve süt ürünleri fiyatlarını manipüle ettikleri ve böylece yetiştiricilerin önemli düzeyde gelir kayıpları yaşattıkları bilinmektedir. Bu durum hayvancılık işletmelerini ekonomik olarak önemli zararlara uğratmaktadır. Yetiştirici birlikleri, üyeleriyle gıda sanayi arasında doğrudan bir köprü oluşturarak süt ve süt ürünleri pazarındaki komisyoncu ve araçları devre dışı bırakacak tedbirler almalıdır. Küçük ve orta ölçekli büyükbaş hayvancılık işletmelerindeki sütün satış olanağının geliştirilmesi amacıyla üretici kooperatifleri daha aktif bir şekilde devreye sokulmalıdır. Hem büyükbaş hem de küçükbaş hayvancılık işletmelerine cevap verecek düzeyde, hayvanları yemleme ve sulama olanağına sahip, hayvan refahı ve hijyen koşullarına uygun canlı hayvan pazarları yapılmalıdır.

12. Sonuç ve Öneriler

Ülkemizde yem bitkileri tarımı ve çayır-mera alanlarımızın, mevcut hayvan varlığımızın yeterli, dengeli ve verime yönelik beslenme ihtiyacını karşılayabilecek düzeyde olmadığı anlaşılmaktadır. Türkiye geneli kaliteli kaba yem üretiminin, hayvan varlığımızın ihtiyacını karşılayamadığı görülmektedir.

Ülkemiz hayvancılığının en önemli sorunu haline gelen kaliteli yem temininin sağlanması amacıyla, temel yem kaynağı durumundaki çayır ve mera alanları ile tarla tarımı içerisindeki yem bitkileri kültürünün geliştirilmesi için bazı önlemlerin en kısa sürede alınarak, dikkatle uygulanması önem arz etmektedir. Doğu Anadolu Bölgesi'nde de benzer bir durum söz konusudur. Mevcut yem bitkisi açığının buğday samanına, anız ve nadas otlatmaları gibi ilkel besleme koşullarına dayalı uygulamalar ile hayvancılığımızın gelişme şansının bulunmadığı unutulmamalıdır.

Doğu Anadolu Bölgesinin iklim koşulları, çayır-meraların durumu değerlendirildiğinde yem bitkileri ve mera varlığımız ile ilgili yapılması gereken çalışmalara öncelik verilmesi gerektiği düşünülmektedir. Bölge genelinde gerek kamu gerekse yetiştirici örgütleri, Ziraat Odaları, kooperatifler ile diğer çiftçi örgütleri tarafından düzenlenecek olan eğitim çalışmaları ile yem bitkileri ekimi teşvik edilmeli ve üreticilere yem bitkilerinin önemi ve yetiştirme teknikleri hakkında güncel bilgiler aktarılması sağlanmalıdır.



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Türkiye’de son 15 yılda, hayvancılık konusunda çok büyük reformlar gerçekleşmiştir. Ancak bu reformlar, büyükbaş hayvan yetiştiriciliği başta olmak üzere sektördeki birçok sorunu çözmeye yeterli olamamıştır. Irkların yeterince ıslah edilememesi, yeterli miktarda ucuz ve kaliteli yem bitkisi üretilmemesi sonucu, 2007-2010 döneminde sığır sayısı hariç hayvan popülasyonunda önemli azalmalar yaşanmıştır. Hayvan varlığında görülen önemli azalma kırsal yoksulluğu artırmanın yanı sıra, canlı hayvan arzının düşmesine ve et ürünleri fiyatlarının yükselmesine yol açmıştır (DPT, 2007). Bu nedenle, ıslah programları geliştirilmeli, belirtilen kapsamda soy kütüğü ve başta süt ve döl verimi olmak üzere verim kontrolü çalışmaları yaygınlaştırılmalıdır (Çapraz, 2004; Kaymakçı ve ark., 2010).

En önemli sorunların başında üreticinin yem ihtiyacını karşılayamaması gelmektedir. Bunun sonucunda, üreticinin maliyeti artmakta ve besi hayvanlarının verimleri düşmektedir. Bu sorunun çözümü çayır-mera alanlarının nicelik-nitelik yönünden iyileştirilmesi ve yönetimi, yem bitkileri üretimine gereken önemin verilmesi ve sağlanan desteğin sürdürülmesi ile mümkün olabilecektir (Anonim, 2011).

Hayvancılık işletmelerinin koşullarını iyileştirmeleri için uygun kredi finansman imkânları, özellikle mevcut küçük ve orta ölçekli besi işletmeleri için, düşük faizli yatırım işletme kredileri kullanımında kolaylık sağlanmalıdır (DPT, 2007 ve Anonim, 2011). Yanı sıra hayvancılık sektöründe örgütlenme teşvik edilmeli ve daha önemlisi mevcut örgütlerin etkinliği de arttırılmalıdır (Tosun ve Demirbaş, 2012).

Süt ve kırmızı et alt sektörleri birbirinin rakibi veya alternatifi değil bütünleyicisidir. Bu nedenle, süt sektöründe rasyonel bir üretim ve pazarlama organizasyonunun kurulması, dönemsel fiyat dalgalanmalarının önüne geçilmesi, et ve süt kurumlarının işbirliğinde piyasa koşullarının düzenlenmesinin etkin şekilde sağlanması ve sürdürülmesi de önemlidir (Anonim, 2011; Anonim, 2014).

Hayvancılık sektörü üstlendiği ekonomik ve sosyal fonksiyonları ile kırsal kalkınmanın sağlanmasında önemli bir yere sahiptir. Büyük ve küçükbaş hayvan yetiştiricilerinin mevcut durumunun iyileştirilmesi ve yeniliklere adapte edilerek geliştirilmesi için Türkiye’de hayvancılık sektöründe daha uzun vadeli planların yapılması gerekmektedir. Sektör ile ilgili politikaların yetiştiricilerin maliyetlerini gözetmesi, bu amaçla kısa vadeli çözümler yerine yapısal önlemlerin alınması Türkiye’de hayvancılık sektörünün devamlılığı açısından zorunlu görülmektedir. Türkiye mevcut potansiyeli ve sektör deneyimi ile ithalat yapan değil ihracat olanaklarını tartışan bir ülke konumuna gelmelidir.



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Kırmızı et sektörünün ikinci önemli parçasını oluşturan kırmızı et işleme sanayiinin kendi ekonomik ve teknik içsel sorunlarının çözümü ile birlikte hayvancılık sektörü ile entegrasyonu sağlanmalıdır. Bu çalışmada yeteri kadar tartışılmayan hayvan refahı ve gıda güvenliği gibi sektörünün ikinci dereceden ancak son derece önemli olan diğer sorunları için de çözümler üretilmelidir.



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KAYNAKLAR

Açıkgöz, E., Hatipoğlu, R., Altınok, S., Sancak, C., Tan, A., Uraz, D., 2005. Yem bitkileri üretimi ve sorunları. Türkiye Ziraat Mühendisliği VI. Teknik Kongresi, 3–7 Ocak 2005, Ankara.

Anonim, 2011. AB uyum sürecinde Türkiye hayvancılık kongresi 2011 kırmızı et komisyonu çalışma sonuç raporu.

Anonim, 2014. www.apelasyon.com/Yazi/167-hayvancilik-ve-kirmizi-et-sektorune-bakis (18.09.2017).

Anonim, 2017. Bitkisel ve Hayvansal Üretim İstatistikleri. T.C. Başbakanlık Türkiye İstatistik Kurumu.

Avcıoğlu, R., Soya, H., Çelen, A.E., 1998. Meralarımızın hukuksal durumu ve mera yasası üzerine görüşler. Ege Bölgesi 1. Tarım Kongresi, Aydın, Cilt:2, 242–249.

Cevheri, A.C., Polat, T., 2009. Şanlıurfa’da yem bitkileri tarımının dünü, bugünü ve yarını. HR.Ü.Z.F. Dergisi. 13(1): 63–67.

Çapraz, İ., 2004. Kırmızı et sektör profili. İstanbul Ticaret Odası Etüt ve Araştırma Şubesi, İstanbul.

DPT, 2007. Dokuzuncu kalkınma planı hayvancılık özel ihtisas komisyonu raporu. T.C. Kalkınma Bakanlığı, Ankara.

Gökkuş A, Koç, A., Çomaklı, B., 1995. Çayır–Mer’a Uygulama Kılavuzu. Atatürk Üniversitesi Ziraat Fak. Yayınları No: 142, 49–50.

Karadağ, Y., Çınar, S., Taşyürek, T., Gökalp, S., Özkurt, M., 2016. Tokat–Kazova ekolojik koşullarında bazı çok yıllık yem bitkilerinin verim ve kalitelerinin belirlenmesi. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi. 25 (Özel Sayı–2): 206–21.

Karakuş, K., 2011. Türkiye’nin canlı hayvan ve kırmızı et ithaline genel bir bakış. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi 1(1):75-79.

Kaymakçı, M., Taşkın, T., Mutaş, S., Kumlu, S., Yalçın, S., Koşum, N., Koyuncu, M., Ün, C., Önenç, A. ve Karaca, O. 2010. Türkiye damızlık üretim stratejisi. Türkiye Ziraat Mühendisliği VII. Teknik Kongresi Bildirileri, 11-15 Ocak s:1055-1070, Ankara.

Kuşvuran, A., Nazlı, R.İ., Tansı, V., 2011. Türkiye’de ve Batı Karadeniz Bölgesi’nde çayır–mera alanları, hayvan varlığı ve yem bitkileri tarımının bugünkü durumu. GOÜ Ziraat Fakültesi Dergisi. 28(2): 21–32.



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Mut, H., Geze, M., Gülümser, E., Başaran, U., Çopur Doğrusöz, M., Ayan, İ., 2016. Yozgat'ta yem bitkileri tarımının genel durumu. I. Uluslararası Bozok Sempozyumu, 5–7 Mayıs 2016, Yozgat, Bildiri Kitabı Cilt:4, 133–139.

Sağlamtimur, T., Tansı, V., Baytekin, H., 1998. Yem Bitkileri Yetiştirme. Çukurova Üniversitesi Ziraat Fakültesi Ders Kitabı No: C–74. 3. Baskı, 238s., Adana.

Saygın Ö., Demirbaş N. 2017 Türkiye’de Kırmızı Et Sektörünün Mevcut Durumu ve Çözüm Önerileri. Hayvansal Üretim 58(1): 74-80, 2017. (21.09. 2017).

Soya, H., Avcıoğlu, R., Geren, H., 2004. Yembitkileri (II. Baskı), Ders Kitabı, Hasat Yayıncılık Ltd. Şti., İstanbul, 223s.

Topçu, G.D., Özkan Ş.S., 2017 Türkiye ve Ege Bölgesi Çayır-Mera Alanları ile Yem Bitkileri Tarımına Genel Bir Bakış. ÇOMÜ Zir. Fak. Derg. (COMU J. Agric. Fac.) 2017: 5 (1): 21–28

Tosun, D., Demirbaş, N., 2012. Türkiye’de kırmızı et ve et ürünleri sanayiinde gıda güvenliği sorunları ve öneriler. Uludağ Üniversitesi Ziraat Fakültesi Dergisi 26(1):93-101.

TÜKETBİR, 2013. Kırmızı et sektör analizi. Tailex-İpard Toplantısı.

Yıldırım A.E., 2015. Kırmızı ette sorunlar ve çözüm önerileri. <https://www.dunya.com/gundem/kirmizi-ette-sorunlar-ve-cozum-onerileri-haberi-272791> (19.09.2017).



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**STOMATAL CHARACTERISTICS OF SOME SAFFLOWER
(*CARTHAMUS TINCTORIUS* L.) CULTIVARS**

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ABSTRACT

This research focused on determining the variation in stomatal characteristics among five safflower (*Carthamus tinctorius* L.) cultivars Balcı, Dinçer, Yekta, Linas, and Olas. Stomata number, stomata width, length, size, and index were investigated, and their relationships were calculated. The results showed that there were significant differences for stomata number, length, and size among the investigated safflower cultivars. The stomata number of the safflower cultivars varied between 292 and 580 number/mm², and stoma size was 563 and 703 µm². The stomata indexes of the safflower cultivars were insignificantly changed between 1.38 and 1.47 and stomata width was 19.8-21.9 µm. The lowest stomata density was counted in Yekta and Olas, while the highest stomata number was observed in Dinçer which was the only spineless cultivar in the study. No significant correlations between stomata number and other traits were determined. It was concluded that stomata number should be used for separating safflower cultivars, and stomatal properties may considerably contribute to clarifying the agronomic performances of safflower cultivars under different environment conditions.

Keywords: *Carthamus tinctorius* L., genotype, stomata density, stomata size



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INTRODUCTION

Safflower (*Carthamus tinctorius* L.) is an annual oil-seed crop mainly produced for high quality edible oil, biodiesel and birdseed. It is well-adapted to arid and semiarid regions of Turkey and the world because of its tolerance to drought, salinity and heat stress (Kaya, 2014). It has highly been advised for the regions suffering from rainfall scarcity such as Central Anatolian, where a traditional crop rotation of wheat-fallow is necessarily applied to increase oil production and farmers' income (Singh et al., 2016).

Stomata are pores constituted by a pair of specialized guard cells, which are found in the surface of aerial parts of the plants. It regulates gas exchange between plant and environment, which allows the entry of CO₂ into the leaf for photosynthesis and an exit for water vapor from the transpiration stream when they open and close, respectively (Wilmer and Fricker, 1996; Hetherington and Woodward, 2003). The plants may regulate their gas exchange rates by varying stomata density in new leaves when they are produced. If the stomata number per unit area (stomata density) is increased, a higher amount of CO₂ can be taken up, and more water can be released (Grant and Vatnick, 2005; Lawson and Blatt, 2014). Stomatal areas on the leaves, which generally covers only 1% of the leaf area, carry out 90% of the total transpiration. In this respect, stomata in leaves have played an important role in adaptation to environmental conditions. Several researches were conducted to determine the stomatal variations of the plants. The density and size of stomata were varied by species and variety in pea (Bozoğlu and Karayel, 2006), in rice (Ohsumi et al., 2007), in wheat (Hassan et al., 2008), in soybean (Cabrera and Diaz, 2002), and in maize (Çarpıcı and Çelik, 2011). Yagci-Tuzun et al. (2019) reported different stomata numbers in five *Carthamus* species in Turkey and Roudbari et al. (2012) indicated that fifteen safflower genotypes possessed different stomata density. Besides, there are several studies on the existence of the relationship between the resistance of plants to various environmental conditions and the stomatal characters. For example, salt-tolerant safflower cultivars are noted to have fewer stomata than susceptible cultivars (Saradadevi and Rajesware Rao, 1978). Also, drought stress negatively affected the frequency of stomata in melon (Kusvuran et al., 2009), in wheat (Maghsoudi and Maghsoudi, 2008; Mehri et al., 2009), in peanut (Çınar et al., 2016), and in safflower (Roudbari et al., 2012). In the present study, we aimed to determine if there were differences among some safflower cultivars registered in Turkey for the stomatal characteristics.



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MATERIALS AND METHODS

This study was carried out at the Department of Field Crops, Faculty of Agriculture, Eskişehir Osmangazi University, Turkey in 2021. The three safflower cultivars Dinçer (in 1983), Balcı (in 2011), and Yekta (in 2019) registered by the Transitional Zone Agricultural Research Institute-Eskişehir, and two cultivars Linas (in 2013) and Olas (in 2015) registered by Trakya Agricultural Research Institute-Edirne were used as material.

The pre-germinated seeds of safflower cultivars were sown to the vials filled with peat:perlite:vermiculite (4:1:1) mixture. Thirty plants from each cultivar were grown in a growth chamber with temperatures of 25°C/15°C day/night, respectively, and relative humidity in the range of 60 to 70%. When the plants were in four leaves stage after 35 days of sowing, stomatal measurements were performed on randomly selected five healthy leaves. The first true leaf from the bottom of each plant was taken out and the bottom epidermal surface (abaxial) of the leaf was peeled and painted by a Feulgen stain. Three-five places of each sample were randomly specified and the number of stomata was counted by 40× objective lens and 10× eyepieces under light microscope system Zeiss Axio Scope A.1. It was calculated in a 0,083 mm² area. In addition, the stomata width and length were measured by an ocular micrometer calibrated using a stage micrometer.

The leaf stomatal density was expressed as the number of stomata per unit leaf area (number of stomata/mm²). Stomata size was calculated by multiplying stomata length and width, and stomata index was stomata length divided by stomata width (Çimen et al., 2016).

The data were analyzed by completely randomized blocks with three replicates by using the MSTAT-C statistical program. The means were compared by LSD test at p<0.05 level.

RESULTS AND DISCUSSION

Analysis of variance of the investigated stomata traits of safflower cultivars were shown in Table 1. The significant differences among safflower cultivars in terms of stomata number, stoma length and stoma size. The differences between cultivars for stomata index and stomata width were insignificant. Mean values and significance levels of the investigated safflower cultivars were illustrated in Table 2.



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Table 1. Analysis of variance of the investigated stomatal traits in safflower cultivars

Source	D.F.	Sum of Squares				
		Number of stomata	Stomata width	Stomata length	Stomata size	Stomata index
Total	19	245800	33.2	58.7	82749	0.127
Cultivar	4	240195**	10.8	40.4**	50704**	0.015
Error	12	5605	22.4	18.3	32045	0.111

**: Significant at $p \leq 0.05$

Table 2. The stomatal properties of the investigated safflower cultivars

Cultivars	Number of stomata (number/mm ²)	Stomata width (μm)	Stomata length (μm)	Stomata size (μm ²)	Stomata index
Balcı	489 ^b	19.8	28.4 ^b	563 ^{b*}	1.44
Dinçer	580 ^a	20.2	28.8 ^b	582 ^b	1.43
Linaz	307 ^d	20.7	28.3 ^b	586 ^b	1.38
Olas	388 ^c	21.9	32.1 ^a	703 ^a	1.47
Yekta	292 ^d	21.0	30.1 ^b	633 ^{ab}	1.44

*: Means followed by the same letter (s) are not significantly different at $p \leq 0.05$.

The significant differences in stomata number, length, and size among the safflower cultivars. Also, the pictures of the stomata of safflower cultivars were shown in Figure 1. The stomata densities of the investigated safflower cultivars changed between 292 and 580 number/mm² (Table 2). The highest stomata density was counted in Dinçer, and it was followed by Balcı (489 number/mm²), Olas (388 number/mm²) and Linaz (307 number/mm²). However, the minimum stomata number was observed in Yekta, which is a newly registered variety. It was observed that low stomatal density was obtained in which is the oldest and spineless cultivar Dinçer. Similar results were determined by Roudbari et al. (2012), who found a significant variation among the stomata density of safflower genotypes. Saradadevi and Rajesware Rao (1978) reported that the stomata density of safflower was 198-212 number/mm² and increased salinity reduced stomata frequency. Yagci-Tuzun et al. (2019) reported that the number of stomata of different *Carthamus* species ranged from 130 to 336 number/mm². Also, Ahmed et al. (1987) demonstrated that stomatal frequency of safflower was improved by drought severity



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and increased phenyl mercuric acetate. Similarly, Songsri et al. (2013) reported significant differences in stomata density among peanut varieties.

While no significant changes were determined in stomatal width, it was measured between 19.8 and 21.9 μm . The highest stomata length was obtained from Olas with 32.1 μm , while the lowest value (28.4 μm) was detected in Balcı. The stomata length of Olas was superior to the other cultivars and no significant differences among Balcı, Dinçer, Linas, and Yekta. These results are in agreement with the findings of Roudbari et al. (2012) who found a limited significant variation in stomata length of 15 genotypes in safflower while drought stress shortened the length of stomata. Besides, Balkan et al. (2018) in wheat, Uprety et al. (2002) in rice reported that the genotypes had different characteristics in terms of the stomata width and length.



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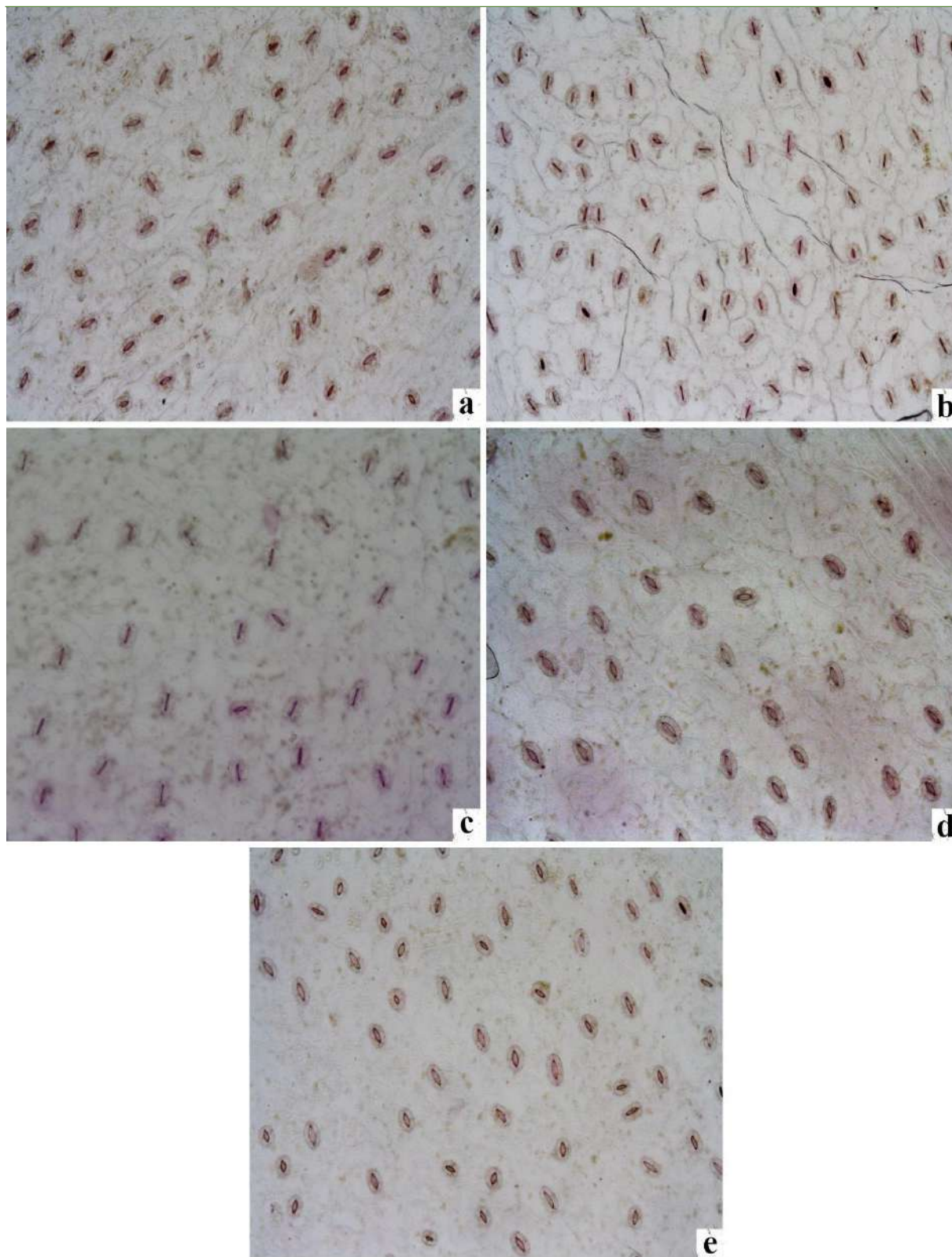


Figure 1. Images of stomata of the investigated safflower cultivars Balcı (a), Dinçer (b), Linas (c), Olas (d), and Yekta (e)



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The stomata size was changed by safflower cultivars. Olas had the highest stomata size with the value of $703 \mu\text{m}^2$ and it was followed by Yekta ($633 \mu\text{m}^2$), Linas ($586 \mu\text{m}^2$) and Dinçer ($582 \mu\text{m}^2$). The lowest stomata size was obtained from Balcı with $563 \mu\text{m}^2$. Stomata size depends on length and width and it affects the stomatal area on leaf surface. Moghbel et al. (2015) indicated that stomata size in safflower was changed between 128 and 181 nm the seedlings subjected to colchicine concentration. Also, Tanzarella et al. (1984) emphasized that stomata size differs between ten *Vicia faba* varieties. Stomata index, an indicator of stomata shape, was not significantly changed by safflower cultivars and it was determined between 1.38 and 1.47 (Table 2).

Table 3. Correlation coefficients among the stomatal traits of safflower cultivars

	Number of stomata	Stomata width	Stomata length	Stomata size
Stomata width	-0.296 ^{ns}	-		
Stomata length	-0.229 ^{ns}	0.554*	-	
Stomata size	-0.301 ^{ns}	0.887**	0.875**	-
Stomata index	0.079 ^{ns}	-0.553*	0.384 ^{ns}	-0.108 ^{ns}

*, **: Significant at $p \leq 0.05$ and $p \leq 0.01$, respectively; ns: not significant

The relationship between stomatal traits of safflower cultivars was calculated and the correlation coefficients with significance levels were given in Table 3. The number of stomata was not significantly correlated with the other characteristics. The width, length and size of the stomata gave a negative correlation with stomata number. The highest significant and positive correlation ($r=0.887^{**}$) was calculated between stomata width and stomata size. The relationship between stomata length and size gave the second highest correlation coefficient. The only negative and significant correlation ($r=-0.553^{*}$) was detected between stomata index and width.

CONCLUSION

The stomatal characteristics can be changed by species, cultivars, types and environmental conditions. Determination of stomatal traits should be useful for agronomic performance of the genotypes. In addition, they may play a crucial role in genotypic characterization and adaptation to environmental conditions. Our results revealed that there was a significant variation in stomatal characteristics especially stomata number among the safflower cultivars. These differences can be characterized for the genotypic identification of safflower. The old and



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spineless cultivar Dinçer gave higher stomata number than the others. It is argued that newly registered cultivars Linas, Olas and Yekta having lower numbers of stomata may probably have higher seed yield or oil content. However, this observation and relationship have to be confirmed using a large number of cultivars under field conditions in order to reach a final decision. It was concluded that the stomatal properties were changed by safflower cultivars with a clear difference and these variations would be helpful for explaining the variation in plant growth and yield performance of cultivars under environmental stresses.

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REFERENCES

- Ahmed, A.M., Abdel-Rahman, A.M., Hassaneina, M. 1987. Effect of soil moisture and the phenyl mercuric acetate on the physiology of lupine and safflower. *Biologia Plantarum* (Praha), 29(5): 374-383.
- Balkan, A., Demirbaş, S., Gök, Ş. 2018. H₂O₂'nin bazı ekmeklik buğday (*Triticum aestivum* L.) genotiplerinde bazı fide dönemi özelliklerine etkisi. *Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi*, 21(6): 837-845.
- Bozoglu, H., Karayel, R. 2006. Investigation of stomata densities in pea (*Pisum sativum* L.) lines/cultivars. *Journal of Biological Sciences*, 6(2): 56-61.
- Cabrera, L.M., Diaz, J.C. 2002. Somatic characterization of three varieties of soya grown in soil under different low humidities. *Ediciones Publicaciones Alimentarias SA*, 39(332): 79-82.
- Çarpıcı, E.B., Çelik, N. 2011. Farklı bitki sıklıkları ve azot dozlarının silajlık mısırın stoma özellikleri üzerine etkileri. *Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 25(1): 79-86.
- Çınar, N., Aydınşakir, K., Dinç, N., Büyüktaş, D., Işık, M. 2016. Yerfıstığında (*Arachis hypogaea* L.) su stresinin stoma özellikleri üzerine etkisi. *Mediterranean Agricultural Sciences*, 29(2): 79-84.
- Çimen, B., Yeşiloğlu, T., İncesu, M., Yılmaz, B., Kaçar, Y.A. 2016. Bazı turunçgil genotiplerinden tetraploid bitki elde edilmesi. *Derim*, 33(2): 175-188.
- Grant, B.W., Vatnick, I. 2004. Environmental correlates of leaf stomata density. *Teaching Issues and Experiments in Ecology*, 1(1): 1-24.
- Hassan S.E., Kalig, I., Khan, A.S. 2008. Genetic mechanism of some physiological traits in spring wheat at two plant population regimes. *Journal Agricultural Research*, 46(4): 315-323.
- Hetherington, A.M., Woodward, F.I. 2003. The role of stomata in sensing and driving environmental change. *Nature*, 424(6951): 901-908.
- Kaya, M.D. 2014. Conformity of vigor tests to determine the seed quality of safflower (*Carthamus tinctorius* L.) cultivars. *Australian Journal of Crop Science*, 8(3): 455-459.
- Kusvuran, S., Dasgan, H.Y., Kuçukkomurcu, S., Abak, K. 2009. Relationship between drought tolerance and stomata density in melon. *IV International Symposium on Cucurbits*, September. 871 pp. 291-300.
- Lawson, T., Blatt, M.R. 2014. Stomatal size, speed, and responsiveness impact on photosynthesis and water use efficiency. *Plant Physiology*, 164(4): 1556-1570.



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Maghsoudi, K., Maghsoudi, M.A. 2008. Analysis of the effects of stomatal frequency and size on transpiration and yield of wheat (*Triticum aestivum* L.). American-Eurasian J. Agric. Environ. Sci., 3: 865-72.

Moghbel, N., Borujeni, M.K., Bernard, F. 2015. Colchicine effect on the DNA content and stomata size of *Glycyrrhiza glabra* var. *glandulifera* and *Carthamus tinctorius* L. cultured in vitro. Journal of Genetic Engineering and Biotechnology, 13(1): 1-6.

Mehri, N., Fotovat, R., Saba, J., Jabbari, F. 2009. Variation of stomata dimensions and densities in tolerant and susceptible wheat cultivars under drought stress. Journal of Food Agriculture & Environment, 7(1): 167-170.

Ohsumi, A., Kanemura, T., Homma, K., Horie, T., Shiraiwa, T. 2007. Genotypic variation of stomatal conductance in relation to stomatal density and length in rice (*Oryza sativa* L.). Plant Production Science, 10(3): 322-328.

Roudbari, Z., Saba, J., Shekari, F. 2012. Use of physiological parameters as tools to screen drought tolerant safflower genotypes. Intl. Res. J. Appl. Basic. Sci., 3(12): 2374-2380.

Saradadevi, C., Rajeswara Rao, G. 1978. NaCl salinity-induced changes in stomatal characteristics of safflower. Proc. Indian Acad. Sci., 87(5): 141-148.

Singh, S., Angadi, S.V., St. Hilaire, R., Grover, K., van Leeuwen, D.M. 2016. Spring safflower performance under growth stage based irrigation in the Southern High Plains. Crop Science, 56(4): 1878-1889.

Songsri, P., Jogloy, S., Junjittakarn, J., Kesmala, T., Vorasoot, N., Holbrook, J.C., Patanothai, A. 2013. Association of stomatal conductance and root distribution with water use efficiency of peanut under different soil water regimes. Australian Journal of Crop Science 7(7): 948-955.

Tanzarella, O.A., De Pace, C., Filippetti, A. 1984. Stomatal frequency and size in *Vicia faba* L. Crop Science, 24(6): 1070-1076.

Upreti, D.C., Dwivedi, N., Jain, V., Mohan, R. 2002. Effect of elevated carbon dioxide concentration on the stomatal parameters of rice cultivars. Photosynthetica, 40(2): 315-319.

Willmer, C., Fricker, M. 1996. Stomata (Vol. 2). Springer Science & Business Media.

Yagci-Tuzun, C., Hacioglu, B.T., Bulbul, A.S., Arslan, Y., Subasi, I. 2019. Comparative anatomical studies on some species of *Carthamus* L. in Turkey. Fresenius Environmental Bulletin, 28(5): 4072-4079.



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**ELAZIĞ İLİNDE SÜT SIĞIRCILIĞI İŞLETMELERİNİN MEVCUT
DURUMU VE VERİM ÖZELLİKLERİNİN İSTATİSTİKSEL ANALİZİ**

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ÖZET

Hayvancılık tüm dünya ülkelerinde olduğu gibi Türkiye’de de önemli bir yere sahiptir. Sığırcılık faaliyetinin kapsadığı süt sığırcılığı hayvancılığın süt ve süt ürünleri üretimi açısından önemli bir dalıdır. Çalışmada, Elazığ süt sığırcılığı işletmelerindeki mevcut durum ortaya koyularak, hayvanların verim özellikleri belirlenerek, tespit edilen eksiklikleri ve uygulamalarda ki hatalar düzeltilerek bir sonuca varmak ve çalışmanın süt sığırcılığı yetiştiriciliğinin ilerlemesinde kullanılabilecek önemli bir kaynak oluşturması amaçlanmıştır. Elazığ Tarım İl Müdürlüğü ile birlikte yürütülen çalışmada Merkez ve 10 ilçede süt sığırcılığı faaliyeti gösteren 300 işletme basit tesadüfi örnekleme yöntemi ile belirlenmiştir. İlde ki yetiştiricilerle 46 sorudan oluşan yüz yüze bir anket uygulaması yapılmıştır. Anket işletmecilerin demografik özellikleri ve işletme özellikleri, yetiştiricilik-üretim-sağlık, destek ve örgütlenme olmak üzere üç bölümden oluşmuştur. Anket uygulaması sonucu elde edilen Veriler IBM SPSS 22 (Sosyal Bilimler İçin İstatistik Programı) paket programında yüzde-frekans Ki-kare, Korelasyon ve Uyum analizleri yapılarak istatistiksel açıdan analiz edilmiştir. Yapılan istatistiksel analizlerde işletmecilerin belirli demografik özellikleri, beslemede kullandıkları yem türleri, tohumlama yaptırma durumları, tercih ettikleri ırk türleri ve işletmelerde ki mevcut sığır sayıları gibi değişkenlerin süt üretimini etkilediği ($P<0,001$, $P<0,01$, $P<0,05$) tespit edilmiştir. Özellikle uyum analizinde laktasyon süresi ile ineklerin doğumdan önce kuruya çıkarılmaları arasında istatistiksel olarak bir ilişki bulunmuş ve bu durumun verimi etkilediği görülmüştür. Sonuç olarak Elazığ’da faaliyet gösteren süt sığırcılık işletmelerinin daha çok küçük aile işletmelerinden oluştuğu ve gelişim gösteremediği görülmüştür. Verimi arttırmak için yem ve süt fiyatlarındaki istikrarsızlık ortadan kaldırılmalı ve sığırcılık faaliyetleri ile ilgili çalışmalar artırılmalıdır.

Anahtar Kelimeler: Elazığ İli, Süt Sığırcılığı İşletmeleri, Verim özellikleri



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**THE CURRENT SITUATION OF DAIRY CATTLE OPERATIONS IN ELAZIG, AND
THE STATISTICAL ANALYSIS OF THEIR YIELD**

ABSTRACT

Livestock is an important sector in Turkey just as it is all over the World. Cattle breeding is an important business line in terms of milk production and dairy products, because its activities involve dairy cattle. The purpose of this study is, to reveal the current situation of the dairy cattle operations in Elazig, to determine the productivity of the cattle, to deduce by overcoming the determined deficiencies and by correcting the faults in implementations, and to generate an important resource for the development of the dairy cattle business. 300 operations which are active in the dairy cattle business in the centrum city district and 10 districts, were determined with the simple random sampling method in the study which was materialized in cooperation with the Provincial Directorate of Agriculture at Elazig. A face-to-face poll of 46 question has been materialized with local breeders. The poll was divided into three parts which were the demographic and operational features of exploiters, farming-breeding-health, and support and organisation. The data obtained with the poll were analysed with percentage frequency, x-square, Correlation and fit analysis in the IBM SPSS 22 packet programme (Statistical software for Social Sciences), and these were analysed in respect of stats. The result of the statistical analyses was that variables like certain demographic peculiarities of exploiters, the feed which is used while feeding the cattle, the seeding situation, the cattle races preferred by exploiters, and the current number of cattle at the operations of breeders had effect on the milk yield ($p<0,001$, $p<0,01$, $p<0,05$). Especially with the fit analysis, a statistical relation was discovered between the lactation period of cattle and the depletion of cattle, and it became evident that this had an impact on the productivity fit analysis. Finally, it's been found out that the dairy cattle operations in Elazig consist of relatively little family-run business, and weren't able to progress. The instability of the feed and mil prices has to be removed, and activities related with cattle business have to be increased for enhancing productivity.

Keywords: Elazig Province, Dairy Cattle Operations, Yield Properties



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1.GİRİŞ

Hayvancılık, dünya üzerinde tüm ülkelerde ekonomik ve sosyal bakımdan büyük bir öneme sahiptir (Kaymakçı ve Önenç, 2007). Yaşam boyunca sürekli değişen ve gelişen sektörlerin aksine hayvancılık yapısal özelliklerinden dolayı yaşam için önemini her zaman sabit tutmuştur (Gülümser, 2011). Öyle ki dünya ülkeleri arasında gelişmişlik düzeyleri tespit edilirken, dikkate alınan birçok faktör ile beraber hayvansal ürün üretimi de önemli rol oynamaktadır. (Öztürk ve Karkacier, 2008) Çeşitli fonksiyonlara sahip olan hayvansal üretim; bölgeler ve sektörler arası orantılı gelişme, sanayileşmeye temel kaynaklar oluşturma, yeni istihdam konusunda sanayi ve hizmet faaliyetlerine destek verme gibi konuları içermektedir (Günlü vd., 2001).

Hayvancılık tarımın gelişip kalkınmasında önemli rol oynar. Toprakta gelen ürünün hayvansal üretime, hayvandan gelen ürünün ise toprağa katkı sağlaması durumunda verimlilik artmaktadır. Bu döngü ne kadar devam ederse üretim kârı da o kadar yükselir (Kaymakçı ve Önenç, 2007; Mutlu vd., 2012).

Verimlilik kavramı; mevcut hammaddeyi talep edilebilecek bir ürüne dönüştürmektir. Tarım ve hayvancılık sektöründe yapılan üretim sonucu verim elde etmek hem işletmeyi yöneten kişiyle hem de hayvanlarla belirlenir. Bu nedenle süt sığırcılığı işletmeleri incelenecek olursa verimlilik durumu, bu işletmelerde de canlılara bağımlı kalmıştır.(Nizam, 2006).

Dünya’da sığırcılık faaliyeti önemli bir süt ve et üretim kaynağıdır. Bunlara bağlı olarak son zamanlarda hayvancılık denildiğinde akıllara ilk olarak sığır yetiştiriciliği gelmektedir (Yıldız ve Aygen, 2008). Türkiye sığır sayısı ve sığırdan elde ettiği üretim miktarları açısından dünya ülkeleri arasında ön sıralarda bulunmaktadır (Akman vd., 2017).

Sığır yetiştiriciliği insanlığa faydası dokunan çok yönlü bir yetiştiricilik koludur. Özellikle süt sığırcılığı sahip olduğu üretim çeşitliliği sayesinde büyük ilgi görmektedir. Memeli grubuna ait olan hayvanların doğumlarından sonra yavrularını beslemeleri için meme bezlerinden besin değeri çok yüksek bir sıvı salgılanır. Süt olarak tanımlanan bu sıvının rengi beyazdır ve kendisine ait tat, koku gibi yapı özellikleri içermektedir. Süt yağ, protein, mineral ve su gibi bileşenlerden oluşur. İçerdiği besin maddelerinin zenginliği nedeni ile insanlık için tüketimi önemlidir. Süt ihtiyacının çoğu sığırdan elde edilmektedir (Doğacı, 2016).

Belirli bir kapasiteye sahip olan, ağırlıklı geliri süttan sağlanan, yönetildiği yemleme biçiminin ve miktarının, hayvan sayılarının, barınak ve diğer yapı malzemelerinin işletmeye göre belirlendiği faaliyet süt sığırcılığı faaliyetidir (Anonim, 2017). Gerek Dünya’da gerekse Türkiye’de süt sığırcılığı temel besin kaynaklarının yanında ekonomik gelişimlere de katkı



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sağlamaktadır. Yılın 12 ayında da süt üretimi yapılabilir. Bu durum laktasyon süresinin uzunluğundan kaynaklanmaktadır (Akman vd., 2017).

Elazığ'da daha önce süt sığırcılığı yapan işletmelerin verim özellikleri hakkında yapılmış bir çalışma bulunmadığı için bu araştırma içeriği temel alınmıştır. Araştırma, Doğu Anadolu Bölgesi Güneybatısında bulunan Elazığ İlinde süt sığırcılığı işletmeleri üzerine uygulanan anket çalışması şeklinde yürütülmüştür. Yapılan bu çalışmada Elazığ'da yapılan hayvan yetiştiriciliğinin ve özellikle süt sığır yetiştiriciliğinin mevcut durumunu, Türkiye'de yapılan hayvancılık içerisinde ki yeri ve önemini, işletme sahiplerinin sosyal ve ekonomik durumlarını, kalkınma ve sanayileşmeye olan etkisini, verim özelliklerini, sağladığı süt ve süt ürünlerinin üretimi ve tüketimini, işletmelerin sorunlarını ve beklentilerini öğrenmek amaçlanmıştır. Ayrıca uygulanan istatistiksel analizlerden elde ettiğimiz veriler sonucunda süt sığırcılığı işletmeleri ile ilgili karşılaşılan sorunlara çözüm önerileri üretmek hedef alınmıştır.

2. DÜNYA'DA SÜT SIĞIRCILIĞI

Toplumlar süt ve süt ürünleri ihtiyacını en çok süt sığırlarından sağlar. Bu nedenle süt sığırcılığı faaliyeti dünya üzerinde büyük önem taşır (Birsin, 2012). Özellikle süt verimi bakımından sığırın yapısal üstünlükleri nedeni ile birçok ülkede süt üretimi için tek kaynak olduğu söylenebilir (Kaymakçı ve Önenç, 2007). Öyle ki dünya süt üretiminin neredeyse tamamı (%86,3-%89,5) sığırdan elde edilmektedir (Anonim, 2018).

Süt ve süt ürünlerinin kökeni dünyada 150 yıllık bir döneme dayanır. Ticaret yönüyle 1980'li yıllara kadar süttten elde edilen ürünler peynir ve tereyağıdır. Dünya üzerinde Hindistan süt üretiminde en yüksek seviyelerde yer alan ülkedir. Almanya, Fransa, Amerika Birleşik Devletleri, Yeni Zelanda ve İrlanda ülkelerinde ki mevcut olan yoğun süt varlığının aksine Meksika, İtalya, Endonezya, Rusya Federasyonu ve Çin ülkelerinde süt ihtiyacı fazladır (Turan vd., 2017).

3. TÜRKİYE'DE SÜT SIĞIRCILIĞI

Türkiye'de büyükbaş hayvancılık söz konusu olduğu zaman sığır ve manda yetiştiriciliği öncelikli olmaktadır (Uygur, 2015). Türkiye'de de bu durum ciddi öneme sahiptir ve sığırdan karşılanan süt üretim miktarı %90 oranındadır (Güzel, 2016).

Türkiye'de süt sığırcılığı amacıyla yetiştirilen yerli ırklar; Yerli Kara, Boz Irk, DAK (Doğu Anadolu Kırmızısı) ve GDAK (Güneydoğu Anadolu Kırmızısı)'tır. Bunların yanı sıra



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yetiştirilen kültür ırkları vardır. Bunlar; Holstein (siyah-alaca), Montofon, Jersey ve Simentaldir (Mayda, 2016).

Tablo 1. Türkiye’de Yıllara Göre Kültür, Melez ve Yerli Sığır Sayıları (Anonim, 2018)

KÜLTÜR, MELEZ, YERLİ SIĞIR SAYILARI							
Yıl	Sığır Sayıları (Baş)						
	Kültür	%	Melez	%	Yerli	%	Toplam
2010	4.197.890	36,9	4.707.188	41,4	2.464.722	22	11.369.800
2011	4.836.547	39,1	5.120.621	41,3	2.429.169	19,6	12.386.337
2012	5.679.484	40,8	5.776.028	41,5	2.459.400	18	13.914.912
2013	5.954.333	41,3	6.112.437	42,4	2.348.487	16,3	14.415.257
2014	6.178.757	43,4	6.060.937	42,6	1.983.415	14	14.223.109
2015	6.385.343	45,6	5.733.803	41	1.874.925	13,4	13.994.071
2016	6.588.527	46,8	5.758.336	41	1.733.292	12,3	14.080.155
2017	7.804.588	48,9	6.536.073	41	1.602.925	10,1	15.943.586
2018.1.Dönem	8.323.488	48,5	7.176.660	42	1.666.046	9,7	17.166.194

Tablo 2’de kültür, melez ve yerli ırkların Türkiye’deki oranları verilmiştir. Mevcut sığır sayısının % 48,5 ‘i kültür, %42’si melez ve %9,7’si yerli sığır ırklarından oluşmaktadır. Sığır yetiştiriciliğinde Türkiye yerli sığır ırkına göre kültür ve melez ırklarını daha çok tercih etmektedir.

Tablo 2. Türkiye’de Yıllara Göre Süt Üretimi (Anonim, 2018)

SÜT ÜRETİMİ (Ton)					
Yıl	Sığır	Koyun	Keçi	Manda	Toplam
2010	12.418.544	816.832	272.811	35.487	13.543.674
2011	13.802.428	892.822	320.588	40.372	15.056.211
2012	15.977.838	1.007.007	369.426	46.989	17.401.262
2013	16.655.009	1.101.013	415.743	51.947	18.223.712
2014	16.998.850	1.113.937	463.270	54.803	18.630.859
2015	16.933.520	1.177.228	481.174	62.751	18.654.682
2016	16.786.263	1.160.413	479.401	63.085	18.489.161
2017	18.762.319	1.344.779	523.395	69.401	20.699.894

Türkiye için sağılan tüm hayvanlardan elde edilen süt üretimi Tablo 3’de verilmiştir. Toplam süt üretimi 20.699.894 ton iken bu üretimin 18.762.319 tonu sığırdan elde edilmektedir. Ülkemizde süt ihtiyacının çok büyük oranda sığır tarafından karşılandığı görülmektedir. Süt sığırcılığı bu nedenle süt ve süt ürünleri üretiminde çok büyük rol oynamaktadır.



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Türkiye’de toplam sağılan hayvan sayısı 28.505.539 ve bu sayının 5.969.047 sağılan sığır sayısıdır. Sığır başına düşen süt üretim miktarı ise 3.143 kg (kilogram)’dır (Anonim, 2018).

Türkiye’de büyükbaş hayvancılık Doğu Anadolu Bölgesi için önemli bir yere sahiptir. Burası büyükbaş hayvancılığın ve daha özele indirgenirse süt sığırıcılığının yoğun bir şekilde yapıldığı bölgedir. Türkiye’de bulunan büyükbaş hayvan sayısının ortalama %24,4’ü Doğu Anadolu Bölgesine aittir. Elazığ ili ise bu bölge üzerinde bulunduğu için hayvancılık sektöründe önemli bir yer tutmaktadır (Aksoy ve Yavuz, 2008).

4. ELAZIĞ’DA SÜT SIĞIRCILIĞI

İlde yetiştirilen hayvan sayıları bakımından incelendiğinde ildeki mevcut sığır sayısı üçüncü sırayı almaktadır. İlk sırayı tavuk, ikinci sırayı koyun ve dördüncü sırayı keçi almaktadır. Hayvancılık faaliyetinde yem fiyatlarının yüksekliği, kaba yem sorunu, süt fiyatının düşüklüğü ve hayvan verimlerinin düşük olması gibi sorunlar bulunmaktadır (Yıldırım vd., 2013). İlde toplam 14.470 sığırıcılık faaliyeti gösteren işletmelerde 28.654 süt sığırının var olduğu bilinmektedir (Anonim, 2017).

Doğu Anadolu Bölgesi içinde bulunan iller arasında Elazığ’ın gelişmişlik düzeyi, göç alma konusunda elverişli durumda olması, nüfus büyüklüğü bakımından sığırıcılıkta et ve süt ürünlerinde önemli bir pazar durumunda olduğu kabul edilebilir (Şeker vd., 2011).

Hayvancılık Elazığ İlinde daha çok ailelerin geçim kaynağı olarak yapılmaktadır. Büyük işletmelere oranla küçük aile işletmeleri mevcut olduğundan süt ve süt ürünlerinin pazarlanması konusunda düzenli bir sistem geliştirilememiştir. Süt ve süt ürünleri kısa süre saklanabildiği için süt sığırıcılığı yapan işletmelerde bu durum olumsuz etki sağlamaktadır ve rekabeti yok etmektedir (Akkılıç vd., 2001).

5. GEREÇ VE YÖNTEM

5.1. Gereç

Çalışmanın ana materyalini süt sığırıcılığı faaliyeti gösteren işletmelerden anket yoluyla toplanan orijinal nitelikli veriler oluşturmaktadır. Elazığ İli merkez ve 10 ilçesinde sığırıcılıkla uğraşan 14.470 işletmeden 28.654 süt sığırına sahip olan ve süt sığırıcılığı faaliyeti gösteren işletmelerden 300 süt sığırıcılığı işletmesi seçilerek anket uygulaması yapılmıştır.

Yetiştiriciler ile yapılan anketten elde edilen veriler kullanılarak Elazığ’da süt sığırıcılığının mevcut durumu ve süt verim özellikleri hakkında bilgiler elde edilmiştir.



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5.2. Yöntem

Araştırmanın ana verilerini oluşturan anket formları daha önce yapılmış olan benzer çalışmalardan toparlanarak hazırlanmış soruları ve işletmecilerle yapılan karşılıklı görüşmeler sonucu tespit edilmiş verileri kapsamaktadır. Temel materyal olan anket 46 sorudan ve üç bölümden oluşmuştur. Birinci bölümde katılımcıların demografik (yaş, cinsiyet, meslek, eğitim durumu, gelir) özellikleri ile ilgili sorular mevcuttur. Anketin ikinci bölümünde işletme sahiplerine yetiştiricilik-üretim-sağlık faktörleri ile ilgili sorular yöneltilmiştir. Bu bölüm daha çok yem, tohumlama, tercih edilen sığır ırkı, süt verimi gibi konuları içermiştir. Son bölümde ise destek ve örgütlenme konusu değerlendirmeye alınmıştır. İşletme sahiplerinin destek almadıkları, üye oldukları birlik veya kooperatif olup olmadığı ve bu konular hakkında karşılaştıkları sorunlar araştırılmıştır.

5.2.1. Verilerin Analizinde Kullanılan İstatistiksel Yöntemler

Süt sığırıcılığı faaliyeti gösteren işletmelerde yetiştiricilerle yapılan anketler bittikten sonra elde edilen veriler düzenlenmiş ve analize hazır hale getirilmiştir. Veriler IBM SPSS 22 paket programı kullanılarak analiz edilmiştir. Tanımlayıcı istatistikler (yüzde-frekans), bazı demografik ve işletme özellikleri ile süt verimi arasındaki ilişki hakkında tahminde bulunmak için Ki-kare analizi, korelasyon analizi ve uyum analizi yapılmıştır.

6. BULGULAR

Sonuçlara bakıldığında ankete katılan işletmecilerin %6'sının kadın %94'ünün ise erkek olduğu görülmüştür. Katılımcıların yaş durumu göz önüne alındığında %33,3 oranı ile en fazla 56 yaş ve üzeri katılımcı, %2 oranı ile de en az 25 yaş ve altı katılımcı tespit edilmiştir. Bu oranlar dışında 26-35 yaş aralığında olan işletme sahiplerinin %11,3, 36-45 yaş aralığında olan işletme sahiplerinin %24,3 ve 46-55 yaş aralığında olan işletme sahiplerinin ise %29 oranında olduğu görülmüştür.



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Tablo 3. İşletmecilerin Cinsiyet, Yaş, Meslek ve Eğitim Durumları

Cinsiyet	Frekans	Yüzde
Kadın	18	6
Erkek	282	94
Toplam	300	100
Yaş	Frekans	Yüzde
25 ve altı	6	2
26-35	34	11,3
36-45	73	24,3
46-55	87	29
56+	100	33,3
Toplam	300	100
Meslek	Frekans	Yüzde
Çiftçi	139	46,3
Serbest-çiftçi	51	17
Emekli-çiftçi	84	28
İşçi-çiftçi	12	4
Devlet memuru-çiftçi	14	4,7
Toplam	300	100
Eğitim	Frekans	Yüzde
Okur-yazar değil	16	5,3
İlköğretim	161	53,7
Ortaöğretim	45	15
Lise	46	15,3
Üniversite	32	10,7
Toplam	300	100

Meslek durumlarına bakıldığında sadece çiftçilikle ilgilenenlerin %46,3 oranında, hem serbest meslek hem de çiftçilikle ilgilenenlerin %17 oranında, emekli ve aynı zamanda çiftçilikle ilgilenenlerin %28 oranında, işçi olup beraberinde çiftçilikle ilgilenenlerin %4 oranında ve son olarak devlet memuru olup çiftçilikle ilgilenenlerin %4,7 oranında olduğu belirlenmiştir. Sadece çiftçi olanların oranının diğer meslek gruplarına göre daha yüksek olduğu belirlenmiştir. İşletme sahiplerinin eğitim durumları araştırıldığında okur-yazar olmayanların %5,3, ilköğretim mezunu olanların %53,7, ortaöğretim mezunu olanların %15, lise mezunu olanların %15,3 ve üniversite mezunu olanların %10,7 olduğu sonucu elde edilmiştir. Eğitim seviyeleri arasındaki oranlar yorumlandığında ankete katılan işletme sahiplerinin ağırlıklı olarak ilköğretim mezunu olduğu ve okur-yazar olmayanların oranının en düşük olduğu belirlenmiştir.

Tablo 4. İşletmelerde Yem Bitkisi Üretimi

İşletmenizde yem bitkisi üretimi var mı?	Frekans	Yüzde
Var	143	47,7
Yok	157	52,3
Toplam	300	100

Çalışmada işletmelerinde yem bitkisi üretimi yapan işletmeciler %47,7 oranında iken yem bitkisi üretimi yapmayanlar %52,3 oranındadır.



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Tablo 5. İşletmelerdeki Günlük Süt Verimi

Günlük inek başına süt üretim miktarı	Frekans	Yüzde
10 kg'dan az	38	12,7
11-15 kg	139	46,3
16-20 kg	89	29,7
21-25 kg	30	10
26-30 kg	4	1,3
31+ kg	0	0
Toplam	300	100

Bu soruya %12,7 oranında işletmeci 10 kg'dan az, %46,3 oranında işletmeci 11-15 kg arasında, %29,7 oranında işletmeci 16-20 kg arasında, %10 oranında işletmeci 21-25 kg aralığında ve %1,3 oranında işletmeci 26-30 kg aralığında süt aldığını belirtmiştir. Bulgular sonucunda işletmelerdeki ineklerin büyük kısmının günlük ortalama 11-15 kg arasında süt verdiği görülmüştür.

Tablo 6. İşletmelerde Yetiştirilen Irklar

Kültür ırkı bulunduruyorsanız hangi ırkını yetiştiriyorsunuz?	Frekans	Yüzde
Simental	256	88,9
Holştayn	30	10,4
Esmer	2	0,7
Jersey	0	0
Diğer	0	0
Toplam	288	100

Yetiştiricilerin %88,9'u Simental yetiştirdiğini belirtirken %10,4'ü Holştayn ve %0,7'si Esmer ırkını yetiştirdiğini belirtmiştir. Jersey ve bunlar dışında bulunan ırkları katılımcılardan hiçbiri tercih etmemiştir.

Tablo 7. Yetiştirilen Sığır Irkına Göre Yıllık İnek Başına Süt Üretimi Ki-Kare Analizi

	Yıllık inek başına süt üretimi (kg)												*
	3000'den az		3001-5000		5001-7000		7001-9000		9001-12000		Toplam		
Hangi ırk?	n	%	n	%	n	%	n	%	n	%	n	%	
Yerli	2	20	2	20	6	60	-	-	-	-	10	100	
Melez	-	-	-	-	2	100	-	-	-	-	2	100	
Kültür	4	1,4	34	11,8	123	42,7	93	32,3	34	11,8	288	100	
Toplam	6	2	36	12	131	43,7	93	31	34	11,3	300	100	

*:P<0,01



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Araştırmada işletmelerinde yerli ırk yetiştirenlerin %60'ı, melez ırkı yetiştirenlerin tamamı ve kültür ırkı yetiştirenlerin %42,7'si yıllık inek başına 5001-7000 kg süt verimi elde ettikleri bulunmuştur. İşletmelerde yetiştirilen ırk türü ve yıllık inek başına süt üretim miktarı arasında istatistiksel olarak yüksek düzeyde anlamlı bir fark bulunmuş ($P<0,01$).

Tablo 8. Yaş, Eğitim, Sığırcılık Geliri, Deneyim, Sığır Sayısı, Yıllık Süt Verimi ve Süt Satış Fiyatı Korelasyon Değerleri

	Yaş	Eğitim	Sığır geliri	Deneyim	Sığır sayısı	Yıllık verim	Süt satış fiyatı
Yaş	1	-0,452**	-0,175**	0,445**	-0,264**	-0,159**	-0,116*
Eğitim	-0,452**	1	0,281**	-0,347**	0,230**	0,221**	-
Sığır geliri	-0,175**	0,281**	1	-0,123*	0,578**	0,371**	-
Deneyim	0,445**	-0,347**	-0,123*	1	-0,167**	-	-0,182**
Sığır sayısı	-0,264**	0,230**	0,578**	-0,167**	1	0,325**	-0,175**
Yıllık verim	-0,159**	0,221**	0,371**	-	0,325**	1	-
Süt satış fiyatı	-0,116*	-	-	-0,182**	-0,175**	-	1

*: $P<0,05$ **: $P<0,01$

Çalışmada işletmecilerin yaş faktörü ile diğer faktörler arasındaki analiz sonuçlarına bakıldığında işletmecilerin yaşları ve sığırcılık deneyimleri arasında pozitif yönde çok yüksek bir ilişki olduğu görülmüştür ($P<0,01$). İşletmecilerin yaşları ve süt satış fiyatı arasında negatif yönde yüksek bir ilişki görülmüştür ($P<0,05$). Eğitim, sığırcılık geliri, mevcut sığır sayısı ve yıllık hayvan başına düşen süt verimiyle ise arasında negatif yönde çok yüksek bir ilişki olduğu görülmüştür ($P<0,01$).

Tablo 9. Açıklanan İnertia Verileri ve Boyut Sayısı

Boyut	Tekil değer	inertia	Ki-Kare	P	Açıklanan inertia	
					Açıklanan	Toplamalı
1	0,352	0,124	41,559	0,000	0,893	0,893
2	0,117	0,014			0,100	0,992
3	0,032	0,001			0,008	1
Toplam		0,139			1	1

Ki-kare Testi sonucunda inertia değerinin sıfırdan farklı olduğu ve P değerinin 0,05'ten küçük olduğu görülmüştür. Bu veriler sonucunda satır ve sütun değişkenleri arasında ilişki olduğu



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söylenbilir. Yani laktasyon süreleri ile kuruda kalma süreleri arasında anlamlı bir ilişki görülmüştür. Veriler incelendiğinde toplam inertianın birinci boyutta %89,3 oranında açıklandığı, ikinci boyutta %10 oranında açıklandığı ve üçüncü boyutta ise %8 oranında açıklandığı görülmüştür.

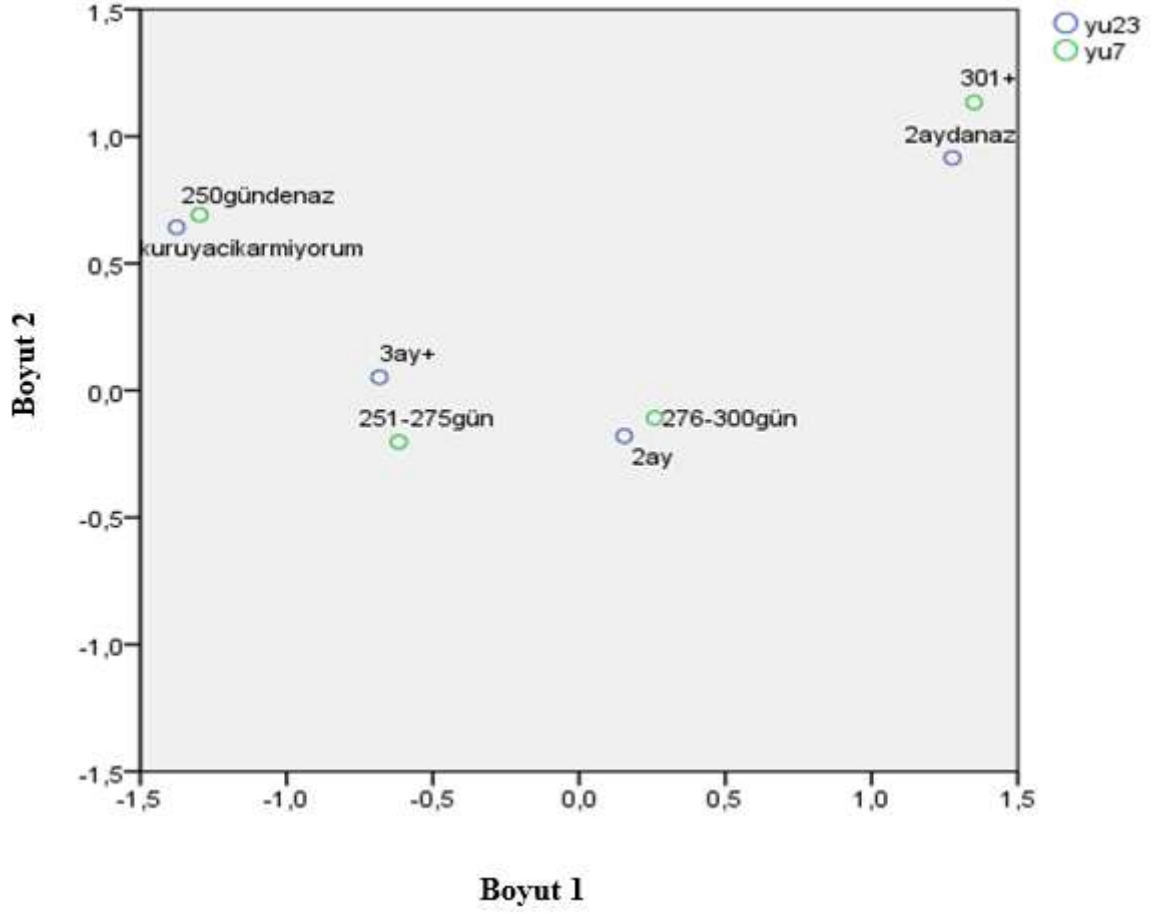
Tablo 10. Satır ve Sütun Verilerinin Açıklandığı İnteria Sonuçları ve Boyutlar Üzerine Katkısı

	Değişken	Mass	Boyut puanları		Inertia	Noktaların boyutlara katkısı		Boyutların noktalara katkısı		Toplam
			1	2		1	2	1	2	
Laktasyon süresi (gün)	250 ve altı	0,087	-1,297	0,692	0,056	0,414	0,353	0,911	0,087	0,997
	251-275	0,200	-0,617	-0,203	0,028	0,216	0,070	0,947	0,034	0,981
	276-300	0,667	0,259	-0,108	0,017	0,127	0,067	0,937	0,055	0,991
	301 ve +	0,047	1,351	1,133	0,037	0,242	0,510	0,805	0,159	0,994
	Toplam	1			0,139	1	1			
Kuruya kalma (ay)	Çıkarıyor	0,073	-1,375	0,642	0,053	0,394	0,258	0,927	0,068	0,995
	2 ve altı	0,077	1,276	0,916	0,052	0,355	0,547	0,853	0,147	1
	2	0,697	0,155	-0,180	0,009	0,047	0,192	0,683	0,309	0,992
	3 ve +	0,153	-0,682	0,052	0,026	0,203	0,004	0,972	0,002	0,974
	Toplam	1			0,139	1	1			

Laktasyon süresinin kategorileri arasında birinci boyut için en çok katkıyı yapan 250 ve altı laktasyon süresine sahip olanlar olarak belirlenmiştir. Kuruda kalma süresi kategorilerinden ise birinci boyut için en çok katkıyı kuruya çıkarmıyorum noktası yapmıştır. Boyutların noktalara olan katkısında ise birinci boyutun laktasyon süresi kategorilerinden 251-275 gün noktasına en fazla oranda katkısı olmuştur. Kuruda kalma süresi kategorilerine bakıldığında ise birinci boyutun en fazla 3 ay ve daha fazla seçeneğine katkısı olduğu görülmüştür. Mass değerleri incelendiğinde en fazla 276-300 seçeneği laktasyon süreleri kategorisinde dikkat çekerken, en fazla 2 ay seçeneği ile de kuruda kalma süresi kategorisi dikkat çekmektedir. Yani bu seçenekler ağırlıklı görülmüştür. Inertia değerlerinde ise toplam inertiyayı laktasyon süresi kategorisinde en fazla 250 gün ve altı noktası açıklarken, kuruda kalma süresi kategorisinde ise en fazla kuruya çıkarmıyor noktası açıklamıştır. Boyut puanları ise noktaların koordinatlar üzerindeki yerlerini belirtmiştir.



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Grafik 1. Düzlem Üzerinde Satır Noktalarının Gösterilmesi

yu7: Laktasyon süresi

yu23: Hayvanların doğumdan ne kadar önce kuruya çıkarıldıkları

Kategorilerin düzlem üzerindeki durumlarına bakıldığında laktasyon süreleri 301 gün ve daha fazla olan ineklerin doğumdan önce kuruya çıkarılma süreleri 2 aydan az olarak görülmüştür. Laktasyon süreleri 276-300 gün olan ineklerin 2 ay kuruda kaldıkları ve 251-275 gün olanların 3 ay ve daha fazla kuruda kaldıkları görülmüştür. Laktasyon süreleri 250 günden az olan ineklerin ise kuruya çıkarılmama durumlarının daha yoğun olduğu görülmüştür.

Tablo 11. Açıklanan Inertia Verileri ve Boyut Sayısı

Boyut	Tekil değer	inertia	Ki-Kare	P	Açıklanan inertia	
					Açıklanan	Toplamalı
1	0,588	0,345	127,749	0,000	0,811	0,811
2	0,272	0,074			0,174	0,985
3	0,079	0,006			0,015	1
4	0,009	0,000			0,000	1
Toplam		0,426			1	1



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Ki-kare Testi sonucunda toplam inertia değerinin sıfırdan farklı olduğu ve p değerinin 0,05'ten küçük olduğu görülmüştür. Bu veriler sonucunda satır ve sütun değişkenleri arasında ilişki olduğu söylenebilir. Yani yemin temin edildiği yerler ve yem ile ilgili karşılaşılan sorunlar arasında anlamlı bir ilişki görülmüştür. Veriler incelendiğinde toplam inertianın birinci boyutta %81,1 oranında açıklandığı, ikinci boyutta %17,4 oranında açıklandığı ve üçüncü boyutta ise %15 oranında açıklandığı görülmüştür. Dördüncü boyutta inertia açıklanmamıştır.

Tablo 12. Satır ve Sütun Verilerinin Açıklandığı İnteria Sonuçları ve Boyutlar Üzerine Katkısı

	Değişken	Mass	Boyut puanları		Inertia	Noktaların boyutlara katkısı		Boyutların noktalara katkısı		Toplam
			1	2		1	2	1	2	
Yem temini	Fabrika	0,220	-0,274	0,116	0,015	0,028	0,011	0,642	0,054	0,695
	Bayi	0,660	-0,189	-0,192	0,022	0,040	0,089	0,638	0,303	0,941
	Koop-birlik	0,067	0,438	1,875	0,072	0,022	0,860	0,105	0,891	0,996
	Kendim	0,047	3,383	-0,459	0,317	0,909	0,036	0,991	0,008	1
	Diğer	0,007	-0,290	-0,398	0,001	0,001	0,004	0,462	0,403	0,865
	Toplam	1			0,426	1	1			
Yem sorunları	Yüksek fiyat	0,903	-0,170	-0,108	0,018	0,045	0,039	0,842	0,158	0,999
	Kalitesizlik	0,023	3,304	-0,181	0,150	0,434	0,003	0,998	0,001	1
	Standart olmaması	0,007	-0,322	-0,703	0,003	0,001	0,012	0,118	0,262	0,380
	Kontrol olmaması	0,020	2,060	1,498	0,064	0,145	0,165	0,776	0,190	0,966
	Temin edememe	0,007	5,757	-1,686	0,136	0,376	0,070	0,953	0,038	0,991
	Diğer	0,040	-0,014	2,202	0,054	0,000	0,712	0,000	0,985	0,986
	Toplam	1			0,426	1	1			

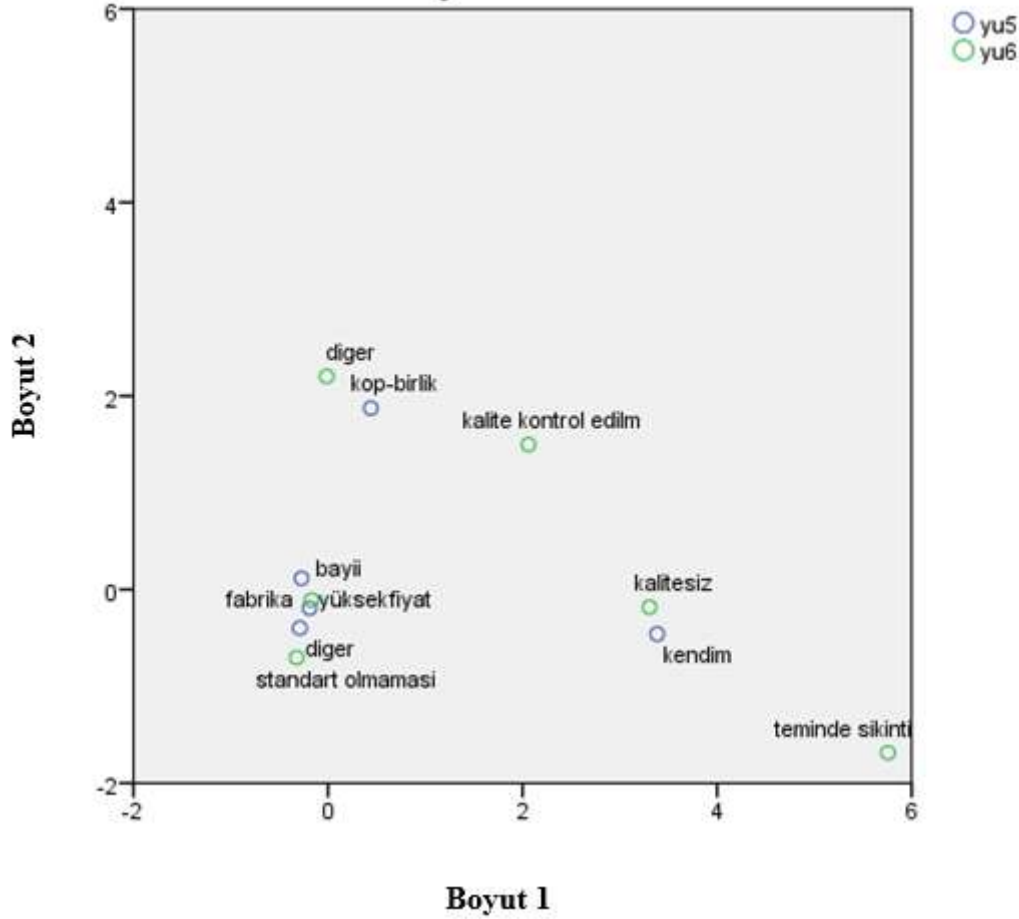
Yem temini kategorileri arasında birinci boyut için en çok katkısı yapan kendim üretiyorum noktası olarak belirlenmiştir. Yem sorunları kategorilerinden ise birinci boyut için en çok katkısı yemin kalitesizliği noktası yapmıştır. Boyutların noktalara olan katkısında ise birinci boyutun yem temini kategorilerinden yine kendim üretiyorum noktasına en fazla oranda katkısı olmuştur. Yem sorunları kategorilerine bakıldığında ise birinci boyutun en fazla yine yemin kalitesizliği seçeneğine katkısı olduğu görülmüştür. Mass değerleri incelendiğinde en fazla bayi seçeneği yem temini kategorisinde dikkat çekerken, en fazla yüksek fiyat ile de yem sorunları kategorisi dikkat çekmektedir. Yani bu seçenekler ağırlıklı olarak görülmüştür. Inertia değerlerinde ise toplam inertia'yı yem temini kategorisinde en fazla kendim üretiyorum noktası



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açıklarken, yem sorunları kategorisinde ise en fazla yemin kalitesizliği noktası açıklamıştır. Boyut puanları ise noktaların koordinatlar üzerindeki yerlerini belirtmiştir.



Grafik 2. Düzlem Üzerinde Satır ve Sütun Noktalarının Birlikte Gösterilmesi

yu5: işletmecilerin yemi temin ettikleri yerler

yu6: işletmecilerin yem ile ilgili karşılaştıkları sorunlar

Kategorilerin düzlem üzerindeki durumlarına bakıldığında yemi kooperatif veya birliklerden temin edenler diğer sorunlar kategorisine çok yakın ve uyumlu bulunmuşken yemin kalitesinin kontrol edilmemesi sorunuyla da yakın bulunmuştur. Yemi fabrikadan, bayiden ve diğer yollarla temin edenlerin yem fiyatının yüksek olması ve yemin belirli bir standardının olmaması sorunları uyumlu görülmüştür ve birbirlerini etkilemişlerdir. Yemi kendisi üreten işletmeciler daha çok yemin kalitesizliğinden şikâyet etmişlerdir. Yem temininde sorun yaşıyorum diyen



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işletmeciler ise diğer kategorilere uzak görülmüş olup yemi kendisi üretenler kategorisine azda olsa yakın görülmüştür.

7. TARTIŞMA

Yapılan araştırmada işletmecilerin cinsiyet bulgularına bakıldığında %94 oranında erkek %6 oranında kadın işletmeci olduğu görülmüştür. Kahramanmaraş ilinde yapılan bir çalışmada ise işletmecilerin erkek oranının %95, kadın oranının ise %5 olduğu belirtilmiştir (Güzel, 2016). İki çalışmada da değerler birbirine yakın bulunmuştur. Kadınların işletmelerde erkeklere göre çok daha pasif kaldığı söylenebilir. Antalya'nın Manavgat ilçesinde yapılan bir çalışmada işletme sahiplerinin %74,2'sinin orta yaşlı, % 22,6'sının yaşlı olduğunu ve %3,2'sinin ise genç olduğu bulunmuştur (Demirtaş, 2006). Antalya Manavgat ilçesinde yetiştiricilerin eğitim durumlarına bakıldığında ilköğretim mezunu olanların %93,6 olduğu, ortaöğretim mezunu olanların %6,4 olduğu ve yüksekokul mezunu olan yetiştirici olmadığı saptanmıştır (Demirtaş, 2006).

Çalışmada işletmelerinde yem bitkisi üretimi yapan işletmeciler %47,7 oranında iken yem bitkisi üretimi yapmayanlar %52,3 oranındadır. Konya Ereğli'de yapılan çalışmada, işletmelerden yem bitkisi üretimi yapanların oranı %60,7 iken yapmayanların oranı 39,3 olarak belirtilmiştir (Aysever, 2016). Edirne'de üreticilerin %90'ı yem bitkisi ürettiklerini, %10'u yem bitkisi üretmediklerini belirtmişlerdir (Balaban, 2006). Sakarya Karasu'da işletmecilerin %13'ü yem bitkisi üretmediğini ifade etmiştir (Bahat, 2015). Köseman ve Şeker (2016), Malatya ili için yaptıkları araştırmada işletmelerin %76'sında yem bitkisi üretimi yapıldığını ve %24'ünde yapılmadığını bildirmişlerdir. Yem bitkisi üretimi yapanların oranı diğer çalışmalara göre düşük bulunmuştur. İlde yem bitkisi üretilen alanların arttırılmasında fayda olacağı yorumu yapılabilir.

Çalışmada katılımcıların %95,3'ü buzağılarını günlük 4 kg'dan fazla sütle beslerken %4,7'si 3-4 kg arasında süt ile beslediğini belirtmiştir. Koyubenbe (2005), bu oranı 9,9 kg olarak bildirmiş, Soydam (2018), günlük buzağların beslendiği süt miktarını 4,24-5,9 kg arasında bildirmiştir.

Kültür ırkı bulunduran yetiştiricilerin %88,9'u Simental yetiştirdiğini belirtirken %10,4'ü Holştayn ve %0,7'si Esmer ırkını yetiştirdiğini belirtmiştir. Van ilinde %48,7 Simental, %44,1 Siyah-Alaca, %7,2 Esmer yetiştirildiği tespit edilmiştir (Bakır, 2002). İç Anadolu Bölgesi'nde %94 Siyah-Alaca, %6 Esmer genotipi seçimlerinin olduğu tespit edilmiştir (Yılmaz, 2006).



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Kahramanmaraş'ta ise %63,9 Siyah-Alaca ve melezi, %34,2 Simental ve melezi, %1,38 Esmer tercih edildiği belirtilmiştir (Güzel, 2016). Bulgular literatür çalışmalarıyla benzerlik göstermemiştir. Yerli ırk bulunduran işletmelere bakıldığında %50 oranında DAK tercih edildiği görülmüştür.

Korelasyon analizi bulguları incelendiğinde yaş faktörü arttıkça işletmecilerin deneyimlerinin artarken ve işletmelerde ki süt satış fiyatlarının, işletmecilerin eğitimlerinin, sığırcılık gelirinin, mevcut sığır sayılarının ve yıllık inek başına düşen süt verimlerinin azaldığı belirtilmiştir. Eğitim faktörü arttıkça işletmelerde ki sığırcılık geliri, mevcut sığır sayısı ve yıllık inek başına düşen süt üretiminin arttığı ve deneyim faktörünün azaldığı belirtilmiştir. Ayrıca eğitim seviyelerinin artması süt fiyatında artış veya azalış gibi bir değişim göstermemiştir. İşletmecilerin yıllık sığırcılıktan elde ettikleri gelir artarken mevcut sığır sayısı, yıllık inek başına süt verimi artmış ve işletmeci deneyimlerinin azaldığı görülmüştür. Ayrıca gelir faktörü ile süt satış fiyatı arasında bir ilişki görülmemiştir. Deneyim faktörü artarken mevcut sığır sayısı ve süt satış fiyatının azaldığı ve süt üretim miktarı ile bir ilişki göstermediği bulunmuştur. Mevcut hayvan sayısı artarken yıllık inek başına düşen süt veriminin arttığı ve süt satış fiyatının azaldığı ifade edilmiştir. Süt üretimi ile süt satış fiyatı arasındaki ilişki araştırıldığında ise aralarında anlamlı bir ilişkinin olmadığı bulunmuştur.

Araştırmada Elazığ ilinde yapılan anket uygulamasında işletmelerde bulunan süt sığırlarının laktasyon süreleri ve doğumdan önce kuruya çıkarılma süreleri arasında bir uyum söz konusu olup olmadığı incelendiğinde iki değişken arasında anlamlı bir ilişki olduğu ve bu değişkenlerin aralarında bir uyum olduğu görülmüştür. Laktasyon süresi 301 gün veya daha uzun olan süt sığırlarının doğuma 2 aydan daha az bir süre kaldığında kuruya çıkarılmaları arasındaki uyum veya yakınlık öteki faktörlere göre daha fazla görülmüştür.

Yetiştiricilerin kesif yemi temin ettikleri yerler ile kesif yem konusunda karşılaştıkları sorunlar arasında bir uyum söz konusu olup olmadığı incelendiğinde ise iki değişken arasında anlamlı bir ilişki olduğu ve aralarında bir uyum olduğu görülmüştür. Kesif yemi fabrikadan, bayiden ve diğer yollarla temin edenlerin, yem fiyatının yüksek olması ve yemin belirli bir standardının olmaması sorunları ile karşılaşmış olmaları uyumlu görülmüştür ve birbirlerini etkilemişlerdir. Ayrıca yemi kalitesiz bulan işletmeciler ve yemi kendileri üretmeyi tercih edenler arasında da daha uyumlu bir ilişki olduğu görülmüştür. Farklı yerlerden kesif yemi temin ettiklerinde yemi kalitesiz buldukları için kendilerinin üretmeyi tercih ettikleri söylenebilir.



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8. SONUÇ ve ÖNERİLER

Sonuç olarak, tüm canlılar için önemini her zaman koruyan süt sığırcılığı faaliyetinin Elazığ ilinde ki mevcut durumu ve verim özellikleri araştırılıp analiz edildiğinde işletmelerin daha çok küçük ve aile işletmelerinden oluştuğu görülmektedir. Genel olarak hayvansal üretim için çevre koşulları uygun olmasına ve işletmecilerin hayvancılığa ilgisi olmasına rağmen yeterli verim elde edilememektedir. İşletmelerdeki mevcut gelir ve süt verimleri bazı koşullara dikkat edilerek süt sığırcılığı için iyileştirmeler yapılabilir. İşletmelerde yetiştirilen ırk türü olarak, ildeki yetiştirme şartlarına uygunluk öncelikli bir şart olmalı ve sadece verim yüksekliğine bakılmamalıdır. Bu bakış açısıyla tercih yapılırsa hayvanlardan daha yüksek verim alınabilir. İşletmelerde daha kaliteli yem ve damızlık kullanımı, süt satış fiyatlarında ve yem fiyatlarında ki istikrarsızlık, işletmecilerin eğitim seviyelerinin düşüklüğü gibi sorunlardan dolayı süt sığırcılığı faaliyeti olumsuz etkilenmektedir. Ayrıca modern pazarlama yöntemleri kullanılarak sütün daha kaliteli şartlarda pazarlanması sağlanabilir. Ayrıca ineklerin laktasyon süreleri, kuruda kalma süreleri gibi özelliklere dikkat edilerek hayvanların süt üretiminin arttırılabileceği söylenebilir.

Hayvancılık ile ilgilenen tüm kurumlar süt sığırcılığı için yapılan faaliyetleri arttırmalı, işletmecilerin bu faaliyetlere daha fazla oranlarda katılmaları ve fiyatlarda ki sıkıntıların giderilmeleri Elazığ ilinde, Doğu Anadolu Bölgesi'nde ve aynı zamanda Türkiye'de süt sığırcılığı açısından verimliliği arttıracak ve ekonomiye katkıda bulunacaktır.



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KAYNAKLAR

Akkılıç ME, Tatlı P, Çerçi H. Elazığ Yöresinde Süt ve Süt Ürünlerinin Pazarlama Yöntemleri ve Problemleri Üzerine Bir Çalışma. Lalahan Hayvan Araştırma Dergisi 2001;42(1): 77-84.

Akman N, Özkütük K, Kumlu S, Yener SM. “Türkiye’de sığır yetiştiriciliği ve sığır yetiştiriciliğinin Geleceği”
http://www.zmo.org.tr/resimler/ekler/71c50ad1a156d72_ek.pdf?tipi=14&sube 21.11.2017.

Aksoy A, Yavuz F. Hayvancılık İşletmelerinin Avrupa Birliğine Uyum ve Rekabet Edebilirliği; Doğu AnadoluÖ. Tarım Ekonomisi Dergisi 2008; 14(1): 37-45.

Anonim. “Hayvancılık Genel Müdürlüğü Kasım 2016”
<http://www.tarim.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf> 17.11.2018.

Anonim. “Hayvancılık İstatistikleri”. <http://www.tuik.gov.tr> 08.10.2017.

Anonim. “Süt Sığırıcılığı faaliyeti”
<http://www.muratgorgulu.com.tr/altekrn.asp?id=102> 05.10.2017.

Avsever F. Konya İli Ereğli İlçesi Süt Sığırıcılığı İşletmelerinin Yapısal Özellikleri. Yüksel Lisans Tezi, Konya: Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, 2016.

Bahat E. Sakarya İli Karasu İlçesi Süt Sığırıcılığı İşletmelerinin Üretim Özellikleri ve Yönetim Uygulamaları. Yüksek Lisans Tezi, Kayseri: Erciyes Üniversitesi, Sağlık Bilimleri Enstitüsü, 2015.

Bakır G. Van İlindeki Özel Süt Sığırıcılığı İşletmelerinin Yapısal Durumu. Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi 2002; 12(2):1-10.

Balaban A. Edirne İli Süt Sığırıcılığının Üretim, Fiyat ve Pazarlama Politikalarının Değerlendirilmesi. Yüksek Lisans Tezi, Tekirdağ: Trakya Üniversitesi, Fen Bilimleri Enstitüsü, 2006.

Birsin S. Balıkesir İli Balya İlçesinde Süt Sığırıcılığı Faaliyetinin Mevcut Durumu, Sorunları ve Çözüm Önerileri. Yüksek Lisans Tezi, Tokat: Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü, 2012.

Demirtaş M. Manavgat İlçesi Süt Sığırıcılık İşletmelerinin Genel Profili Üzerine Bir Araştırma. Yüksek Lisans Tezi, Aydın: Adnan Menderes Üniversitesi, Sağlık Bilimleri Enstitüsü, 2006.



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Doğacı T. Batı Karadeniz Bölgesi'ndeki Bazı Süt Sığırcılığı İşletmelerinde Sağım Hatalarının Araştırılması. Yüksek Lisans Tezi, Isparta: Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, 2016.

Gülümser B. Türkiye'de Süt Sığırcılığında Döl ve Süt Verimi Üzerinde Yapılan Araştırmaların Değerlendirilmesi. Yüksek Lisans Tezi, Tekirdağ: Namık Kemal Üniversitesi, Fen Bilimleri Enstitüsü, 2011.

Günlü A, İmik H, Tekerli M. Afyon İli Süt Sığırcılık İşletmelerinin Genel Özellikleri İle Karlılık ve Verimlilik Analizleri. Lalahan Hayvan Araştırma Dergisi 2001; 41(1): 1-12.

Güzel M. Kahramanmaraş İli Süt Sığırcılığı İşletmelerinin Yapısal ve Mekanizasyon Özelliklerinin Belirlenmesi ve Değerlendirilmesi. Yüksek Lisans Tezi, Kahramanmaraş: Kahramanmaraş Sütçü İmam Üniversitesi, Fen Bilimleri Enstitüsü, 2016.

Kaymakçı M, Önenç A. Türkiye Süt Sığırcılığı Kurultayı. 1. Baskı, İzmir: Meta Basım, 2007.

Koyubenbe N. İzmir İli Ödemiş İlçesinde Süt Sığırcılığının Geliştirilmesi Olanakları Üzerine Bir Araştırma: Hayvansal Üretim Dergisi 2005; 46(1): 8-13.

Köseman A, Şeker İ. Malatya İlinde Sığırcılık İşletmelerinin Mevcut Durumu: Yapısal Özellikler. Fırat Üniversitesi Sağlık Bilimleri Veteriner Dergisi 2016; 30(1): 5-12.

Mayda F. İzmir İlinde Süt Sığırcılığı Yapan İşletmelerin Ekonomik Analizi ve Sütün Pazar Arzı. Yüksek Lisans Tezi, Kahramanmaraş: Kahramanmaraş Sütçü İmam Üniversitesi, Fen Bilimleri Enstitüsü, 2016.

Mutlu Çamoğlu S, Yılmaz H, Gül A, Görgülü M. Kooperatifler Aracılığı ile Hayvan Dağıtımı Kapsamında Desteklenen Süt Sığırcılığı İşletmelerinde Pazara Katılım Düzeyini Etkileyen Faktörlerin (Üretici ve İşletmeye Ait) Analizi: Adana İli Örneği. Tarım Ekonomisi Dergisi 2012; 18(1): 13-22.

Nizam S. Aydın İlinde Pazara Yönelik Süt Sığırcılığı İşletmelerinin Verimliliklerinin Belirlenmesi. Yüksek Lisans Tezi, Aydın: Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü, 2006.

Öztürk D, Karkacier O. Süt Sığırcılığı Yapan İşletmelerin Ekonomik Analizi(Tokat İli Yeşilyurt İlçesi Örneği). GOÜ Ziraat Fakültesi Dergisi 2008; 25(1): 15-22.

Soydam AE. Kütahya İli Tavşanlı İlçesi Süt Sığırcılığı İşletmelerinin Yapısı ve Sorunları. Yüksek Lisans Tezi, Isparta: Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, 2018.



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Şeker İ, Özen A, Güler H, Şeker P, Özden İ. Elazığ'da Kırmızı Et Tüketim Alışkanlıkları ve Tüketicilerin Hayvan Refahı Konusundaki Görüşleri. Kafkas Üniversitesi Veteriner Fakültesi Dergisi 2011; 17(4): 543-550.

Turan Z, Şanver D, Öztürk K. Türkiye'de Hayvancılık Sektöründen Süt İnekçiliğinin Önemi ve Yurt İçi Hasılaya Katkısı ve de Dış Ülkelerle Karşılaştırılması. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi 2017; 10(3): 60-74.

Uygur AM. İzmir İli Süt Sığırcılığının Mevcut Durumu ve Geliştirmesi Üzerine Bir Araştırma. Doktora Tezi, İzmir: Ege Üniversitesi, Fen Bilimleri Enstitüsü, 2015.

Yıldırım A, Arı M, Yıldırım G, Menteş Y, Karaca M. Elazığ İlinin Tarımsal Potansiyeli Sorunları ve Çözüm Önerileri. Elazığ İl Gıda Tarım ve Hayvancılık Müdürlüğü Yayınları. Elazığ, 2013.

Yıldız AŞ. Ankara İli Damızlık Sığır Yetiştiricileri Birliğine Bağlı Süt Sığırcılığı İşletmelerinde Bazı Endemik Hastalıkların İşletme Düzeyinde Meydana Getirdiği Ekonomik Kayıplar. Doktora Tezi, Ankara: Ankara Üniversitesi, Sağlık Bilimleri Enstitüsü, 2008.

Yıldız N, Aygen S, Özçelik M. Elazığ Koşullarında Yetiştirilen Doğu Anadolu Kırmızısı (DAK) İneklerde Süt, Döl Verimi ve Beden Ölçüleri II. Süt Verim Özellikleri, Beden Ölçüleri, Beden Ağırlığı, Buzağı Doğum Ağırlığı ve Yaşama Gücü. Fırat Üniversitesi Sağlık Bilimleri Dergisi 2008; 22(5): 261-266.

Yılmaz E. Tarım ve Köyişleri Bakanlığı Projeleri Kapsamında Süt Sığırcılığı Yapan Bazı Tarımsal Kalkınma Kooperatiflerindeki Sığırların Verim Özellikleri İle Bu İşletmelerin Yapısal Durumlarının Belirlenmesi. Yüksek Lisans Tezi, Van: Yüzüncü Yıl Üniversitesi, Fen Bilimleri Enstitüsü, 2006.



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**SÜT VERİMİNİ ETKİLEYEN FAKTÖRLERİN (SAĞIM SÜRESİ, CANLI AĞIRLIK,
DIŞ SICAKLIK, İÇ SICAKLIK) YAPAY SİNİR AĞLARI İLE MODELLENMESİ**

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ÖZET

Hayvancılık insanoğlunun en eski faaliyetlerinden biri olup evcil hayvanları yetiştirmek ve bunlardan yarar sağlama amacı ile yapılır. Bilgisayar teknolojisinin gelişmesi ile yapay zekâ alanında yapılan çalışmaların hız kazanmasıyla farklı problemler için birçok çözüm yöntemleri de gelişmiştir. Son yıllarda tarımda yapay zeka uygulamalarında da kullanımı da artmıştır. Yapay zekanın kullanımının artmasında ve daha kullanışlı olmasında ileriye dönük tahminler, sınıflandırma, optimizasyon, ve oluşturulan karar destek sistemlerin etkisi olmuştur. Çalışmamızın hayvan materyalini Pasinler ilçesi sınırları içerisinde bulunan iki adet özel tarım işletmesinde yetiştirilen 2-3 yaş arası 26 adet Siyah alaca ırkı inekler oluşturmıştır. Çalışmamız için günlük olarak tutulan süt verim kayıtları ve bunlara ilişkin süt verimini etkileyen faktörler (sağım süresi, iç sıcaklık, dış sıcaklık ve canlı ağırlık) her gün kaydedilerek Ocak-Mart dönemi 90 gün boyunca elde edilen veriler kullanılmıştır. Çalışmada süt veriminin tahmini için Yapay Sinir Ağları ve Çoklu Doğrusal Regresyon Analizi yapılmış. Her yaklaşımın kendisine ait avantaj ve dezavantajlar gözlenerek benzer çalışmalarda daha uygun olan modelin seçilmesi için bu iki model için karşılaştırmalar yapılmıştır. Yapay Sinir Ağları(YSA) ve Çoklu Doğrusal Regresyon (ÇDR) Analizleri için SPSS programı kullanılmıştır. Çoklu regresyonda belirleme katsayısı (R^2) değeri %95 ile sağım süresi, canlı ağırlık, dış sıcaklık, iç sıcaklık değişkenlerini açıklama gücü yüksek bulunmuştur. Yapay sinir ağlarında elde edilen R^2 %98 değeri çoklu regresyon değerine göre açıklama gücü oldukça yüksek olarak bulunmuştur. Ayrıca çoklu regresyon analizi ile sağım süresi ve iç sıcaklık değişkenlerin seçilen %5 anlamlılık seviyesinde süt verimi üzerinde önemli bir katkısı olduğu tespit edilmiştir($P=0,000<0,05$). Fakat dış sıcaklık bağımsız değişkeni ile ($P=0,391>0,05$) canlı ağırlık bağımsız değişkeni ($P=0,353>0,05$) regresyona önemli bir katkısı olmadığı tespit edilmiştir. Yapay Sinir Ağlarında ise süt verimini en çok sağım süresi (%49,2) sırasıyla iç sıcaklık (%37), dış sıcaklık (%9) ve canlı ağırlık (%4) oranlarında etkilediği sonucuna ulaşılmıştı. İki model arasında yapılan karşılaştırma sonucunda bir yapay sinir ağı modeli, tahmin gücü yüksek bir model olan çoklu doğrusal regresyon analizine göre açıklama gücü daha yüksek ve daha etkili bir tahmin tekniği olabileceği tespit edilmiştir.

Anahtar Kelimeler: YSA, Süt verimi, Çoklu doğrusal regresyon



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**MODELING OF THE FACTORS AFFECTING MILK PRODUCTION IN
LIVESTOCK (MILKING TIME, LIVE WEIGHT, EXTERNAL TEMPERATURE,
INTERNAL TEMPERATURE) WITH ARTIFICIAL NEURAL NETWORKS**

ABSTRACT

Animal husbandry is one of the oldest activities of humankind which is done with the aim of the raising domestic animals and benefiting from them. With the development of computer technology and the acceleration of studies in the field of artificial intelligence, many solution methods have been developed for different problems. In recent years, the use of artificial intelligence in agriculture has also increased. Forward-looking predictions, classification, optimization, and decision support systems have been effective in increasing the use of artificial intelligence and making it more useful. The animal material of our study consisted of 26 Holstein Friesian cows between the ages of 2-3, which were raised in two private agricultural enterprises within the borders of Pasinler district. For our study, daily milk yield records and the factors affecting milk yield (milking time, internal temperature, external temperature and live weight) were recorded every day and the data obtained during the 90 days of January-March period. In the study, Artificial Neural Networks and Multiple Linear Regression Analysis were performed for the estimation of milk yield. By observing the advantages and disadvantages of each approach, comparisons were made for these two models in order to select the more suitable model in similar studies. SPSS program was used for Artificial Neural Networks (ANN) and Multiple Linear Regression (MDR) Analysis. The coefficient of determination (R^2) value of 95% in multiple regression was found to be high in explaining the variables of milking time, live weight, outside temperature and inside temperature. The R^2 value of 98% obtained in artificial neural networks was found to be quite high in explanatory power compared to the multiple regression value. In addition, with multiple regression analysis, it was determined that milking time and internal temperature variables had a significant contribution on milk yield at the selected 5% significance level ($P=0.000<0.05$). However, it was determined that the independent variable of outside temperature ($P=0.391>0.05$) and the independent variable of live weight ($P=0.353>0.05$) did not make a significant contribution to the regression. In Artificial Neural Networks, it was concluded that milk yield was most affected by milking duration (49.2%), internal temperature (37%), external temperature (9%) and body weight (4%), respectively. As a result of the study, it is determined that the artificial neural network model can be more effective estimation technique than multiple linear regression analysis.

Keywords: Artificial Neural Networks, Milk yield, Multiple Linear Regression



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1.GİRİŞ

Bilgisayar teknolojisinin gelişmesi ile yapay zekâ alanında yapılan çalışmaların hız kazanmasıyla farklı problemler için birçok çözüm yöntemleri de gelişmiştir. Son yıllarda tarımsal alanda kullanımı artan yapay zekâ uygulamaları kullanılmaktadır. Yapay zekanın kullanımının artmasında ve daha kullanışlı olmasında ileriye dönük tahminler, sınıflandırma, optimizasyon ve oluşturulan karar destek sistemlerin etkisi olmuştur. Bu özellikler hayvancılık alanında çalışan araştırmacıların ve yetiştiricilere büyük yarar ve kolaylık sağlamıştır. Hayvancılıkta hastalıkların teşhisi, canlı ağırlık, süt verimi tahmininde, seleksiyon, ıslah çalışmalarında, damızlık değer tahmini, kızgınlık teşhisi, ayıklama kararlarının alınmasında ve bunun gibi birçok problemin çözümünde başarı ile uygulanmaktadır (Akıllı ve Atıl, 2014).

Sharma ve ark. (2007), melez süt sığırlarında 305 günlük süt verimini tahmin etmek için çoklu doğrusal regresyon modeli ile yapay sinir ağları kullanılmıştır. Girdi değişkenleri hangi genetik gruba ait oldukları, doğum periyodu, yaş, doğum ağırlığı, doğum mevsimi, buzağılama mevsimi, buzağılama yaşı, buzağılama periyodu, buzağının ağırlığı, pik verimi, pik veriminin kaç günde oluştuğu şeklindedir. Çalışmada elde edilen sonuç regresyon modeline kıyasla yapay sinir ağı modelinin süt verimini tahminlemede %92 daha iyi sonuçlar elde edildiği yönündedir. Takma ve ark. (2012) çalışmalarında Siyah Alaca ineklerinin laktasyon süresi, buzağılama yılı ve servis periyodunun laktasyon süt verimi üzerinde etkisini incelemiştir. Yapay sinir ağları ve çoklu regresyon ile modellemişlerdir. Bu iki modelin uyum yetenekleri karşılaştırıp ve sonuç olarak yapay sinir ağlarının regresyon analizine alternatif bir yöntem olabileceğini belirtmişlerdir.

Hosseinia et al. (2007), yapılan çalışmada ilk laktasyon bilgilerini kullanarak ikinci laktasyon süt ve yağ performanslarını tahmin edilebilmesini sağlayan yapay sinir ağlarını kullanarak model oluşturulmuştur. 305 günlük süt ve yağ verimleri, gün içinde yapılan sağım sayısı, parite, buzağılama mevsimi, buzağılama yaşı, kümülatif 305 günlük süt ve yağ verimleri, ve ne kadar süre kayıt tutulduğu bilgileri girdi değişkeni olarak kullanılmıştır. Ve sonuç olarak yapay sinir ağları yetiştiriciler için kolaylık sağlayacağı ve faydalı olabileceği birçok çalışmada kullanılabileceği sonucuna varılmıştır.

Bayata ve Hattatoğlu (2010), bu çalışmada, yapay sinir ağları ve çok değişkenli istatistiksel analiz(ÇDR) kullanılarak 1974–2007 yılları arasındaki gerçekleşen kaza sayıları ve ceza alan sürücü sayıları verileri ile modelleme yapılmıştır. İki modelinde karşılaştırılması sonucunda YSA'nın ÇDR'ye göre daha yüksek R^2 değeri ve ortalama karesel hatasının(OKH) daha düşük



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olduğu tespit edilmiştir. Sonuçlara göre YSA yöntemi daha kullanışlı ve başarılı bir model olduğu kabul görmüştür.

Yavuz ve Deveci (2012), yapılan çalışmada, yapay sinir ağı modeli kullanılarak Adana ilinin hava sıcaklık değeri tahmini edilmiştir. Bu çalışmada tahmin edilen sonuçlar ile yapay sinir ağlarının gerçek sonuçlarının oldukça birbirine yakın değerler olduğu görülmüştür. Yapay sinir ağı, veriler arasındaki doğrusal olmayan ilişkileri öğrenerek daha önce karşılaşmadığı sorular üzerinden genelleme yaparak sonuca ulaşmayı sağlar. Bu özellikler yapay sinir ağını daha kullanışlı ve tercih edilir bir duruma getirmiştir.

2.MATERYAL

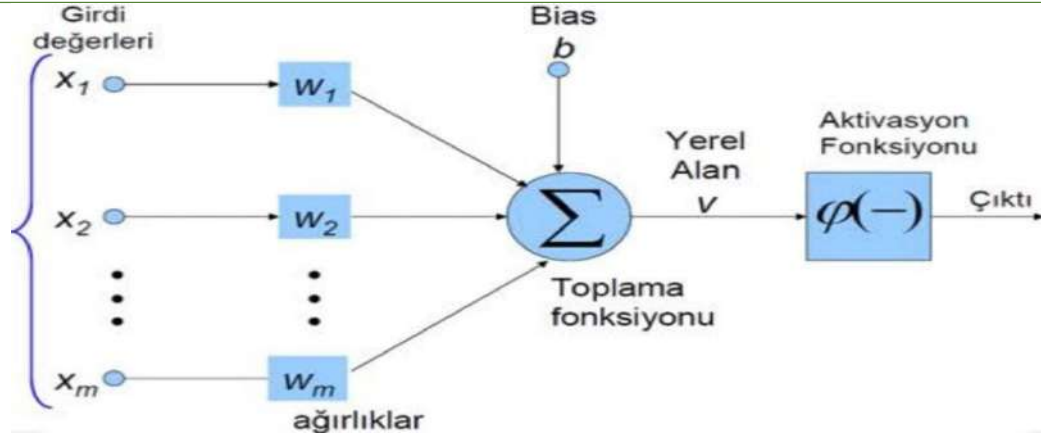
Çalışmamızın hayvan materyalini Pasinler ilçesi sınırları içerisinde bulunan iki adet özel tarım işletmesinde yetiştirilen 2-3 yaş arası 26 adet Siyah alaca ırkı inekler oluşturmıştır. Çalışmamız için günlük olarak tutulan süt verim kayıtları ve bunlara ilişkin süt verimini etkileyen faktörler (sağım süresi, iç sıcaklık, dış sıcaklık ve canlı ağırlık) her gün kaydedilerek Ocak-Mart dönemi 90 gün boyunca elde edilen veriler kullanılmıştır.

Ahırlarda yapılan ölçümlerde ahır içi sıcaklık ölçümü için termometre kullanılmış olup, dış sıcaklık verileri Meteoroloji 12. Bölge Müdürlüğü'nden temin edilmiştir. Sağım verileri sabah ve akşam olmak üzere günde iki kez otomatik sağım sistemi ile elde edilmiştir.

3. METOT

Yapay sinir hücreleri insanda bulunan sinir hücrelerini taklit ederek onlar gibi çalışma prensibi gösterirler. Yapay sinir hücresi beş temel kısımdan oluşur (Hamzaçebi,2009).

- Girdiler
- Ağırlıklar
- Toplama fonksiyonları
- Aktivasyon fonksiyonu
- Çıktı



Şekil 1. Yapay sinir ağının genel yapısı (Keskenler ve Keskenler, 2017)

$$NET = \sum_{i=1}^m X_i \cdot W_i$$

Aktivasyon fonksiyonu hücreye gelen girdi değerlerini işleme görevi görerek çıktı değerlerini üretir. En yaygın olarak kullanılan Çok Katmanlı Algılayıcı modelinde aktivasyon fonksiyonu olarak sigmoid fonksiyonu kullanır. Bu fonksiyon; (Öztemel, 2012).

$$F(NET) = \frac{1}{1 + e^{-NET}}$$

3.2 ÇOKLU LİNEER REGRESYON

Regresyon analizi iki veya daha fazla çok değişken arasındaki ilişkiyi tespit etmek için kullanılan bir metottur. Regresyon analizindeki amaç bağımsız değişkenler ile bağımlı değişkendeki toplam değişmeye olan etkisinin belirlenmesi ve bağımsız değişkenlerin değerinden yola çıkarak bağımlı değişkenin tahmin edilmesini sağlamaktır. Regresyon analizinin matematiksel modelinde bir bağımlı değişken olur. Bir bağımlı değişken ve tek bir bağımsız değişken kullanılıyorsa ‘ basit regresyon’ birden fazla bağımsız değişkende kullanılıyorsa ‘çok değişkenli regresyon analizi’ olarak isimlendirebiliriz (Gökçin,2019).

Çoklu doğrusal regresyon modelinde y bağımlı değişken, β_0, β_1 ve β_2 değişkenin bilinmeyen parametreleri, x_i bağımsız değişkeni, p adet açıklayıcı değişken ve ϵ_i şansa bağlı hata terimlerini gösterir.

$$y_i = \beta_0 + \beta_{1x1} + \beta_{2x2} + \dots + \beta_{pxip} + \epsilon_i \quad i = 1, 2, \dots, n$$

şeklinde yazılabilir (Kutner vd., 2005).



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4.BULGULAR

Tablo 1. Model özeti

Model	R	R ²	Düzeltilmiş R ²	Tahminin standart hatası
1	0.975 ^a	0.950	0.948	40.8993

Tablo 2’de elde edilen sonuçlara göre bağımlı değişken süt verimi ile bağımsız değişkenler arasında çoklu regresyon katsayısı R ile gösterilmiştir ve değeri 0,975’dir. Bu değer bağımlı değişken ile bütün bağımsız değişkenler arasındaki ilişkiyi gösterir. Ve elde edilen sonuç ile ilişkinin yüksek olduğu görülmektedir. Gösterilen R² değeri ile bağımlı değişkendeki değişimin ne kadarının bağımsız değişkenler ile açıklandığını gösterir. Regresyonun açıklama gücü 0,950 bulunmuştur. Elde edilen bu sonuca göre süt veriminin %95’lik kısmı bağımsız değişkenler(dış sıcaklık, sağım süresi, canlı ağırlık ve iç sıcaklık) tarafından açıklanmaktadır.

Tablo 2. Regresyon katsayıları

Model	Standardize edilmemiş katsayılar		Standardize edilmiş katsayılar		t	P
	B	Standart hata	Beta			
Sabit	5313.738	81.392			65.286	0.000**
Dış sıcaklık	1.785	2.070	0.061		0.863	0.391
Sağım süresi	123.134	4.086	0.741		30.137	0.000**
İç sıcaklık	37.470	5.248	0.490		7.140	0.000**
Canlı ağırlık	-0.119	0.127	-0.032		-0.934	0.353

**; P<0,01

Y= Süt verimi

X₁ =dış sıcaklık

X₂ =sağım süresi

X₃ =iç sıcaklık

X₄ =canlı ağırlık

Tablo 5, bağımsız değişkenlerin bağımlı değişken üzerindeki etkisini gösterir. B sütunun da regresyon katsayıları verilmiştir. Bu katsayıları kullanarak süt verimi ile ilgili tahmin edebiliriz. Bunun için öncelikle bu katsayılar ile denklemi kurarız aşağıdaki gibi,

$$Y = 5313,738 + 1,785X_1 + 123,134X_2 + 37,470X_3 - 0,119X_4$$

Elde edilen bu denklem ile dış sıcaklık, sağım süresi ve iç sıcaklık değişkenlerinin süt verimi ile doğru orantılı olduğunu ve bu değişkenlerdeki artışın süt verimini artıracak olduğunu



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göstermektedir. Fakat canlı ağırlık değişkeni süt verimi arasında ters orantılı bir ilişki söz konusudur. Canlı ağırlığındaki artış diğer bağımsız değişkenler sabit tutulduğunda süt verimi üzerinde azalmaya sebep olur.

Diğer tüm bağımsız değişkenler sabit tutulduğunda dış sıcaklıktaki bir birimlik artırma süt veriminde 1,785 g artışa, sağım süresindeki bir birimlik artırma 123,134 g artışa, iç sıcaklıktaki bir birimlik artırma 37,470 g artışa, canlı ağırlıktaki bir birimlik artış süt veriminde 0,119 g azalmaya sebep olmaktadır.

Tablo 5'te gösterilen sağım süresi ve iç sıcaklık değişkenlerin seçilen %5 anlamlılık seviyesinde süt verimi üzerinde önemli bir katkısı bulunmaktadır ($P=0,000<0,05$). Fakat dış sıcaklık bağımsız değişkeni ile ($P=0,391>0,05$) canlı ağırlık bağımsız değişkeni ($P=0,353>0,05$) regresyona önemli bir katkısı bulunmamaktadır.

Tablo 3. İşlem özeti

Örnek eğitim sayısı	70	76.9%
Örnek test sayısı	21	23.1%
Geçerli	91	100.0%
Dışarda kalan	0	
Toplam	91	

Tasarlan YSA modelinde toplam 91 veriden 70 veri örnek eğitim sayısı için kullanıldı. 21 veri de test sayısı için kullanıldı.

Tablo 4. Yapay sinir ağı modeli

Giriş Katmanı	Bağımsız Değişkenler	1. Dış Sıcaklık 2. İç Sıcaklık 3. Sağım Süresi 4. Canlı Ağırlık
Gizli Katman	Gizli Katman Sayısı Gizli Katman İçindeki Bölüm Sayısı Aktivasyon Fonksiyonu	1 5 Hiperbolik Tanjant
Çıkış Katmanı	Bağımlı Değişken Çıkış Katmanı Birim Sayısı Bağımlı Değişkenlerin Yeniden Ölçekleme Metodu Aktivasyon Fonksiyonu Hata fonksiyonu	Süt Verimi 1 Standartlaştırılmış Hiperbolik Tanjant Kareler Toplamı

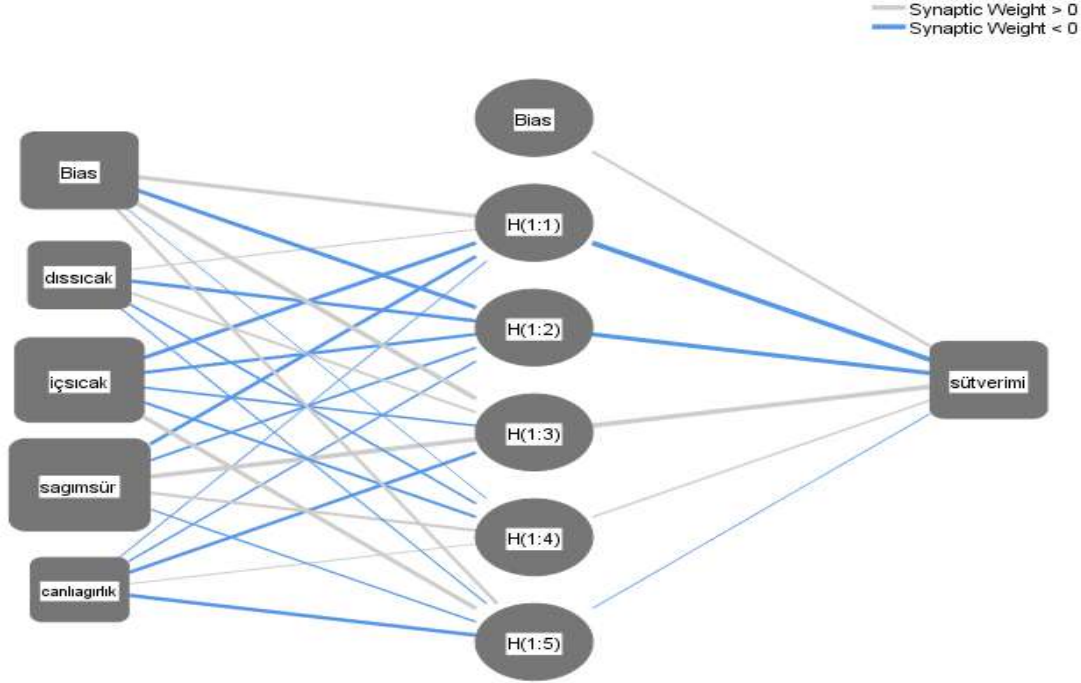
Tasarlanan YSA modelinde giriş katmanında dört adet bağımsız değişken çıkış katmanında bir bağımlı değişken vardır. Oluşturulan modelde bir gizli katmandan ve beş elemanı vardır. YSA



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modeline giriş verileri dış sıcaklık, iç sıcaklık, sağım süresi, canlı ağırlık çıkış verisi olarak süt verimine ait veriler kullanılmıştır.



Şekil 2. Yapay sinir ağı modeline ait katmanlar

Şekil 1’de yapay sinir ağına ait katmanlar gösterilmektedir. Giriş katmanında dış sıcaklık, iç sıcaklık, sağım süresi, canlı ağırlık gösterilmektedir. Oluşturulan modelde bir gizli katman ve beş eleman görülmektedir. Çıkış katmanında ise süt verimi yer alıyor.

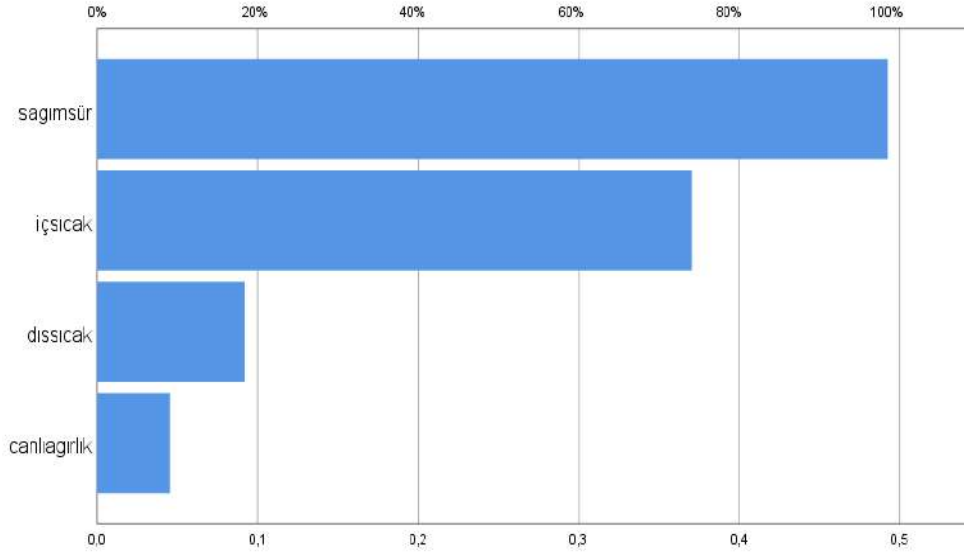
Tablo 5. Bağımsız değişkenlerin sonuca etki dereceleri

Bağımsız değişkenler	Önem derecesi	Normalize edilmiş önem
Dış sıcaklık	0.092	18.7%
İç sıcaklık	0.370	75.2%
Sağım süresi	0.492	100.0%
Canlı ağırlık	0.045	9.2%

Görüldüğü gibi süt verimini en çok sağım süresi (%49,2) daha sonra iç sıcaklık (%37), dış sıcaklık (%9), canlı ağırlık (%4) oranında etkilenmektedir.



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Şekil 3. Bağımsız değişkenlerin süt verimine etki oranları

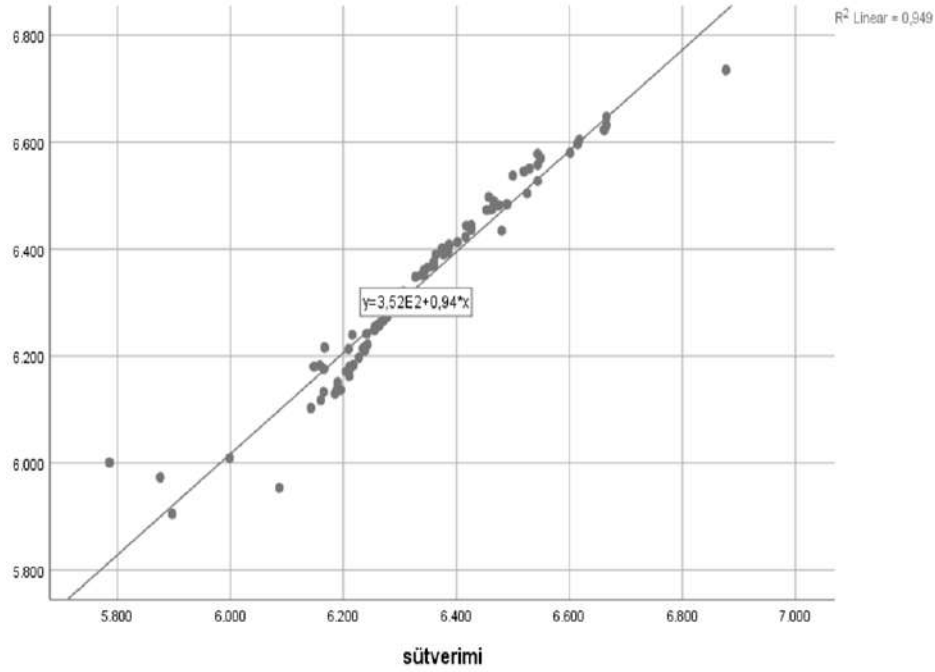
Grafikte de görüldüğü gibi süt verimini en çok sağım süresine göre değişmektedir. Süt verimine en az etkisi olan canlı ağırlıktır.

Haftalar	Ortalama Gerçek Süt Verimi	Ortalama Tahmini Süt Verimi
1.	6309.4	6296.7
2.	6296.6	6283.3
3.	6126.5	6144.7
4.	6101.5	6129
5.	6372.1	6355.9
6.	6297.3	6310.8
7.	6305	6304.1
8.	6350.4	6339.6
9.	6372.2	6355.1
10.	6377.6	6382.4
11.	6494.8	6473.7
12.	6436.2	6431.5
13.	6497	6499.9

Tablo 6'da YSA modelinin ürettiği gerçekleşen değer ile tahmin değerleri karşılaştırılmış.



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Grafik 1. Bağımsız değişkenlerin bağımlı değişken ile ilişkisini gösteren saçılım grafiğı

Gösterilen R^2 değeri ile bağımlı değışkendeki değışimin ne kadarının bağımsız değışkenler ile açıklandığını gösterir. YSA'nın açıklama gücü 0,949 bulunmuştur. Elde edilen bu sonuca göre st veriminin değışimi %94,9 değeri ile dış sıcaklık, sağıım süresi, canlı ağırlık ve iç sıcaklık değışkenlerini açıklama gücü oldukça yüksektir.

5. TARTIŞMA ve SONUÇ

Bu çalışmada st verimini etkileyen faktörler olan canlı ağırlık, dış sıcaklık, iç sıcaklık ve sağıım süresi değışkenlerini çoklu regresyon ve yapay sinir ağırlarını karşılaştırarak incelendi. St veriminin doğru tahmin edilmesi işletmeciler ve yetiştiricilere ekonomik st veriminin sağlanması ve etkileyen faktörlerin tam olarak belirlenerek uygun ortam koşullarının oluşturulmasını sağlar.

Günümüzde oldukça önem kazan ve birçok alanda da başarılı sonuçlar elde edilen çalışmalarla (Toprak, 2017; Tezbaşaran, 2016; Bahadır, 2016; Tekin, 2014; Kasaplı, 2014; Koç, 2012; Çırak, 2012; Lee, 2010; Helhel, 2009) YSA 'nın alternatif olarak kullanılabileceğı ortaya çıkmıştır.

St verimi yüksek çevre sıcaklığında oldukça fazla etkilenir. Sıcaklık stresinde st veriminde azalma ve hayvanların davranışlarında değışiklikler gözlenmiştir. Sıcaklık stresi şiddetli



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olduğunda süt veriminde azalma %25'den fazla olabilir. Orta düzey sıcaklık stresine maruz kalan hayvanlarda da yaklaşık %10 oranında süt veriminde azalma olmaktadır. Ayrıca sıcaklık stresine maruz kalan ineklerde bir sonraki la-laktasyonda % 12 oranında azalma olduğu belirlenmiştir (Yavuz ve Biricik, 2009). Süt sığırlarında ahır sıcaklığı(iç sıcaklık) 0-20°C gibi oldukça geniş sınırlar arasındadır. En uygun çevre sıcaklığı 10 °C olarak tespit edilmiştir(Yağanoğlu,1981).

Miller ve ark.(1976) yapmış oldukları çalışmada toplam sağım süresi ve laktasyon süt verimi arasında 0.50 düzeyinde pozitif genetik korelasyon katsayısı tespit etmişlerdir. Sonuç olarak süt verimindeki artışın sağım süresini yükselteceği tespit edilmiştir. Günlük süt verimi ile sağım süresi arasında yüksek derecede pozitif korelasyonlar olduğu açıklanmıştır (Ovesan,1972).

Hayvancılıkta çoklu regresyon modeli genel olarak sıklıkla kullanılmaktaydı. Yapay sinir ağlarının da alternatif olabileceği sonuçlarına ulaşılmıştır. Çoklu regresyonda R^2 değeri%95,0 ile sağım süresi, canlı ağırlık, dış sıcaklık, iç sıcaklık değişkenlerini açıklama gücü yüksek bulunmuştur. Yapay sinir ağlarında elde edilen R^2 %94,9 değeri çoklu regresyon değerine oldukça yakındır. Ayrıca çoklu regresyon analizi ile sağım süresi ve iç sıcaklık değişkenlerin seçilen %5 anlamlılık seviyesinde süt verimi üzerinde önemli bir katkısı bulunmuştur ($P=0,000<0,05$). Fakat dış sıcaklık bağımsız değişkeni ile ($P=0,391>0,05$) canlı ağırlık bağımsız değişkeni ($P=0,353>0,05$) regresyona önemli bir katkısı bulunmamıştır. Yapay Sinir Ağlarında ise süt verimini en çok sağım süresi (%49,2) daha sonra iç sıcaklık (%37,0) dış sıcaklık (%9,2), canlı ağırlık (%4,5) oranında etkilediği sonucuna ulaşılmıştır.

Bu sonuçlarda gösteriyor ki yapay sinir ağları alternatif olarak kullanılabilir ve hayvancılık alanında araştırmacılara, yetiştiricilere ve işletmelere yarar sağlayarak ve güvenilir olarak çalışmalara ışık tutabileceği ortaya konulmuştur.

İki model arasında yapılan karşılaştırma sonucunda yapay sinir ağı modeli çoklu doğrusal regresyon modeli ile oldukça yakın sonuçlar vermiş olup, özellikle açıklama gücü yüksek ve çoklu bağlantının olduğu modellerde kullanılması avantaj sağlamaktadır.



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KAYNAKLAR

- Akıllı, A. ve Atıl, H., 2014. Süt Sığırcılığında Yapay Zeka Teknolojisi: Bulanık Mantık ve Yapay Sinir Ağları. Hayvansal Üretim, 55(1), 39.
- Bahadır, E., 2016. Using neural network and logistic regression analysis to predict prospective mathematics teachers' academic success upon entering graduate education. Educational Sciences, (16), 943-964.
- Bayata, H. F. ve Hattatoğlu, F., 2010. Yapay sinir ağları ve çok değişkenli istatistik yöntemlerle trafik kaza modellemesi. Fen Bilimleri Enstitüsü Dergisi, 3(2), 207-219.
- Çırak, G., 2012. Yükseköğretimde Öğrenci Başarılarının Sınıflandırılmasında Yapay Sinir Ağları ve Lojistik Regresyon Yöntemlerinin Kullanılması. Yüksek Lisans Tezi, Eğitim Bilimleri Enstitüsü, Ankara.
- Gökçin, G. M., 2019. Çimento ve Taş Kömürü Örnek Sektörlerinde Stok Miktarı Tahmini İçin Sınıflama Tipi Modeller İle Çoklu Regresyon Modellerinin Karşılaştırılması. Doktora Tezi, Sosyal Bilimler Enstitüsü, Ankara.
- Hamzaçebi, C., 2009. Yapay Sinir Ağları: Tahmin Amaçlı Kullanımı Matlab ve Neurosolutions Uygulamalı. Ekin Yayınevi, No:1-105 s, Bursa.
- Helhel, Y., 2009. Makroekonomik Değişkenler Ve Döviz Kuru İlişkisi: Yapay Sinir Ağı Ve Yaklaşımları İle Öngörü Modellemesi. Doktora Tezi, Sosyal Bilimler Enstitüsü, Isparta.
- Hosseinia, P. Edrisi, M. Edriss, M. A. and Nilforooshan, M. A., 2007. Prediction of second parity milk yield and fat percentage of dairy cows based on first parity information using neural networks system. J. Appl. Sci., (7) 3274-3279.
- Kasaplı, K., 2014. İçme Suyu Şebekelerinde Maliyet Tahmini Amacıyla Yapay Sinir Ağları Kullanımı. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, İstanbul.
- Keskenler, M. F. ve Keskenler, E. F., 2017. Geçmişten günümüze yapay sinir ağları ve tarihçesi. Takvim_i Vekayi, 5(2), 10.
- Koç, G., 2012. Tünel Sistemlerinde Araç Kaynaklı Hava Hızlarının Yapay Sinir Ağları Kullanılarak Modellenmesi. Doktora Tezi, Fen Bilimleri Enstitüsü, Ankara.
- Kutner, M. H. Nachtsheim, C. J. Neter, J. and Li, W., 2005. Applied Linear Statistical Models. McGraw-Hill Irwin Companies Inc., Brent Gordon, (Newyork), 21-260.
- Lee, Y.J., 2010. Neurel network based approach for predicting learning effect in desing students. International Journal of Organizational Innovation, (1), 250-270.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
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Miller, R. H. Pearson, R. E. Wienland, B. T. and Fulton, L. A., 1976. Genetic parameters of several measures of milk flow rate and milking time. J. Dairy. Sci., 59 (5), 957-964.

Ovesan, E., 1972. Milking ability in relation to size and shape of teats. Anim. Prod., (15), 251-257

Öztemel, E., 2012. Yapay Sinir Ağları. Papatya Yayıncılık, No: 25-49 s, İstanbul.

Sharma, A. K. Sharma, R. K. and Kasana, H. S., 2007. Prediction of first lactation 305-day milk yield in Karan Fries dairy cattle using ANN modeling. Applied Soft Computing, (7), 1112-1120.

Takma, Çiğdem, Atıl, Hülya ve Aksakal, Vecihi (2012). Çoklu Doğrusal Regresyon ve Yapay Sinir Ağı Modellerinin Laktasyon Süt Verimlerine Uyum Yeteneklerinin Karşılaştırılması, Kafkas Üniversitesi Veterinerlik Fakültesi Dergisi, 18 (6): 941-944

Tekin, A., 2014. Early prediction of students' grade point averages at graduation: A data mining approach. Eurasian Journal of Educational Research, (54), 207-226.

Tezbaşaran, E., 2016. Temel Bileşenler Analizi Ve Yapay Sinir Ağı Modellerinin Ölçek Geliştirme Sürecinde Kullanılabilirliğinin İncelenmesi. Doktora tezi, Eğitim Bilimleri Enstitüsü, Mersin.

Toprak, E., 2017. Yapay Sinir Ağı, Karar Ağaçları Ve Ayırma Analizi İle PISA 2012 Matematik Başarılarının Sınıflandırma Performanslarının Karşılaştırılması. Doktora tezi, Eğitim Bilimleri Enstitüsü, Ankara.

Yağanoğlu, A.V., 1981. Atatürk Üniversitesi Ziraat Fakültesi İşletmesindeki Süt Sığırcı Barınağının Sorunları ve Geliştirilme Olanakları Üzerine Bir Araştırma. Doktora Tezi, Fen Bilimleri Enstitüsü, Erzurum

Yavuz, H.M. ve Biricik, H., 2009. Süt sığırlarının sıcak stresinde beslenmesi. Uludağ Univ. J.Fac. Vet. Med. (28), 1-7.

Yavuz, S. ve Deveci, M., 2012. İstatiksel normalizasyon tekniklerinin yapay sinir ağı performansına etkisi. Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, (40), 167-168.



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**PHYSIOLOGICAL RESPONSES OF PEPPER CULTIVARS TO COLD STRESS AT
SEEDLING TRANSPLANTATION STAGE**

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ABSTRACT

Cold stress is one of the most important stress factors in pepper cultivation after transplanting in continental and subtropical regions. Generally, low temperature adversely affects seedling growth and even results in death. In the study, the responses of some pepper (*Capsicum annuum* L.) cultivars to cold stress were determined during the seedling transplantation stage. The seedlings of eight pepper cultivars (Acı Kıl, Acı Sivri, Çarliston, Demre, Dolma, Jalapeno, Tatlı Kıl, and Tatlı Sivri) were grown for 6 weeks and hardened at 10 °C for 2 days before cold treatment. After then, they were exposed to the cold temperature of -2 °C for 2 hours. Chlorophyll content (SPAD), leaf dry matter, relative water content (RWC), relative injury (RI), and cell membrane stability (CMS) were investigated in the seedlings from control and cold treatment. Compared to control plants, the cultivars with the minimum changes in the investigated traits due to cold treatment were considered cold-tolerant. The results showed that pepper cultivars gave different responses to cold stress. Cold stress caused increased chlorophyll content and CMS, while RWC was decreased. Leaf dry matter of pepper cultivars was changed and the dry matter of Dolma, Acı Kıl, and Demre was enhanced after cold treatment. These cultivars also gave higher relative injury and relative water content, but lower CMS and chlorophyll content were identified. Acı Kıl and Demre possessed the highest relative injury after cold treatment. It was concluded that the cold sensitivity in pepper resulted from genotypic factors and the cold-tolerant cultivars should be preferred in the regions with low-temperature risk after transplantation.

Keywords: *Capsicum annuum* L., cultivar, membrane stability, ion leakage, low temperature



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INTRODUCTION

One of the most cultivated vegetables in Turkey is pepper (*Capsicum annuum* L.). In 2020, it has been cultivated on an area of 77.786 hectares with a fresh fruit production of 2.606.905 tons (Anonymous, 2021). It is grown in greenhouses, outdoor fields, and net houses, and is widely consumed as a fresh, spice, and dried by humans. It is an excellent source of vitamin A, B (B₁, B₂, and B₃), C, E, and P (Citrin) besides capsaicin (Bosland and Votava, 2000). Capsaicin, the main constituent causing hotness, helps in digestion; prevents heart diseases, and dilates blood vessels (Amjad et al., 2007).

Pepper is a warm-season vegetable crop and needs the same growing conditions as tomato and eggplant. Although it can be sown directly in the field, young seedling transplantation is generally preferred by producers (Bosland and Votava, 2000). Its seeds germinate at an optimum soil temperature of 30°C (O'Sullivan and Bouw, 1984). Low-temperature stress at sowing can result in poor germination, emergence, erratic stand establishment, and plant growth and development, ultimately this results in reduced early and total marketable yields (Stoffella et al., 1988; Korkmaz and Korkmaz, 2009). Also, it causes damaged seedlings and reduced fruit set and yield or even may kill the transplants (Javanmardi et al., 2013; Rajametov et al., 2020). The pepper plants are highly susceptible to low temperatures and grow poorly in temperatures below 12°C (Wien, 1997). Even the optimum temperature for pepper growth is higher than that for tomato. For this reason, firstly young seedlings or transplants are grown under greenhouse, and then they are transplanted to the field. For example, Central Anatolian region with the temperate climate of Turkey, low temperatures during early spring and autumn limit vegetation periods of pepper under outdoor field conditions. Adverse effects of low temperature have been reported by several researchers. Namely, chlorophyll content in pepper was reduced by cold treatment (Rajametov et al., 2020). King et al. (1982) and Javanmardi et al. (2013) found a higher electrolyte leakage in tomato and pepper seedlings after chilling. However, the beneficial effects of exogenous application of 5-aminolevulinic acid for enhancing chilling tolerance of pepper seedlings were demonstrated by Korkmaz et al. (2010). Determination of cold-tolerant pepper cultivars has gained importance for successful pepper production in outdoor field conditions. The study was aimed to screen genotypic variations among pepper cultivars with different fruit types for tolerance to low temperature in terms of some physiological traits.



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MATERIALS AND METHODS

The study was conducted with eight pepper cultivars (Acı K11, Acı Sivri, Çarliston, Demre, Dolma, Jalapeno, Tatlı K11, and Tatlı Sivri) with different fruit types. The seeds of pepper cultivars were planted to the vials filled with peat:perlite:vermiculite (4:1:1) mixture. Plants were grown in a growth chamber with day and night temperatures of approximately 24°C and 18°C, respectively, and relative humidity in the range of 60 to 70%. After 21 days of sowing, seedlings were transferred to plastic pots containing a mixture of peat: perlite of 2:1 ratio. When the plants were 42 days old, they were put in a growth chamber set at 10 °C for 2 days for hardening. After the seedlings were firstly chilled at 5°C for 6 hours, and then cold treatment was performed at -2°C for 2 hours. No lighting and moisture were provided during the cold treatment.

Relative water content (RWC) was determined by using five fresh leaves from each replication were directly weighed to determine fresh weight (FW), and then immersed in falcon tubes filled with 50 mL distilled water for 24 h. The leaves were placed into the tubes after they were slightly rolled. After the incubation period, the leaves were gently surface dried with paper towels to drain excess water and weighed to determine the turgid weight (TW). They were then dried in an oven at 80°C for 24 h to identify dry weight (DW) (Korkmaz et al., 2010).

$$\text{RWC} = [(\text{FW}-\text{DW}) / (\text{TW}-\text{DW})] \times 100.$$

Five fully expanded young leaves (3rd leaf) were chosen from each replicate from the genotypes. The leaves were immediately washed for 5 minutes with deionized water to remove solutes from leaf surfaces. Ten disc segments (1 cm diameter) obtained from these leaves were directly placed into glass test tubes filled with distilled water. The tubes were incubated at 10°C for 24 h and then allowed to cool in room conditions before measuring the electrical conductivity (EC₁) of the contents. Afterwards, the tubes were autoclaved at 121°C for 20 min to determine the electrical conductivity of the dead leaves (EC₂). Ion leakage was measured with a conductivity meter (WTW 3.15i, Germany). The cell membrane stability (CMS) was determined according to the formula;

$$\text{CMS (\%)} = [1 - (\text{EC}_1/\text{EC}_2)] \times 100$$

$$\text{RI (\%)} = [(\text{ILs} - \text{ILc}) / (100 - \text{ILc})] \times 100$$

where ILs and ILc are the percentage ion leakage for the cold stress and control sample, respectively (Gulen and Eris, 2003).



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Chlorophyll content was measured using a SPAD meter (Konica-Minolta SPAD 502Plus, Japan) and evaluated as SPAD value, which is the index value displayed by Konica Minolta Chlorophyll meters, with highly correlated with chlorophyll density (Süß et al., 2015). SPAD values were recorded using the same leaves from the same plants before sampling. Five plants were used in each replicate, a total of twenty measurements was performed for each treatment. The experiment was established at two factors factorial in a completely randomized design (CRD) with four replicates. ANOVA was performed with the MSTAT-C program (Michigan State University v. 2.10). The differences between the means were compared using LSD ($P < 0.05$).

RESULTS AND DISCUSSION

The mean values and analysis of variance of dry matter, relative water content, chlorophyll content, and cell membrane stability of the seedlings of pepper cultivars exposed to cold temperature were shown in Table 1. A 2-way interaction was found significant for relative water content, chlorophyll content, and cell membrane stability. Cold temperature caused increased cell membrane stability while dry matter, relative water content, and chlorophyll content were higher in seedlings in control. Higher dry matter and lower relative water content were obtained from Çarliston and Demre. Mean chlorophyll content was the highest in Tatlı Kıl. However, they were changed by cold treatment and pepper cultivars gave different responses.

Table 1. Mean values and analysis of variance of the investigated traits of pepper cultivars under control and cold stress.

Factors	Dry matter (%)	Relative water content (%)	Chlorophyll content (SPAD)	Cell membrane stability
<i>Cold treatment</i>				
Control	19.2 ^a	91.7 ^a	50.2 ^a	10.86 ^{b†}
Cold	18.5 ^b	87.5 ^b	49.2 ^b	13.37 ^a
<i>Cultivars</i>				
Acı Kıl	16.2 ^e	92.4 ^a	49.6 ^{bc}	10.56 ^d
Acı Sivri	19.6 ^c	86.4 ^{cd}	50.9 ^b	12.72 ^b
Çarliston	22.1 ^a	87.9 ^{bc}	42.8 ^c	12.86 ^b
Demre	22.1 ^a	86.1 ^d	49.0 ^c	12.15 ^{bc}
Dolma	14.1 ^f	93.3 ^a	49.1 ^c	10.05 ^d
Jalapeno	20.6 ^b	92.5 ^a	46.6 ^d	16.80 ^a
Tatlı Kıl	18.3 ^d	89.4 ^b	58.8 ^a	11.47 ^c
Tatlı Sivri	18.2 ^d	88.6 ^b	51.0 ^b	10.32 ^d
<i>Analysis of variance</i>				
Cold	*	**	*	**
Cultivar	**	**	**	**
Cold×Cultivar	ns	**	**	**

†: Levels not connected by the same letter are significantly different. *, ** significant at 5% and 1% respectively. ns: nonsignificant.



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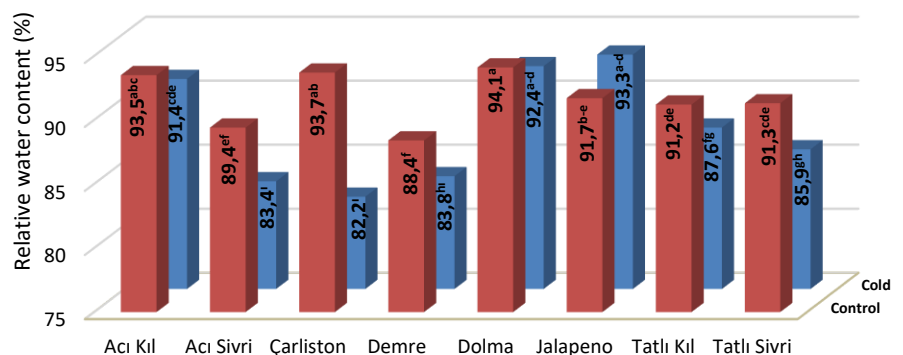


In control plants, relative water content was changed by pepper cultivars and the highest value was observed in Dolma (94.1%), Çarliston (93.7%), and Acı K11 (93.5%). After cold treatment, it was markedly decreased depending on cultivars except for Jalapeno (Figure 1a). The highest decrease was occurred in Çarliston and followed by Acı Sivri and Tatlı Sivri. Only one pepper cultivar, which was Jalapeno, increased relative water content under cold stress. Similarly, our results were confirmed by Javanmardi et al. (2013) who found that leaf relative water content was reduced by chilling stress in tomato and pepper seedlings and the amount of decrease was promoted with extended low-temperature duration.

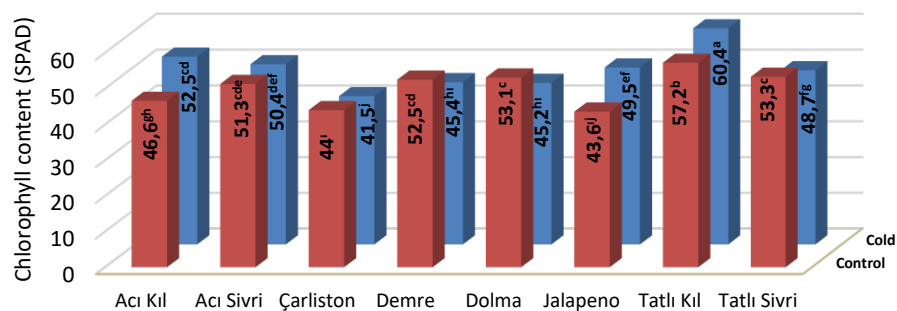
The responses of pepper cultivars to cold stress were different for chlorophyll content. It was increased in cultivars Acı K11, Jalapeno and Tatlı K11 under cold temperature while the other cultivars' chlorophyll content decreased (Figure 1b). Tatlı K11 possessed the highest chlorophyll content with 60.4 SPAD after cold stress. Our results are in agreement with the findings of Rajametov et al. (2020) in pepper and Javanmardi et al. (2013) in tomato and pepper, who found a negative relationship between chlorophyll content and cold treatment but the relationship was depending on the seedling growth stage and pepper genotype.



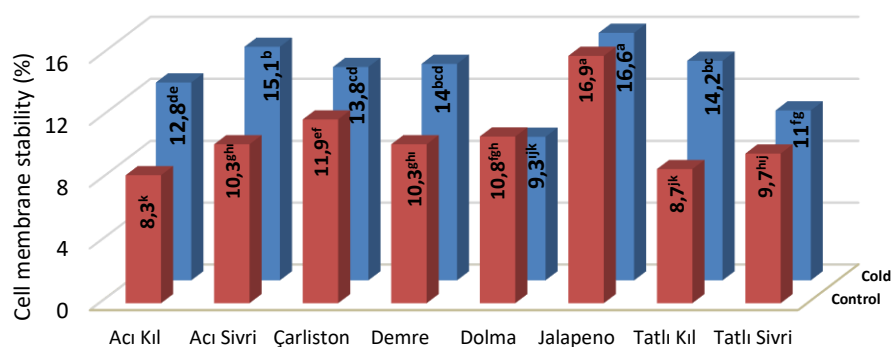
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a



b



c

Figure 1. Relative water content (a), chlorophyll content (b), and cell membrane stability (c) of 6-week old seedlings of pepper cultivars before and after cold treatment.

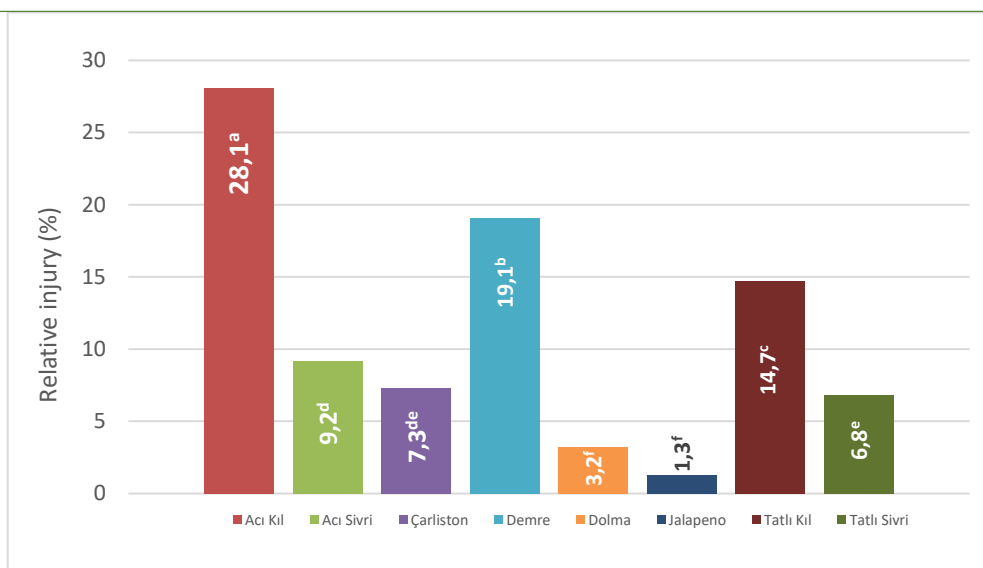


Figure 2. Relative injury of 6-week old seedlings of pepper cultivars before and after cold treatment. Mean values on each column followed by the same letters are not significant.

Generally, cell membrane stability was improved in the seedlings subjected to cold stress except for Dolma, while Jalapeno produced similar values before and after cold treatment (Figure 1c). Also, the highest cell membrane stability was obtained in Jalapeno. The differences between control and cold stress for cell membrane stability were the highest in Tatlı Kıl, followed by Acı Sivri and Acı Kıl. Similar results were observed by King et al. (1982) and they indicated that chilling stress increased electrolyte leakage in tomato when it was applied in the morning or evening. Also, Javanmardi et al. (2013) found that electrolyte leakage in pepper seedlings was increased when the duration of low temperature was extended.

Relative injury is a comparison of ion leakage from leaf tissues of control and stressed plants and is a valuable indicator of the level of leaf tissue damage in pepper seedlings resulting from several stress conditions. Pepper cultivars gave significantly different relative injury and three cultivars had higher values than the others as seen in Figure 2. The highest relative injury was calculated in Acı Kıl with 28.1% and it was followed by Demre (19.1%) and Tatlı Kıl (14.7%), respectively. Jalapeno and Dolma reached the minimum relative injury and they were found the least affected cultivars from cold stress.

CONCLUSION

There were significant differences among pepper cultivars for cold stress; therefore, the selection of suitable cold-tolerant pepper cultivars enhances seedling set, stand establishment,



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and provides optimum plant population. In this study, all the seedlings of pepper cultivars survived after low-temperature stress. Ac1 K1l, Demre, and Tatlı K1l were the most affected pepper cultivars and they were classified as cold-sensitive. However, Jalapeno, Dolma, and Tatlı Sivri were the least influenced pepper cultivars from cold stress and they were considered as cold-tolerant cultivars. No clear relationship between fruit type and cold tolerance was observed. It was concluded that cold-tolerant pepper cultivars regardless of fruit type should be selected for successful pepper production in frost-prone areas especially at transplanting time.

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REFERENCES

- Amjad, M., K.Z.Q. Iqbal, I. Ahmad, M.A. Riaz, Z.A. Saqib, 2007. Effect of seed priming on seed vigour and salt tolerance in hot pepper. *Pak. J. Agri. Sci.*, 44(3):408-416.
- Anonymous, 2021. Turkish Statistical Institute. <https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr> accessed: 12.12.2021
- Bosland, P.W., E.J. Votava, 2000. Peppers: Vegetable and Spice Capsicums. CABI Publishing New York, NY, pp. 97-134.
- Gulen, H., A. Eris, 2003. Some physiological changes in strawberry (*Fragaria × ananassa* 'Camarosa') plants under heat stress. *J. Hortic. Sci. Biotech.*, 76:894-898. <https://doi.org/10.1080/14620316.2003.11511715>
- Javanmardi, J., M. Rahemi, M. Nasirzadeh, 2013. Physiological and reproductive responses of tomato and pepper transplants to low-temperature conditioning. *International Journal of Vegetable Science*, 19:294-310.
- King, A.I., M.S. Reid, B.D. Patterson, 1982. Diurnal changes in the chilling sensitivity of seedling. *Plant Physiology*, 70:211-224.
- Korkmaz, A., Y. Korkmaz, 2009. Promotion by 5-aminolevulinic acid of pepper seed germination and seedling emergence under low-temperature stress. *Scientia Horticulturae*, 119(2):98-102.
- Korkmaz, A., Y. Korkmaz, A.R. Demirkıran, 2010. Enhancing chilling stress tolerance of pepper seedlings by exogenous application of 5-aminolevulinic acid. *Environmental and Experimental Botany*, 67:495-501.
- O'Sullivan, J., W.J. Bouw, 1984. Pepper seed treatment for low-temperature germination. *Can. J. Plant Sci.*, 64:387-393.
- Rajametov, S., E.Y. Yang, M.C. Cho, S.Y. Chae, H.B. Jeong, 2020. Screening of pepper (*Capsicum* L.) seedling tolerance to low temperature. *Agrarian Scientific Journal*, 78-82. [10.28983/asj.y2020i11](https://doi.org/10.28983/asj.y2020i11)
- Stoffella, P.J., A. Pardossi, F. Tognoni, 1988. Temperature and seed treatment effects on taproot growth of young bell peppers. *Adv. Hort. Sci.*, 2: 8-10.



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Süß, A., M. Danner, C. Obster, M. Locherer, T. Hank, K. Richter, 2015. Measuring leaf chlorophyll content with the Konica Minolta SPAD-502Plus-theory, measurement, problems, interpretation. EnMAP Field Guides Technical Report, GFZ Data Services. <https://doi.org/10.2312/enmap.2015.010>

Wien, H.C., 1997. Peppers. In: Wien, H.C. (Ed.), The Physiology of Vegetable Crops. CABI Publishing, New York, NY, pp. 259-293.



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A MINOR FEED LEGUME CROP: YELLOW LUPINE (*Lupinus luteus* L.)

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ABSTRACT

Legume crop yellow lupine varieties has seeds with high protein content up to 61%. The seeds also contain oleic acid and linoleic acid. It is cultivated in Australia, Europe (Poland and Mediterranean countries) and South American countries. Main disadvantages of the yellow lupin are pod shattering, hard seed coat, high alkaloid content, sensitivity to some abiotic stresses (extreme temperatures, drought, salinity and alkalinity) and sensitivity to sap-sucking insects such as aphids. But wide seed collections capturing species-wide diversity exist and significant breeding progress are on the way following the release of its genetic map. Here in this review, new informations related to yellow lupin are extracted from discrete study subjects from international publications to inform researchers on this valuable legume species.

Keywords: Forage crop, legume, Yellow Lupine, *Lupinus luteus* L., protein



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INTRODUCTION

Yellow lupine (*Lupinus luteus* L.), as a member of Fabaceae L. family, has a practical importance. Due to high level of storage protein content of the seeds, it is used as feedstock for the production of high-protein animal feed (Glazinska et al., 2017). Yellow lupin is a minor crop grown in several temperate countries (Parra-Gonzalez et al., 2012). It is cultivated in Poland, Australia and Mediterranean countries (Wilmowicz et al., 2016). *L. luteus* fits well to sustainable agriculture with its high seed protein content but requires genetic improvement to fulfil its potential (Lichtin et al., 2020). A protein-rich novel nongenetically modified lupin variety named AluProt-CGNA® have a great protein content in dehulled seeds (61 g protein/100 g, DM), which is higher than soybean and other lupin varieties (Burgos-Diaz et al., 2016). Lupine seeds are interesting, non-genetically modified, low cost, alternative to soybean as a source of protein and oil. Ferchichi et al., (2021) compared seed contents of three wild species of lupine (*Lupinus albus*, *Lupinus luteus*, and *Lupinus angustifolius*). *L. albus* seeds were the highest protein and oleic acid and lowest starch containing species. Large differences were found between *L. luteus* ecotypes for oleic acid and linoleic acid content, ranging from 165.0-303.0 mg/kg DM and from 306.0-617.0 mg/kg DM, respectively. Little amount of miristoleic acid, lignoceric acid, and margaric acid were found in lupine seeds for the first time. After overcoming the main disadvantages of the yellow lupin (pod shattering, hard seed coat and high alkaloid content), a significant breeding progress was achieved in a short period. Further genetic improvement of cultivars of this species is justified by its importance in crop rotation, high protein content of seeds (about 45%) and ability to grow on poor soils (Swiecicki et al., 2000). Yellow lupin is an annual legume crop productive in highly infertile and acidic soils. Yellow lupin belongs to the 'Old World' group of lupin species and is closely related to narrow-leafed lupin. Yellow lupin shares similar climatic adaptation to narrow-leafed lupin over which it offers some additional advantages such as greater water-logging tolerance and disease resistance. Despite its promise, yellow lupin is grown only as a niche crop in Australia, Europe and South America, and has attracted very limited breeding attention (Iqbal et al., 2020a).



Fig. 1. *Lupinus luteus* L. (Anonymus, 2020)

Bartkiene et al., (2016) evaluated the chemical composition, nutritional value, fatty acid composition and elements in seeds of the yellow lupine (*Lupinus luteus* L.) variety ‘Vilciai’, the narrow-leaved lupine (*Lupinus angustifolius* L.) variety ‘Vilniai’ and the six new hybrid lines (Nos. 1700, 1701, 1703, 1072, 1734 and 1800) bred from the narrow-leaved lupine (*L. angustifolius*) in Lithuania. Oleic and linoleic unsaturated fatty acids were the dominant fatty acids in lupine seeds, which accounted for on average 33.2% and 38.4% of the total fatty acids, respectively. The highest protein content, was determined in ‘Vilciai’ (*Lupinus luteus*) seeds (40.8%) and for the tested hybrid lines it was by 20.1–25.7% lower. Alkaloid content of the seeds of ‘Vilciai’ and ‘Vilniai’ were 0.021% and 0.030%, respectively. While for the new hybrid lines of *L. angustifolius*, alkaloid content was less and varied between 0.011% to 0.012%. Analysis revealed that new hybrid lines were highest in Na content (from 1.07 to 1.19 mg/g DM, respectively). Highest content of Mg and K was in ‘Vilciai’ variety seeds (3.44 and 13.9 mg/g DM, respectively). Highest contents of Mn, Fe, Zn and Se were determined in ‘Vilciai’ seeds (147.6, 73.5, 59.8 and 0.13 µg/g DM, respectively). The concentration of nonessential elements in the tested lupine seeds was far below the levels that cause a health risk.



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Mature seeds of yellow lupine contains sucrose and raffinose type oligosaccharides and galactosyl cyclitols as main soluble carbohydrates (Zalewski et al., 2010). Thambiraj et al., (2018) was extracted seed polysaccharides of yellow lupin and determined a range of biological activities such as significant antioxidant, immunostimulatory and prebiotic activities and indicated their great potential as nutraceutical and functional agents.

Maknickiene et al., (2013) tested lupine varieties for alkaloids in Lithuania and they compared yellow lupine (*Lupinus luteus* L.) and narrow-leaved lupine (*Lupinus angustifolius* L.) varieties. In all phenological stages, in the stems of yellow lupine, alkaloid levels were lower than in the narrow-leaved lupine. At flowering stage, average alkaloid level in the leaves was lower than the stems. Highest average alkaloid levels were determined in the pods (0.114 ± 0.007) and flowers (0.114 ± 0.006) of narrow-leaved lupines, and the lowest level in the seeds (0.022 ± 0.003) of yellow lupines.

Borek et al., (2009) conducted a study on the dynamics of lipid accumulation in developing seeds of three lupine species. Lupine seeds were found different for lipid content. Yellow lupine seeds were containing about 6%, white lupine (*Lupinus albus* L.) were containing 7–14%, and Andean lupine (*Lupinus mutabilis* Sweet) were containing about 20% of lipids by DM.

Feeding studies

Kaczmarek et al., (2016) were characterized 11 yellow lupine batches. All batches contained low alkaloid. These were evaluated in two broiler bioassays and determined that energy utilization was negatively correlated with raffinose content in lupine cultivars.

Inclusion of up to 20% yellow lupin seeds into diet did not decrease laying rate and egg weight in the study of Rutkowski et al., (2017). In line with the increasing lupin content in diets the egg quality was deteriorated (except for yolk pigmentation).

Serrano et al., (2011) indicated in their study that the lupinine possesses a strong anti-palatability effect, but does not appear to pose short-term health risks for rainbow trout (*Oncorhynchus mykiss*).

Yellow lupine up to 240 g/kg of a diet was effective as soybean meal substitute for turkeys in the study of Zdunczyk et al., (2016). Dietary yellow lupine led to desirable changes in intestinal microbiota composition. Dietary yellow lupine benefits cecal fermentation processes. Raw yellow lupine seed meal was found a safe and effective dietary substitute for soybean meal in starter diets for young turkeys as a result of the study.



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Genetics and Breeding

Major constraints to the wider cropping of yellow lupin include lack of diversity in the domesticated gene pool and a historic focus on adaptation to a limited range of environments. Existing varieties are also sensitive to some abiotic stresses (extreme temperatures, drought, salinity and alkalinity) and sensitive to sap-sucking insects such as aphids. Availability of genetic resources for yellow lupin are good and include extensive seed collections capturing species-wide diversity and three recombinant inbred line populations. Yellow lupin is behind its well-resourced sister species (narrow-leaved lupin) in terms of genomic resources but is now in progress. Transcriptomic datasets was used to generate molecular markers to investigate the reasons of flower and pod abortion in the species. First genetic map for yellow lupin was released and used to investigate phenology, domestication traits and productivity under water-limiting conditions. Transgenesis methods were developed for yellow lupin for genome editing activities in future. Efforts are underway to develop a high-quality reference genome sequence for yellow lupin (Iqbal et al., 2020a).

Transgenic yellow lupin plants were generated by meristem co-cultivation with *Agrobacterium tumefaciens* (Li et al., 2000).

Excessive flower and pod abscission is an economic drawback as proper seed formation is required for the productivity of the species. Generative organ detachment takes place at the basis of the pedicels and during plant growth, these cells respond to specific signals that trigger separation and lead to the abolition of cell wall adhesion. Little is known about the molecular network controlling the yellow lupine organ abscission (Glazinska et al., 2017).

Lupin alkaloids are known to be responsible for resistance to herbivorous insects, but total seed alkaloid level must remain under 0.02% for animal and human consumption. A key goal for breeding for aphid resistance of cultivated lupins is to manipulate the levels and distributions of alkaloids (Adhikari et al., 2012).

The transformation of wild plants into domesticated crops usually modifies a common set of characters referred to as ‘domestication syndrome’ traits such as the loss of pod shattering, seed dehiscence, loss of seed dormancy, reduced anti-nutritional compounds and changes in growth habit, phenology, flower and seed color. Understanding the genetic control of domestication syndrome traits facilitates the efficient transfer of useful traits from wild progenitors into crops through crossing and selection. Domesticated forms of yellow lupin possess many domestication syndrome traits, while their genetic control remains a mystery. Vernalisation



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responsiveness, alkaloid content, flower and seed colour in yellow lupin were each found key domestication traits (Iqbal et al., 2020b).

Agronomy

Yellow lupin may have potential as a new legume crop for coarse-textured, acidic, waterlogged areas in Western Australia (Davies et al., 2000). Almost the entire lupin industry of Western Australia is based on the single species *Lupinus angustifolius* L. (narrow-leaved lupin), which is very well adapted to coarse-textured, mildly acid soils. However, *L. angustifolius* is not well suited to the strongly acid sand plain soils along the low rainfall fringe of Western Australian agricultural areas, and alternative grain legume species may be preferable. These soils have very low nutrient contents, often high levels of extractable Al in the subsoil, and are common in areas where severe brown spot and root rot disease is caused by *Pleiochaeta setosa*. Yellow lupin may be a better species on these soils (French et al., 2001).

Anthrachnose susceptibility and ill-adapted flowering time severely affect *Lupinus luteus* yield (Lichtin et al., 2020). *Phytophthora cinnamomi* is an aggressive pathogen on yellow lupin, causing root rot, wilt and death of the crop, common in oak-rangeland ecosystems in southwestern Spain (Serrano et al., 2010).

Yellow lupine green manure cropping is an important part of the current biological reclamation treatments used in sand mining cast reclamation in southern Poland prior to reforestation (Pietrzykowski et al., 2017).

CONCLUSIONS

Legume crop yellow lupine varieties has seeds with high protein content up to 61%. The seeds also contain oleic acid and linoleic acid.

Main disadvantages of the yellow lupin are pod shattering, hard seed coat, high alkaloid content, sensitivity to some abiotic stresses (extreme temperatures, drought, salinity and alkalinity) and sensitivity to sap-sucking insects such as aphids. But extensive seed collections capturing species-wide diversity exist and significant breeding progress are on the way following the release of its genetic map.

Yellow lupin is a feed suitable especially for birds and fishes.



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REFERENCES

- Adhikari, K. N., Edwards, O. R., Wang, S., Ridsdill-Smith, T. J., & Buirchell, B. (2012). The role of alkaloids in conferring aphid resistance in yellow lupin (*Lupinus luteus* L.). *Crop and Pasture Science*, 63(5), 444-451.
- Anonymus. (2020). www.tarbigem.com.tr/urunler/yem-bitkileri/sari-aci-bakla-lupinus-luteus
- Bartkiene, E., Bartkevics, V., Starkute, V., Krungleviciute, V., Cizeikiene, D., Zadeike, D., & Maknickiene, Z. (2016). Chemical composition and nutritional value of seeds of *Lupinus luteus* L., *L. angustifolius* L. and new hybrid lines of *L. angustifolius* L. *Zemdirbyste-Agriculture*, 103(1).
- Borek, S., Pukacka, S., Michalski, K., & Ratajczak, L. (2009). Lipid and protein accumulation in developing seeds of three lupine species: *Lupinus luteus* L., *Lupinus albus* L., and *Lupinus mutabilis* Sweet. *Journal of experimental botany*, 60(12), 3453-3466.
- Burgos-Diaz, C., Piornos, J. A., Wandersleben, T., Ogura, T., Hernández, X., & Rubilar, M. (2016). Emulsifying and foaming properties of different protein fractions obtained from a novel lupin variety AluProt-CGNA®(*Lupinus luteus*). *Journal of food science*, 81(7), C1699-C1706.
- Davies, C. L., Turner, D. W., & Dracup, M. (2000). Yellow lupin (*Lupinus luteus*) tolerates waterlogging better than narrow-leafed lupin (*L. angustifolius*) I. Shoot and root growth in a controlled environment. *Australian Journal of Agricultural Research*, 51(6), 701-709.
- Ferchichi, N., Toukabri, W., Vrhovsek, U., Nouairi, I., Angeli, A., Masuero, D., ... & Trabelsi, D. (2021). Proximate composition, lipid and phenolic profiles, and antioxidant activity of different ecotypes of *Lupinus albus*, *Lupinus luteus* and *lupinus angustifolius*. *Journal of Food Measurement and Characterization*, 15(2), 1241-1257.
- French, R. J., Sweetingham, M. W., & Shea, G. G. (2001). A comparison of the adaptation of yellow lupin (*Lupinus luteus* L.) and narrow-leafed lupin (*L. angustifolius* L.) to acid sandplain soils in low rainfall agricultural areas of Western Australia. *Australian Journal of Agricultural Research*, 52(10), 945-954.
- Glazinska, P., Wojciechowski, W., Kulasek, M., Glinkowski, W., Marciniak, K., Klajn, N., ... & Kopcewicz, J. (2017). De novo transcriptome profiling of flowers, flower pedicels and pods of *Lupinus luteus* (yellow lupine) reveals complex expression changes during organ abscission. *Frontiers in plant science*, 8, 641.



**ISPEC 8th INTERNATIONAL CONFERENCE
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and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- Iqbal, M. M., Erskine, W., Berger, J. D., & Nelson, M. N. (2020b). Phenotypic characterisation and linkage mapping of domestication syndrome traits in yellow lupin (*Lupinus luteus* L.). *Theoretical and Applied Genetics*, 133(10), 2975-2987.
- Iqbal, M. M., Erskine, W., Berger, J. D., Udall, J. A., & Nelson, M. N. (2020a). Genomics of yellow lupin (*Lupinus luteus* L.). In *The Lupin Genome* (pp. 151-159). Springer, Cham.
- Iqbal, M. M., Erskine, W., Berger, J. D., Udall, J. A., & Nelson, M. N. (2020). Genomics of yellow lupin (*Lupinus luteus* L.). In *The Lupin Genome* (pp. 151-159). Springer, Cham.
- Kaczmarek, S. A., Hejdysz, M., Kubis, M., Kasproicz-Potocka, M., & Rutkowski, A. (2016). The nutritional value of yellow lupin (*Lupinus luteus* L.) for broilers. *Animal Feed Science and Technology*, 222, 43-53.
- Li, H., Wylie, S. J., & Jones, M. G. K. (2000). Transgenic yellow lupin (*Lupinus luteus*). *Plant Cell Reports*, 19(6), 634-637.
- Lichtin, N., Salvo-Garrido, H., Till, B., Caligari, P. D., Rupayan, A., Westermeyer, F., & Olivos, M. (2020). Genetic and comparative mapping of *Lupinus luteus* L. highlight syntenic regions with major orthologous genes controlling anthracnose resistance and flowering time. *Scientific reports*, 10(1), 1-15.
- Maknickiene, Z., Asakaviciute, R., Baksienė, E., & Razukaš, A. (2013). Alkaloid content variations in *Lupinus luteus* L. and *Lupinus angustifolius* L. *Archives of Biological Sciences*, 65(1), 107-112.
- Parra-Gonzalez, L. B., Aravena-Abarzúa, G. A., Navarro-Navarro, C. S., Udall, J., Maughan, J., Peterson, L. M., ... & Maureira-Butler, I. J. (2012). Yellow lupin (*Lupinus luteus* L.) transcriptome sequencing: molecular marker development and comparative studies. *BMC genomics*, 13(1), 1-15.
- Pietrzykowski, M., Gruba, P., & Sproull, G. (2017). The effectiveness of Yellow lupine (*Lupinus luteus* L.) green manure cropping in sand mine cast reclamation. *Ecological Engineering*, 102, 72-79.
- Rutkowski, A., Hejdysz, M., Kaczmarek, S., Adamski, M., Nowaczewski, S., & Jamroz, D. (2017). The effect of addition of yellow lupin seeds (*Lupinus luteus* L.) to laying hen diets on performance and egg quality parameters. *J. Anim. Feed Sci*, 26(3), 247-256.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
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24-25 December 2021
BINGOL, TURKEY**



- Serrano, E., Storebakken, T., Penn, M., Øverland, M., Hansen, J. Ø., & Mydland, L. T. (2011). Responses in rainbow trout (*Oncorhynchus mykiss*) to increasing dietary doses of lupinine, the main quinolizidine alkaloid found in yellow lupins (*Lupinus luteus*). *Aquaculture*, 318(1-2), 122-127.
- Serrano, M. S., Fernández-Rebollo, P., De Vita, P., Carbonero, M. D., Trapero, A., & Sánchez, M. E. (2010). *Lupinus luteus*, a new host of *Phytophthora cinnamomi* in Spanish oak-rangeland ecosystems. *European journal of plant pathology*, 128(2), 149-152.
- Swiecicki, W., Rybczynski, J., & Swiecicki, W. K. (2000). Domestication and genetics of the yellow lupin [*Lupinus luteus* L.] and the biotechnological improvement of lupins. *Journal of Applied Genetics*, 41(1).
- Thambiraj, S. R., Phillips, M., Koyyalamudi, S. R., & Reddy, N. (2018). Yellow lupin (*Lupinus luteus* L.) polysaccharides: Antioxidant, immunomodulatory and prebiotic activities and their structural characterisation. *Food chemistry*, 267, 319-328.
- Wilmowicz, E., Frankowski, K., Kućko, A., Świdziński, M., de Dios Alché, J., Nowakowska, A., & Kopcewicz, J. (2016). The influence of abscisic acid on the ethylene biosynthesis pathway in the functioning of the flower abscission zone in *Lupinus luteus*. *Journal of plant physiology*, 206, 49-58.
- Zalewski, K., Nitkiewicz, B., Lahuta, L. B., Głowacka, K., Socha, A., & Amarowicz, R. (2010). Effect of jasmonic acid–methyl ester on the composition of carbohydrates and germination of yellow lupine (*Lupinus luteus* L.) seeds. *Journal of Plant Physiology*, 167(12), 967-973.
- Zdunczyk, Z., Krawczyk, M., Mikulski, D., Jankowski, J., Przybylska-Gornowicz, B., & Juskiewicz, J. (2016). Beneficial effects of increasing dietary levels of yellow lupine (*Lupinus luteus*) seed meal on productivity parameters and gastrointestinal tract physiology in eight-week-old turkeys. *Animal Feed Science and Technology*, 211, 189-198.



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ERZURUM İLİNDE YETİŞEN LAVANDİN (*Lavandula X intermedia* EMERIC EX LOISEL.) BİTKİSİNİN ANTİOKSİDAN AKTİVİTESİ

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ÖZET

Tıbbi ve aromatik bitkiler her geçen gün daha fazla alanda kullanılan ve daha çok yetiştirilen bitkiler arasında yer almaktadırlar. Hoş kokuları ile bilinen baharat bitkilerinin yanı sıra uçucu yağlı tıbbi aromatik bitkiler de son günlerde günlük hayatımızda kullanılmaktadır. Parfümeri ve boya sanayiinde ham madde ve katkı maddesi olarak yer alan uçucu yağlar son zamanlarda gıda sanayiinde de aroma verici olarak kullanılmaktadır. Ayrıca günlük yaşantımızda baharat ya da çay olarak da sıkça bu bitkiler tüketilmektedir. Bütün bu sebeplerden dolayı tıbbi aromatik bitkilerin yetiştiriciliği yaygınlaşmaktadır. Lavandin (*Lavandula x intermedia* Emeric ex Loisel.) bitkisi özellikle çiçekleri kullanılan hoş kokulu bir bitkidir. Bu bitki farklı iklim koşullarına elverişli olmasından ve yaygın kullanımından dolayı gün geçtikçe daha geniş alanlarda yetiştirilmektedir. Antioksidanlar vücudumuzda bulunan serbest radikalleri etkisiz hale getirmektedirler. Böylece hastalıklara yakalanma ihtimalini azaltan antioksidanlar özellikle bitkisel ürünlerde türlere göre değişen miktarlarda bulunmaktadır. Bu sebeple beslenme alışkanlıklarımızda özellikle antioksidanlarca zengin gıdaları tercih etmeliyiz. Günlük hayatta kullanılan tıbbi aromatik bitkilerden özellikle gıda alanında yararlanılacak olanlar için antioksidan aktivitesinin belirlenmesi önem arz etmektedir. Bu çalışmanın amacı Erzurum İli Merkez ilçe ekolojik koşullarında yetiştirilen lavandin (*Lavandula x intermedia* Emeric ex Loisel.) bitkisinin antioksidan aktivitesini belirlemektir. Bu amaçla 2021 yılı Ağustos ayında Erzurum ilinde yetiştirilen lavandin bitkisine ait çiçekler gölgede kurutulmuştur. Lavandin çiçeklerinin toplam fenolik (TP) değeri 1,768 mg GAE/g numune, toplam flavonoid (TF) değeri 0,509 mg QE/g numune olarak belirlenirken, 1, 1-difenil-2-pikrilhidrazil (DPPH) değeri de 3,290 SC₅₀ mg/mL olarak belirlenmiştir. Birçok farklı alanda kullanılan lavandin çiçeklerinin gıda alanında da kullanımı hakkında öngörü oluşturulabilmesi için antioksidan aktivitesinin belirlendiği bu çalışmada sonuç olarak; günlük hayatta lavandin çiçeklerinin gıda olarak kullanılması için antioksidan aktivitesinin uygun olduğu görülmüştür.

Anahtar Kelimeler: Lavandin, lavanta, antioksidan, tıbbi aromatik bitkiler



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**ANTIOXIDANT ACTIVITY OF LAVANDIN (*Lavandula x intermedia* Emeric ex
Loisel.) PLANT GROWING IN ERZURUM**

ABSTRACT

Medicinal and aromatic plants are among the plants that are used and grown more and more every day. In addition to the spice plants known for their pleasant scents, medicinal aromatic plants with essential oils are also used in our daily lives recently. Essential oils, which are used as raw materials and additives in the perfumery and paint industry, have recently been used as flavoring in the food industry. In addition, these plants are frequently consumed as spice or tea in our daily life. For all these reasons, the cultivation of medicinal aromatic plants is becoming widespread. Lavandin (*Lavandula x intermedia* Emeric ex Loisel.) is a fragrant plant, especially the flowers of which are used. This plant is grown in wider areas day by day due to its suitability for different climatic conditions and its widespread use. Antioxidants neutralize free radicals in our body. Thus, antioxidants, which reduce the possibility of getting diseases, are found in varying amounts depending on the species, especially in herbal products. For this reason, we should prefer foods rich in antioxidants in our eating habits. It is important to determine the antioxidant activity of medicinal aromatic plants used in daily life, especially for those that will be used in the field of food. The aim of this study is to determine the antioxidant activity of the lavandin (*Lavandula x intermedia* Emeric ex Loisel.) plant grown in the ecological conditions of the central district of Erzurum. For this purpose, the flowers of the lavandin plant grown in Erzurum province in August 2021 were dried in the shade. The total phenolic (TP) value of lavandin flowers was determined as 1.768 mg GAE/g sample, the total flavonoid (TF) value was determined as 0.509 mg QE/g sample, and the 1.1-diphenyl-2-picrylhydrazil (DPPH) value was determined as 3.290 SC₅₀ mg/mL. determined. As a result of this study, in which the antioxidant activity of lavandin flowers, which are used in many different areas, is determined in order to make a prediction about the use of lavandin flowers in the field of food; It has been observed that the antioxidant activity of lavandin flowers is suitable for use as food in daily life.

Keywords: Lavandin, lavender, antioxidant, medicinal aromatic plants



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GİRİŞ

Tıbbi ve aromatik bitkiler son yıllarda kullanım alanlarının genişlemesi ve bu bitkilere duyulan ihtiyacın artması ile geniş üretim alanları bulmaktadır. Bu bitkilerin kök, gövde, yaprak ve çiçek gibi kısımları kullanıldığı gibi bazen tamamı da kullanılmaktadır. Ayrıca tıbbi aromatik bitkilerden elde edilen uçucu yağlar da günlük hayatımızda yerini almaktadır.

Lavanta bitkisi, Lamiaceae (Labiatae) familyasına ait bir uçucu yağlı bitki olarak bilinmektedir (Beus, 2006; Baydar, 2013, Erbaş ve ark., 2017). Lavandin (*Lavandula × intermedia* Emeric ex Loisel.) bitkisi de aynı familyada yer alan ve kültürü yapılan önemli bir uçucu yağ bitkisidir. Lamiaceae familyasının Türkiye’de 46 cins ve 571 türü bulunmaktadır. Avrupa, Batı Hindistan ve Kuzey Afrika bölgelerinde lavanta türlerinin doğal olarak yetiştiği bilinmektedir (Kara ve ark., 2014; Erbaş ve ark., 2017).

Lavanta çiçekleri ortalama %1-3 oranında uçucu yağ içermektedir. Lavanta uçucu yağının %60-65’ini monoterpen alkoller oluşturmaktadır. Monoterpen alkollerin yaklaşık %20-45’ini ise linalol, %25-46’sını da linalyl asetat oluşturmaktadır. (Edwards ve ark., 2015).

MATERYAL VE METOD

Bitki Materyali

Bu çalışmada Erzurum ili merkez ilçede kültür bitkisi olarak yetiştirilen lavandin (*Lavandula × intermedia* Emeric ex Loisel.) bitkisinin çiçekleri materyali olarak kullanılmıştır.

Toplam Polifenol Madde (Tp) Tayini

Bu yöntem, lavandin örneklerinde bulunan fenolik maddelerin Folin Ciocalteu reaktifi ile renkli kompleks oluşturması prensibine dayanmaktadır (Singleton ve Rossi, 1965; Singleton ve ark., 1999). Bu yöntem özellikle bitkilerde toplam fenolik madde tayininde en sık kullanılan yöntem olarak bilinmektedir. Reaksiyon sonunda oluşan koyu mavi renkli kompleksin 760 nm’de ölçümü yapılmaktadır. Sonuçlar 1 g örnek başına mg gallik asit eşdeğeri (mg GAE/g) olarak belirlenmiştir.

Toplam Flavonoid Madde (Tf) Tayini

Fenoliklerin bir alt grubu olarak bilinen flavonoidler bitkilerde bulunan doğal antioksidan kaynakları olarak bilinmektedirler. Bu yöntem Fukumoto ve Mazza (2000)’e göre yapılmıştır. Gerçekleşen reaksiyon sonucunda meydana gelen sarı renkli kompleks 415 nm’de ölçülmesiyle toplam flavonoid madde miktarı belirlenmiştir.

Demir (/Iii) İndirgeme Antioksidan Güç (Frap) Tayini



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Demir (/III) İndirgeme antioksidan güç (FRAP) tayini kompleksinin antioksidanların varlığında indirgenerek mavi renkli kompleks Fe(II)-TPTZ oluşması ve oluşan bu kompleksin 595 nm’de maksimum absorbans vermesi esasına dayanan bir yöntemdir. Lavandin çiçek ekstraktlarındaki antioksidan kapasitenin ölçülmesinde FRAP oldukça geçerli bir yöntem olarak kabul edilmektedir (Benzie and Strain, 1996).

Dpph Radikal Temizleme Aktivitesi Tayini

DPPH (2,2-difenil-1-pikrilhidrazil) ticari olarak piyasadan temin edilebilen bir radikal olarak bilinmektedir. Bu radikale ait 100 μM ’lık metanolik çözelti hazırlanmıştır. Bu yöntem Molyneux (2004)’e göre uygulanmıştır. Örneklerin metanolik ekstraktları kendi çözücülerini ile seyreltilerek değişik konsantrasyonlarda hazırlanmıştır. Eşit hacimde (750 μL) DPPH çözeltisi ve lavandin çiçek çözeltileri karıştırılıp oda sıcaklığında 50 dakika inkübasyona bırakılmıştır. Bu süre tamamlandıktan sonra DPPH’nin maksimum absorbansının gözlemlendiği 517 nm’de absorbanslar okunmuştur.

BULGULAR VE TARTIŞMA

Bu çalışmada Erzurum ili merkez ilçede kültür bitkisi olarak yetiştirilen lavandin (*Lavandula* \times *intermedia* Emeric ex Loisel.) bitkisinin çiçeklerinin TP, TF, FRAP ve DPPH değerleri belirlenerek antioksidan aktivitesi belirlenmiştir.

Tablo 1. Lavandin (*Lavandula* \times *intermedia* Emeric ex Loisel.) bitkisinin çiçek kısımlarının antioksidan aktivitesi

Lokasyon	TP (mg GAE/ g numune)	TF (mg QE/g numune)	FRAP (μmol $\text{Fe}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}/\text{g}$ numune)	DPPH SC_{50} mg/mL
Erzurum	1.768 \pm 0.08	0.509 \pm 0.007	23.719 \pm 0.581	3.290 \pm 0.016
Trolaks				0.004 \pm 0.00

Yapılan analizler sonunda Lavandin (*Lavandula* \times *intermedia* Emeric ex Loisel.) bitkisinin çiçek kısımları için TP 1.768 mg GAE/g numune, TF 0.509 mg QE/g numune, FRAP 23.719 μmol $\text{Fe}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}/\text{g}$ numune ve DPPH 3.290 SC_{50} mg/mL olarak belirlenmiştir. Elde edilen sonuçlar Karagözler ve ark., (2013) ve Kıvrak (2018) tarafından yapılan çalışmalardan farklı bulunmuştur. Ortaya çıkan bu farkın çalışmalarda kullanılan türlerin ve yetiştirilme koşullarının farkından kaynaklandığı düşünülmektedir.

SONUÇ



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Bu çalışmada Erzurum ili merkez ilçede kültür bitkisi olarak yetiştirilen lavandin (*Lavandula* × *intermedia* Emeric ex Loisel.) bitkisinin kurutulmuş çiçek kısımlarının antioksidan aktivitesini belirlemek amacı ile yapılan TP, TF, FRAP ve DPPH analizlerinde elde edilen bulgular değerlendirilmiştir. Lavandin bitkisinin çiçeklerinin antioksidan kapasitesi ve biyoaktif özellikleri konusunda literatürde kapsamlı çalışmalara rastlanamamıştır. Elde edilen bulguların bundan sonra yapılacak daha kapsamlı çalışmalara kaynaklık edebileceği düşünülmektedir.



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KAYNAKLAR

- Baydar, H. (2013). Tıbbi, Aromatik ve Keyf Bitkileri Bilimi ve Teknolojisi. Süleyman Demirel Üniversitesi Yayınları, Yayın No:51, Isparta.
- Benzeie, I.F.F., Strain, J.J. (1996). The ferric reducing ability of plasma (FRAP) as a measure of antioxidant power: The FRAP assay. *Journal Analytical of Biochemistry*, 239, 70-76.
- Beus, C. (2006). Growing and Marketing Lavender. Washington State University, 28p, Washington.
- Edwards, S. E., da Costa Rocha, I., Williamson, E. M., Heinrich, M. (2015). *Phytopharmacy: An evidence-based guide to herbal medicinal products*: John Wiley & Sons.
- Erbaş, S., Kucukyumuk, Z., Baydar, H., Erdal, İ., & Şanlı, A. (2017). Effects of different phosphorus doses on nutrient concentrations as well as yield and quality characteristics of lavandin (*Lavandula × intermedia* Emeric ex Loisel. var. Super). *Turkish Journal of Field Crops*, 22(1), 32-38.
- Fukumoto, L.R., ve Mazza, G. (2000). Assessing antioxidant and prooxidant activities of phenolic compounds. *Journal of Agricultural Food Chemistry*, 48, 3597–3604.
- Kara, N., Baydar, H. (2014). Kuruma yöntemleri, depolama koşulları ve sürelerinin lavanta (*lavandula* spp.)’nın uçucu yağ oranı ve bileşenlerine etkisi. *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 24(2), 185-192.
- Karagözler, A.A., Yavaşer, R., Sunna, Ç. (2013). Lavanta Bitkisinin Bazı Antioksidan Özelliklerinin İncelenmesi. 3. Kozmetik Kongresi, 15-17 Subat 2013, Antalya.
- Molyneux, P. (2004). The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songklanakarin Journal of Science and Technology*, 26, 211–219.
- Singleton V.L. ve Rossi J.A., (1965). Colorimetry of Total Phenolics with Phosphomolybdic-Phosphotungstic Acid Reagents, *American Journal of Enology and Viticulture*, 16, 144-158.
- Singleton V.L., Orthofer R. ve Lamuela-Raventos R.M., (1999). Analysis of Total Phenols and Other Oxidation Substrates and Antioxidants by Means of Folin-Ciocalteu Reagent, *Methods in Enzymology*, 299, 152-178.



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**BALIK VE BAZI HAYVAN GRUPLARINDA PİNEAL BEZ VE MELATONİN
ETKİLERİ**

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ÖZET

Pineal bez, görme duyusunun ışık demetini organizmanın her organına iletilmesi görevini yapar. Pineal bezin salgı fonksiyonu iki ana grup ile salgılanır. Bunların içinde en önemlisi Melatonindir. Melatonin beyin epifizindeki hücreler tarafından üretilen bir hormondur. Serotoninin bir türevidir. Melatonin seviyesi arttığında serotonin seviyesi azalmaktadır. Melatonin, pineal bezde gün içerisinde sentez edilir. Melatonin üretimi ve salınımı karanlık-gece ile başlar ve aydınlık -gündüz ile son bulur. Melatonin düzeyi karanlığın süresine bağlıdır. Bu nedenle melatonin “karanlığın kimyasal anlatımı” veya “endokrin sistemin drakulası” gibi isimlerle de anılır. Melatoninin salınımı diyet, uyku süresi ve organizmanın yapısına göre değişiklik gösterir. Balıkların fizyolojileri büyüme ve üreme gibi fonksiyonlarının ışıkla ilgisi olduğu bilinmektedir. Yapılan bazı çalışmalar sonucu, melatonin hormonunun sentezlenmesinin karanlık periyotta arttığı, ışık periyotunda azaldığı görülmüştür. Yani epifiz bezinin melatonin salgısı gündüz baskılanırken geceleri faaliyete geçer. Başka bir ifadeyle, melatonin kış ayları boyunca yaz mevsiminde olduğundan çok daha fazla salgılanmaktadır. Yapılan bir başka çalışmada en yüksek melatonin düzeyi gece 11:00-03:00 arasında olduğu görülmüştür. Bu konu ile ilgili diğer canlılar üzerinde birçok çalışma yapılmıştır. Oysa balıklar üzerinde bu konu ile ilgili çalışma yok denecek kadar azdır. Bu derleme bu konu hakkında araştırmacılara ışık tutacaktır.

Anahtar Kelimeler: Pineal bez, Melatonin, Balık



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**EFFECTS OF PINEAL GLAND AND MELATONIN IN FISH AND SOME ANIMAL
GROUPS**

ABSTRACT

The pineal gland carries out the task of transmitting the light beam of the sense of sight to every organ of the organism. The secretory function of the pineal gland is secreted by two main groups. The most important of these is Melatonin. Melatonin is a hormone produced by cells in the pineal gland. It is a derivative of serotonin. When the level of melatonin increases, the level of serotonin decreases. Melatonin is synthesized in the pineal gland during the day. Melatonin production and release begins with dark-night and ends with light-day. The level of melatonin depends on the duration of darkness. For this reason, melatonin is also referred to as "chemical expression of darkness" or "dracula of the endocrine system". The release of melatonin varies according to diet, sleep time and the structure of the organism. It is known that functions such as physiology, growth and reproduction of fish are related to light. As a result of some studies, it has been observed that the synthesis of the hormone melatonin increases in the dark period and decreases in the light period. In other words, while the melatonin secretion of the pineal gland is suppressed during the day, it becomes active at night. In other words, melatonin is secreted much more during the short months than during the summer. In another study, the highest melatonin level was observed between 11:00 and 03:00 at night. Many studies have been done on other living things related to this subject. However, there are hardly any studies on this subject on fish. This review will shed light on this subject for researchers.

Keywords: Pineal Gland, Melatonin, Fish



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1. GİRİŞ

Biyolojik sistemlerde prooksidan ve antioksidan dengenin bozulmasıyla oluşan oksidatif stres, birçok patolojik olguyla ilişkilidir. Canlılar, prooksidan etkilerin hasarına karşı antioksidan ajanlarla savunmaya çalışırlar. Prooksidan ve antioksidan sistemler arasındaki dengenin bozulması sonucu oluşan oksidatif stres, diyabet, romatoid artrit, Alzheimer hastalığı gibi birçok patolojik durumun yanı sıra yaşlılıkta ortaya çıkmaktadır (Sies,1997; Dalle-Donna vd., 2003).

Pineal bezin salgı fonksiyonu iki ana grup ile salgılanır. Pineal bezin başlıca salgısı melatonindir. Güçlü antioksidan özellik gösteren melatonin etkinliği enfeksiyon hastalıklarında, diyabette, yorgunluk sendromunda, uyku bozukluklarında, yaşlanmada ve hatta depresyonda gösterilmiştir (Sies, 1997).

2. PİNEAL BEZ

Pineal bez, görme duyusunun ışık demetini organizmanın her organına iletilmesi görevini yapar. Pineal bez kemirici türü memelilerde yüzeysel ve derin pineal bez olmak üzere iki kısımdır. İnsan dahil diğer memelilerde pineal bez tek kısımdan oluşur. Pineal bezin salgı fonksiyonu iki ana grup ile salgılanır. Bunların içinde en önemlisi Melatonindir. Pineal bezde melatonin dışında indolaminlerin ve peptidlerin de bulunur. Bunlar pineal bezin de ön hipofiz gibi çok hormonlu bir organ olabileceği yargısına yol açmıştır (Wilson ve Foster, 1985). Epifiz bezi memelilerde sekretuar, balıklarda ve amfibienlerde fotoreseptif, sürüngenlerde ve kuşlarda ise hem fotoreseptif hem de sekretuar fonksiyonları üstlenmiş bir organdır (Arendt, 1995).

3. MELATONİN

Antioksidanları anlatan bir kitapta melatonin ile ilgili bölümü aynen şu ifadelerle başlıyor. Harika bir ilaç hayal edin, öyle bir ilaç olsun ki yaşam sürenizi %25 uzatabilsin ve 120 yaşınıza kadar yaşamanızı mümkün kılsın. Ayrıca genç kalmanızı, çalışmaktan, cinsellikten sosyal aktivitelerden aldığınız zevki aynı enerji ile devam ettirsin. Öyle bir ilaç olsun ki yan etkisi olmasın, vücutta doğal olarak sentezlensin. Aslında böyle bir ilacın adı “melatonin”dir.

Melatonin, memelilerin başlıca beyinde serebral yarıküreler arasındaki pineal bezden ve ayrıca over, lens ve kemik iliği hücreleri ile safra ve gastrointestinal sistemden sentezlenip salgılanan bir hormondur (Reiter vd.,1995).



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Deride, pigment granüllerin değişiminden ve derin dokuların güneşin zararlı radyasyonuna karşı korunmasından sorumlu olan, melatonin, gastrointestinal kanalda enterokromofin hücrelerde sentezlenmekte ve post-prandinal olarak dolaşıma salıverilmektedir. Safrada sentezlenen melatonin ise okside kolesterol türevlerine ve safra asidine karşı safra yollarının mukozasını ve epitelini oksidatif hasara karşı korumaktadır (Kontürek vd.,2007).

Melatonin birçok gıda kaynağında bulunmakla birlikte melatonin içeriği gıdalara göre çok farklılıklar göstermektedir. Harici (eksojen) olarak diyetle alınan en zengin melatonin kaynakları yumurta, balık, bazı mantarlar, arpa, yulaf, çimlenmiş tohum, sert kabuklu yemişler, tıbbi bitkiler gibi ürünlerdir.

3.1. Melatoninin Fizyolojik Etkileri:

Melatonin fotoperiyod ile ilgili bilgiyi vücudun fizyolojisine aktararak sirkadyen ritmin (vücudun biyolojik saati) ve organizmanın fonksiyonlarının düzenlenmesinde rol oynar. İnsanda pek çok biyokimyasal, fizyolojik ve davranışsal değişkenlerde olduğu gibi plazmadaki melatonin düzeyleri de 24 saatlik periyod içinde düzenli iniş çıkışlar gösterir. Gece ışığa maruz kalındığında pineal fonksiyonlar akut olarak baskılanır (Liebmann vd.,1997).

Melatonin ile kortizol ilişkisi her iki hormonunda immun sistemde etkileri yönünden önemlidir. Melatonin ve kortizol düzeyleri ters yönde hareket eder. Kortizol akşam yatma saatlerinde düşüktür, oysa melatonin, kortizol tam olarak düştükten birkaç saat sonra pik yapar. Normal salgılama düzeninin bozulması ya da kanser riski açısından bu durum önemlidir. Araştırmacılar düşük melatonin ve yüksek kortizol seviyelerinde çeşitli hastalıkların ortaya çıkabileceğini bildirmişlerdir. Yani bu iki hormon arasındaki denge sağlıklı olmak için önemlidir (Millet vd.,1999; Guardiola-Lemaitre, 2007).

3.2. Melatoninin Endokrinolojik Etkileri:

Melatoninin, hipotalamus-hipofiz-gonadlar sistemi üzerinde inhibitör bir etkiye sahip olduğu kabul edilmektedir (Keleştimur,1999; Arendt, 1995; Reiter, 1981; Erlich ve Apuzzo,1985). Direk etkisini, üreme sisteminde yer alan reseptörlerine bağlanarak gerçekleştirir. Deney hayvanlarında yapılan çalışmalarda, Leydig hücrelerinde melatoninin bağlandığı reseptörler gösterilmiştir ve melatoninin direkt testis üzerine etki ederek, Leydig hücrelerinden testosteron sentezini inhibe ettiği bildirilmiştir (Ellis, 1972; Vera vd., 1993).

Melatonin ayrıca tiroid, böbreküstü bezi gibi diğer endokrin organlar üzerinde de etkilidir. Tiroid bezi fonksiyonları üzerinde genel bir inhibitör etki gösterir (Keleştimur, 1996; Erlich ve Apuzzo, 1985; Binkley, 1988).



3.3. Melatoninin Non-Endokrinolojik Etkileri

a) Uyku ritminin düzenlenmesi: Melatonin gece boyunca düşük düzeyde salgılanması uykunun azalmasına, uykuya duyulan ihtiyacında artmasına neden olur. Akşamın erken saatlerinde yeterli miktarda melatonin salgılanmazsa uyuma güçleşir. Pineal bezin fazla miktarda ve uzun süre melatonin salgıladığı durumlarda ise uyku isteği devam eder (Arendt, 1995).

b) Kardiyovasküler sistem üzerinde koruyucu etkisi: Melatonin kanda kolesterol seviyesini düşürmekte, hipertansiyon riskini azaltmaktadır (Cagnacci, 1996).

Sıçanlarda yüksek dozda (400mg/kg) melatonin uygulaması sonucu kaslarda gevşeme görülmektedir (Erlich ve Apuzzo, 1985).

Melatonin, hem yağda hem de suda çözünabilir özelliğe sahip olması sebebiyle, vücudun her hücresine nüfuz edebilir ve bu sebeple de vitamin ve mineral antioksidanlara göre çok daha etkilidir. Melatonin, hücresel düzeyde mitokondrilere nüfuz edebilen birkaç antioksidandan birdir. Bu sebeple melatonin diğer antioksidanlardan ayıran önemli özelliği mitokondrileri oksidasyon hasarından korumasıdır (Arendt, 1995).

Melatonin hormonu epifiz bezindeki pineosit hücreleri tarafından gece salgılanan bir hormondur. Gece salgılanmasının nedeni ise pineosit hücrelerinin ışığa duyarlı olmaları ve yüksek ışık düzeyinde hormon salınımını kesmeleridir.

Işığın şiddetinin azalmaya başlamasıyla salgılanmaya başlar ve tam karanlık ortam oluştuktan birkaç saat sonra maksimum düzeye çıkar. Melatonin hormonunun çeşitli fizyolojik etkileri vardır. Melatonin salgılanması gece arttığı için ve ışığa duyarlı olduğu için balıkların karanlık zamanında uyutulması en mantıklı olanıdır. Balıkların uyuyunca renginin açılması ise melatonin hormonunun bir etkisidir. Renginin açılması aynı zamanda melatonin sentezinin üst seviyelere çıktığı işaretini verir. Ayrıca melatonin en çok baskılayan ışık yeşildir. En az etki eden ise kırmızı ve mavinin tonlarıdır. Melatonin hormonu aynı zamanda biyolojik saatin düzenlenmesinden sorumlu olan hormondur. Bütün vücut fonksiyonlarını gece düzene sokar. Melatonin savunma sistemini güçlendirir. Bunu da büyük ölçüde stresin etkilerini azaltarak ve vücuttaki bağıışıklıktan 1.derece sorumlu mineral olan çinkonun seviyesini kanda artırarak yapar. Melatoninin bu iki etkisi aynı zamanda yaşlanmayı geciktirici özelliktedir (URL,1).

Balıklar rahatsızlandığında onların daha çabuk iyileşmesini sağlamak için ışık miktarını kısarak melatonin miktarı daha da artıp iyileşmeye katkı sağlar. Melatoninin kanserleşmeyi ve vücutta



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meydana gelen mutasyonları baskılayıcı nitelikte olduğu da saptanmıştır. Bu konudaki araştırmalar hala devam etmektedir (URL,1).

Melatoninin uzun süreli ve yüksek düzeylerde bulunduğu dönemlerde uzun günlerde döl veren türlerin üremesi engellenirken, kısa günlerde döl veren türlerin üremesi uyarılmış olur.

3.4. Yaşlanmayla Melatonin Ritminin Azalması

Yeni doğanda melatonin ritmi 3-4 aylık olana kadar görülmez ve melatonin düzeyi düşüktür. Bir yaşına kadar gelişir ve 1-3 yaş arasında en yüksek düzeyine ulaşır. Daha sonra yavaş yavaş düşer. İlerleyen yaşla birlikte melatonin ritmi bozulur ve pineal melatonin üretiminde giderek artan bir azalma gözlenir. Yaşlanmayla birlikte pineal bezin serotonininden melatonin oluşturma yeteneği de azalır. Gece melatonin üretim ve salınımının azalmasının yanında, melatonin yaşlılarda daha kısa süreli bir yükselme gösterir.

3.5. Melatonin Sentezinde Aydınlık-Karanlık Kontrolü Ve Fotoperiyodizm

Mevsimsel fonksiyonların günün uzunluğu ile ilişkilendirilmesine fotoperiyodizm denilmektedir. Melatonin tüm türlerde gece sentezlenmekte ve salgılanmaktadır. Gece ne kadar uzarsa melatonin salgılanması o kadar uzun sürmektedir (Arendt, 1995). Işık karanlık fazın başında veya sonunda salgılanmayı baskılamakta ve ritmi düzenlemektedir.

Birçok hayvansal organizmada olduğu gibi, hayvansal su ürünlerinde de fotoperiyotun algılanması ışığın çeşitli reseptörler aracılığı ile alınıp beyine iletilmesiyle olmaktadır. Araştırılan çoğu balık türünde ışığın, ön beynin talamus bölgesinde yaralan ve bol kan damarına sahip epifiz bezi (pineal) ile gözün retina tabakasının üzerinde bulunan fotoreseptör hücreler aracılığıyla algılandığı belirlenmiştir. Omurgasızlarda ise gözün retina tabakası, göz sapı optik lop aracılığıyla algılanır (Withyachumnarnkul vd.,1990; Withyachumnarnkul, 1992).

Işığa ait bilgilerin algılanması, canlıda bazı fizyolojik-endokrinolojik aktivitelere yön vermektedir. Bu aktivitelerdeki ilk ve en önemli değişim, bahsedilen bu organlardan salgılanan serotonin ve melatonin düzeylerinde gözlenmektedir. Bu hormonların ilkinin düzeyi aydınlık dönemde yüksek iken, melatonin bazal düzeyde kalmaktadır. Karanlık dönemde ise tersi olmaktadır. Melatonin salgılanma süresi gecenin uzunluğu ile ilişkilidir. Gece ne kadar uzarsa melatonin salgılanması o kadar uzun sürer. Bu iki hormonun sözü edilen organlar dışında muhtemelen balıkların sindirim kanalından (bağırsakda) salgılandığı belirtilmektedir (Klein vd., 1997; Bromage vd., 2001).

Ancak bunlar türe bağlı olarak değişmekle birlikte, gün boyu salgılanır. Bunların sadece bir kısmı kana verilir. Bağırsak hareketlerini düzenlemede görev alırlar.



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Serotonin bir aminoasit olan triptofandan, melatonin ise serotonininden sentezlenir. Omurgasızlarda melatonin ve onun enzimleri özellikle göz saplarında, optik lop veya beyinde bulunmaktadır (Withyachumnarnkul vd.,1990; Withyachumnarnkul, 1992).

Uzun yapay fotoperiyot uygulamasıyla su ürünlerinin büyümesindeki artışın oranı şüphesiz türe ve gelişim evresine göre değişiklikler göstermektedir. Birçok deniz balığı ve salmonidler, fotoperiyot uygulamalarına artan gelişim yanıtını verirler (Boeuf ve Bail, 1999). Buna karşın yapay fotoperiyotun dil balığı (*Solea solea*) ve deniz tarağı (*Pecten maximus*) nın büyümesinde olumlu etkisine rastlanmamıştır (Fuchs, 1978; Duinker,1996). Levrek (*Dicentrarchus labrax*) sürekli aydınlatma (24 saat) büyüme için yararlıdır. Ancak gelişim için uygun değildir (Cerqueira vd., 1991). Morina (*Gadus morhua*)’ da uzun yapay fotoperiyot uygulamasının % 40 ın üzerinde büyüme artışına, kış yassı balığı (*Pleuronectes americanus*) nda sürekli ışığın doğal fotoperiyottakine göre hayatta kalma ve büyüme oranında artışa neden olduğu sonuçları hakkında fikir vermesi açısından örnek olarak verilebilir (Davie,2005).

4. MELATONİN HORMONU ÜZERİNE YAPILAN ÇALIŞMALAR

Epifiz ve onun melatonin üreten salgı bezi (pineal gland), ışık/karanlığa bağlı günlük olayların gerçekleşmesinde rol oynamaktadır. Çeşitli türlerle (*Tinca tinca*, *Carassius auratus*, *Esox lucius*, *Sparus aurata*, *Onchorhynchus mykiss*, *O.Masou* v.b) yapılan çalışmalar sonucu melatonin hormonunun sentezlenmesinin karanlık periyotta arttığı, ışıktaki ise azaldığı görülmüştür.

Yani epifiz bezinin melatonin salgısı gündüz baskılanırken, geceleri faaliyete geçmektedir. Benzer şekilde vücutta kış ayları boyunca, yaz mevsiminde olduğundan çok daha fazla melatonin salgılanmaktadır (Falcon,1999; Herrero vd.,2003). Bu yüzden melatonin hormonu gece hormonu olarak nitelendirilmektedir.

Tilapialarla yapılan bir çalışmada saat 21:00 den 6:00 a kadar (karanlık periyot) plazma melatonin konsantrasyonu artarken 9:00 dan 18 e kadar (ışık periyot) düştüğü görülmektedir (Nikaido,2004). Yine turnalarla yapılan başka bir çalışmada, en yüksek melatonin salınımının saat 11: 00-13:00 arasında gerçekleştiği görülmektedir (Falcon,1999).

Gürsoy vd., 2011’de Van Yöresinde yetişen Van Gölü balığı (inci kefalı) ve alabalıkta melatonin hormonu seviyesini ölçmüştür. Araştırma materyali olarak da Van Gölü’nde yetişen Van Gölü balığı (inci kefalı) ve özel tesislerde yetiştirilen alabalık kullanılmıştır. Araştırma, insanlar gibi bu hormonun salgılandığı hayvanlar olan balıklarda; gelişim ve stres hormonu olan



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melatoninin bu özelliği göz önünde bulundurarak yürütülmüştür. (Metot; melatonin hormonu, canlılardan (Van Gölü balığı ve alabalıkta)alınan kanda, özel kitlerle elisa cihazı ile ölçülerek yapılmıştır.

Epifiz bezinde triptofandan ve retinadan sentezlenen melatonin hormonu, biyolojik saatin düzenlenmesi ve mevsimsel değişikliğe olan adaptasyon gibi birçok fonksiyona sahip olduğu belirtilmektedir. Balıklarda glikoz dengesi, beslenme ve harekete de etki ettiği bildirilmektedir. Son yıllarda balıklarla yapılan çalışmalarda melatonin, güçlü bir antibiyotik olarak tanımlanmaktadır. Beyin hormonu melatoninin, fizyolojik ve davranışla ilgili olaylarda, günlük ritim ve iç salgı hormonlarının düzenlenmesinde de oldukça önemli olduğu tespit edilmiştir. Melatoninin en iyi bilinen etkileri üreme fizyolojisi ile ilgili olmakla beraber, bu hormonun immün sistemi özellikle hücresel bağışıklığı hem direk hem de indirekt yollarla etkilediği ileri sürülmektedir (Randall vd., 1991; Pesonen vd., 2000). Pineal bezden salgılanan melatoninin, immün fonksiyonlar için temel bir eser element olan çinko seviyelerini düzenlediği ileri sürülmektedir. Melatoninin immün sistem üzerinde bahsedilen bütün etkilerinde çinko temel bir aracı gibi görülmektedir.

Melatoninin eksikliğinin aynı zamanda çinko noksanlığı ile sonuçlanması bu bulguları desteklemektedir. Bu bulgular, balıkların beslenme ve hareketlerine yön veren biyolojik parametreleri düzenleyen ve genellikle 24 saatlik ritimler halinde işleyen, belirli iç saatler bulunmaktadır. Canlıların vücut saatini, dünyanın kendi çevresindeki dönme hareketi nedeniyle ortaya çıkan aydınlık- karanlık döngüsüne göre ayarlayan biyolojik saate sirkadiyan saat denilmektedir. Günün 24 saati boyunca canlı vücudunda bir sürü fizyolojik ve metabolik değişiklik görülmektedir. Balıklarda epifiz bezinin sirkadiyan sistemin bir parçası olduğu bildirilmektedir. Balıklarda epifiz bezi (pineal organ), ışıkla ilgili bilgilere uyum sağlayan, sinir sistemi ve vücutla ilgili uyarımları içeren ışığa karşı hassas alıcı sinirler (fotoreseptörler) olarak görev yaptığı açıklanmaktadır. (Ekström ve Meissl, 1997; Ligo vd., 1998). Memeli olmayan diğer omurgalılarda olduğu gibi balıklarda da melatonin, öncelikle photoneuroendocrine olarak görev yapan epifizde ki fotoreseptör hücreler tarafından üretilip kana salgılanmaktadır (Falcon vd., 1992).

Pek çok balık türünün pinealde ki melatonin salınımını sağlayan biyolojik saate sahip olduğu yapılan çalışmalarla kanıtlanmıştır (Ligo vd., 1991). Çipuraların (*Sparus aurata L.*) ışık algılayıcı hücrelere, biyolojik saate ve melatonin sentezinin bulunduğu bir mekanizmaya sahip olduğu, ablalıklar gibi bir takım balıkların ise bu mekanizmaya tam sahip olmadığı



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bildirilmektedir (Ron ve Okimoto,1999). Buna ilaveten, alabalık (*Oncorhynchus mykiss*) (Randall vd., 1991) ve masu salmonunda (*O.Masou*) (Ligo vd., 1998) ölçülü salgılama karanlıkta devam etmediğinden ötürü salmonların beyin epifizinin (pineal) melatonin salınımı yapan biyolojik saatten yoksun olduğu ileri sürülmektedir. Alabalık beyin epifizi (pineal) hem iyi gelişmiş hem de ışığa karşı çok hassas hücrelere sahip olmasına rağmen, melatoninin salgılanma hızını ayarlayıp ayarlamadığı da hala araştırılmamıştır (Ekström ve Meissl, 1997;Ligo vd.,1998).



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KAYNAKLAR

Arendt, J., Chapman, H., Reiter, R.J., 1995. Melatonin and the Mammalian Pineal Gland, London, The Mammalian Pineal Gland: Structure and Function. Am J Anat 1981;162:287-313:6-49.

Arendt, J., 1995. The Pineal Gland: Basic Physiology and Clinical Implications. In: Degroot IJ, Eds. Endocrinology. 3rd. Ed. Philadelphia: W.B. Saunders, 433-442.

Binkley, S., 1988. The Pineal: Endocrine and Nonendocrine Function, New Jersey, Prentice Hall Endocrinology Series. 1988: 185-191.

Boeuf, G., Le Bail, P.Y., 1999. Does Light Have An Influence On Fish Growth? Aquaculture, 177: 129-152.

Bromage, N., Porter, M., Randall, C., 2001. The Environmental Regulation Of Maturation In Farmed Finfish with Special Reference To The Role Of Photoperiod And Melatonin, Aquaculture, 197: 63-98.

Cagnacci, A., 1996. Melatonin In Relation To Physiology In Adult Humans. J Pineal Res; 21:200-13.

Cerqueira, R.V., Chatain, b., Lavens, P., Jaspers, E., Ollevier, F., 1991. Photoperiodic Effects On The Growth and Feeding Rhythm of European Seabass, *Dicentrarchus Labrax*, Larvae in Intensive Rearing. Larvi'91, Special Publ. Eur. Aquacult Soc., 15:304-306.

Dalle-Donne, I., Giustarini D., Colombo R., Rossi R., & Milzani A. 2003. Protein carbonylation in human diseases. Trends in molecular medicine, 9(4), 169 – 176.

Davie, A. 2005. Effects of photoperiod manipulation on growth and reproduction in Atlantic cod (*Gadus morhua* L.)

Duinker, A., 1996. Effect of Photoperiod On Growth And Feeding Rate Of Scallop.

Ekström, P, Meissl, H., 1997. The Pineal Organ of Teleost Fishes. Rev Fish. Biol Fish 7:199-284.

Ellis. L. C., 1972. Inhibition Of Rat Testicular Androgen Synthesis in Vitro By Melatonin And Serotonin. Endocrinology 1972; 90:17-28.

Erlich, S.S., Apuzzo, M.L.J. 1985. The Pineal Gland: Anatomy, Physiology and Clinical Significance. J Neurosurg 1985;63:321-41

Falcon, J., Thibault, C., Begay, V., Zachmann, A., collin, J-P., 1992. Regulation of the Rhythmic Melatonin Secretion By the Fish Pineal photoreceptor Cells. In: Rhythms in Fishes, Editor Ali M. A., Plenum Press, 167-198, New York.



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on AGRICULTURE, ANIMAL SCIENCES
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Falcon, J., 1999. Cellular Circadian Clocks in the Pineal. *Progress In Neurobiology*, 58:121-162.

Fuchs, J., 1978. Influence De La Photoperiode Sur La Croissance Et La Survei De La Larve Et Du Juvenile Desole (*Solea solea*) En Elavage. *Aquaculture*, 15:63-74.

Guardiola-Lemaitre, B., 2007. Melatoninergic Receptor Agonists and Antagonists: Therapeutic Perspectives. *J Soc Biol*, 201: 105-113.

Gürsoy, T., Atasoy, N., Alacabey, İ., 2011. Van Yöresinde Yetişen Vena Gölü Balığı (İnci Kefali) Ve Alabalıkta Melatonin Hormonunun Ölçülmesi Hacettepe J. Biol & Chem., 39(4), 421-426.

Herrero, M.J., Madrid J.A., Sanchez-Vazquez F.J., 2003. Entrainment To Light Of Circadian Activity Rhythms In Tench (*Tinca Tinca*). *Chronobiol Int*, 20(6), 1-17.

Ligo, M., Kezuka H., Aida K., Hanyu I., 1991. Circadian Rhythms of Melatonin Secretion From Superfused Goldfish (*C. auratus*) Pineal Glands in Vitro. *Gen Comp Endocrinol*, 83: 152-8.

Ligo, M., Kitamura S., Ikuta K., Sanchez-Vazquez F. J., Ohtani-Kaneko R., Hara, M., Hirata K., Tabata, M., Aida, K., 1998. Regulation By Light and Darkness of Melatonin Secretion From The Superfused Masu Salmon (*Oncorhynchus masou*) Pineal Organ. *Biol Rhythm Res.*, 29: 86-97.

Liebmman, P.M., Wölfler, A., Felsner. P., Hofer. D., Schauenstein. K., 1997. Melatonin and the Immune System. *Int Arch Allergy Immunol*, 112:203-211.

Keleştimur H., 1996. İnsanda Pineal Bezin Fonksiyonlar.. Fırat Üniversitesi Sağlık Bilimleri Dergisi. 10 (1) : 141-7.

Kilic, E., ÖUzdemir, Y. G., Bolay, H., Keleştimur, H., & Dalkara, T. (1999). Pinelectomy aggravates and melatonin administration attenuates brain damage in focal ischemia. *Journal of Cerebral Blood Flow & Metabolism*, 19(5), 511-516.

Klein, D. C., Coon, S.L., Roseboom, P.H., Weeler, J.L., Bernard, M., Gastel, J.A., Zatz, M., Iuvone, M., Rodriguez, I.R., Begay, V., Falco N.J., Cahill, G., Cassone, V.M., Baler, R., 1997. The Melatonin Rhythm-generating enzyme: Molecular Regulation of Serotonin N-Acetyltransferase in the Pineal Gland. *Recent Prog. Horm. Res.*, 52:307-357.



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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Konturek, S.J., Konturek, P.C., Brzozowska, I., Pawlik, M., Sliwowski, Z., Czesnikiewicz-Guzik, M., Kwiecien, S., Brzozowski, T., Bubenik, G.A., Pawlik, W.W., 2007. Localization And Biological Activities of Melatonin In Intact and Diseased Gastrointestinal Tract (GIT). *J Physiol Pharmacol*, 58: 381-405,

Millet, B., Touitou, Y., Poirier, M.F., Bourdel, M.C., Amado, I., Hantouche, E.G., Bogdan, A., Olie, J.P., 1999. Obsessive - Compulsive Disorder: Evaluation of Clinical and Biological Circadian Parameters During Fluoxetine Treatment. *Psychopharmacology (Berl)*, 146: 268-274.

Nikaido, Y., 2004. Estimation of plasma melatonin fluctuation by cannulation in tropical fish. *International Congress on the Biology of Fish*. www.fishbiologycongress.org.

Pesonen, M., Korkalainen, M., Laitinen J.T., Andersson, T.B., Vakkuri O., 2000. 2,3,7,8-Tetrachlorodibenzo-P-Dioxin Alter Melatonin Metabolism in Fish Hepatocytes. *Chemico-Biological Interactions* 126: 227-240.

Randall, C., Thrush, M., Bromage, N., 1991. Absence of an Endogenous Component Regulating Melatonin Secretion In The Rainbow Trout. In: Arent J, Pevet P, Editors. *Advances in Pineal Research*, London: John Libbey . 5:279-81.

Reiter, R.J., Melchiorri, D., Sewerynek, E., Poeggeler, B., Barlow-Walden, L., Chuang, J., Ortiz, G.G., Acuna-Castroviejo, D.A., 1995. Review of the Evidence Supporting Melatonin's Role as an Antioxidant. *J Pineal Res*, 19: 149- 165.

Reiter, R.J., 1981. The Mammalian Pineal Gland: Structure and Function, *Am J Anat*, 162: 287-313.

Ron, B., Okimoto, D.K., 1999. Melatonin Release From the Pineals of Two Sparids: *Sparus aurata* And *Acanthopagrus bifasciatus*. *Adv. Exp. Med. Biol.*, 460:73-77.

Sies, H., 1997. Oksidatif stres: Oksidanlar ve antioksidanlar. *Experimental Physiology: Translation and Integration*, 82: 291-295.

URL 1. <http://Www.Akvaryumunuz.Com/index.Php/Makvgenelkonular/86.Html>

Vera, H., Tijmes, M., Ronco, A.M., Valladares, L.E., 1993. Melatonin Binding Sites in Interstitial Cells From Immature Rat Testis. *Biol Res* 1993; 26 (3): 337-40.

Wilson, L.D., Foster, D.W., 1985. The Pineal Gland And Circumventricular Organs. *Textbook Of Endocrinology*, 7th Ed. WB Saunders Co. Philadelphia, 1985; 535-539.



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and RURAL DEVELOPMENT
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BINGOL, TURKEY**



Withyachumnarnkul, B.,1992. N Acetyltransferase And Melatonin Levels İn The Optic Lobe Of Giant Freshwaterprawns, *Macrobrachium Rosenbergii* De Man. Comp. Biochm. Physiol. 102: 703-707.

Withyachumnarnkul, B., Poolsanguan, B., Poolsanguan, W.,1990. Continuous Darkness Stimulates Bodygrowth of the Juvenile Giant Freshwater Prawn, *Macrobrachium rosenbergii* De Man. Chronobiol. Int., 7:93-67.



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DENEY HAYVANLARINDA SINDİRİM SİSTEMİ ANATOMİSİ

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ÖZET

Günümüzde basit omurgalı hayvanlardan gelişmiş memeli hayvanlara kadar birçok hayvan türü denek olarak kullanılmaktadır. Deneyler de en fazla kullanılanlar sıçan, fare, tavşan ve balık, orta düzeyde kullanılanlar ise domuz, kobay, hamster ve maymundur. Deney hayvanları aşı, ilaç, zehirlilik çalışmaları ve biyolojik testlerde kullanılır. Genel olarak birbirinden farklı anatomik yapıya sahip olan deney hayvanlarının özellikle sindirim sistemi anatomilerini karşılaştırmak amacıyla bu derleme hazırlandı. Kobaylarda Diş formülü 2 (İ 1/1, C 0/0, P 1/1, M 3/3) toplamda 20 diş. Hamster premolar dişin yokluğundan dolayı uzun bir diastema'ya sahiptir (4). Sıçanlarda diş formülü İ 1/1, C 0/0, M 3/3 şeklindedir. Fare Diş formülü 2 (İ: 1/1, C: 0/0, P: 0/0, M: 3/3) toplam 16 adet diş bulunur. İncisiv ve molar diş arasında diastema mevcuttur. Tavşanların diş formülü İ 2/1, C 0/0, PM 3/2, M 3/3 şeklindedir. Kobayda tükrük bezleri olarak gl. parotis, gl. submaxillaris, gl. sublingualis, gl. orbitalis (zygomaticum) bulunur. Ancak sıçanda hemen m. temporalis'in üzerinde ona yaslanmış kulak kepçesinin cranialin'de büyük bir gl. orbitalis externa ile bulbus oculi'nin ventro-caudal'inde küçük bir gl. infraorbitalis bulunur. Tavşanlarda gl. parotis, gl. mandibularis, gl. zygomatica (gl. orbitalis), gl. buccales, gl. sublinguales bulunur. Kobay ve tavşanda torus linguae mevcuttur. Hamster Uzun bir dile sahiptir. Sıçanın tonsillaları yoktur. Fare de dil basıktır. Tavşanda her iki tarafta da tonsilla bulunur. Tavşanlarda sacculus rotundus bulunur. Farelerde ön mide kör bir kese teşkil eder. Safra kesesi suriye hamsterlarında mevcut iken avrupadaki hamsterlarda yoktur. Sıçanlarda vesica felleae yoktur. Sonuç olarak sindirim sistemi anatomisi deney hayvanlarında karşılaştırmalı olarak derlenmiştir.

Anahtar kelimeler: Sindirim sistemi, Anatomi, Deney hayvanları



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ANATOMY OF DIGESTIVE SYSTEM IN EXPERIMENTAL ANIMALS

ABSTRACT

Today, many animal species, from simple vertebrate animals to advanced mammals, are used as subjects. The most commonly used experiments were rats, mice, rabbits and fish, and intermediate ones were pigs, guinea pigs, hamsters and monkeys. Test animals are used in vaccines, drugs, toxicity studies and biological tests. In order to compare the digestive system anatomies of experimental animals having different anatomical structures in general, this review was prepared. Teeth formula 2 (I 1/1, C 0/0, P 1/1, M 3/3) in guinea pigs totaling 20 teeth. The hamster has a long diastema due to the absence of premolar teeth (4). In rats, the dental formula is 1/1, C 0/0, M 3/3. Mouse dental formula 2 (I: 1/1, C: 0/0, P: 0/0, M: 3/3) contains a total of 16 teeth. There is a diastema between incisive and molar teeth. The tooth formula of rabbits is in the form I 2/1, C 0/0, PM 3/2, M 3/3. In guinea pig salivary glands as gl. parotid, gl. submaxillaris, gl. sublingualis, gl. orbitalis (zygomaticum). However, the rat has a large external orbital gland in the cranial of the auricle leaning against it just above the musculus temporalis, and a small glandulae infraorbitalis in the ventro-caudal of the bulbus oculi. Rabbits have parotid gland, mandibular gland, zygomatic gland (orbital gland), buccal gland sublingual gland. Torus linguae is present in the guinea pig and rabbit. Hamster has a long tongue. The rat does not have tonsils. The mouse is also flattened. The rabbit has tonsilla on both sides. The rabbits have sacculus rotundus. In mice, the anterior stomach forms a blind sac. Gall bladder is present in Syrian hamsters but not in European hamsters. There is no vesica felleae in rats. As a result, the anatomy of the digestive system was compared comparatively in experimental animals.

Keywords: Digestive system, Anatomy, Experimental Animals



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INTRODUCTION

In general, animals used in scientific research, experiments and biological tests are defined as "Experimental Animals". They are mostly grown in laboratories or on farms for use in scientific research. These animals are born in artificial environments or cages, and are terminated after being used in research, experiments and tests (22,23). Again, among these animals, animals such as rats, mice, guinea pigs, hamsters and rabbits, which are generally produced with special techniques in laboratories, can be called "Laboratory Animals". It has been suggested that they can be defined as 'Experimental Animals'. It is seen that animals such as horses, cats, dogs and monkeys, which were used in many scientific studies in the past, are used in limited numbers today, especially due to ethical concerns (1,24).

The Basic Study Areas Where Animal Experiments Are Made Today Are:

- ☐ Research, education and practice in the fields of medicine, veterinary medicine, dentistry, pharmacy and basic biology.
- ☐ Research, diagnosis and treatment of diseases or health problems in humans and animals.
- ☐ Substances, products or applications such as drugs, vaccines, toxins, antitoxins and antiserums used in humans and animals; research on production, safety, efficacy, quality and side effects, and standardization and testing of drugs and biological substances and additives.
- ☐ Investigation of physiological and etiological events in humans and animals.
- ☐ Toxicological studies for environmental protection and environmental pollution.
- ☐ Forensic research (1).

GENERAL FEATURES OF EXPERIMENTAL ANIMALS

Morphological Characteristics of Rats and Mice

In both species, class Mammalia, Order Rodentia, family Muridae, rats belong to *Rattus* species and mice belong to *Mus musculus* species. These species, which are most preferred in laboratory research, can be found almost everywhere in the world. They adapt very well to environmental conditions (1).

The bodies of the rats are covered with long and hard hairs, and there are rings and scales on the tail. The mouse tail is long, slender and bare, although the tail regulates both balance and hemoethermia. The ears of the rats are large compared to the head, the eyes are small, the nose is long, and the tail length is equivalent to the body length. The tail and body length of the mice are equal to each other and the body length is 12-15 cm excluding the tail. Adult mice weigh



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30 g. It has an average lifespan of 2 years. The body length of the rats is 20-25 cm, excluding the tail, and their weight is 200-500 gr. as much. Their life span is around 2.5-3.5 years on average. In both species, the senses of hearing and smell are well developed; however, the sense of sight is weak, mice cannot distinguish colors, they are cold-resistant creatures. These are omnivorous animals, and coprophagy (= excrement eating) characteristics of rats can also be observed (1,6,).

The most commonly used rat species are Wistar albino, Sprague-Dawley, Long Evans.

The most commonly used mouse species is *Mus musculus domesticus* = *Mus domesticus domesticus*.

General Characteristics of Hamster

They are active at night and sleep and rest during the day. The sense of smell is developed. They do not like loud places. Their eyesight is poor. They love to dig. They need to run long distances. In addition to storing food in their mouths, they also stock up on suitable places inside their cages. They prefer to live alone and cannot get along with other hamsters (21,22).

General Characteristics of Guinea pigs

It belongs to the class Mammalia, order Rodentia, *Cavia apere aporcellus*, and is native to South America. They were brought to Europe as pet animals by the Spanish in the 16th century (1). Their bodies are covered with straight hair, their head is large, their ears and eyes are small, and they do not have a tail. They have short legs. Its length is around 14 cm at birth and around 30 cm in adults. The average adult weight is 900-1200 gr. It has a pair of nipples located in the inguinal region. They are herbivores. They can eat their feces. Their lifespan is on average 4-5 years. Breeding females have a shorter lifespan and live an average of 2 years. They show continuous polyestrus that is not seasonal. They can give birth twice a year. The offspring are born fully feathered, with developed teeth and open eyes (1,21,22).

General Characteristics of Rabbits

The Rabbit Logomorpha group belongs to the Leporidae family. They have a pair of small incisors behind the first incisive tooth, especially in the upper jaw. Rabbits have a long head and short, white fur. They are herbivores; they do not consume meat. Their reproductive abilities are high. They breed until about 3-4 years old and give birth 4-6 times a year. Their life span ranges from 5 to 15 years. Adult males 2-4 kg.; females are 2-5 kg. around (1,21,22).

DIGITAL SYSTEM ANATOMY IN EXPERIMENTAL ANIMALS



Anatomy of the Digestive System in Guinea Pigs

Tooth formula: 2 (I 1/1, C 0/0, P 1/1, M 3/3) 20 teeth in total. All teeth are hypsodont and persist until they fall. There are no clear, obvious lines on the palatum. The tip of the tongue is relatively long and the torus linguae is present (3).

Salivary Glands (Gll. Salivales)

Gl. parotid: It is in the ventral part of the ear and is in the form of the letter "Y". Its duct, ductus parotideus, is about 3 cm long and m. Proceeding along the dorsal edge of the massetericus, it opens into the vestibulum buccale at the level of the molar teeth (4).

Gl. submaxillaris: It is composed of many lobules. The duct is approximately 4 cm. It is long and passes between the musculus digastricus and the musculus pterygoideus medialis and opens to the caudal of the incisors (4).

Gl. sublingualis: It is located on the sides of the tongue. They have four or five draining ducts and they open into the oral cavity from the caudal of the place where the duct of the glandula submaxillaris opens (4).

Gl. orbitalis (Zygomaticum): It is located ventral to the bulbus oculi and extends along the arcus zygomaticum. The duct of this gland emerges from the anterior of the gland, passes between the orbita and the musculus masseter, and opens into the oral cavity from the caudal point of the ductus parotideus (4).

Oesophagus: It is 8-11 cm long in adult guinea pigs. Tunica muscularis carries transverse striated muscle fibers up to the cardia of the stomach (3).

Stomach (Gaster): It is pear-shaped and located to the left of the median line in the cavum abdominis. It has a less prominent blind sac to the left of the Cardia region. It has a capacity of 10-25 cm and shows a slight enlargement before the pylorus (figure -1). The muscle layer is well developed in the pylorus area. The right side of the cranial face is covered by the left lobe of Hepar. When the stomach is full, it reaches the ventral wall of the abdomen. It lies in the caudal of the diaphragm between the 9-11 costae of the left abdominal wall (8).

Small intestines (Intestinum tenue): The length of all small intestines is about 125 cm in adults (19).

Doudenum: It is quite short and is typically divided into 3 parts (cranial part, pars descendens and pars ascendens). It has a very short mesoduodenum and is connected to the hepar by the ligamentum hepatoduodenale and to the colon by the ligamentum doudenocolicum (12).

Jejunum: Located on the left and long. It is a rather spiral structure and has a long meso (4).



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Ileum: It is very short and the jejunum and ileum average 1 meter long. The ligamentum ileocaecale is quite prominent (4).

Large intestines (Intestunum crassum): The average length of all large intestines is 86 cm (4).

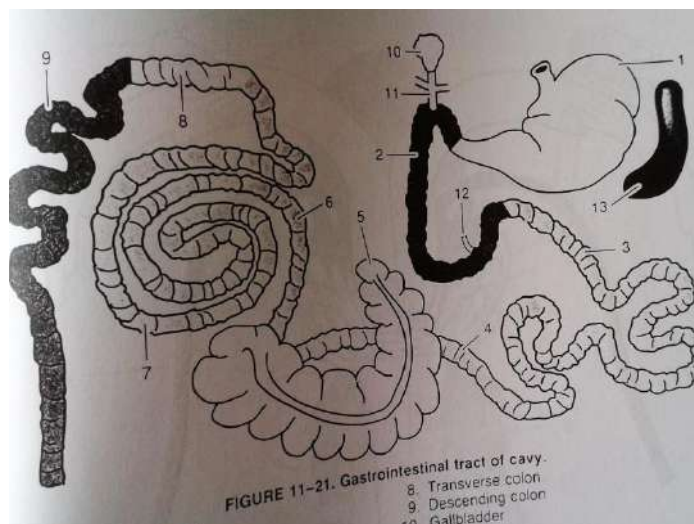


Figure 1: Anatomy of the Digestive System in Guinea Pigs (8)

Caecum (Blind intestine): It occupies 1/3 of the abdominal cavity. It is the largest part of the digestive system (19). It has two taenia libera, one dorsal and one ventral, and a mesenterial taenia. The caecum is located transversely in the abdominal cavity. Its convexity is directed towards the caudale. The ileum opens into the convex part on the left side. The left part of the caecum is large. There is a valvula at the junction with the Colon. Its left extension represents the processus vermiformis.

Colon: It almost surrounds the caecum and runs parallel to the vertebral column. The pars ascendens, located ventral to the caecum, is connected to the caecum by the plica ileocecale. After making the ansa spiralis between the abdominal wall and the caecum near the right kidney, it forms the colon transversum. On the left, it passes to the pars descendens, where small sacculations are seen, and ends with the rectum.

Rectum: The sequel to Colon.

Liver (hepar): It is located on the right side of the abdominal cavity and is 3-4% of body weight and weighs 23-24 gr. weighs. Lobus dexter is larger than lobus sinister. The lobus caudatus can sometimes be as large as the lobus dexter. Each main lobe is divided into two. Vesica felleae is



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embedded in the lobus medialis of the lobus dexter. Part of lobus caudatus proc. The papillaris is small and irregular. Vesica felleae is relatively small and filled with bile.

Pancreas: It has a common appearance in the mesoduodenum and omentum majus. It extends to the left kidney. The ductus pancreaticus opens into the pars descendens of the duodenum. It opens only to the pars ascendens of the ductus pancreaticus accessorius duodenum.

Hamster Digestive System Anatomy

Cavum oris: has a long diastema due to the absence of the premolar tooth.

It has a long tongue (4).

Gaster: It consists of glandular and non-glandular (cutane) parts (margo plicatus). The first part of the stomach, like the finger, is largely separate from the other part. The mucous membranes of both parts are different and the first stomach is open and the second stomach is reddish in color. The length of the intestines is around 70 cm, 4-5 times the body length (3).

Jejunum: It is very long (4).

Caecum: Located on the left side of the cavum abdominis and is large. It consists of colon ascendens, colon transversus, and colon descendens (4).

Hepar: It is similar to the dog liver, as the right and left lobes are divided into medial and lateral parts. Lobus quadratus and lobus caudatus are also present. As in other animals, proc. caudatus is very prominent. Color is dark red. While the gallbladder is present in Syrian hamsters, it is absent in European hamsters (12).

Pancreas: It is associated with the stomach and duodenum (3).

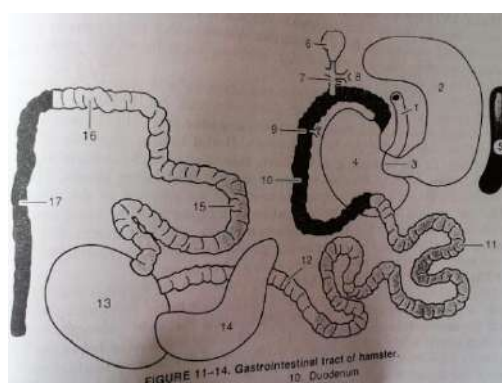


Figure 2: Hamster Digestive System Anatomy (12)

Digestive System Anatomy in Rats



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Its mouth structure is similar to that of other rodents. The tongue has mechanical and gustatory papillae. They do not have tonsils. The salivary glands are like those of other mammals. However, the rat has a large glandula orbitalis externa in the cranial of the auricle leaning against it just above the musculus temporalis, and a small glandula infraorbitalis in the ventro-caudal of the bulbus oculi. The teeth are monodont type and the dental formula is I 1/1, C 0/0, M 3/3 (12).

oesophagus; It has an average length of 7-8 cm and continues as transverse striated muscle fibers from the tunica muscularis to the pars cardiaca of the stomach (4).

Gaster: It is located in the cranial of the cavum abdominis, between the 11-12 costa, and is adjacent to the hepar anteriorly and the lien posteriorly. Within the curvatura minor is the processus papillaris of the liver. A small part of the foregut can reach the left kidney (4).

Gaster has two distinct types of mucosa. Most of it, which is glandular in external view, is also the saccus caecus, which is seen as a blind sac.

The thin-walled, off-white, well-developed blind sac is considered to be the anterior stomach, and this part constitutes 2/5 of the stomach. The other remaining yellowish-reddish, thick-walled part is the main stomach, which is glandular and extends to the pylorus (3).

Duodenum; It is S-shaped, follows the facies visceralis of the hepar, moves towards the right abdominal wall, and then runs along the lumbar muscles, and after a while, it tends to the median line and connects to the colon transversum (12).

Jejunum: Suspended by a long mesojejunum. It makes countless folds. Most of it is located on the right side of the abdominal cavity. There are several lymph nodes in the radix region of the mesenterium. 70-90 cm with ileum. length (4).

Ileum: It is the continuation of the jejunum. And it opens directly to the colon (3).

Caecum: It constitutes the most voluminous part of the large intestine. It is pushed to the left side of the cavum abdominis, almost in the shape of the number 6, a part of which is curled up on itself. The middle part shows a narrowing and the rest of this articulation is accepted as processus vermiformis. The caecum is 6-9 cm in length (4).



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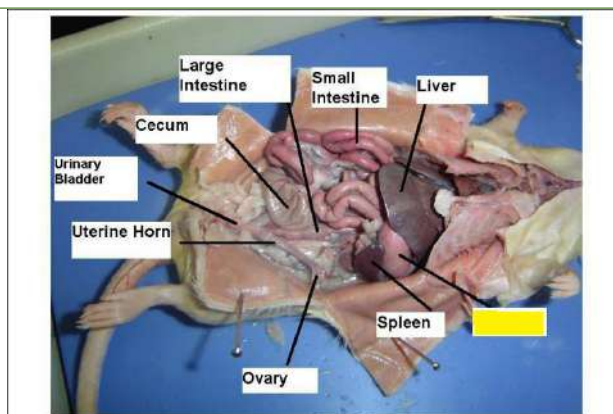


Figure 3: Rat Digestive System Anatomy (25)

Colon: After the caecum, it progresses as the colon ascendens, colon transversus and colon descendens and ends with the rectum (4).

Hepar (liver): Looping is obvious. Vesica felleae is absent. The lobus sinister is larger than the other lobes and is divided into medial and lateral lobes. Lobus dexter also has medial and lateral lobes. The medial part is divided into cranial and caudal lobules. There are also lobus caudatus and processus papillaris. It is attached to the cartilago xyphoidea by the hepar ligamentum falciformis. The hepar, which is attached to the stomach by the ligamentum gastro-hepatica, to the duodenum by the ligamentum hepato-duodenale, and to the ren dexter by the ligamentum hepato-renale, is fixed from the sides by the ligamentum triangulare dexter and sinister in addition to these ligaments. Bile opens into the duodenum with the ductus choledochus (4).

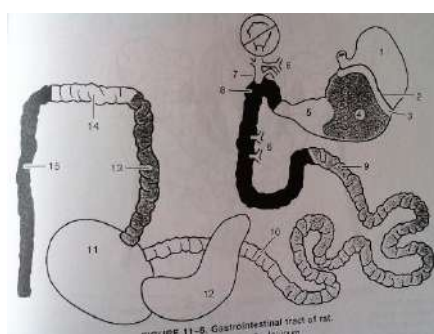


Figure 4: Rat Digestive System Anatomy (12)

Pancreas: Its weight is around 550 mg. It is very common. While the body of the pancreas is associated with the cranial part of the duodenum, the right lobe is close to the pars descendens and the left lobe is close to the pylorus of the stomach (4).



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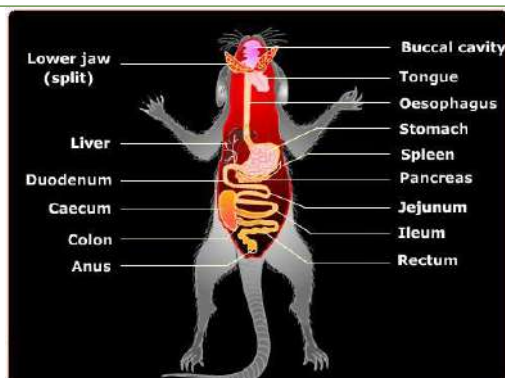


Figure 5: Rat's Digestive System Anatomy 3D (26)

Digestive System Anatomy in Mice

Cavum oris: Like all other rodents, rats' incisive teeth continue to wear throughout their lives. Tooth formula: 2 (I: 1/1, C: 0/0, P: 0/0, M: 3/3) There are a total of 16 teeth. There is a diastema between the incisive and molar teeth (12).

The language is flat.

Oesophagus: It is 7-8 cm long and opens to the cardia part of the stomach.

Gaster (stomach): It appears to be located in the cranial of the cavum abdominis and almost transversely to the long axis of the body. Where it is located, between the 11 and 12 costa, it contacts the left abdominal wall with a small triangle of the anterior stomach. The stomach is divided into glandular and non-glandular parts. Structurally, it is almost the same as that of rats. The anterior stomach forms a blind sac (figure -1).

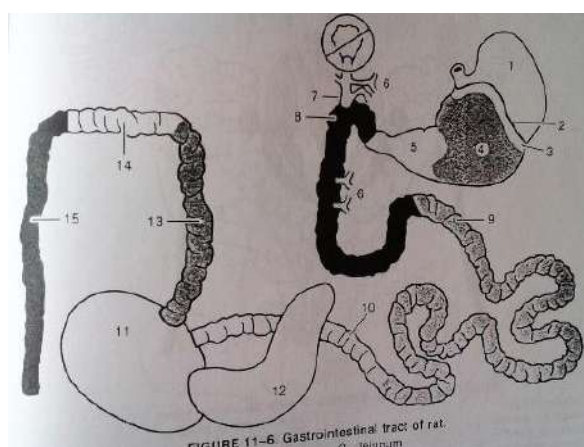


Figure 6: Anatomy of the Digestive System in Mice (12)

Duodenum: It follows an S shape and the mesoduodenum is short.

Jejunum: Makes many folds (ansa) in the abdominal cavity.



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Ileum: Located next to the caecum and connected to the caecum by the plica ileo-caecale.

Caecum: Similar to the stomach and located on the right side of the abdominal cavity. Caput caeci is comma-shaped.

Colon: It begins as the colon ascendens within the concavity of the caecum and continues as the colon transversum and colon descendens, and ends with the rectum. Intestines average 65 – 67 cm. in length. Large intestines from this 0.9 -11cm. small intestines 54 - 57 cm. appears in length.

Hepar: It conforms to the concavity of the diaphragm and its facies diaphragmatica is cambered. Lobus quadratus is slightly larger.

Ligaments seen in rat liver are also found in mice. Between the lobus quadratus and the lobus intermedius is the vesica felleae. Lobus caudatus has a large processus caudatus. In addition, there are 2 processes papillaris in hepar. Hepar weighs 2.8 g on average and constitutes 6.90% of body weight. Vesica felleae is present (3).

Pancreas: It has two lobes. The cranial part extends close to the pylorus (4).

Digestive System Anatomy in Rabbits

The entrance to the oral cavity, which is surrounded externally by the cheeks and lips, is limited by the lips and teeth. Rabbits have 3 types of teeth in their oral cavity. These are incisors, premolars and molar teeth, respectively. Rabbits have a large toothless area between the incisors and premolar teeth. This area is called diastema (2).

The dental formula of rabbits is $I \frac{2}{1}, C \frac{0}{0}, PM \frac{3}{2}, M \frac{3}{3}$. There is a pair of long teeth in the upper jaw and 1 pair of small teeth just behind them (22).

Palatal state: It is covered with 4-5 cm long transversal rugae. Their number varies between 16-26. The torus linguae is evident on the tongue. Frenulum linguae prominent. Behind the radix of the tongue is the small tonsilla on both sides. Cavities are sinus tonsillaris and are very rare (4).

Gl. parotid: It is lobular and brownish in color ventral to the ear. The ductus parotideus pierces the buccal mucosa opposite the upper second molar tooth and opens into the vestibulum buccale (4).

Gl. mandibularis: It is located ventro-medial to the angulus mandible. It is densely lobed. It is 2 cm long, 750-800 mg in weight. The ductus mandibularis emerges from the dorsal aspect of the gland and passes the musculus digastricus dorsally. It crosses the nervus lingualis and opens next to the frenulum linguae (4).



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Gl. zygomatica (gl. orbitalis): It is located between the arcus zygomaticus and the periorbita. It has a lobular structure and is 600-700 mg in light brown appearance. On the lateral edge of its ventral surface, 2-4 ductus excretorius are seen leaving the gland, they open into the mouth (4).

Gl. buccales: They are found scattered all over the cheek (3).

gl. Sublinguales: It is between the corpus linguae and the pars molars of the os mandibulae (4).

Oesophagus: It is 12-15 cm long and has mucosa glands near the pharynx. After passing the esophagus diaphragm, it enters the stomach (4).

Rabbits have a voluminous stomach. The gastric mucosa is divided into three as pars fundica, pars cardiaca and pars pylorica. The Cardia region is small. The posterior surface of the stomach is in contact with the pancreas and colon. Cardia has a diverticulum. A large lymph node is seen where the esophagus enters the stomach. Cardia has whitish circular folds. The pylorus region first makes an enlargement called the antrum pylori. The muscles in this area are well developed. Mucosa color is pale red in fundus and pale yellow in pylorus (2,5,9).

Duodenum: After leaving the pylorus, it courses to the right and slightly dorso-cranial. It forms a short pars cranialis. It then continues caudal to the left as pars descendens. After forming the pars transversa by making ansa caudales with a few folds at the level of the last lumbar vertebrae, it is directed towards the stomach in the cranial direction again, and joins with the jejunum by making the flexura duodeno-jejunalis at the level of the ventral of the pars cranialis. With the ductus choledochus, the ductus pancreaticus opens into the pars cranialis (2,5).

Jejunum: It hangs on the dorsal wall of the abdominal cavity by a long mesojegenalis in the left 1/3 of the cavum abdominis, making numerous large ansas. It unites with the caecum through the ligamentum iliocaecale (3).

Ileum: Shortly before this intestine opens into the caecum, it makes an enlargement in the form of a sac or balloon called the sacculus rotundus. There are those who include it in caecum. The mucosa of Sacculus rotundus is light gray. It contains a large amount of lymph follicles. It is also called cecal tonsil (18). The ileum enters the caecum like a spindle-shaped tube with a diameter of 1-3 mm. This region is attached to the median line of the ceiling of the abdominal cavity by a ligament called the mesoileum. Near its cranial edge, almost at the level of the pole caudalis of the ren dexter, there are lentil-sized cranial mesenterial lymph nodes. These are 0.5-1.4 cm in size. In addition, small lymph nodes are found where it connects to the mesenterium of the intestine (4,15,16).



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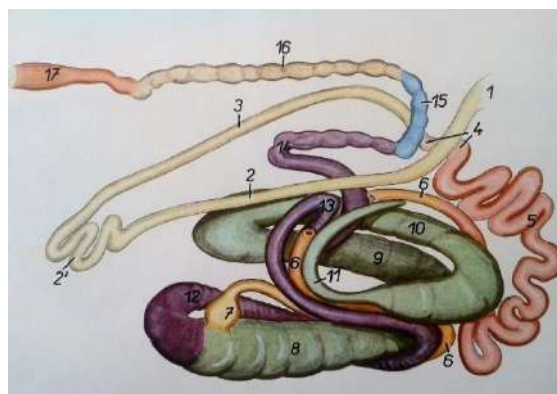


Figure 7: Anatomy of the Digestive System in Rabbits (2,5)

Caecum: As soon as the abdominal cavity is opened, it immediately draws attention as a large intestine. This double spiral is in folds. It fills 1/3 of the abdominal cavity and 1/5 in old animals. However, its capacity is 6-12 times more. It has a caudal hood at the beginning. The widest part of the middle of the corpus is 3-4 cm. There are two, taenia. One is taenia libera and the other is taenia vasculosa. There are approximately 25 haustras. Processus vermiformis is 8-12 cm long, 0.5-1 cm thick. It is more strongly formed in young animals than in old ones. Compared to other non-ruminant creatures such as horses, their caecum is well developed (7,9,10).

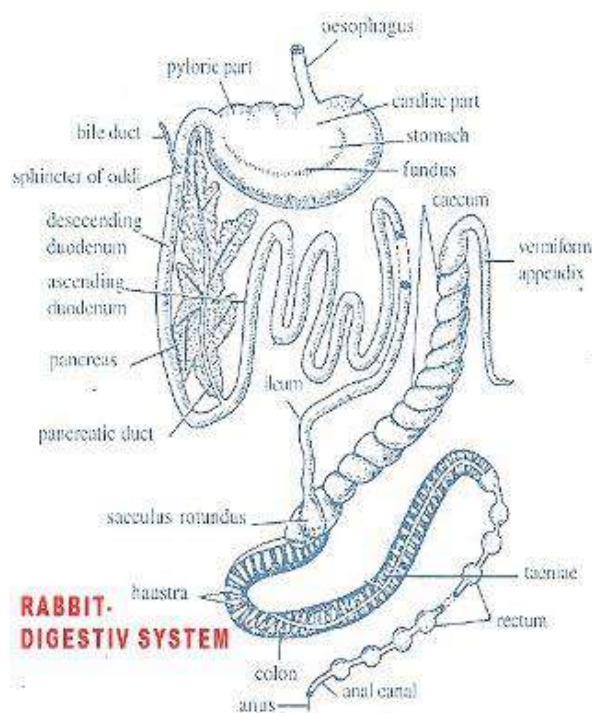


Figure 8: Rabbit Digestive System (27)



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Colon: It has haustras on it. Colon; It consists of three parts: colon ascendens, colon transversum, and colon descendens. Three taenia, two free and one mesenterial taenia, are seen on the colon (10).

Rectum: It is the continuation of Colon and ends with the anus (4).

Hepar: 3-4% of body weight. The lobed edges are sharp with deep incisuras. League. falciformis, inc. The umbilicalis is very deep. With this incisura, it is divided into the hepar lobus dexter and the lobus sinister. An accessor lobe is separated from each lobe. The left main lobe is larger than all lobes (2).

Right hepatic half lobus accessorius with a narrow bridge lobus caudatus and small proc. It consists of the main lobe fused with the papillaris. Lobus papillaris is two in number. Impressio renalis is prominent (20).

Vesicafellae: It is small and its blunt end does not reach the free edge of the hepar. The ductus cysticus, which has a duct, merges with that of the left lobus ductus hepaticus, and the two form the ductus choledocus. Three small ductus hepatocystici from other lobes are seen near the collum of the sac. It opens into the duodenum near the ductus choledochus pylorus (5).

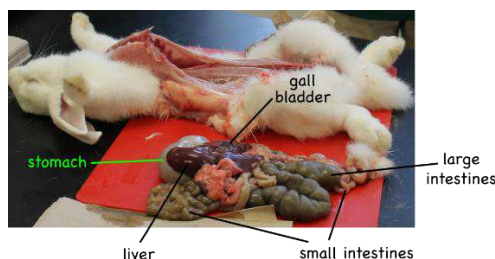


Figure 9: Rabbit Digestive System (28)

Pancreas: Located in the narrow left part of the stomach. The ductus pancreaticus traverses the organ. It usually opens separately, sometimes together, together with the ductus choledochus, into the pars ascendens of the duodenum. It weighs 300-600 g (4).

CONCLUSION

As a result, the general characteristics of the experimental animals and the anatomical differences of the digestive systems were compiled from various sources and presented.

ACKNOWLEDGEMENT



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REFERENCES

- Barone, R., Pavaux, C., Blin, P.: Atlas D' Anatomie Du Lapin. Paris, 1973.
- Besley, BA., Craige, EH.: Besley's Practical Anatomy of the Rabbit. Eight Edition, Toronto University of Press, Toronto, 1969.
- Çalışlar T. Laboratuvar Hayvanları Anatomisi, İstanbul Üniversitesi yayınları ISBN: 975-404-004-4. İstanbul 1987.
- Çalışlar T.: Laboratuvar Hayvanları Anatomisi, Fırat üniv. Veteriner Fak. Yayınları, Ankara, Ankara Üniv. Basımevi, 1978.
- Deeb B. Digestive system and disorders. In: Flecknell PA, ed. Manual of Rabbit Medicine and Surgery. Quedgeley, UK: British Small Animal Veterinary Association; 2000:39–46. 6.
- Deney Hayvanları Fizyolojisi, Refah Ve Fizyolojisi, Refah Ve Davradış Özellikleri Doç. Dr. Mehmet ÇAY F.Ü. Veteriner Fakültesi Fizyoloji AD.
- Donnelly TM. Disease problems of chinchillas. In: Quesenberry KE, Carpenter JW, eds. Ferrets, Rabbits and Rodents, Clinical Medicine & Surgery. 2nd ed. St. Louis, MO: Saunders; 2004:255–265.
- Flecknell PA. Guinea pigs. In: Meredith A, Redrobe S, eds. BSAVA Manual of Exotic Pets 4th ed. Quedgeley, UK: British Small Animal Medical Association; 2002:52–64. 8.
- Harcourt-Brown F. Textbook of Rabbit Medicine. Oxford, UK: Butterworth Heinemann; 2002. 2.
- Harkness JE, Wagner JE. The Biology and Medicine of Rabbits and Rodents. 4th ed. Media, PA: Williams and Wilkins; 1995. 7.
- Hofer HL, Crossley DA. Chinchillas. In: Meredith A, Redrobe S, eds. BSAVA Manual of Exotic Pets. 4th ed. Quedgeley, UK: British Small Animal Medical Association; 2002:65–75. 9.
- James E., Smallwood, D.V.M., M.S. "A Guided Tour of Veterinary Anatomy" domestic ungulates and Laboratory Mammals, 0-7216-3731-0 United States of America 1992.
- Johnson-Delaney CA. Exotic Companion Medicine Handbook for Veterinarians. Lake Worth, FL: Zoological Education Network; 1996, 1997. 5.
- Kozma, C., Macklin, W., Lurance, MC., Mauer, R.: Anatomy, Physiology and Biochemistry of the Rabbit. New York, San Francisco, London, Academic Press, 1974.



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Lebas, F., Coudert, P., Rouvier, R., Rochambeau, H.: The Rabbit Husbandry, Health And Production. F.A.O. Animal Production And Health Series, no:21, Rome, 1986.

Lowe JA, deBlas C, Wiseman J. The Nutrition of the Rabbit, New York, NY: CABI Publications; 2000. 4.

O'Malley B. Clinical Anatomy and Physiology of Exotic Species: Structure and Function of Mammals, Birds, Reptiles, and Amphibians. London, UK: Elsevier Saunders; 2005.

Özgüden, T., Bahadır, A.: Veteriner Anatomi, İç Organlar, U. Ü. Vet. Fak. Yayınları, Bursa, 1997.

Schley, P.: Kaninchen/von Peter Schley, Stuttgart, Ulmer, 1985.

University of washington animal use training session rabbit lab handout 2010.

Yavru, N., Yavru, S. 2000. Deney Hayvanları. Selçuk Ü. Veteriner F. Yayınları, Konya.

Yavru, N., Yavru, S.: Deney Hayvanları, Konya, Selçuk Üniv. Veteriner Fak. Yayın Ünitesi, 1996.

Zutphen, L.F.M., Baumans, V., Beynen, A.C., 2003. Laboratuvar Hayvanları Biliminin Temel İlkeleri(Çeviri editörü: İde, T.), Medipres, Ankara.

Armutak, E.İ., Yiğit, F.: Laboratuvar Hayvanları Rehberi, Nobel Tıp Kitapevleri, 978-605-335-067-5, 2014.

[https://www.chegg.com/flashcards/rat-digestive-system-ac3ea185-3506-4388-a720-d13daee32b1b/deck\(13.12.2021\)](https://www.chegg.com/flashcards/rat-digestive-system-ac3ea185-3506-4388-a720-d13daee32b1b/deck(13.12.2021))

<https://ratdissectionplace.weebly.com/digestive-system.html> (13.12.2021)

[https://www.bioscience.com.pk/topics/zoology/item/317-digestive-system-of-rabbit\(13.12.2021\)](https://www.bioscience.com.pk/topics/zoology/item/317-digestive-system-of-rabbit(13.12.2021))

<https://montessorimuddle.org/dissecting-rabbits/> (13.12.2021)



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**BİR SAZ KEDİSİNDE (*FELIS CHAUS*) SKELETON APPENDICULARE ÜZERİNE
MORFOLOJİK VE OSTEOMETRİK ÖLÇÜMLER**

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ÖZET

Bu çalışmada Kafkas Üniversitesi Yaban Hayatı Koruma ve Kurtarma Rehabilitasyon Merkezine Humerus kırığı tanısıyla getirilen Kafkas Üniversitesi Veteriner Fakültesi Eğitim Araştırma ve Uygulama Hastanesi'nde tedavi altına alınıp yapılan tüm müdahalelere rağmen kurtarılamayan 1 adet dişi saz kedisi kullanıldı. Kadavrada deri ve kaslar diseke edildikten sonra ön ve arkabacak kemikleri ortaya çıkarıldı. Klasik maserasyon yöntemiyle temizlendi ve kurutuldu. Skeleton appendiculare'ye ait sağ ve sol bacak kemiklerinin önemli noktalarından Driesch (1976)'ın belirlediği yönteme göre digital kumpas yardımı ile ölçüler alındı. Anatomik oluşumların N.A.V. (2017)'a göre isimlendirilmeleri yapıldı. Spina scapulae'nin facies lateralis'i ½ oranında ikiye böldüğü görüldü. Cavitas glenoidalis üzerinde çengel şeklinde tuberculum infraglenoidale bulunuyordu. Margo caudalis üzerinde belirgin bir çıkıntının varlığı tespit edildi. Os scapula'nın uzunluğu 97.10 ± 0.13 mm, os humerus'un uzunluğu 347.50 ± 3.53 mm, os radius'un uzunluğu 131.76 ± 0.94 mm, os ulna'nın uzunluğu 143.49 ± 0.54 mm, olarak ölçüldü. Pelvis, tibia ve fibula'nın uzunlukları sırasıyla 103.30 mm, 154.57 ± 0.06 mm, 147.68 ± 0.19 mm. olarak tespit edildi. Os femurun uzunluğunun da 149.56 ± 0.23 mm olduğu analiz edildi. Her iki os femur üzerinde fabellalara ait eklem yüzleri görülmedi. Foramen obturatum'un belirgin bir şekilde büyük olduğu gözlemlendi. Foramen obturatum uzunluğu ortalama 25.36 ± 0.05 mm olarak ölçüldü. Sonuç olarak bu çalışmada, literatürde pek fazla rastlanılmayan bir Saz kedisinde skeleton appendiculare'nin oluşumuna katılan kemiklere ait morfolojik ve morfometrik değerler belirlenerek, bu alandaki bilgi eksikliğinin giderilmesine katkıda bulunuldu. Elde edilen bulguların, bilimsel araştırmalara, seksüel dimorfizm değerlendirmelerine, zooarkeolojik çalışmalara ve felidae familyasında yapılacak operasyonlara katkı sağlayacağı kanaatine varıldı.

Anahtar kelimeler: Saz kedisi, makroanatomi, morfometri, skeleton appendiculare



**A MACROANATOMİC AND MORPHOMETRIC STUDY ON THE
APPENDİCULAR SKELETON IN AN JUNGLE CAT (*FELİS CHAUS*)**

ABSTRACT

In this study, one female Jungle cat, which was brought to the Kafkas University Wildlife Protection and Rescue Rehabilitation Center with the diagnosis of humerus fracture, was treated at the Training, Research and Application Hospital of the Faculty of Veterinary Medicine, and could not be saved despite all the interventions. After dissecting the skin and muscles of the cadaver, the bones of the forelimb and hindlimb were exposed. It was cleaned and dried using the classical maceration method. Measurements were taken from the important points of the right and left leg bones of the appendicular skeleton with the help of digital caliper according to the method determined by Driesch (1976). They were named according to N.A.V. (2017). It was seen that spina scapulae divided the facies lateralis into two parts at a rate of $\frac{1}{2}$. Tuberculum infraglenoidale was found to be hook-shaped on the cavitas glenoidalis. The presence of a prominent protrusion on margo caudalis was detected. The length of the scapula was 97.10 ± 0.13 mm, the length of the os humerus was 347.50 ± 3.53 mm, the length of the os radius was 131.76 ± 0.94 mm, and the length of the os ulna was 143.49 ± 0.54 mm. The lengths of the pelvis, tibia, and fibula were 103.30 mm, 154.57 ± 0.06 mm, and 147.68 ± 0.19 mm, respectively. The length of the os femur was also analyzed to be 149.56 ± 0.23 mm. Articular surfaces of fabella were not observed on both os femur. The foramen obturatum was observed to be significantly larger. The mean length of the foramen obturatum was measured as 25.36 ± 0.05 mm. As a result, in this study, the morphological and morphometric values of the bones involved in the formation of the skeleton appendiculare in a Jungle cat, which is not very common in the literature, were determined and contributed to the elimination of the lack of knowledge in this area. It was concluded that the findings will contribute to scientific research, sexual dimorphism evaluations, zooarchaeological studies and operations to be performed in the felidae family.

Keywords: Appendicular Skeleton, Macroanatomy, Morphometry, Felis chaus



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INTRODUCTION

The Jungle cat (*Felis chaus*) is a long-legged and short-tailed wildcat. The humid regions of Asia are the habitat of this cat. The reed cat has beige fur with no obvious markings or markings. It only has black rings on its tail. There are black hairy forelocks at the tips of their ears, which reminds them of a lynx. This causes it to be described as a swamp lynx. Its body length is 70 cm and in addition to this, there is a 30 cm tail. The habitat of the reed cat is swamps, moist meadows, reed forests, and coastal scrub and heathland. Exceptionally, the reed cat is also seen in relatively drier environments. However, it looks for the water source near here as well. The reed cat is distributed over an area from Sri-Lanka through India and Mesopotamia to the Idil Delta and the Xinjiang Uyghur Region. Its only population on the African Continent occurs in Egypt, in the lower Nile Valley. It is also a type of cat found in Turkey. It has been recorded in Eğirdir Lake, Nallıhan, Manavgat Stream, Akyatan Lake, Porsuk Stream in Turkey (Vikipedi, 13.12.2021).

Factors affecting bone development are age, gender, nutrition, hormones (growth hormones, thyroid hormones, sex hormones, glucocorticoids), genetic potential, exercise, and diseases (Johnstone 2004). The cingulum membrane is formed by the thoracici os coracoides, the clavícula, and the scapula. In domestic mammals, os coracoides shrinks and is located medial to the scapula as processus coracoideus (König and Liebich 2015).

Ossa Membri Thoracici

Scapula: It is the bone that is fully formed from the forelimb arch bones in domestic mammals. Scapula has two faces, facies costalis and facies lateralis. Facies costalis contains anatomical structures called facies serrata, fossa subscapularis. Facies lateralis include spina scapula, tuber spina scapula, fossa supraspinata, and fossa infraspinata. In the canine scapula, spina scapulae divides the facies lateralis of the scapula into two equal depressions. The ratio of fossa infraspinata to fossa supraspinata is 1/1. The lower end of the spina scapulae forms the acromion. Dogs have processus hamatus. Cats also have processus suprahamatus. The scapula has 3 sides, namely margo dorsalis, margo cranialis and margo caudalis (Dursun 2008). Cartilago scapulae is present in the form of a narrow strip in carnivores on Margo dorsalis. With the union of margo dorsalis, margo cranialis and margo caudalis, three angles are formed, namely angulus cranialis, angulus caudalis and angulus ventralis. Angulus ventralis has a pit called cavitas glenoidalis at its tip. This cupping includes the caput humeri and participates in the shaping of the shoulder joint (Bahadır and Yıldız 2014).



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Humerus: The extremitas proximalis of the humerus includes caput humeri, collum humeri, tuberculum majus, crista tuberculi majoris, tuberculum minus, crista tuberculi minoris, tuberculum intermedium, and sulcus intertubercularis. sulcus m. on the corpus humeri. brachialis, tuberositas deltoidea, and tuberositas teres major. In carnivores, the tuberculum minus is not divided into cranial and caudal parts. The extremitas distalis of the humerus is formed by the condylus humeri. In carnivores, the condylus humeri consists of an outer small capitulum humeri and an inner larger trochlea humeri. The fossa radialis is the fossa radialis, on the anterior surface of the condylus humeri. There is another depression called fossa coronoidea on the medial side of the fossa radialis. During the flexion of the elbow, the processus coronoideus medialis of the ulna enters this cavity, which exists only in the cat. The fossa olecrani is the depression on the upper and posterior surface of the condylus humeri. The fossa olecrani is bordered on both sides by the epicondylus lateralis and the epicondylus medialis. There is a hole called foramen supracondylare, which exists only in cats, on the epicondylus medialis. Arteria brachialis and nervus medianus pass through this hole, which exists only in the cat. In the dog, the fossa radialis is connected to the fossa olecrani via the foramen supratrochleare. fossa radialis (Dursun 2008, Bahadır and Yıldız 2014).

Skeleton antebrachii: It consists of the medial radius and the lateral ulna. The extremitas proximalis of the radius includes the caput radii, fovea capitis radii, collum radii, and tuberositas radii. The extremitas distalis of the radius is called the trochlea radii because of its spool shape. On the outer surface of the lower end of the radius, incisura ulnaris, which is prominent in carnivores and is an articular surface, is present. It fits the distal end of the incisura ulna. This harmony shapes the articulatio radioulnaris distalis, which is also present in carnivores. Inner side of the lower end of the radius is the processus styloideus medialis. The upper end of the ulna is stronger and thicker. The upper part of the radius beyond the radius is called the olecranon. The free end of the olecranon is also called the tuber olecrani. The protrusion on the anterior edge of the olecranon is called the processus anconeus. In pigs and carnivores, the distal end of the ulna terminates by forming the processus styloideus. In carnivores, the ulna and radius are two separate bones. They are movably articulated with each other through two proximal and distal joints. The tuber olecrani has three projections. (Bahadır and Yıldız 2014, König and Liebich 2015).



Skeleton manus

Ossa carpi: Ossa carpi, carpus, that is, the forelimb bones form the first part of the forefoot skeleton. It is a total of 8 bones arranged in two rows on top of each other. There are 4 bones in the upper or proximal row and 4 bones in the lower or distal row. Bones in the upper proximal row from the radial side to the ulnar side; os carpi radiale, os carpi intermedium, os carpi ulnare and os carpi accessorium. Carnivores have 3 bones in the proximal row of the ossa carpi. Os carpi radiale and os carpi intermedium merged to form os carpi intermedioradiale. There are 4 bones in the lower or distal row of the forelimb bones. These are os trapezium, os trapezoideum, os capitatum, and os hamatum (Dursun 2008, König and Liebich 2015).

Ossa metacarpalia: metacarpus Ossa metacarpalia 1-5 or metacarpus (forefoot metacarpal bones) are the bones that form the second part of the forefoot skeleton (skeleton manus), after the forelimb bones (ossa carpi). Carnivores have 5 metacarpuses. The shortest and thinnest of the metacarpus is the number 1 metacarpus located medially. Os metacarpale 2 is longer than 1 and slightly shorter than 3 and 4. The longest metacarpuses are 3 and 4 metacarpuses. Metacarpus number 5 is the thickest of the metacarpuses (Dursun 2008, Nickel et al. 1986).

Ossa digitorum manus: Ossa digitorum manus are the bones that come after the metacarpal bones. In carnivores, they are numbered from the medial to the lateral as the first, second, third, fourth, and fifth fingers. Carnivores have 5 metacarpus. There is 1 finger following each metacarpus distally. These animals have a total of 5 fingers. Each finger has three phalanges. Phalanges are named as first finger, second finger, third finger bone from proximal to distal, as well as phalanx proximalis, phalanx media and phalanx distalis. Carnivores have 2 phalanges in the first finger. Phalanx proximalis has a body with two ends. The articular surfaces in the phalanx proximalis of carnivores are shallow. The palmar part of the articular pit is divided by a deep notch into two ligament mounds. The distal end of the phalanx is divided by a sagittal groove into two convex articular surfaces. Phalanx media is the second of the phalanges. Its length is only half the length of the phalanx proximalis. It has an upper end facing the phalanx proximalis, its body, and the end facing the phalanx distalis. The phalanx media of carnivores is 2/3 the length of the phalanx proximalis. The articular pit at its proximal end is divided into two concave faces. Its distal end is divided into 2 convex articular surfaces by a sagittal crista. Phalanx tertia or phalanx distalis are different according to animal species. It carries the nail and conforms to the shape of the nail. The phalanx distalis of carnivores is tapered on both sides



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like a pressed nail. Foramen soleare axiale and foramen soleare abaxiale are found (Dursun 2008, Nickel et al. 1986).

Ossa sesamoidea: Carnivores' sesame bones have 2 os sesamoideum proximalis in the palmar part of each articulatio metacarpophalangea. In the palmar of each articulatio interphalangea distalis, there is a cartilage instead of the os sesamoideum distal. Carnivores have os sesamoideum dorsal, one on the dorsal aspect of each articulatio metacarpophalangea. These bones can sometimes be found on the dorsal aspect of the articulatio interphalangea proximalis (Dursun 2008, Nickel et al. 1986).

Ossa Membri Pelvini

The hind leg is attached to the trunk via the os ilii, os ischii, and os pubis, which form the cingulum membrane pelvis.

Os coxae (Hip bone): It is formed by the union of the os ilium, os ischii and os pubis. The relevant parts of these three bones combine to form the pit called the acetabulum. Incisura acetabuli, a backward and outward slit of the acetabulum, is large in carnivores. The os ilium in Craniodorsal is divided into two parts, corpus ossis ilii and ala ossis ilii. Crista iliaca is convex. Facies glutea are in the lateral direction and have formed a pit. Spina ischiadica is blunt and low. Tuber ischiadicum is single ridge (Nickel et al. 1986).

Femur: The longest and thickest of the skeletal bones. It is examined in three parts, the upper end, the body and the lower end. In Extremitas proximalis, the trochanter major is in the plane of the caput ossis femoris. In the extremitas distal, tuberositas supracondylaris is located instead of fossa supracondylaris. On the upper surface of the condyles at the distal end of the femur, m. It carries an articular surface for the articulation of gastrocnemii. The articular surfaces of sesame bones are facies articularis sesamoidea lateralis, facies articularis sesamoidea medialis (König and Liebich 2015).

Patella: It is oval in shape. It is the largest sesame bone in the body. It has two faces, namely the basis patellae and the apax patellae, the facies articularis and the facieas cranialis.

Skeleton cruris: Ossa cruris corresponds to skeleton antebrachii on the front leg. It consists of two bones. Of these bones, the tibia on the inside and the fibula on the outside. The two bones together are called the ossa cruris. The tibia is the longest bone of the body after the femur. It has a body with two ends. In carnivores, the fibula is fully present and extends to the distal end of the tibia and even slightly exceeds this end. The malleolus lateralis at the distal end of the tibia is formed by the fibula in carnivores. Carnivores have an incisura fibularis specific to the



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articulation of the malleolus lateralis on the outer side of the axial end of the tibia. The distal end of the tibia is divided into two articular pits by a crista oblique to the long axis of the body. There is an articular surface called the distal Uucufacies articularis capitis fibulae. Between the caput fibulae and the corpus is the indistinct collum fibulae. The lower end of the fibula is called the malleolus lateralis. Medial to this end is an articular surface, facies articularis malleoli, which articulates with the talus. On the outer surface of the malleolus lateralis m. peroneus longus and m. There is a groove through which the tendons of the peroneus brevis pass. This groove is called sulcus malleolaris (Nickel et al. 1986).

Skeleton pedis: It consists of three groups of bones: ankle bones (ossa tarsi, Tarsus), metatarsal bones (ossa metatarsi-metatarsus) and toe bones (ossa digitorum pedis-phalanges pedis).

Ossa tarsi: It consists of a piece of bone inserted between the proximal and distal rows and these two rows. In the proximal row are the talus and calcaneus. In the distal row, there are os tarsale I, os tarsale II, os tarsale III, and os tarsale IV, arranged side by side from medial to lateral. Between these two rows of bones is the os naviculare (König and Liebich 2015).

Ossa metatarsalia: Carnivores have five metatarsals.

Ossa digitorum pedis: Similar in shape and number to the forelimb bones (Dursun 2008).

In the present study, it was aimed to determine the morphological and morphometric values of the bones that participated in the formation of the skeleton appendiculare in a Jungle cat. The findings obtained; It is thought that it will contribute to scientific research, sexual dimorphism evaluations, zooarchaeological studies and operations in the felidae family.

MATERIAL and METHOD

One female Jungle cat, which was brought to Kafkas University Wildlife Protection and Rescue Rehabilitation Center with the diagnosis of humerus fracture, was treated at the Training, Research and Application Hospital of the Faculty of Veterinary Medicine, and could not be saved despite all the interventions. In order to carry out the study, the permission numbered E-21264211-288.04-1112005 was obtained from the General Directorate of Nature Conservation and National Parks of the Ministry of Agriculture and Forestry, based on the conditional permission obtained from the Animal Experiments Local Ethics Committee of Kafkas University with the code KAU-HADYEK/2021-038. The bones forming the appendicular skeleton were macerated for three days in water with 10-15% sodium bicarbonate (NaHCO_3) added (Taşbaş and Tecirlioğlu 1965). After cooling, the bones were thoroughly cleaned and



kept in 10% hydrogen peroxide (H₂O₂) solution for one day to whiten. After the bones were thoroughly washed, they were left to dry (Taşbaş and Tecirlioğlu 1965). Measurements were taken with the help of digital caliper according to the method determined by Driesh (1976) on all bones forming the skeleton apenciculare. N.A.V. They were named according to (2017).

Macroanatomical and Morphometric Findings

Scapula

It was seen that spina scapulae divided the facies lateralis equally. Margo cranialis was convex. Margo caudalis had a prominent protrusion. Tuberculum infraglenoidale was hook shaped.

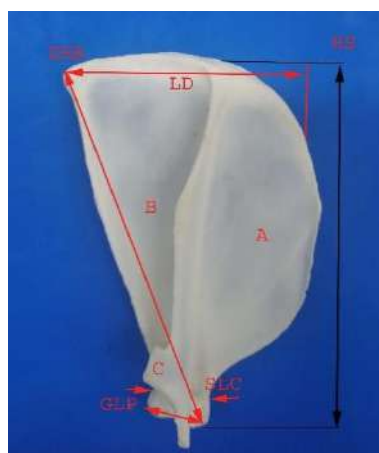


Figure 1: HS. Height of scapula, DHA: Diagonal height, SLC: smallest length of the collum scapulae, GLP: Greatest length of the processus articularis, LD: Dorsal length, A: Fossa supraspinata, B: Fossa infraspinata, C: Processus suprahamatus

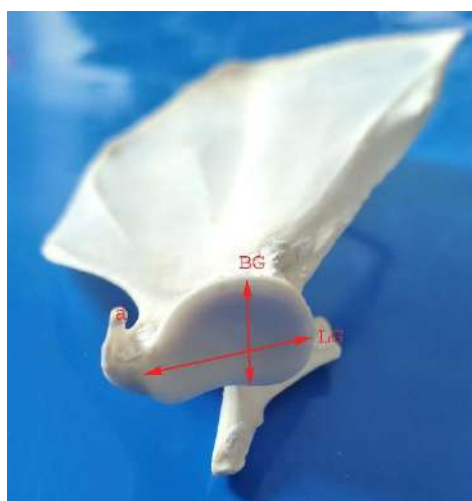


Figure 2: BG: Breadth of the glenoid cavity, LG: Length of the glenoid cavity, a: Tuberculum infraglenoidale



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Table 1: Some parameters of Scapula

Parameters	Mean \pm standard deviation
HS	97.10 \pm 0.13 mm
DHA	100.32 \pm 2.00
LD	56.13 \pm 0.87
SLC	14.70 \pm 0.26
GLP	16.91 \pm 1.25
LG	13.92 \pm 0.45
BG	11.28 \pm 0.35

Humerus

Caput humeri exceeded the tuberculum majus level. Fossa olecranii was quite deep. Foramen supracondylare was present.



Figure 3: GL: greatest length, GLC: Greatest length from caput, Dp: Depth of the proximal end, SD: Smallest breadth of diaphysis, Bd: Breadth of the distal end

Table 2: Some parameters of Humerus

<< <	Mean \pm standard deviation
GL	132.55 \pm 0.35
GLC	130.70 \pm 1.55
DP	20.10 \pm 0.37
SD	84.25 \pm 0.07
Bd	20.62 \pm 0.08
BT	15.62 \pm 0.06

Radius and Ulna



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It was observed that the extremitas proximalis of the ulna was wider and stronger than the radius. Processus anconeus was quite pointed. There were three projections on the tuber olecrani.



Figure 4/A: GL: Greatest length, BP: Breadth of the proximal end, SD: Smallest breadth of diaphysis, Bd: Breadth of the distal end

Ulna

Figure 4/B: GL: Greatest length, DPA: Depth across the processus anconeus, SDO: Smallest depth of the olecranon

Table 3: Some parameters of Radius

Radius Parameters	Mean \pm standard deviation
GL	131.76 \pm 0.94
<u>BP</u>	<u>9.37 \pm 0.25</u>
<u>SD</u>	<u>8.43\pm0.03</u>
<u>Bd</u>	<u>15.48 \pm 0.22</u>

Table 4: Some parameters of Ulna

Ulna Parameters	Mean \pm standard deviation
GL	143.49 \pm 0.54
DPA	15.68 \pm 0.27
SDO	12.60 \pm 0.91



The proximal row of ossa carpi consists of three bones: os carpi intermedioradiale, os carpi ulnare and os carpi accessorium; It was determined that the distal row consisted of 4 bones: os carpale primum, os carpale secundum, os carpale tertium and os carpale quartum.

Pelvis

Incisura acetabulum was found to be wide in os coxae. Spina ischiadica blunt. The foramen obturatum was quite wide. Facies glutea was pitted. Tuber ischiadicum was seen to have a single protrusion. Tuberositas iliaca found in facies iliaca was in the shape of the letter "C".

Table 5: Some parameters of Pelvis

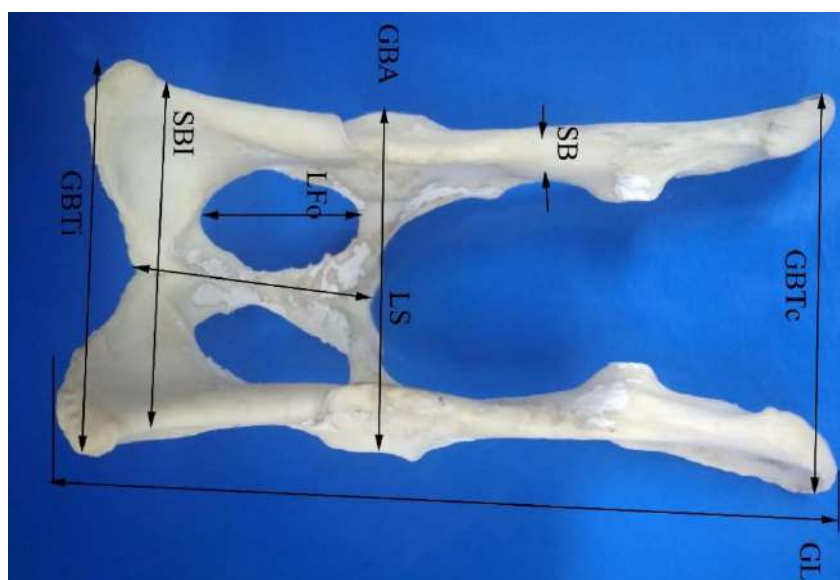


Figure 5: GL: Greatest length of one half, LS: Length of the symphysis, SH: Smallest height of the shaft of the ilium, SB: Smallest breadth of the shaft of ilium, LFo: Inner length of the foramen obturatum, GBTC: Greatest breadth across the Tuber coxarum, GBA: Greatest breadth across the acetabula, GBTi: Greatest breadth across the Tuber ischiadiaca, SBI: Smallest breadth across the bodies of the ischia



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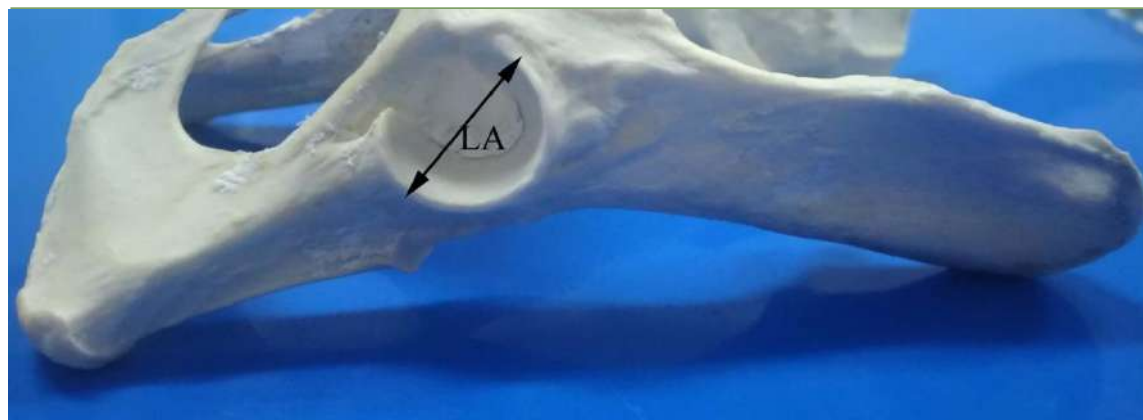


Figure 6: LA: Length of Acetabulum

Table 6: Some parameters of Femur

Pelvis Parameters	Mean \pm standard deviation
GL	103.30 mm
LA	14.64 mm
LS	38.75 mm
SB	5.68 mm
LFO	24.36 mm
GBTc	54.24 mm
GBA	48.21 mm
GBTi	50.96 mm
SBI	45.38 mm

The caput femoris was quite large. Fovea capitis femoris fit. The fossa trochanterica was quite deep. The articular surface of the fabella was not seen at the distal end of the fem

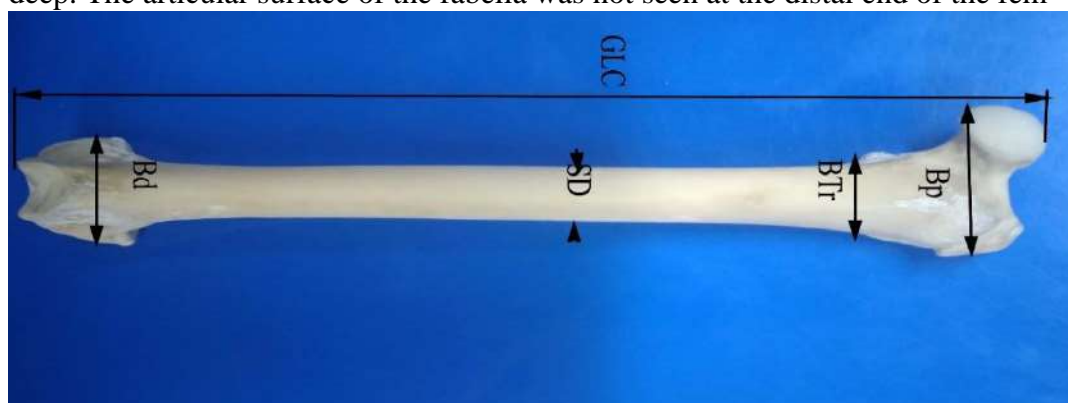


Figure 7: GL: Greatest Length, GLC: Greatest length from caput femoris, Bp: Breadth of proximal end, BTr: Breadth of collum femoris, SD: Breadth of diaphysis, BD: Breadth of distal end



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Table 7: Some parameters of Ossa cruris

Femur Parameters	Mean \pm standard deviation
GLC	149.56 \pm 0.23
Bp	25.22 \pm 0.02
BTr	12.35 \pm 0.64
SD	10.40 \pm 0.78
Bd	22.79 \pm 0.26

The tibia and fibula were fully present. He had a prominent tibia crista.

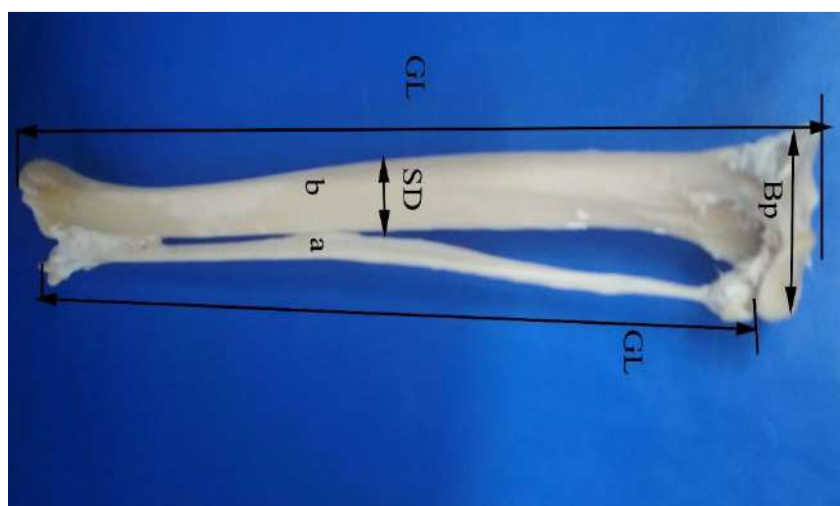


Figure 8/b: GL: Greatest length, Bp: Breadth of the proximal end, SD: Smallest breadth of the diaphysis

Fibula

Figure 8/a: GL: Greatest length

Tibia-fibula Parameters	Mean \pm standard deviation
GL	154.57 \pm 0.06
Bp	24.28 \pm 1.06
SD	10.65 \pm 0.19
Fibula GL	147.68 \pm 0.19

CONCLUSION

As a result, in this study, the morphological and morphometric values of the bones involved in the formation of the skeleton appendiculare in a Saz cat, which is not very common in the literature, were determined and contributed to the elimination of the lack of knowledge in this



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area. It is thought that the findings will contribute to scientific research, sexual dimorphism evaluations, zooarchaeological studies and operations to be performed in the felidae family.



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REFERENCES

- https://tr.wikipedia.org/wiki/Sazl%C4%B1k_kedisi (13.12.2021)
- König HE, Liebich HG, 2015: Veteriner Anatomi (Evcil Memeli Hayvanlar), Medipres, 6. baskı, 151-295.
- Bahadır A, Yıldız H (2014): Veteriner Anatomi Hareket Sistemi & İç organlar, Ezgi kitabevi, genişletilmiş 5. Baskı, 56-90.
- Dursun N (2008): Veteriner Anatomi I, Medisan yayınevi, 12. Baskı, 1-73
- Nickel R, Schummer A, Seiferle E, Frewein J, Wilkens H, Wille KH: The Locomotor System of the Domestic Mammals. Verlag Paul Parey, Berlin, Hamburg, 1986.
- Taşbaş M, Tecirlioğlu S (1965) Maserasyon tekniği üzerinde araştırmalar. Ankara Üniv Vet Fak Derg, 12: 324-330.
- Driesch VDA (1976) A Guide to the Measurement of Animal Bones from Archaeological sites. Peabody Museum Bulletin I. Cambridge M.A. Harvard University: 103-130
- NAV (Nomina Anatomica Veterinaria). The international committee on veterinary gross anatomical nomenclature. 6th ed. Columbia: Editorial Committee; 2017.



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**TÜRKİYE’DE ÖRTÜALTI
YETİŞTİRİCİLİĞİ ve YENİ GELİŞMELER**

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ÖZET

Dünya nüfusunun hızla artması, tüketicinin alışkanlıklarının değişmesi, sağlıklı ve güvenilir gıda talepleri, iklim değişiklikleri ve tarım alanlarının çeşitli faktörlere bağlı olarak tehdit altında olması insanları yeni arayışlara girmiştir. Seracılık da bu arayışlardan biri olmuştur. Seracılık birim alandan maksimum verimin alınmasına yönelik arayışlar sonunda gelişmiştir. Üretim kontrol altında tutulurken sağlıklı, güvenilir, izlenebilir ve standart ürünler elde edilmektedir. Üretici kazancı açısından bakıldığında da ürünlerin açık alanda yetiştirildiği dönemler dışında yetiştirilmesi oldukça kârlı bir faaliyet olarak karşımıza çıkmaktadır. Ülkemiz örtüaltı yetiştiriciliği açısından son derece elverişli bir konumda yer almaktadır. Bu durum özellikle dış pazar rekabetimizi ülkemiz lehine çevirmektedir. Örtüaltı tarımı, birim alandan yüksek verim alınmasını sağlayan bir üretim sistemidir ve ülkemizde örtüaltı tarımı alçak plastik tüneller ve seralardaki üretimi kapsamaktadır. Toplam örtüaltı alanımız 2019 yılı itibarı ile 427.675 da’a ulaşmıştır. Bu alanın %30’sı (126.367 da) alçak plastik tünel, geriye kalan % 69’u (292.238 da) ise sera (yüksek tünel, cam ve plastik sera) alanlarından oluşmaktadır. Örtüaltı yetiştiriciliği iklimin uygun olduğu yerlerde yaygınlaşmış olup, üretim genelde diğer Akdeniz ülkelerinde olduğu gibi sadece anti-don amaçlı ısıtma ve/veya korumanın olduğu, basit yapılar altında gerçekleştirilmektedir. Bununla birlikte ülkemizde ileri teknoloji kullanan iklim kontrollü büyük ölçekli modern sera işletmeleri de kurulmakta olup, bu işletmeler için jeotermal alanlar tercih edilmektedir. Ülkemiz modern sera varlığı ise yaklaşık 13 bin dekadır. Bu seralarda topraksız tarım yöntemi ile ihracata yönelik üretim yapılmaktadır. Bu makalede ülkemiz örtüaltı yetiştiriciliğinin zaman içerisindeki gelişimi ve mevcut durumu, yetiştiriciliği yapılan türler, örtüaltı kurulumu, sera ve üretim teknolojileri ile konularında bilgi verilmiştir.

Anahtar Kelimeler: Örtüaltı, Sera Teknolojisi, Topraksız Tarım.



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**INVESTIGATION OF POST DISASTER SPATIAL CHANGE BY IMAGE
EVALUATION AND SEMANTIC DIFFERENTIATION METHODS**

ABSTRACT

The rapid increase in the world population, the change in consumer habits, healthy and safe food demands, climate changes and the fact that agricultural areas are under threat due to various factors have started to search for new people. Greenhouse cultivation has also been one of these pursuits. Greenhouse cultivation has developed as a result of the search for maximum efficiency from the unit area. While the production is kept under control, healthy, reliable, traceable and standard products are obtained. From the point of view of the producer's income, it is a very profitable activity to grow the products outside the periods when they are grown in the open field. Our country is located in an extremely favorable position in terms of greenhouse cultivation. This situation especially turns our foreign market competition in favor of our country. Greenhouse agriculture is a production system that ensures high efficiency from the unit area, and greenhouse agriculture in our country includes production in low plastic tunnels and greenhouses. Our total greenhouse area has reached 427,675 da as of 2019. 30% of this area (126.367 decares) consists of low plastic tunnels and the remaining 69% (292.238 decares) consists of greenhouse (high tunnel, glass and plastic greenhouse) areas. Greenhouse cultivation has become widespread in places where the climate is suitable, and production is generally carried out under simple structures with heating and/or protection for anti-frost purposes, as in other Mediterranean countries. In addition, climate-controlled large-scale modern greenhouse enterprises using advanced technology are also being established in our country, and geothermal areas are preferred for these enterprises. Our country's modern greenhouse assets are approximately 13 thousand decares. In these greenhouses, production is carried out for export with soilless farming method. In this article, information is given on the development and current status of greenhouse cultivation in our country, the species cultivated, the support given to the inputs used in greenhouse setup and cultivation, greenhouse and production technologies, and marketing opportunities.

Keywords: Greenhouse, Greenhouse Technology, Soilless Agriculture, Marketing.



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1. GİRİŞ

Örtüaltı tarımı, bitkilerin mevsimleri dışına kaydırılarak ya da mevsimleri dışında yetiştirilmesine olanak sağlayan bir yetiştiricilik şeklidir. Ülkemizde örtüaltı tarımı, alçak plastik tüneller, yüksek tüneller ve cam ve plastik örtü materyali ile örtülmüş seralardaki üretimi kapsamaktadır. Alçak plastik tünellerde bitkiler mevsimleri dışına kaydırılarak yetiştirilmekte ve üretimde erkencilik hedeflenmektedir. Yüksek tünellerde ve seralarda yapılan üretimde bitkiler mevsimleri dışında yetiştirilmektedir. Ülkemizde örtüaltı tarımı, plastiğin tarımda kullanımının başlamasıyla ticari önem kazanmıştır. 1970’li ve 1980’li yıllarda ekolojik koşulların uygun olduğu bölgelerde yayılmaya başlamıştır. 1990’lı yıllarda sera yatırımlarına ve serada yetiştiriciliğe uygulanan kaynak kullanımı ve destekleme fonu teşviki de alan artışında önemli katkı sağlamıştır. Bu yıllarda yüksek teknolojinin kullanıldığı modern seralar kurulmaya başlamış ve topraksız tarım kullanım alanı bulmuştur. 2000’li yıllarda sürdürülebilir üretim tekniklerinin ve sertifikalı üretimin yaygınlaşmaya başladığı görülmektedir (Tüzel ve ark., 2015). Günümüzde bahçe bitkileri türlerinin sağlık üzerindeki etkilerinin anlaşılması ile değişen tüketici talepleri yönlendirici olmaktadır. Kentlerdeki alanların değerlendirilmesine yönelik uygulamalar ve küçük alanların hacim olarak etkin kullanımını sağlayan ve kontrollü koşullarda yapılan dikey tarım uygulamaları son yıllardaki önemli gelişmelerdir.

2. TÜRKİYE’DE ÖRTÜALTI YETİŞTİRİCİLİĞİ

2.1. Alan

Türkiye, örtüaltı yetiştiriciliği bakımından dünyada ilk dört ülke arasında, Avrupa’da ise İspanya’nın ardından ikinci sırada yer almaktadır (TUIK, 2019). Toplam örtüaltı alanımız 2018 yılı itibarı ile 772 bin 91 dekara ulaşmıştır. Bu alanın 126.367 da alçak plastik tünel, yüksek tünel 18.995 da, cam 26.353 da ve plastik 246.890 da sera alanlarından oluşmaktadır (Çizelge 1), (TUIK 2019). Toplam örtüaltı alanı 2008 ve 2018 yılları arasında %42.4 oranında artmıştır. Plastik sera, yüksek ve alçak tünel alanlarındaki artış oranları sırasıyla %74.1, %70.6 ve %16.5 olmuştur. Cam sera alanları ise ürün fiyatlarındaki dalgalanmalardan etkilenerek %5’lik bir azalma göstermiştir (TUIK, 2019).



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Çizelge 1. 2019 Yılına Ait Örtüaltı Kayıt Sistemi Verileri

Örtüaltı Tipi	İşletme Sayısı	Örtüaltı Sayısı	Alan (da)
Cam Sera	10.060	19.720	26.353
Cam ve Plastik Sera	2.744	3.875	9.070
Plastik Sera	40.409	81.106	246.890
Toplam Sera	53.213	104.701	282.313
Yüksek Tünel	2.179	6.936	18.995
Alçak Tünel	1.668	5.201	126.367
GENEL TOPLAM	57.060	116.838	427.675

Örtüaltı yetiştiriciliği özellikle iklim koşullarının uygun olduğu Akdeniz sahil kuşağında gelişmiştir. Örtüaltı alanımızın %84'ü Akdeniz bölgesinde yer almaktadır. Antalya 286.52 da ile en önemli merkezdir ve bu ilimizi sırasıyla Mersin (201.06 da) ve Adana (160.49 da) izlemektedir. Adana ve Hatay (1109.6 da) özellikle alçak plastik tünel alanlarının yoğunlaştığı merkezlerdir. Bu illeri Akdeniz ve Ege Bölgesi arasında geçit olan Muğla (39.048 da) izlemektedir. İzmir ve Aydın'da sırasıyla 14.016 ve 12.717 da'lık örtüaltı varlığına sahiptir (TUIK 2020). Türkiye'de seraların yüzde 46'sı plastik seradan oluşuyor. Geri kalanların yüzde 24'ü alçak tünel, 17'si yüksek tünel, yüzde 13'ü ise cam sera olmuştur.

Ülkemiz örtüaltı üretim miktarı bakımından 2002 yılında 4.271 000 ton üretim alınırken; 2019 yılından itibaren 8.437.000 ton üretim olmuştur (Çizelge 2), (TUIK 2020).

Çizelge 2. Ülkemiz Örtüaltı Üretim Miktarları (Bin Ton)

Yıllar	Cam sera	Plastik sera	Yüksek	Alçak tünel	Toplam
2002	999	1.980	369	923	4.271
2003	1.188	2.134	404	801	4.528
2004	1.218	2.041	383	713	4.354
2005	1.182	2.129	412	743	4.465
2010	1.345	2.895	601	910	5.750
2014	1.259	3.554	744	919	6.482
2015	1.276	3.676	805	963	6.720
2016	1.289	4.011	838	1.028	7.165
2017	1.319	4.168	792	1.104	7.383
2018	1.316	4.615	891	1.249	8.071
2019	1.311	4.902	875	1.349	8.437



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2.2. Yetiştiriciliği Yapılan Türler

Seralarda yetiştirilen ana ürün grubu sebzelerdir (%94), bunu meyve türleri (%5) ve kesme çiçek ve iç mekan bitkileri izlemektedir. Örtüaltındaki bitkisel üretim değerinin yaklaşık olarak 10 milyar TL olduğu tahmin edilmektedir (TUIK 2019). Ülkemizde 2018 yılındaki 30 milyon ton sebze üretiminin yaklaşık 8 milyon tonu örtüaltında gerçekleştirilmiştir. Üretimde de Antalya %49'luk payla (48.938.739 ton) birinci sıradadır ve bu ilimizi sırasıyla, Mersin %18 (17.609.868 ton), Adana %11.35 (11.148.797 ton) ve Muğla %8.23(8.084.515 ton) illeri takip etmektedir. Bu 4 ildeki toplam örtü altı üretimimiz yaklaşık 98.243.938 ton ile ülkemiz toplam örtüaltı üretiminin yaklaşık %86'sını oluşturmaktadır (Çizelge 3), (TUIK 2019).

Çizelge 3. İllere Göre Sera Üretim Değerleri

İller	Sera Üretimi (Ton)	Yüzdelik Oran (%)
Antalya	48.938.739	49.81
Mersin	17.609.868	17.92
Adana	11.148.797	11.35
Muğla	8.084.515	8.23
İzmir	2.703.743	2.75
Samsun	1.766.864	1.80
Hatay	795.211	0.81
Aydın	761.853	0.78
Diğer 73 İl	6.434.348	6.55
TÜRKİYE	98.243.938	100.0

Sebze üretiminde domates ve hıyar üretimi sırasıyla % 48 ve %14'lik oran ile ilk iki sırada yer almaktadır. Solanaceae grubu sebzelerin payı %65, Cucurbitaceae familyası sebzelerinkini ise %32'dir. Cucurbitaceae sebzeleri içinde karpuz özellikle alçak plastik tünel altında çok yüksek miktarlarda üretilmektedir. Bu iki familya üyesi sebzelerin dışında da çok çeşitli sebze türlerinin örtüaltında yetiştirildiği görülmektedir. Seralarda meyve türlerinin üretimi de giderek önem kazanmıştır. Son 20 yılda toplam örtüaltı meyve üretimimiz 5.7 kat artış göstermiş ve 2018 yılı itibarı ile örtüaltında 535 515 ton meyve üretilmiştir. 2000'li yılların başında seralarda sadece çilek ve muz yetiştiriciliği yapılırken, günümüzde bu iki meyve türüne asma ve sert çekirdekli meyve türlerinin (şeftali, kayısı, erik, nektarin) yetiştiriciliği eklenmiştir (Çizelge 4), (TUIK 2020).



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Çizelge 4. Örtüaltında Yetiştirilen Ürünler

Ürünler	Üretim (Ton)	Oran (%)	Ürünler	Üretim (Ton)	Oran (%)
Domates	4.083.681	48	Patlıcan	323.009	4
Hıyar	1.156.997	14	Kabak	211.953	3
Karpuz	877.505	10	Kavun	205.340	2
Biber	749.769	9	Çilek	195.206	2
Muz	424.837	5	Diğer	200.702	2
TOPLAM		8.436.616			

3. SERA TEKNOLOJİSİ

3.1. İşletme Özellikleri

Ülkemizdeki sera işletmeleri, büyüklükleri, yapısal özellikleri, üretim maliyetleri, iklimlendirme koşulları, teknoloji kullanımları gibi çeşitli özellikleri bakımından farklılık göstermektedir. İşletmeler düşük teknoloji kullananlar, orta ölçekli teknoloji kullananlar ve yüksek teknoloji kullananlar olmak üzere gruplanabilmektedir. Düşük teknoloji kullanan seralar basit yapılardır ve ısıtma yoktur. Açıkta yapılan yetiştiriciliğe benzer uygulamalar görülür. Orta ölçekli olanlarda ısıtma sistemi düşük teknoloji kullananlara göre daha etkin olduğundan, sera içindeki iklim koşulları dış hava koşullarından nispeten farklılık gösterir. Topraksız tarım dahil olmak üzere daha ileri teknoloji kullanılabilir ve uygulamalar kısmen yada tam otomatik olabilir. Yüksek teknoloji kullanan seralarda yatırım maliyeti yüksektir. Isıtma, havalandırma, evaporatif soğutma, aydınlatma, karbondioksit gübrelemesi gibi uygulamalarla iklim kontrolü yapılır ve sera içerisinde dış hava koşullarından tamamen bağımsız bir ortam yaratılır. Üretimde sera hacminden azami düzeyde yararlanan üretim sistemleri kullanılır (Pardossi ve ark., 2004). Ülkemizde ileri teknoloji kullanan sera varlığı yaklaşık olarak 1200 ha'dır ve işletmelerin ortalama büyüklükleri 27 da civarındadır. Ülkemizde son 10 yılda ortalama örtüaltı işletme büyüklüğü 2 da'dan 4 dekara yükselmiştir (TÜİK, 2019).

3.2. Örtü Malzemesi ve Konstrüksiyon

Türkiye'de 1995 yılında 363.042 dekar alanda seracılık yapılırken 2014 yılında 649.118 dekara çıkarak ikiye katlanmıştır. Söz konusu yaklaşık toplam alanın 80.975,71 dekara cam, 298.651,01 dekara plastik, 112.771,37 dekara yüksek tünel ve 156.720,03 dekara alçak tünel



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seralardır. Türkiye seracılığında gelişimi incelendiğinde yıllık ortalama artış hızı % 15 dolayındadır. Aşağıdaki tabloda da görüleceği üzere yıllar itibarıyla seracılık alanları katlanarak artarken sera niteliklerinde farklılar oluşmuştur. Niteliklerine göre dağılımda plastik sera alanı artışını sürdürürken alçak tünel alanı düşüşe geçmiştir (Çizelge 5), (TUIK 2020).

Çizelge 5. Ülkemiz Örtüaltı alanlarının son 12 yıldaki değişimi (1000 da)

Yıllar	Cam sera	Plastik sera	Yüksek tünel	Alçak tünel	Toplam
1995	34	109	21	199	363
2002	64	180	61	230	536
2003	70	167	61	185	483
2004	72	169	66	171	478
2005	65	171	67	164	468
2010	81	231	82	171	564
2014	81	299	113	157	649
2015	80	309	113	162	664
2016	80	329	113	170	692
2017	86	355	120	191	752
2018	78	369	114	211	772
2019	75	379	111	224	790

Yukarıdaki grafikte de görüldüğü üzere yıllar itibarıyla seracılık alanları katlanarak artmıştır. Niteliklerine göre dağılımda plastik sera alanı diğer türlere göre daha yüksek artış göstermiştir. Cam seralar ise maliyetler göz önüne alındığında daha az tercih edilmektedir. Yüksel tünel seralar düzenli artış göstermekle beraber alçak tünel seralar dönem dönem artış ve azalışlar göstermiştir.

2018 yılı itibarı ile toplam sera alanı içerisinde cam seralar 7811 ha ile %13.92, plastik seralar ve yüksek tüneller ise %86.07'lik bir paya sahiptir. 2000'li yıllardan itibaren plastik sera ve özellikle yüksek tüneller artış göstermiştir. Plastik örtü materyalinin ucuz olması ve yüksek tünel ve/veya basit yapıların plastik ile örtülme kolaylığı, bu örtü materyalinin kullanımını yaygınlaştırmıştır. Ülkemizde cam sera varlığı son 5 yıl içerisinde azalma gösterse de, diğer Akdeniz ülkeleriyle karşılaştırıldığında alan fazladır. Bunun da başlıca nedenleri düz cam fiyatlarının daha düşük olması, yapım işçiliğinin ucuz olması, diğer Akdeniz ülkelerine göre yağışlı dolayısıyla bulutlu günlerin fazla olması nedeniyle yüksek ışık geçirgenliği ve kış aylarında sera içindeki aşırı nemin daha az buğulanmaya yol açmasıdır (Titiz 2004). İleri teknoloji kullanan seralarda galvanize edilmiş konstrüksiyon materyali hatta bazı işletmelerde



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alüminyum kullanılırken, küçük işletmelerde halen demir kullanılabilmektedir. 3.3. İklimlendirme Seralar bitkilerin mevsimleri dışında yetiştirilmesine olanak sağlayan yapılar olduğundan, seracılığın yapılacağı lokasyondaki iklim koşulları ve sera içinde bitki gelişimini etkileyen sıcaklık, CO₂, ışık, nem gibi faktörlerin bitki gereksinimini karşılayacak şekilde düzenlenmesi, diğer bir ifade ile sera içinde iklimlendirme kontrolünün olması verim üzerine doğrudan etkilidir. Türkiye'nin en büyük şansı ve avantajı ısıtmada kullanabileceği -jeotermal enerji gibi• yenilenebilir enerji kaynaklarının bulunmasıdır. Ülkemiz jeotermal enerji kaynakları bakımından, dünyada 7'nci, Avrupa da ise 1'inci sırada yer almaktadır. Jeotermal enerji kullanım alanları arasında sera ısıtması %25.6'lık bir oran ile kaplıca ve merkezi ısıtmadan sonra üçüncü sırada yer almaktadır (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015). Ülkemizde 2018 yılı sonundaki jeotermal enerji kullanım kapasitesinin 5000 MWt'a yükseldiği, toplam jeotermal ısı kapasitesinin de 35500 MWt'a ulaştığı bildirilmektedir. Jeotermal enerji varlığı açısından potansiyel oluşturan alanların %78'i Batı Anadolu'da, %9'u İç Anadolu'da, %7'si Marmara Bölgesi'nde, %5'i Doğu Anadolu'da ve %1'i diğer bölgelerde yer almaktadır (Enerji ve Tabii Kaynaklar Bakanlığı 2019). Isıtma yapılan sera varlığı toplam sera alanı içinde %3'lük bir paya sahiptir ve sera ısıtmasında kullanılan enerji kaynakları arasında kömürden sonra jeotermal enerji %30'luk bir oran ile 2. sırada yer almaktadır (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015). Ülkemizde, jeotermal enerji ile ısıtılan sera varlığının 4.344 dekar olduğu rapor edilmektedir (TÜİK, 2019). Jeotermal sera alanlarının %76'sında üretimde "iyi tarım" uygulamaları esas alınmakta ve %90'nında "topraksız tarım" üretim sistemi kullanılmaktadır. Yetiştirilen ürün türleri arasında domates en yüksek orana (%97) sahiptir (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015).

3.3. Örtüaltı Bitki Yetiştiriciliği Çeşitleri ve Teknolojileri

Seralar, gerek üretimin mümkün olmadığı kış periyodunda üretime olanak tanınması ve gerekse doğanın öngörülemeyen olumsuz etkilerinin minimize edilmesi amacıyla, çevre şartları kontrol edilebilen veya düzenlenebilen cam, plastik, fiberglas gibi ışığı geçiren materyallerle yapılan bitkisel üretimdir. Örtüaltı ve turfanda sebzeciliği birbirinden farklıdır. Turfanda sebzecilik, iklime bağlı kalınarak veya kısmen kontrol altına alınarak özellikle mikro klimaya sahip bölgelerden yararlanarak pazara erken veya geç dönemde ürün çıkarıldığı yetiştiriciliktir. Örtüaltı yetiştiriciliğinde ise ortamdaki klima özellikleri kısmen veya tamamen kontrol altına alınarak pazara ürün çıkarmak dönemini ayarlayabilmektir. Sera, çevre koşullarının olumsuz etkisini kısmen veya tamamen ortadan kaldırarak bitkisel üretim yapmaya yarayan seralar alçak



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veya yüksek sistemler olarak tanımlanmaktadır. Her bir tarımsal ürünün en verimli yetiştirildiği koşullar üründen ürüne farklılık göstermektedir.

3.3.1. Örtüaltı Bitki Yetiştiriciliğinde Geleneksel Teknikler

Seralarda sağlanan yapay koşullar; ısıtma, havalandırma, sulama ve gübreleme, ilaçlama olup bütün bunlar teknoloji kullanımı ile gerçekleştirilir. Söz konusu yapay ortam, sera ve alçak plastik tüneller altındaki üretimi kapsamaktadır. Alçak plastik tüneller; bitki sıraları üzerine yaklaşık 60 cm yarıçaplı ve yarım daire kesitli yerleştirilmiş iskeletlerin üzerinin yumuşak plastik örtülerle örtülmesi sonucu elde edilen yapılardır. Alçak plastik tünel altında yapılan bitkisel üretimde erkencilik amaçlanır. Bu nedenle, seracılık tekniklerini; yetiştiriciliği yapılan ülkeleri farklı enlem derecelerinin sonucu olan iklim ve farklı sera teknolojileri göz önüne alınarak şöyle sınıflandırmamız mümkündür.

Yüzeysel Örtüler: Örtüaltı yetiştiriciliğinde malçlama, yüzeysel örtüler, yastıklar şeklinde yapılan ve kısa veya uzun süre bitkilerin üzerini kapatan, ayrıca tüm tarımsal işlemlerin dışardan yapıldığı sistemler olarak sınıflandırılmaktadır.

Alçak tüneller: Turfanda amacıyla cam, plastik v.b. ışık geçirebilen malzeme ile kaplanarak değişik şekillerde yapılan, yüksek sistemli bir örtüaltı yetiştiriciliği yapısıdır.

Yüksek tüneller: Örtüaltı yetiştiriciliğinde insanın içerisine rahatça girebileceği, tarımsal mekanizasyona olanak sağlayan, ancak ısıtma, havalandırma sistemleri genellikle olmayan, dar ve yarım daire kesitli yapılardır. Bu örtü tiplerinin hepsi plastik örtülerdir

Seralar: Tüm iklim elemanlarının denetimine olanak sağlayabilecek örtülü yapılardır. Seracılık, iklimle ilgili çevre koşullarına, tümüyle veya kısmen bağlı kalmadan gerektiğinde sıcaklık, ışık, nem ve hava gibi etmenler denetim altında tutularak bütün yıl boyunca çeşitli kültür bitkileriyle bunların tohum, fide ve fidanlarını üretmek, bitkileri korumak, sergilemek amacıyla cam, plastik v.b. ışık geçirebilen malzeme ile kaplanarak değişik şekillerde yapılan, yüksek sistemli bir örtüaltı yetiştiriciliği yapısıdır.

3.3.3. Örtü Altı Yetiştiriciliğinde Yeni Teknikler

Modern seracılık geçmişi ise 18. yüzyıl sanayi devrimi ve sonrasında geliştirilen malzemeler kullanılarak yapılmıştır. Daha sonra ABD ve Avrupa'da sera yapımı, endüstri ile birlikte birinci dünya savaşından sonra hızlı bir şekilde gelişmeye başlamıştır. Günümüzde uluslararası seracılığa bakacak olursak, seraların dünya üzerinde geniş bir yayılma alanı olduğunu görürüz. Bu geniş yayılma alanı üzerinde ekolojik etmenler ve sera teknolojisinin oldukça farklı olduğu görülmektedir. Ülkemiz dünya üzerinde seracılık açısından uygun bir konumdadır. Birçok



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ülkede olmayan iklim avantajımız vardır. Halen gelişmekte olan seracılığımız da bunun göstergesidir. Bu bölgelerde ilkbahar ve sonbahar devrelerinde güneş enerjisinin pasif sistemlerle kullanılarak kısa devrelerde daha ekonomik ve pratik seralarda ürün yetiştirilmesi planlanırsa, hormon kullanmaya gerek kalmadan ve uygun yeterli ilaçlama ile turfanda ürün elde edilmesi mümkündür. Bugün örtü altı yetiştiriciliği, Ekim-Temmuz ayları arasındaki dönemde 8 aylık sebze ihtiyacını karşılayan bir kısmını ihraç eden ve yüzbinlerce kişinin geçimini sağlayan önemli bir sektör haline gelmiştir. Ülkemiz seracılığı Marmara, Ege ve Akdeniz kıyı şeridinde dağılma ve gelişme göstermektedir. Bu dağılım içerisinde yer yer yoğun üretim alanları doğmuştur. En kuzeyde Yalova çevresindeki mikro klimada görülen seracılık, batıda İzmir ve Muğla çevresinde, güneyde Antalya ve Mersin dolaylarında yoğunlaşmakta ve oradan Hatay'a uzanmaktadır. Türkiye'de örtüaltı bitki yetiştiriciliği TÜİK verileri paralelinde 4 ana başlık altında inceleyebiliriz. Bu sınıflandırmalar, sera alanlarının niteliklerine göre dağılımı, bu alan üzerinde yetiştirilen sebze, meyve ve süs bitkileri yetiştiriciliği şeklindedir.

3.3.4. Örtüaltı Topraksız Tarım

Günümüzde, pek çok ülkede, seralarda üretimin büyük bir kısmı topraksız tarım ile gerçekleştirilmektedir. Aslında topraksız yetiştiricilik 17.yy'dan günümüze bitki beslenme konusundaki bilgilerimizin çoğu su ve kum kültürü denemelerinden elde edilmiştir. Topraksız tarımın, seralarda ticari anlamda yaygın kullanımı ise 1970'li yıllara rastlamaktadır. Bunun nedeni ise bu yıllarda ortaya çıkan enerji krizi sonucu buhar ile toprak dezenfeksiyonunun çok pahalı bir uygulama haline gelmesidir. Bu şekilde kullanılmaya başlanılan topraksız tarım günümüze kadar artan bir hızla yaygınlaşmıştır, hatta bazı ülkelerde sera üretimi tamamen topraksız tarım ile yapılmaktadır. Topraksız tarımın geleneksel yetiştiriciliğe göre üstün yanları şu şekilde özetlenebilir; Toprağın bulunmadığı veya kalitesinin üretim için yeterli olmadığı yerlerde yetiştiricilik yapılabilir. Toprak yorgunluğu ortadan kalkar, aynı yerde arka arkaya aynı ürünler yetiştirilebilir. Toprak kaynaklı hastalık ve zararlılar ile yabancı otlar sorun olmaktan çıkar, toprak dezenfeksiyonuna gerek kalmaz. Ürünlerde dezenfektan kalıntısı sorunu ile karşılaşılmaz. Su ve besin maddeleri etkin bir şekilde kullanılır, su ve gübre kullanımı azalır. Seraların jeotermal ile ısıtılmasının getirdiği çok önemli avantajlar;4 Bitkinin ihtiyaç duyduğu sıcaklığı sağlayacak yeterli bir ısıtma verimi % 50-60 oranında artırabilmektedir. Bu nedenle jeotermal kaynak kullanılarak ısıtılan seralarda, bitki gelişimi ve dölleme için gereken sıcaklık daha ekonomik şartlarda sağlanmakta, bu sayede gerekli havalandırma yapılarak sera içi rutubet kontrol edilmekte ve bundan kaynaklanabilecek hastalıklar oluşmayarak, verim



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yükselmektedir. Sera atmosferine jeotermal karbondioksitin verilmesi verimi % 40 artırmaktadır. Sera içi sıcaklık döllenme için gereken sıcaklığın üstünde olmakta bu da verimi artırmaktadır. Bu sayede gerekli havalandırma yapılabilmekte ve sera içi rutubet yükselmemekte ve bundan kaynaklanabilecek hastalıklar oluşmamaktadır. Bu, Avrupa Birliği'nin ve Uluslararası Gıda/Sağlık örgütlerinin istediği bir koşuldur. İdeal iç sıcaklık nedeniyle hormonsuz üretim mümkün olmaktadır. Seraların teknik, ekonomik, ticari işletmesi için büyüklüğünün en az 25.000 m² olması, ısıtma hesaplarına esas olan dış dizayn sıcaklığının -15°C'den daha soğuk olmaması ve kış ayları dış hava ortalama sıcaklığının + 5°C'den daha düşük olmaması gerekmektedir. Jeotermal enerji günümüzde, özellikle gıda tedariki amaçlı seracılık tarımsal üretim açısından son derece önemli bir noktaya gelmiştir. Jeotermal enerji, hem düşük karbondioksit emisyon oranı ile hava kirliliği yaratmaması hem de yenilenebilir olması nedeniyle en önemli alternatif enerji kaynağıdır. Bunun yanında güneş ve rüzgâr gibi diğer yenilenebilir enerji kaynakları ile kıyaslandığında kesintisiz olması nedeniyle önemli bir üstünlüğe sahiptir. Jeotermal enerji politikası oluşturulmalı ve jeotermal kullanım teşvik edilmelidir. Yapılacak yatırımlar, mümkün olduğunca jeotermal enerjinin kullanılacağı entegre tesisler şeklinde planlanmalıdır. Ülkemiz jeotermal enerji kaynakları potansiyeli açısından; Avrupa'da 1 inci, Dünyada 7'nci sırada yer almaktadır. Ülkemizde, jeotermal enerji ile ısıtılan sera varlığı 4.344 dekadır. Örtüaltı sebze üretimi 7.814.543 ton, örtüaltı meyve üretimi 622.073 ton ve örtüaltı süs bitkileri üretimi 1.238.975.594 adettir. (TÜİK, 2020) Ülkemiz modern sera varlığı yaklaşık 13 bin dekadır. Bu seralarda topraksız tarım metodu ile ihracata yönelik üretim yapılmaktadır.

4. SONUÇ

Örtüaltı tarımı, tünel ve/veya seraların kuruluşundan başlayarak, bitkisel üretimi ve pazarlamasını içine alan uzun bir zincirden oluşur. Özellikle seracılıkta pek çok yeni teknoloji bu zincir içerisinde bir veya birden fazla yerde kullanılmaktadır. Isıtmada ülkemiz jeotermal enerji varlığı açısından önemli bir avantaja sahiptir ve yatırımlar bu nedenle bu kaynakların olduğu bölgelere kaymaktadır. Jeotermal enerji kullanımının yaygınlaştırılmasına yönelik çalışmalara hız verilmelidir. Ancak jeotermal kaynakların sürdürülebilir kullanımı sağlanmalıdır. Örtüaltı tarımının, özellikle seracılığın, arazilerin ekonomik kullanımına olanak sağlaması nedeniyle ülkemiz genelinde artışının önümüzdeki yıllarda da hızla devam etmesi beklenmektedir. Ülkemiz, uygun iklimsel ve coğrafi koşullar, pazar ülkelere yakınlık, ucuz



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iřgücü, sulama suyu miktarı ve kalitesi, alternatif yenilenebilir enerji kaynaklarının varlığı gibi nedenlerle seracılık açısından önemli avantajlara sahiptir. Ancak alan artışına paralel olarak üretimin de sürdürülebilir bir şekilde artması gerekir. İnsan ve çevre sağlığının ön plana çıktığı günümüzde örtüaltı tarımında da yeni arayışların ve yeniliklerin “ekonomik” ve “çevre dostu” olması şartı aranmaktadır.



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KAYNAKÇA

Enerji ve Tabii Kaynaklar Bakanlığı, 2019. <https://www.enerji.gov.tr/tr-TR/Sayfalar/Jeotermal> (Erişim tarihi:13.11.2019).

Pardossi, A., Tognoni, F., Incrocci, L., 2004. Mediterranean Greenhouse Technology. *Chronica Horticulture* 44(2):28-34.

Titiz, S., 2004. Modern Seracılık: Yatırımcıya Yol Haritası. Ansiad, Antalya, 124 s.

TUIK, 2019. www.tuik.gov.tr (Erişim tarihi:13.11.2019)

TUIK, 2020 <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Tarla-Ve-Bahce-Bitkileri/Ortu-Alti-Yetistiricilik>.

Tüzel, Y., Gül, A. 2008. Seralarda İyi Tarım Uygulamaları. Tıbyan Yayıncılık. ISBN:978-9944-172-07-3, 172 s, İzmir.

Ulusal Jeotermal Seracılık Stratejisi Raporu, 2015. Gıda, Tarım ve Hayvancılık Bakanlığı Jeotermal Seracılık Stratejilerinin Geliştirilmesi Faaliyeti Ulusal Jeotermal Seracılık Stratejisi Raporu.. [https://www. Tarım ve Orman Bakanlığı](https://www.Tarım ve Orman Bakanlığı), 2019.

<https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/> BUGEM. pdf (Erişim tarihi: 16.12.2021).



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ÖZET

Sektörlerin artan su ihtiyacına mevcut su kaynaklarının cevap verememeye başladığı 2020'lerde, en çok su ihtiyacının olduğu sektör olan tarımda sulama suyunun daha etkin ve daha ekonomik kullanılması gerekmektedir. Bu yüzden sulama randımanının yüksek olduğu basınçlı sulama yöntemleri tercih edilmelidir. Basınçlı sulama yöntemleri içerisinde damla sulama yöntemi %95'in üzerinde sulama randımanı olması sebebiyle son yıllarda öne çıkmıştır. Su kayıplarının ciddi bir şekilde önlendiği bu yöntemde, alanın tamamı ıslatılmaz ve su sadece bitkinin kök bölgesine uygulanır. Bölge koşulları, iklim ve bitki çeşidine göre sulama suyunun ne zaman ve ne kadar uygulanacağını belirlemek çok önemlidir. Yarı kurak iklim kuşağı içerisinde olan Trakya Bölgesi ülkemizin önemli bir tarım bölgesidir. Bölgede birçok bitkinin yetiştiriciliği yapılmaktadır. Bunlardan biride pazar payı giderek yükselen ve gıda sektöründe birçok alanda değerlendirilen kapa biberdir. Araştırma 2016 ve 2017 yıllarında Tekirdağ ilinde yürütülmüştür. Çalışmada damla sulama yöntemi altında farklı düzeylerde sulama suyu uygulamalarıyla salçalık biberin su verim ilişkisi belirlenmiştir. Deneme A sınıfı buharlaşma kabından 3 günlük toplam buharlaşmanın %125, 100, 75 ve 50'sinin uygulanması ile 4 farklı sulama konusundan oluşmuştur. Elde edilen sonuçlara göre ilk yıl verim tepki faktörü (ky), 1.34 olarak elde edilirken, ikinci yıl verim tepki faktörü (ky) 0.85 olarak hesaplanmıştır. Çalışmanın iki yıllık sonuçlarının birlikte değerlendirilmesiyle $[1-(Y_a/Y_m)]=1.01[1-(E_t/E_m)]$ denklemi elde edilmiş ve verim tepki faktörü (ky) 1.01 olarak hesaplanmıştır. 2016 ve 2017 yıllarında I₁ uygulamasındaki maksimum sulama suyu miktarına göre değerlendirildiğinde I₂, I₃ ve I₄ uygulamalarında sırasıyla ortalama %19.7, %39.3 ve %58.9 su eksikliği meydana gelmiştir. Buna bağlı olarak verimdeki azalma miktarları sırasıyla %8,6, %32 ve %46,5 olmuştur.

Anahtar Kelimeler: Kapa biber, Damla sulama, Verim tepki faktörü



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THE SEASONAL WATER-YIELD RELATIONSHIP OF PASTE PEPPER

ABSTRACT

In the 2020s, when the existing water resources cannot respond to the increasing water needs of the sectors, irrigation water should be used more effectively and more economically in agriculture, which is the sector with the highest water used. Therefore, pressure irrigation methods with high irrigation efficiency should be preferred. Among the pressure irrigation methods, the drip irrigation method has come to the fore in recent years due to its irrigation efficiency of over 95%. In this method, where water losses are seriously prevented, the entire area is not wetted and irrigation water is applied only to the root zone of the plant. It is very important to determine when and how much irrigation water will be applied according to the climate, plant species and regional conditions. The Thrace Region, which is in the semi-arid climate zone, is an important agricultural region of our country. Many plants are cultivated in the region. One of them is capia pepper, whose market share is increasing gradually and which is used in many areas in the food industry. The research was carried out in Tekirdağ province in 2016 and 2017. In the study, yield responses of capia pepper to irrigation water applied at different levels were determined. The experiment was carried out under 4 different irrigation treatments in which 125%, 100%, 75% and 50% of the total evaporation amount for 3 days from the A class evaporation pan were applied. According to the results obtained, the first year yield response factor (k_y) was calculated as 1.34, while the second year yield response factor (k_y) was calculated as 0.85. By evaluating the two-year results of the study, the equation $[1 - (Y_a/Y_m)] = 1.01[1 - (E_a/E_m)]$ was obtained and the yield response factor was calculated as 1.01. When evaluated according to the maximum amount of irrigation water in the I_1 application in 2016 and 2017, an average of 19.7%, 39.3% and 58.9% water deficiency occurred in the I_2 , I_3 and I_4 applications, respectively. Accordingly, the amount of decrease in yield was 8.6%, 32% and 46.5%, respectively.

Keywords: Capia Pepper, Drip irrigation, Yield response factor



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GİRİŞ

Dünya biber üretimi 36.1 milyon ton olup, ilk sırada 17.8 milyon ton ile Çin, 3.3 milyon ton ile Meksika ikinci, Türkiye ise 2.6 milyon ton ile 3. sırada yer almaktadır (FAO 2017). Kappa biberi [*Capsicum annuum* L. var. Conoides (Mill.) Irish], uzun konik yapılı, etli, kırmızı renkli ve tatlı bir tada sahip biber tipi olup ülkemizde uzun yıllardan beri “salçalık” ve “yağlık” biber olarak kullanılmaktadır (Akgün, 2010; Karaağaç ve Balkaya, 2010; Demirel ve ark., 2012; Kumari, 2012; Özdikmenli ve Zorba 2015).

Su kaynaklarının hızlı nüfus artışı ve küresel iklim değişikliğinden dolayı giderek azalmaya başlaması sulama uygulamalarında suyu en etkin kullanan yöntem olarak damla sulama yöntemini ön plana çıkarmaktadır. Yöntem altında verimde ciddi bir azalmaya neden olmayacak bir sulama programının ve düzeyinin eldesi çok önemlidir.

Ekonomik değeri yüksek olan bitkinin bölge koşullarında sulama programının oluşturulması gerekmektedir. Önceki çalışmalarda bitkinin su stresine hassas olduğu, yapılacak su kısıntısının verimi ciddi oranda etkilediği açıklanmıştır (Dağdelen, 2001; Demirel ve ark., 2012; Şen, 2015; Sezen ve ark., 2016).

Bu çalışmada salçalık biberin farklı düzeylerdeki sulama suyu miktarları altında elde edilen verim değerleri ve verim tepki faktörü belirlenmiştir.

MATERYAL VE METOD

Çalışma Tekirdağ koşullarında iki yıl süreyle yürütülmüştür. Deneme topraklarının fiziksel özelliklerini belirlemek için farklı derinliklerden alınan toprak numunelerden Blake (1965) ile Benami ve Diskin (1965)’de verilen esaslara göre tarla kapasitesi, solma noktası, hacim ağırlığı, kullanılabilir su tutma kapasitesi değerleri ve bünye sınıfı tayin edilmiş ve Çizelge 1’de verilmiştir.

Çizelge 1. Araştırma alanı topraklarının fiziksel özellikleri

Profil derinliği (cm)	Bünye sınıfı	TK		SN		Hacim ağırlığı (g cm ⁻³)	Kullanılabilir su tutma kapasitesi (mm)
		%	mm	%	mm		
0-30	Killi-tın	26,01	116,26	17,91	80,06	1,49	36,20
30-60	Killi-tın	28,45	134,85	19,71	93,43	1,58	41,42
0-60			251,11		173,49		77,62



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Deneme alanı topraklarında yapılan çift silindirli infiltrometre testleri neticesinde toprağın infiltrasyon hızı 12 mm h^{-1} olarak belirlenmiştir. Sulama suyunun kalite sınıfını belirlemek için yapılan ölçümde suyun kalitesi T_2S_1 olarak elde edilmiştir. Deneme toprakları bünye sınıfı ve su alma hızına göre damlatıcı debisi 4 L h^{-1} , damlatıcı aralığı ise $0,45 \text{ m}$ olarak hesaplanmıştır. Bu çalışmada salçalık veya yağlık biber olarakta isimlendirilen kapy biberi [*Capsicum annuum* L. var. conoides (Mill.) Irish] materyal olarak kullanılmıştır. Biber fideleri 2016 yılında 19 Mayıs, 2017 yılında ise 23 Mayıs tarihinde deneme parsellerine sıra arası 0.7 m ve sıra üzeri 0.3 m aralıklarla dikilmiştir.

Deneme, tesadüf blokları deneme desenine göre 3 tekrarlamalı olarak 2016-2017 yetiştirme dönemlerinde, iki yıl süre ile yürütülmüştür. Sulama aralığı iklim koşulları ve çiftçi uygulamaları dikkate alınarak 3 gün olarak belirlenmiştir. Sulama suyu miktarlarının tespitinde A sınıfı buharlaşma kabından ölçülen açık su yüzeyi buharlaşmasının farklı miktarları esas alınmıştır.

Deneme konuları;

I_1 : 3 günlük toplam buharlaşma miktarı $\times 1,25$

I_2 : 3 günlük toplam buharlaşma miktarı $\times 1,00$

I_3 : 3 günlük toplam buharlaşma miktarı $\times 0,75$

I_4 : 3 günlük toplam buharlaşma miktarı $\times 0,50$ şeklinde oluşturulmuştur.

Uygulanacak sulama suyu miktarı 3 günlük yığışımlı buharlaşma değerleri kullanılarak aşağıdaki Eşitlik (1) yardımıyla hesaplanmıştır (Kanber ve ark. 2004).

$$I = K_{pc} \times E_p \times P \quad (\text{Eş. 1})$$

Eşitlikte;

I : Uygulanacak sulama suyu miktarı (mm),

K_{pc} : Buharlaşma kabına bağlı katsayı,

E_p : Yığışımlı buharlaşma miktarı, (mm),

P : Damlatıcı aralığı ve lateral aralığına göre belirlenen ıslatılan alan yüzdesi (%),

dir.

Bitki su tüketimi, 60 cm toprak derinliği esas alınarak aşağıda verilen Eşitlik (2) ile (su bütçesi eşitliği) belirlenmiştir (Walker ve Skogerboe, 1987). Bu amaçla, sulama uygulaması öncesi her bir deneme konusunda 60 cm toprak derinliğinde her 30 cm 'lik toprak derinliğinde kuru ağırlık yüzdesine göre toprak nemi değerleri belirlenmiştir.

$$ET = I + P + C_p - D_p \pm R_f \pm \Delta S \quad (\text{Eş. 2})$$



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Eşitlikte;

ET: bitki su tüketimi (mm),

I: dönem boyunca verilen sulama suyu miktarı (mm),

P: dönem boyunca meydana gelen yağış (mm),

C_p: kılcal yükselişle kök bölgesine giren su miktarı (mm),

D_p: derine sızma kayıpları (mm),

R_f: deneme parsellerine giren ve çıkan yüzey akış miktarı (mm),

ΔS: kök bölgesi nem değişimleri (mm) ifade etmektedir.

Çalışmanın yapıldığı yerde taban suyu olmadığından, kılcal hareketle bitki kök bölgesine su girişi olmadığı göz önüne alınarak C_p değeri göz ardı edilmiş ve basınçlı sulama sisteminden yararlanıldığından dolayı yüzey akış miktarları da göz önüne alınmamıştır (Kanber, 1997).

Denemede hasat ilk yıl 13 Eylül 2016, ikinci yıl 14 Eylül 2017 tamamlanmıştır. Konulara göre verim değerleri ve bitki su tüketimi değerleri belirlenmiştir. Biber verimi ile evapotranspirasyon arasındaki ilişki Stewart denklemine göre (Eşitlik 3) değerlendirilmiştir (Doorenbos ve Kassam, 1988).

$$\left[1 - \left(\frac{Y_a}{Y_m}\right)\right] = k_y \left[1 - \left(\frac{ET_a}{ET_m}\right)\right] \quad (\text{Eş. 3})$$

Eşitlikte;

Y_a = gerçek verim, kg/da,

Y_m = maksimum verim, kg/da,

(Y_a /Y_m)= oransal verim,

(1-Y_a /Y_m)= oransal verim azalması,

k_y = su-verim ilişkisi faktörü,

ET_a = gerçek bitki su tüketimi, mm,

ET_m= maksimum bitki su tüketimi, mm,

(ET_a /ET_m)= oransal bitki su tüketimi,

(1- ET_a /ET_m)= oransal bitki su tüketimi açığıdır.



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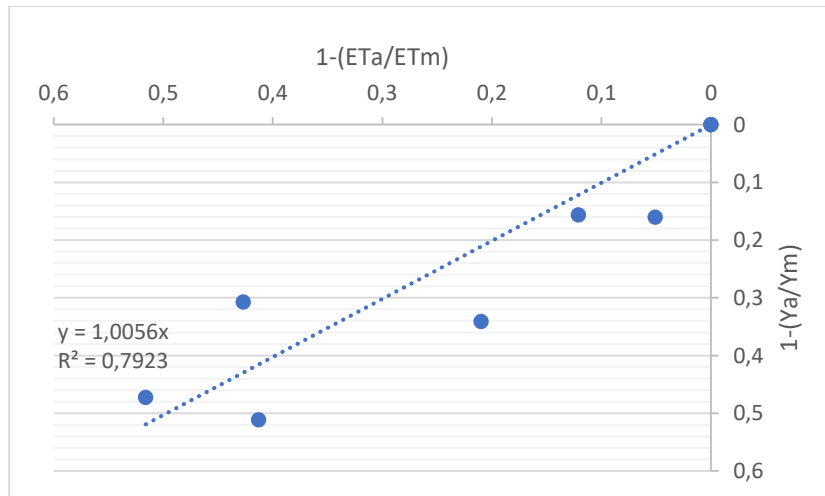
BULGULAR VE TARTIŞMA

Çalışmada sezonluk oransal bitki su tüketimi azalışına karşılık oransal verim azalması değerleri Çizelge 2’de verilmiştir.

Çizelge 2. Salçalık biberin sezonluk oransal bitki su tüketimi azalışına karşılık oransal verim azalması

Yıl	Sulama Konusu	Ya (kg/da)	Ym (kg/da)	1- (Ya/Ym)	Eta (mm)	Etm (mm)	1- (Eta/Etm)	Uygulanan sulama suyu (mm)	Sulama suyu tasarrufu (%)
2016	I ₁	3391	3391	-	936,5	936,5	-	857,1	-
	I ₂	3219	3391	0,051	785,3	936,5	0,161	688,7	19,6
	I ₃	2678	3391	0,210	616,2	936,5	0,342	520,3	39,3
	I ₄	1991	3391	0,413	457	936,5	0,512	351,9	58,9
2017	I ₁	4292	4292	-	889	889	-	748,8	-
	I ₂	3771	4292	0,121	750,3	889	0,156	602	19,6
	I ₃	2456	4292	0,428	616,2	889	0,307	455,3	39,2
	I ₄	2074	4292	0,517	469	889	0,472	308,5	58,8

Çalışmada ilk yıl en yüksek verim I₁ sulama konusunda 3391 kg/da olarak elde edilmiştir. Maksimum verimin elde edildiği sulama konusunda sezonluk toplam 857,1 mm sulama suyu uygulanmıştır. Deneme süresince 47,2 mm yağış kaydedilmiştir. Maksimum bitki su tüketimi 936,5 mm olarak yine bu konudan elde edilmiştir. Denemenin ikinci yılında da en yüksek verim I₁ sulama konusundan 4292 kg/da olarak elde edilmiştir. Maksimum verimin elde edildiği sulama konusunda sezonluk toplam 748,8 mm sulama suyu uygulanmıştır. Denemenin ikinci yılı süresince 103,6 mm yağış kaydedilmiştir. Maksimum bitki su tüketimi I₁ konusundan 889 mm olarak elde edilmiştir.



Şekil 1. Mevsimlik verim tepki faktörü (ky)



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Çalışmanın sonuçlarına göre ilk yıl verim tepki faktörü (ky), 1,34 olarak elde edilirken, ikinci yıl verim tepki faktörü (ky) 0,85 olarak hesaplanmıştır. Çalışmanın iki yıllık sonuçlarının birlikte değerlendirilmesiyle $[1-(Y_a/Y_m)]=1.01[1-(E_t/E_{tm})]$ denklemi elde edilmiş ve verim tepki faktörü (ky) 1,01 olarak hesaplanmıştır (Şekil 1). Dağdelen ve ark. (2004) ortalama verim tepki faktörünü 1,14, Sezen ve ark. (2011) ise 1,08 olarak elde etmişlerdir. Elde edilen ky değeri yapılan diğer çalışmaların sonuçlarına yakın olmuştur. 2016 ve 2017 yıllarında I₁ uygulamasındaki maksimum sulama suyu miktarına göre değerlendirildiğinde I₂, I₃ ve I₄ uygulamalarında sırasıyla ortalama %19,7, %39,3 ve %58,9 su eksikliği meydana gelmiştir. Buna bağlı olarak verimdeki azalma miktarları sırasıyla %8,6, %32 ve %46,5 olmuştur. Bölgede salçalık biber yetiştiriciliğinde yaratılacak su eksikliğinin biber veriminde azalmalara yol açacağı belirlenmiştir. Bu yüzden bitkinin ihtiyaç duyduğu su miktarı zamanında ve tam olarak karşılanmalıdır.



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KAYNAKLAR

- Akgün, M., 2010. Biber Salçası Üretim Tesisi Sanayi profili. Sanayi araştırma ve geliştirme genel müdürlüğü. T.C. Sanayi ve Ticaret Bakanlığı.
- Benami, A., Diskin, M.H. (1965). Design of Sprinkling Irrigation. Lowdermilk Faculty of Agricultural Engineering Publication 23, Technicon, Israel Institute of Tecnology, 1-165, Haifa, Israel.
- Blake, G.R. (1965). Bulk density methods of soil analysis. Soil Science Society of America, Madison, Part I. Am. Soc. Agron. 9: 374-390.
- Dağdelen, N. (2001). Büyüm Menderes havzası koşullarında sanayi biberinde farklı sulama aralığı ve sulama düzeyinin verim ve kalite üzerine etkileri. Ege Üniversitesi (Doktora Tezi), İzmir.
- Dağdelen, N., Yılmaz, E., Sezgin, F., Gürbüz, T., 2004. Effects of water stress at different growth stages on processing pepper (*Capsicum annuum*) yield, water use and quality characteristics. Pak. J. Biol. Sci. 7 (12), 2167–2172.
- Demirel, K., Genç, L., Saçan, M. (2012). Yarı Kurak Koşullarda Farklı Sulama Düzeylerinin Salçalık Biberde (*Capsicum Annum* Cv. Kapija) Verim ve Kalite Parametreleri Üzerine Etkisi. Tekirdağ Ziraat Fakültesi Dergisi, 9(2):7-15
- Doorenbos, J. and Kassam, A.H. Yield Response to Water. FAO Irrig. Drain Paper 33, Rome, 1988
- Kanber, R. (1997). Sulama. Çukurova Üniversitesi Ziraat Fakültesi Ders Kitabı. Genel Yayın No. 174. Ders Kitapları Yayın No. 52. 530s. Adana.
- Kanber, R., Steduto, P., Aydın, Y., Ünlü, M., Özmen, S., Çetinkökü, Ö., Özekici, B., Diker, K., Sezen, MS. (2004). Damla sulama sistemiyle fertigasyon uygulamalarının antepfıstığında gelişme, verim ve periyodisiteye etkisinin incelenmesi. Tübitak. TARP 1825.
- Karaağaç, O. and A. Balkaya, 2010. Bafra kırmızı biber popülasyonlarının [*Capsicum annuum* L. var. *Conoides* (Mill.) Irish] tanımlanması ve mevcut varyasyonun değerlendirilmesi. Anadolu J. Agric. Sci. 25(1):10-20.
- Kumari, S. 2012. Influence of climate change in capsicum production.104-107p.Vegetable production under changing climate scenario. 1-21 September. Nauni /Solun.
- Özdikmenli, S. and N. Zorba, 2013. Traditional Red Roasted Pepper (TFP_1780) The 2nd International Symposium on "Traditional Foods from Adriatic to Caucasus" 24-26 October 2013. Struga (Ohrid Lake) / Macedonia.



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Sezen, S.M., A. Yazar., S. Tekin., S. Eker., B. Kapur., 2011. Yield and quality response of drip-irrigated pepper under Mediterranean climatic conditions to various water regimes African Journal of Biotechnology Vol. 10(8), pp. 1329-1339.

Sezen, SM., Yazar, A., Tekin, S., Şengül, H. (2016). Salçalık Biber Bitkisinde Damla Yöntemiyle Uygulanan Farklı Sulama Düzeylerinin Verim Üzerine Etkileri ve Ekonomik Analizi. Araştırma Makalesi, KSÜ Doğa Bil. Derg., 19(3): 310-318, 2016

Şen, E. (2015). Sanayi biberinde (*Capsicum annuum* L.) damla sulama uygulamalarının bazı verim ve kalite özellikleri üzerine etkileri. (Yüksek Lisans Tezi). Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü, Aydın.

Walker, WR., Skogerboe, GV. (1987). Surface Irrigation. Theory and Practice. Prentice-Hall. Englewood Cliffs. 375pp. New Jersey.



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**BAZI ARAZI ÖZELLİKLERİNİN COĞRAFI BİLGİ SİSTEMLERİ İLE
BELİRLENMESİ VE TARIM AÇISINDAN DEĞERLENDİRİLMESİ: GİRESUN İLİ
ŞEBİNKARAHİSAR İLÇESİ ÖRNEĞİ**

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ÖZET

Bu çalışma, Giresun ilinin Şebinkarahisar ilçesinde bazı arazi özelliklerinin coğrafi bilgi sistemleri kullanılarak belirlenmesi ve tarım açısından değerlendirilmesi amacıyla yapılmıştır. Bu amaçla, ilçeye ait yükselti, eğim, bakı, kabartı ve CORINE arazi örtüsü 2018 haritaları hazırlanmış ve alan hesaplamaları yapılmıştır. Haritalar, sayısal yükseklik modeli (DEM) verisi (SRTM 1 Arc-Second Global/~30 meters) kullanılarak oluşturulmuştur. Haritalar ve alan hesaplamaları ArcGIS-ArcMap 10.3 programında yapılmıştır. Şebinkarahisar ilçesinin yükselti değerleri 750 m ile 3102 m arasında bulunmuştur. Çalışma alanındaki yükselti grupları 12 sınıfa ayrılmıştır. 156,372 km²'lik bir alan kaplayan 1.466 m-1.610 m aralığındaki yükselti grubu, ilçedeki en geniş alana sahip grup olarak belirlenmiştir. Araştırma alanında % 12-20, % 20-30, % 30-45 ve % 45'ten fazla eğime sahip olan alanların toplam miktarı 1193,672 km² olarak hesaplanmıştır. Bu durum, ilçenin toplam alanının çok büyük bir kısmının tarımsal faaliyetler açısından önemli bir sorun oluşturduğunu ortaya koymaktadır. Geriye kalan eğim gruplarında (% 0-2, % 2-6 ve % 6-12) yer alan arazilerde mevcut yapılmakta olan tarımsal üretime ek olarak, farklı alternatif tarım ürünlerinin tespit edilmesi ve yetiştirilmesi için gerekli çalışmaların yapılmasının uygun olacağı kanaatine varılmıştır. 225,602 km²'lik bir alanı kaplayan güney (157.5°-202.5°) bakı grubu ve 200,565 km²'lik bir alanı kaplayan güneydoğu (112.5°-157.5°) bakı grubu, ilçedeki en geniş alana sahip 2 grup olarak saptanmıştır. Şebinkarahisar ilçesinde, yüksek eğim gruplarına ilave olarak, iklim koşulları da tarımsal üretimi zorlayan bir etken olarak öne çıkmaktadır. Çalışmada değerlendirilen arazi özelliklerinin yanında bazı önemli uzun yıllar iklim verileri ortalamalarının da yorumlamaları yapılmıştır. Şebinkarahisar ilçesinde yapılmış olan bu çalışmada elde edilen verilerin, ilerleyen zamanlarda çeşitli tarımsal ürünlerin yetiştiriciliği için uygun alanların belirlenmesi amacıyla ilçede yapılabilecek araştırmalara yardımcı bir kaynak oluşturabileceği düşünülmektedir.

Anahtar Kelimeler: CBS, tarım, arazi özellikleri, harita, Şebinkarahisar



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**DETERMINATION OF SOME LAND PROPERTIES WITH GEOGRAPHICAL
INFORMATION SYSTEMS AND EVALUATION IN TERMS OF AGRICULTURE:
THE CASE OF ŞEBİNKARAHİSAR DISTRICT OF GİRESUN PROVINCE**

ABSTRACT

This study was conducted to identify of some land characteristics and evaluate in terms of agriculture in Şebinkarahisar district of the Giresun province by using geographical information systems. For this purpose, elevation, slope, aspect, hillshade and CORINE land cover 2018 maps of the district were prepared and area calculations were made. The maps were created using digital elevation model (DEM) data (SRTM 1 Arc-Second Global/~30 meters). Maps and area calculations were made in ArcGIS-ArcMap 10.3 program. Elevation values of Şebinkarahisar district were found between 750 m and 3102 m. Elevation groups in the study area are divided into 12 classes. Covering an area of 156,372 km², the elevation group in the range of 1.466 m-1.610 m was determined as the group with the largest area in the district. The total amount of areas with slopes of 12-20%, 20-30%, 30-45% and more than 45% in the research area was calculated as 1193,672 km². This situation reveals that a very large part of the total area of the district constitutes an important problem in terms of agricultural activities. It was concluded that it would be appropriate to carry out the necessary studies for the determination and cultivation of different alternative agricultural products in addition to the existing agricultural production on the lands located in the remaining slope groups (0-2%, 2-6% and 6-12%). The south (157.5°-202.5°) aspect group covering an area of 225,602 km² and the southeast (112.5°-157.5°) aspect group covering an area of 200,565 km² were determined as the 2 groups with the largest area in the district. In Şebinkarahisar district, in addition to the high slope groups, climatic conditions also stand out as a factor forcing agricultural production. In addition to the land characteristics evaluated in the study, some important long-term climate datas averages were also interpreted. It is thought that the datas obtained in this study, which was made in Şebinkarahisar district, can be a helpful source for researches that can be done in the district in order to determine suitable areas for the cultivation of various agricultural products in the future.

Keywords: GIS, agriculture, land properties, map, Şebinkarahisar



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1. GİRİŞ

Artan nüfus karşısında insanların beslenmesini sağlayabilmek amacıyla sınırlı olan arazi kaynaklarını etkin bir şekilde kullanabilmek gerekmektedir. Arazi kaynaklarını en iyi şekilde kullanabilmek, izleme ve değerlendirme yapabilmek için envanterleri çıkarılmalıdır. Bilgisayar ve uydu teknolojisinde meydana gelen gelişmeler mevcut arazi kaynaklarının envanterlerinin çıkarılmasında, bu arazilerde meydana gelen değişimlerin izlenmesinde önemli kolaylıklar sağlamaktadır (Everest ve ark., 2011). Geniş bir yelpazede kullanılabilme imkanının olması, coğrafi bilgi sistemleri metodolojisini kullanan bir çok CBS yazılımının (software) üretilmesine ve kullanılır olmasına zemin hazırlamıştır. Çünkü farklı bilim dalları ve meslek grupları, CBS metodolojisini kullanarak, ihtiyaçları doğrultularında, kendi çalışmalarına daha iyi yanıt verecek niteliklere sahip kendi yazılımlarını geliştirmişlerdir (Turoğlu, 2008). Coğrafi bilgi sistemleri ve uzaktan algılama tekniklerini kullanarak; tarım alanlarının yönetim ve kullanım faaliyetlerinin planlanmasında, çabuk, doğru ve objektif karar verilmesi sağlanabilecektir (Özyazıcı ve ark., 2016). Arazi kullanım projeksiyonları, kırsal alanlarda arazi kullanımındaki değişimin gelecekteki dinamiklerinin anlaşılmasını ve dolayısıyla daha uygun plan ve politikaların geliştirilmesini kolaylaştırmaktadır (Cerrillo ve ark., 2020).

Tarımsal üretim ve doğal kaynaklarının sürdürülebilirliğini sağlayabilmek için, arazileri mevcut potansiyellerinde değerlendirmek temel esastır. Bunun için de öncelikle mevcut toprak kaynakları saptanmalıdır. Topraktan düzenli bir şekilde yararlanılabilmesi için toprak koruma ile ilgili gereklerin yerine getirilmesi gerekmektedir. Arazi kullanmadaki en önemli problem arazilerin yeteneklerine uygun olarak kullanılmamasıdır (Candemir ve Özdemir, 2010). Toprak ve su kaynakları potansiyelini korumak için en önemli konu mevcut durumun saptanması ve ileri projeksiyona yönelik tahminlerin belirlenerek alınabilecek önlemlerin ortaya konulmasıdır (Bağdatlı ve ark., 2014).

Gerek ülkemizde gerekse gelişmekte olan ülkelerde yer alan tarımsal nitelikli araziler, plansız arazi kullanımı, yoğun toprak işleme sonucu toprak erozyonu, sanayi ve imar sektöründeki gelişmelere paralel olarak tarım dışı taleplerin artması ile gün geçtikçe oransal olarak azalmaktadır. Kırsal bölgelerdeki eğitim sorunu, dünya üzerinde yaşanan hızlı nüfus artışı, sektörel kurumsal desteklerin yetersizliği veya olmayışı vb. nedenler ile tarımsal niteliğe sahip araziler baskı altındadır. Arazilerin yanlış kullanım planlaması ile yönetilmesinin neticesinde, birbirlerine ekonomik anlamda bağlı olan sektörler arasında uyumsuzluk görülmektedir. Bitki örtüsünün kaybolduğu, hatalı toprak işlemenin yapıldığı ve arazi kullanım planlarından yoksun



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özellikle eğim oranı yüksek arazilerde çoğu bölgede ana kayaç yapısının ortaya çıktığı, tarım toprağının tamamen kaybolduğu görülmektedir. Bu durum toprağın su ve organik madde tutma kapasitesinin kaybına, çoraklaşmaya ve sonucunda tarımsal üretime uygun olmayan, çölleşmiş ve kurak alanlar meydana gelmesine yol açmaktadır. Bu tablo nihayetinde tarımsal üretimde kayıp, kırsal kalkınmada yavaşlama veya durma, kırsaldan kente olan göçün artışı, tarım arazilerinin nitelik ve nicelik olarak azalması ve değerlerinin düşmesi vb. gibi birçok ekolojik, ekonomik, sosyal, ve kültürel sorunları da beraberinde getirmektedir. Sonuçta doğal kaynaklarımız bozulmakta ve sürdürülebilir kırsal kalkınmanın ana lokomotifi olan tarım sektörü tehlikeye girmektedir (Saykılı ve ark., 2017). Başayığıt ve Uçar (2019), Kars ili arazilerinin % 27.46'sının orta-dik (% 6-20), % 20.99'unun çok dik (% 20-30), % 19.54'ünün düz-düze yakın (% 0-2), % 16.75'inin ise sarp (% 30 +) eğime sahip olduklarını tespit etmişlerdir. İl arazilerindeki düz alanların ise % 3.98'lik bir kısma karşılık geldiğini belirtmişlerdir. Mercan ve Arpağ (2020), yaklaşık 8633 km²'lik araştırma alanında; Mardin ilinin toplam alanının % 47.54'ünün % 6'dan düşük eğim değerlerine sahip olduğunu ve bu alanların ilin çoğunlukla güney bölgelerinde yer aldığını tespit etmişlerdir. İlin ortalama rakımının yaklaşık 1083 metre olduğunu saptamışlardır. Alansal bakımdan güney-güneydoğu ve güneybatı yönüne bakan bakı alanının % 43.88, kuzey-kuzeydoğu ve kuzeybatı yönüne bakan bakı alanının ise % 30.24 olduğunu tespit etmişlerdir. Mardin ilinin özellikle güney bölgesinde daha yaygın olarak yer alan eğimi düşük, topografik olarak alçak alanların tarım için oldukça elverişli olduğunu ve topoğrafik olarak yüksek olan kesimlerin tarımsal üretim açısından sınırlı imkânlar sunduğunu belirlemişlerdir. Türker (2021), CORINE verilerinin doğruluğu konusundaki tartışmalara rağmen bu veri setinin kullanılmasıyla arazi/alan hakkında önemli çıkarımlar yapılabileceğini bildirmiştir. Bununla beraber bu veri setinin kullanımının şehir bölge planlama, peyzaj mimarlığı, orman mühendisliği, ziraat mühendisliği, coğrafya, haritacılık ve ilgili birçok disiplin için önemli bir yardımcı olduğunu ve karar vericiler için de önemli bir yol gösterici olduğunu ifade etmiştir.

Bu çalışmada, coğrafi bilgi sistemlerinden faydalanılarak, Giresun ilinin Şebinkarahisar ilçesine ait bazı arazi özelliklerinin belirlenmesi ve tarımsal açıdan değerlendirilmesi amaçlanmıştır. Bununla beraber bu çalışmanın, ilçede gelecekte yapılabilecek çeşitli araştırmalar için yardımcı bir kaynak olabileceği düşünülmektedir.



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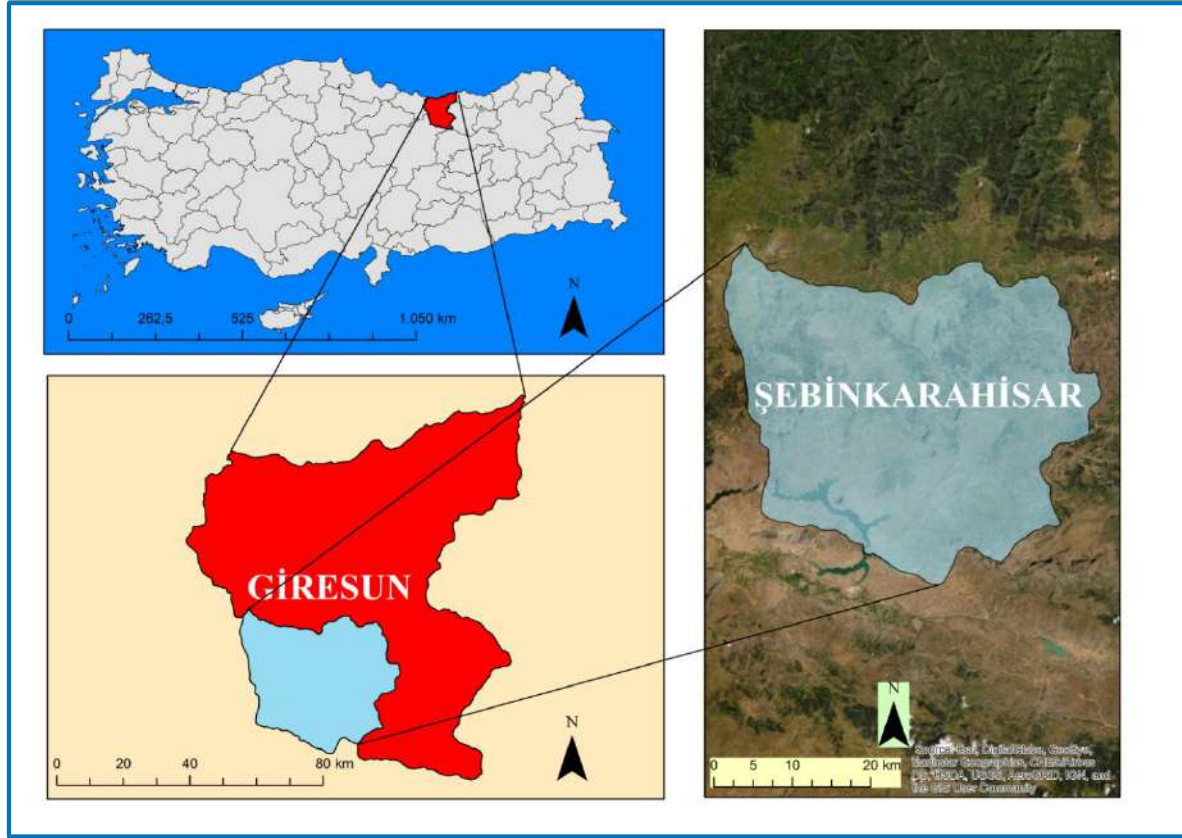


2. MATERYAL VE YÖNTEM

Giresun iline bağlı bir kent merkezi olan Şebinkarahisar, Doğu Karadeniz Dağlarının güney yamaçlarında ve Avutmuş Çayı vadisinin kuzey yamaçlarında kurulmuştur (Yılmaz, 2006). İlçenin alanı 1396 km²'dir (Anonim, 2021a). Yükseltisi 1364 m olan Şebinkarahisar ilçesinde 1965 ve 2017 yılları arasındaki 53 senelik süreçte; yıllık toplam yağış miktarı ortalama 583.5 mm ve yıllık ortalama sıcaklık değeri de 9.13 °C olarak belirlenmiştir. Yıllık açık (Bulutsuz) günler sayısı ortalaması 126.10 ve yıllık bulutlu günler sayısı ortalaması da 198.70 olarak saptanmıştır (Anonim, 2018a). İlçenin yüksek kesimlerinde geçim kaynağı olan hayvancılık ve tarımla uğraşmaktadır. Birçok köyde, küçükbaş ve büyükbaş ahır hayvancılığı yaygın olup süt toplama merkezleri de bulunmaktadır. Arıcılık ve süt besiciliğinin yaygınlaşmasının yöre halkına olumlu katkıları olmuştur. Yörede hayvan otlatmaya uygun alanlar yetersiz olduğu için, otlatma genellikle ormanlık alanlarda ki yaylalarda yapılmaktadır. Koyun, keçi ve sığır dışında ciddi boyutlarda olmamakla birlikte manda, at, eşek ve katır gibi yük hayvanları da bulunmakta olup, kümes hayvancılığı da yapılmaktadır (Aybar, 2014). Şebinkarahisar ilçesine ait konum haritası (Şekil 1), Anonim (2021b)'den indirilen Türkiye mülki idare sınırları verileri kullanılarak; World Geodetic System (WGS) 1984 Datumu ile ArcGIS-ArcMap 10.3 programında hazırlanmıştır. İlçenin yükselti, eğim, bakı, kabartı ve CORINE 2018 arazi örtüsü haritalarının yapımında, USGS (2021)'den elde edilen sayısal yükseklik modeli (DEM) verisi (SRTM 1 Arc-Second Global/~30 meters) kullanılmıştır. Datum/Projeksiyon dönüşümleri WGS 1984 UTM Zone 37 N olacak şekilde yapılmıştır. Haritaların yapımında ve alanların hesaplanmasında ArcGIS-ArcMap 10.3 programından faydalanılmıştır. Çalışmada kullanılan CORINE 2018 arazi örtüsü verilerine (Corine Land Cover - ESRI FGDB 2018 Vector ESRI Geodatabase v2020_20u1 5.0 GB), European Environment Agency (EEA) (2021)'den ulaşılmıştır. CORINE 2018 harita lejantı, Anonim (2018b) kullanılarak yapılmıştır.



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Şekil 1. Şebinkarahisar ilçesinin konumunu gösteren harita

3. BULGULAR VE TARTIŞMA

Yükselti ve eğim, jeomorfolojik birimleri, süreçleri, iklimi, hidrografyayı, toprak oluşumunu ve niteliğini, bitki örtüsünün çeşitlenmesini, dağılışını ve katlaşmasını, hayvan dağılışını, tarımı, hayvancılığı doğrudan etkilemektedir. Türkiye’de ortalama yükselti 1141 m’dir (Elibüyük ve Yılmaz, 2010). Yükselti, arazi kullanım desenini değiştiren doğal faktörlerdendir. Tarım alanları, çoğunlukla artan yükseltiye bağlı olarak azalma eğilimi göstermektedir. Yükseltideki artış, yeryüzü şekillerine bağlı bir şekilde genelde eğimin de artmasına bağlı olarak tarımsal faaliyete uygun düzlük alanların azalmasına sebep olmaktadır. Yükselti artışının, tarım alanlarının azalması üzerindeki önemli etkisi iklim elemanlarının değişmesine bağlı olarak, vejetasyon süresinin kısılmasıdır. Otlak alanları ise yükseltiden daha az etkilenen bir karakterdedirler. Otlak alanları, tarım alanlarının çevresinde ve daha yüksek zonlarda genişleme eğilimindedirler (Taş ve Yakar, 2010).

Şebinkarahisar ilçesinin yükselti değerleri 750 m ile 3.102 m aralığında saptanmış ve 12 sınıfa ayrılmıştır. İlçenin yükselti grupları haritası Şekil 2’de; yükselti gruplarının alanları da Şekil



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3'te sunulmuştur. Buna göre, 1.466 m ile 1.610 m aralığındaki yükselti grubu en geniş alanı kaplamaktadır (156,372 km²). 16,444 km²'lik alanıyla 2.630 m ile 3.102 m aralığındaki yükselti grubu en az alana sahip olarak bulunmuştur. 750-986 m yükselti grubu 113,088 km²; 986-1.154 m yükselti grubu 137,573 km²; 1.154-1.314 m yükselti grubu 141,161 km²; 1.314-1.466 m yükselti grubu 149,562 km²; 1.610-1.755 m yükselti grubu 152,932 km² yüzölçümündeki alanları kapsamaktadırlar. 1.755-1.899 m, 1.899-2.040 m, 2.040-2.197 m, 2.197-2.384 m ve 2.384-2.630 m yükselti gruplarının alanları da sırasıyla 141,988 km², 141,666 km², 118,638 km², 72,733 km² ve 51,866 km² olarak belirlenmiştir. Taş ve Yakar (2010), Afyonkarahisar ilinde, yerleşim alanları, sanayi alanları ve tarım alanlarının 900-1300 m yükselti aralığında kümелendiğini ve 1300 m yükseltiden itibaren doğal ortamda insan faaliyetlerini olumsuz yönde etkileyici değişimler yaşandığını bildirmişlerdir. Şebinkarahisar'da yapılmış olan mevcut çalışmada, ilçenin yüzölçümünün yarısından fazlasını kaplayan bir alanın, 1.314 m'den fazla yükselti değerlerine sahip olduğu saptanmıştır. Bu durum da, ilçedeki tarımsal faaliyetleri sınırlandıran önemli faktörlerden birisinin yükselti olduğunu ortaya koymaktadır.

Eğim, topoğrafyayı, dolayısıyla arazi kullanımını etkileyen bir parametredir (Özalp ve ark., 2013). En eğimli bölgesi, Karadeniz Bölgesi olan Türkiye'de, maksimum % 388 eğimler bulunmaktadır. Türkiye'nin ortalama eğimi % 17 civarındadır. Bu eğim genel olarak % 3 ile % 30 arasında değişim göstermektedir (Elibüyük ve Yılmaz, 2010).

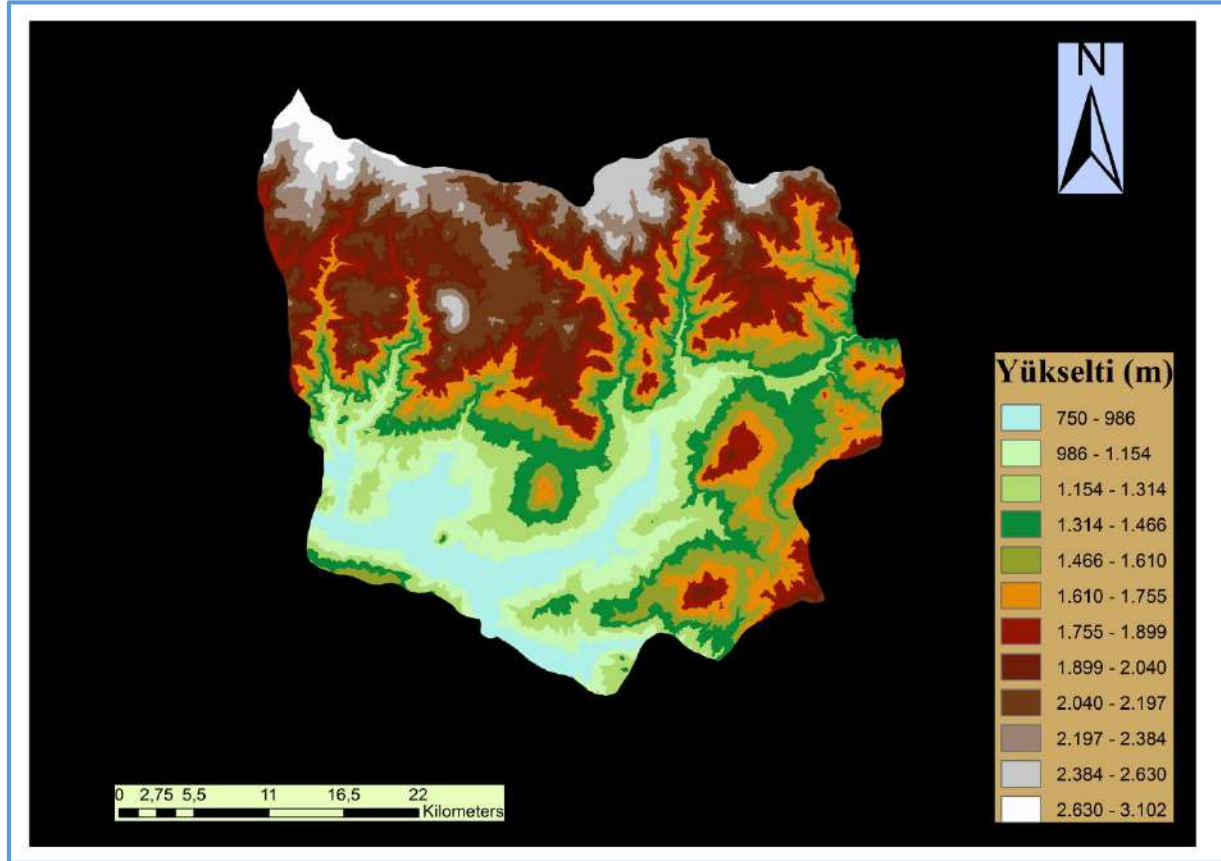
Giresun ilinin Şebinkarahisar ilçesindeki eğim (basit eğim) grupları, Dizdar (2003)'e göre sınıflandırılmıştır. İlçenin eğim gruplarını gösteren harita Şekil 4'te; eğim gruplarının kapladığı alanlar da Şekil 5'te sunulmuştur. Buna göre eğim grupları; düz veya düze yakın (% 0-2), hafif eğimli (% 2-6), orta eğimli (% 6-12), dik eğimli (% 12-20), çok dik eğimli (% 20-30), sarp (% 30-45) ve çok sarp (% 45+) olmak üzere 7 sınıfa ayrılmıştır. İlçede sarp eğim grubundaki arazilerin (% 30-45) en geniş alanı (318,631 km²) kapsadığı belirlenmiştir. Bunu takiben % 45+ ve % 20-30 eğim gruplarındaki arazilerin de sırasıyla 304,947 km² ve 300,94 km² yüzölçümlerine sahip oldukları saptanmıştır. Düz veya düze yakın, hafif eğimli, orta eğimli ve dik eğimli araziler de sırasıyla; 15,561 km², 41,341 km², 143,463 km² ve 269,154 km² yüzölçümlerine sahiptirler. Dengiz ve ark. (2019), Hakkâri ilinde, toplam alanın yalnızca % 3.9'unun % 6'dan düşük eğim değerlerine sahip olduğunu saptamışlardır. İlin % 21.5'inin % 6-30 arasında eğim değerlerine sahip olduğunu, % 30'un üzerinde eğimli sahaların da ilin % 74.6'sını oluşturduğunu belirtmişlerdir.



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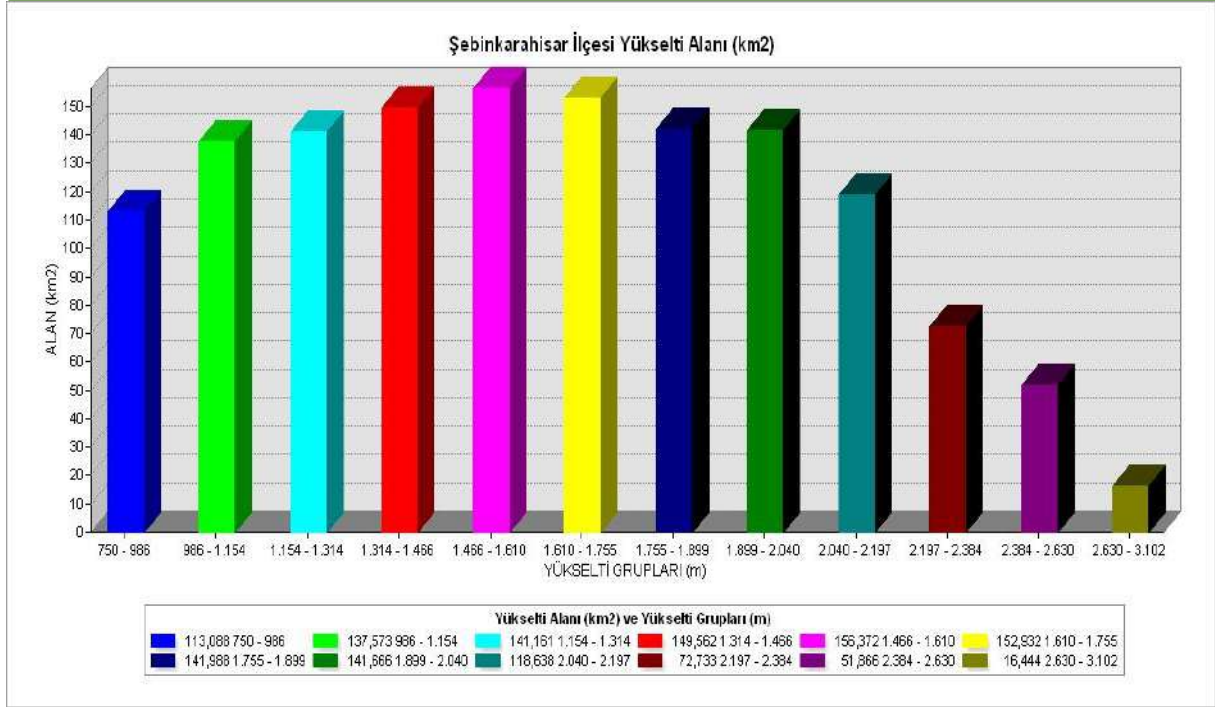
Şebinkarahisar ilçesinde yapılan mevcut çalışmadaki eğim değerleri, ilçenin, tarımsal faaliyetler için zorlu koşullara sahip olduğunu göstermiştir. İlçede toplamda 200,365 km²'lik bir alanın % 12 eğimden daha düşük değerlerde olduğu saptanmıştır. Buna karşın geriye kalan alanın eğim değerlerinin tarım için sınırlayıcı olabileceği belirlenmiştir.



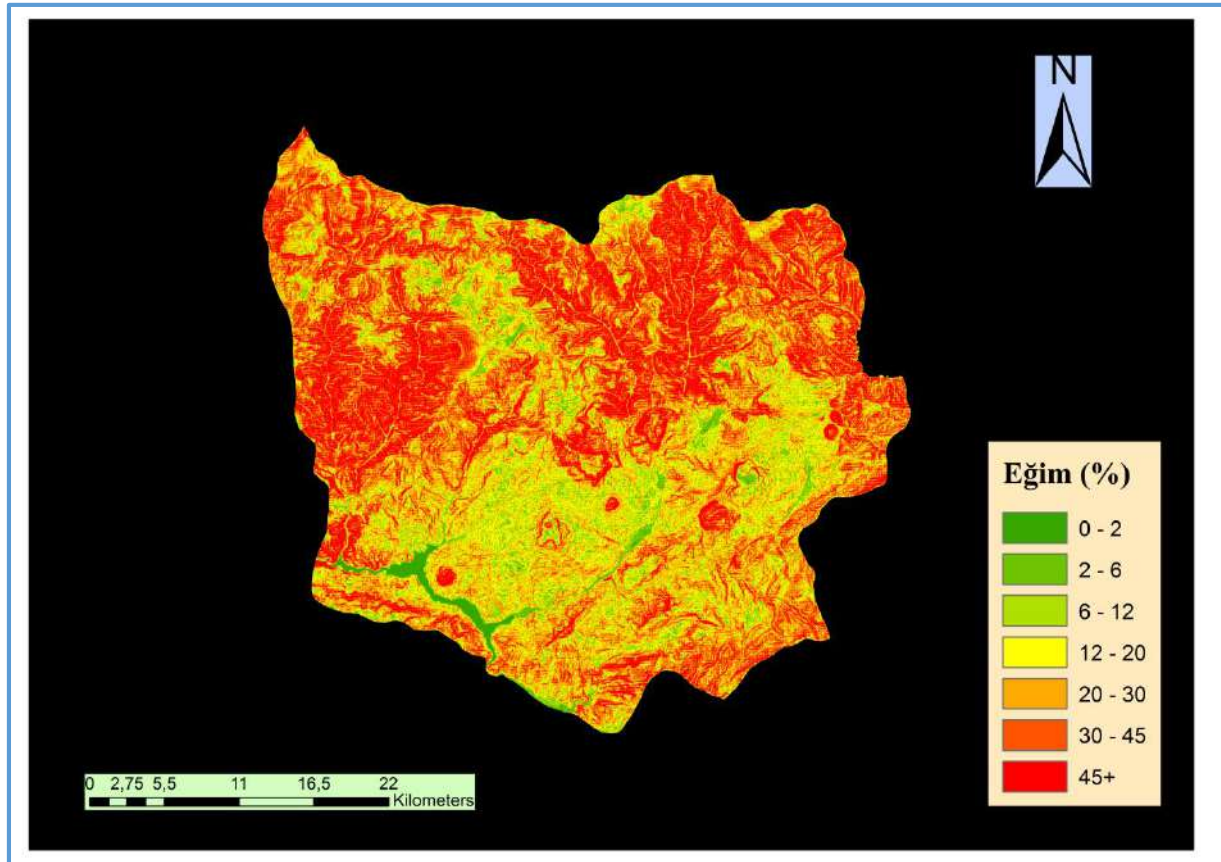
Şekil 2. Şebinkarahisar ilçesinin yükselti haritası



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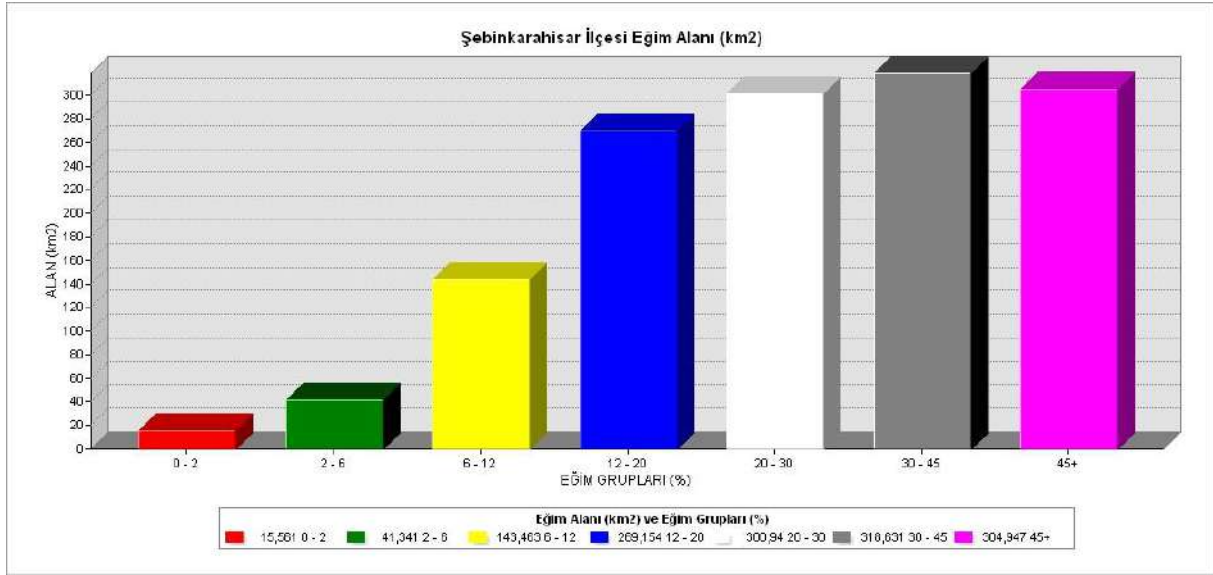
Şekil 3. Şebinkarahisar ilçesinin yükselti gruplarına göre alan sınıflandırması



Şekil 4. Şebinkarahisar ilçesinin eğim gruplarını gösteren harita



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Şekil 5. Şebinkarahisar ilçesinin eğim gruplarına göre alan sınıflandırması

Bakının etkisi, hem güneşlenme, hem de maruz kalınan rüzgâr tiplerini etkilediği için arazinin nemliliği üzerindeki etkin rolü ile açıklanabilmektedir (Şahin ve Karatepe, 2020). Yalçın ve Yüce (2020), güney yönlü arazilerin güneş ışığından daha fazla faydalanacağını belirtmişlerdir. Şebinkarahisar ilçesinin bakı yönleri ve dereceleri 10 sınıf halinde saptanmış olup; Şekil 6’da gösterilmiştir. Hesaplanan bakı alanları da Şekil 7’de sunulmuştur. İlçede, güney bakılı (157.5° - 202.5°) alanlar $225,602 \text{ km}^2$ en geniş yayılımı göstermektedir. $200,565 \text{ km}^2$ ’lik yüzölçümüne sahip olan güneydoğu bakılı (112.5° - 157.5°) alanlar da ilçedeki en geniş yayılımı gösteren ikinci bakı grubu olarak belirlenmiştir. Güneybatı bakılı (202.5° - 247.5°) alanların da $188,29 \text{ km}^2$ ’lik bir yer kapladığı saptanmıştır. Bakı yönü batı (247.5° - 292.5°) olan alanlar $192,117 \text{ km}^2$ yüzölçümüne sahiptir. İlçede, 0° - 22.5° kuzey bakılı olan alanlar $61,374 \text{ km}^2$ ’yi kaplarken; 337.5° - 360° kuzey bakılı alanlar $63,336 \text{ km}^2$ ’lik alanı kaplamaktadırlar. Kuzeybatı (292.5° - 337.5°) bakıdaki sahalar $154,731 \text{ km}^2$; kuzeydoğu (22.5° - 67.5°) bakıdaki sahalar da $124,587 \text{ km}^2$ yüzölçümlerine sahip olarak bulunmuşlardır. Doğu bakılı (67.5° - 112.5°) alanların yüzölçümü $172,917 \text{ km}^2$ olarak belirlenmiş ve düz bakılı (-1°) alanların da $10,463 \text{ km}^2$ yüzölçümüne sahip olduğu saptanmıştır. Yalçın ve Yüce (2020), Burdur ilinin arazi bakısının genel olarak güneye doğru olduğunu saptamışlardır. Dengiz ve ark. (2019), Hakkâri ilinin orta bölümünde % 0.4 oranında düzlük alanların bulunduğunu, güney doğu bakısına sahip olan alanların da oransal olarak daha fazla yer aldığını bildirmişlerdir.

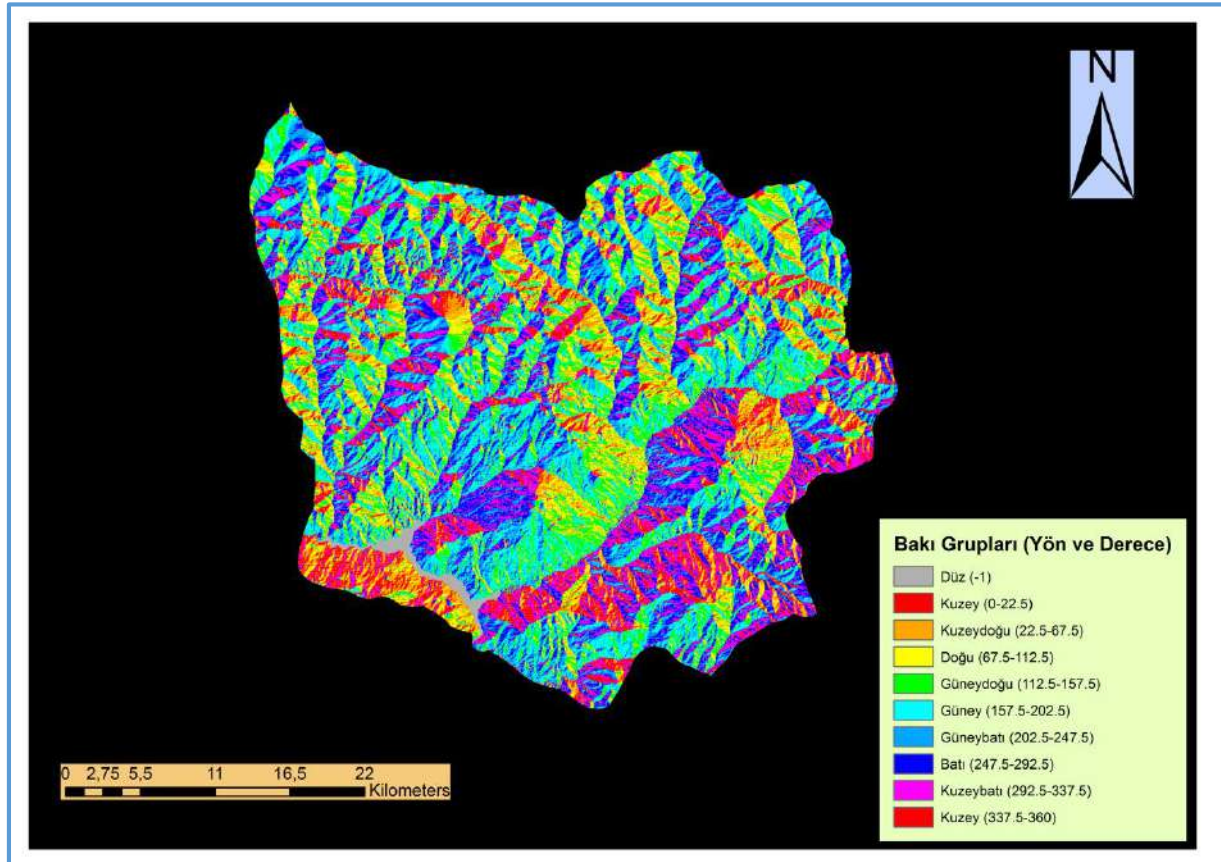


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Giresun'un Şebinkarahisar ilçesinde yapılan mevcut çalışmada, güney, güneydoğu ve güneybatı bakılı alanların toplam miktarı 614,457 km²'dir. Bu rakam yaklaşık olarak ilçenin tüm alanının yarısına yakındır. Bu da, iklim bakımından kış koşullarının zorlu bir faktör olduğu Şebinkarahisar ilçesinde, Anonim (2018a)'in 1965 ve 2017 yılları arasındaki 53 yıllık verileri de dikkate alındığında, bulutsuz (açık) günlerin aylık ortalamasının 10 günden fazla olduğu haziran, temmuz, ağustos, eylül ve ekim aylarında güneş ışıklarından faydalanma imkânını arttırmaktadır.

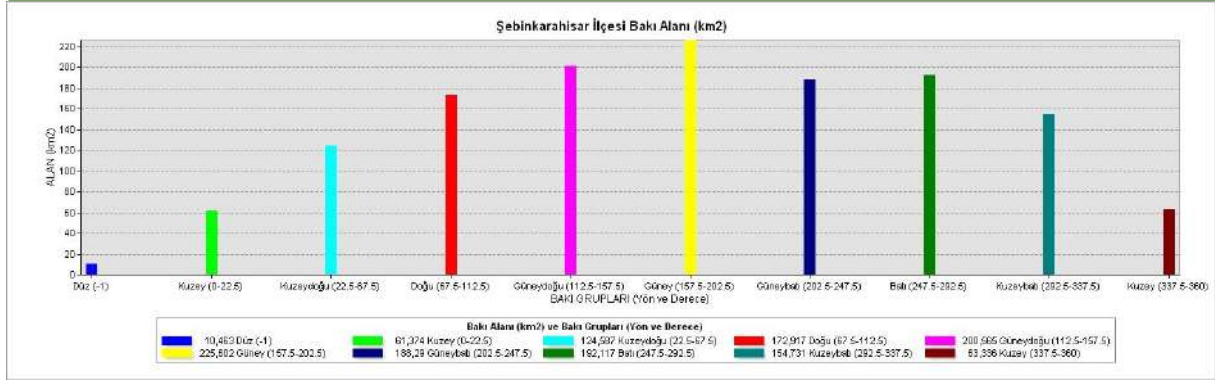
Şebinkarahisar ilçesindeki bu çalışmada, yükselti, eğim ve bakı haritalarına ilave olarak, ilçedeki arazi özelliklerinin gösterimini desteklemek amacıyla bir kabartı haritası da hazırlanmış ve Şekil 8'de gösterilmiştir. Bununla birlikte ilçenin, CORINE arazi örtüsü 2018 haritası Şekil 9'da sunulmuştur.



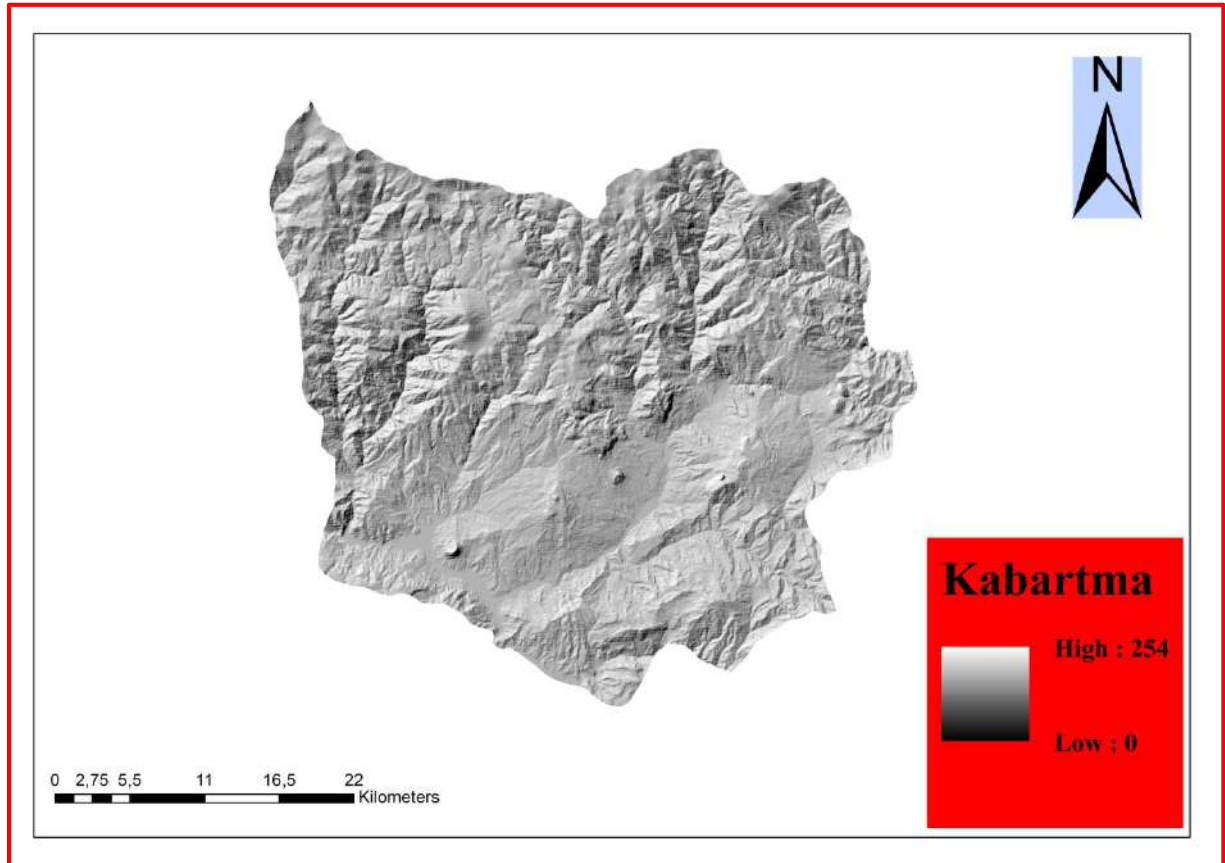
Şekil 6. Şebinkarahisar ilçesinin bakı haritası



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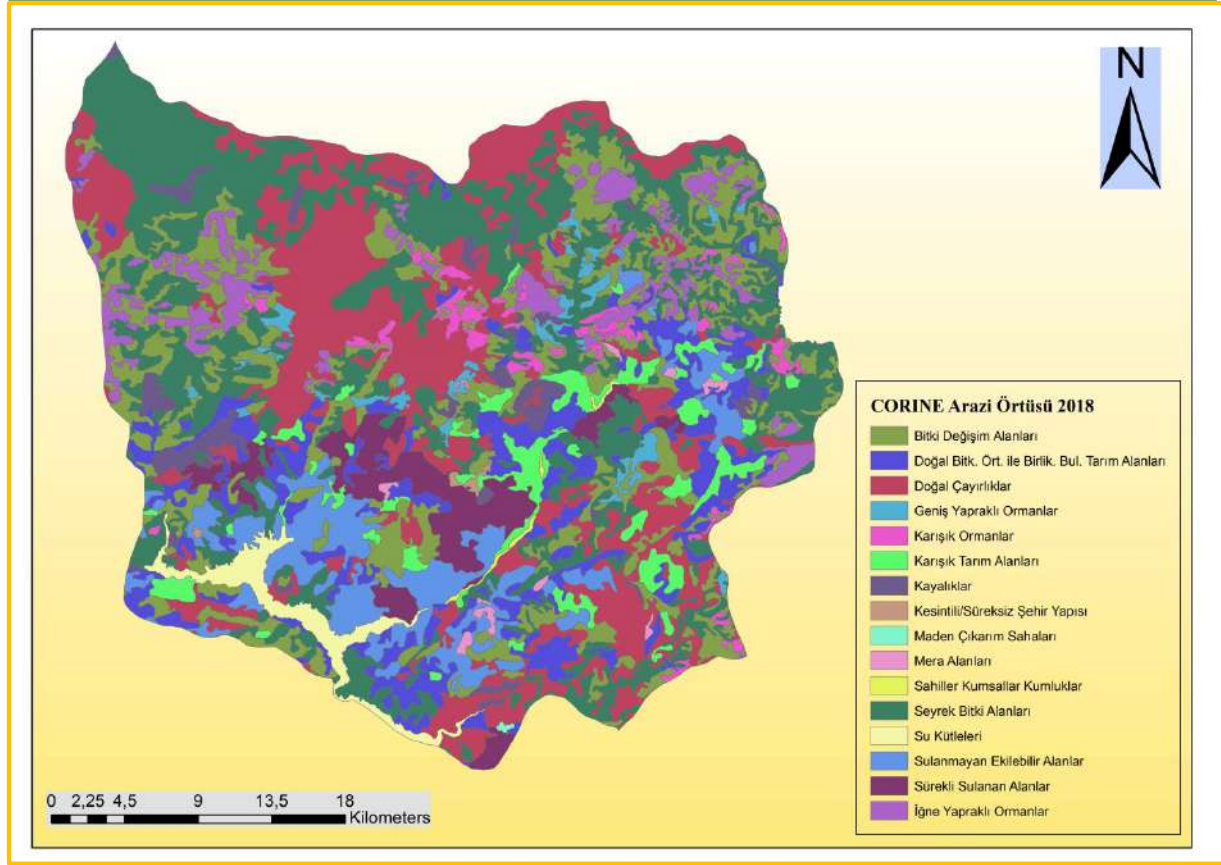
Şekil 7. Şebinkarahisar ilçesinin bakı gruplarına göre alan sınıflandırması



Şekil 8. Şebinkarahisar ilçesinin kabartı haritası



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Şekil 9. Şebinkarahisar ilçesinin CORINE arazi örtüsü 2018 haritası

4. SONUÇ VE ÖNERİLER

Kırsal arazilerin tarımsal anlamda en iyi şekilde değerlendirilebilmeleri için bulundukları yörelere ait topoğrafik özellikler, iklim, jeoloji, jeomorfoloji, toprak özellikleri, su kaynakları gibi birçok önemli faktöre ilişkin bilgi sahibi olunması gerekmektedir. Coğrafi bilgi sistemleri bu anlamda belirtilen özelliklerin haritalanması ve alanlarının hesaplanması gibi önemli faydalar sağlamaktadır.

Giresun ilinin Şebinkarahisar ilçesinde yükselti ve eğim değerlerinin tarım için sınırlandırıcı faktörler olduğu saptanmıştır. 1396 km²'lik ilçe yüzölçümünün toplamda 391,822 km²'sini kaplayan bir alanın 750 m-1.314 m aralığında yükselti değerlerine sahip olduğu belirlenmiş olup, tarımsal faaliyetlerin bu alanlarda uygun bir şekilde yapılabileceği sonucuna ulaşılmıştır. Çalışma alanında % 12-20, % 20-30, % 30-45 ve % 45'ten fazla eğime sahip olan alanların toplam miktarının 1193,672 km² gibi ilçe için yüksek bir değere ulaşması, eğimin tarımsal faaliyetler için kısıtlayıcı koşullar oluşturabileceğini ortaya koymaktadır. İlçedeki diğer eğim gruplarında (% 0-2, % 2-6 ve % 6-12) yer alan arazilerde mevcut yapılan tarımsal üretime ek olarak, farklı alternatif tarım ürünlerinin belirlenmesi ve yetiştirilmesi için gerekli araştırma-



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geliştirme çalışmalarının yapılmasının uygun olacağı düşünülmektedir. Alternatif ürün seçimlerinde ilçenin özellikle iklim, yükselti ve eğim koşulları göz önünde bulundurulmalıdır. Bakı değerlendirmesine göre; güney, güneydoğu ve güneybatı bakılı alanların toplam miktarı 614,457 km² olarak hesaplanmıştır. Bu değer dikkate alındığında, iklim yönünden kış şartlarının zorlayıcı bir etmen olduğu Şebinkarahisar ilçesinde, bulutsuz (açık) günlerin aylık ortalamasının 10 günden fazla olduğu haziran, temmuz, ağustos, eylül ve ekim aylarında güneş ışıklarından önemli düzeyde faydalanılabileceği sonucuna ulaşılmıştır. Belirlenen ayları kapsayacak şekilde ilçede güneş enerjisi sistemlerinden de faydalanılarak, seralarda iyi miktarda mevsimine uygun ürün yetiştiriciliği de yapılabilir. CORINE arazi örtüsü 2018 haritası incelendiğinde, ilçede yükselti değerlerinin fazlaştığı doğal çayırliklarda ve çeşitli yükseltilerdeki mera alanlarında mevcut yapılmakta olan hayvancılığa destek olmak amaçlı çeşitli çayır ve mera bitkilerinin yetiştirilebileceği de düşünülmektedir. Geriye kalan diğer alanların da tarıma uygun olanlarını tespit etmek için yerinde arazi gezmelerinin yapılmasının, toprak analizleri ile çiftçiler için gübreleme planlarının hazırlanmasının, tarıma önemli bir katkı sağlayabileceği düşünülmektedir. Bunlara ilave olarak, ilçedeki akarsu kaynaklarının su analizlerinin de yapılması, sulama sularının niteliklerinin ortaya konması için önemli olacaktır.



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KAYNAKLAR

- Anonim, 2018a. Giresun Meteoroloji İstasyon Müdürlüğü Verileri. T.C. Orman ve Su İşleri Bakanlığı, Meteoroloji Genel Müdürlüğü, Giresun / Türkiye.
- Anonim, 2018b. CORINE Arazi Örtüsü Bilgi Notu. Tarım ve Orman Bakanlığı.
- Anonim, 2021a. İl ve İlçe Yüzölçümleri. T.C. Milli Savunma Bakanlığı, Harita Genel Müdürlüğü. <https://www.harita.gov.tr/urun/il-ve-ilce-yuzolcumleri/176> (Erişim Tarihi: 11 Kasım 2021).
- Anonim, 2021b. Türkiye Mülki İdare Sınırları Verileri. T.C. Milli Savunma Bakanlığı, Harita Genel Müdürlüğü. <https://www.harita.gov.tr/urun/turkiye-mulki-idare-sinirlari/232> (Erişim Tarihi: 11 Kasım 2021).
- Aybar, M. 2014. Arazi Kullanımlarındaki Değişimin Sosyo-Ekonomik Koşullarla Değerlendirilmesi: Şebinkarahisar Örneği. Gümüşhane Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Gümüşhane, 63 sayfa.
- Bağdatlı, M. C., İstanbulluoğlu, A., Bayar, A. N. 2014. Toprak ve Su Kaynakları Potansiyelinin Coğrafi Bilgi Sistemleri (CBS) Yardımıyla Belirlenmesi: Tekirdağ - Çerkezköy İlçesi Uygulaması. Afyon Kocatepe Üniversitesi Fen ve Mühendislik Bilimleri Dergisi, 14(1): 17-25.
- Başayığıt, L., Uçar, G. 2019. Kars İli Arazileri ve Toprak Özelliklerinin Coğrafi Bilgi Sistemleri ile Değerlendirilmesi. Kafkas Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 12(1): 15-27.
- Candemir, F., Özdemir, N. 2010. Samsun İli Arazi Varlığı ve Toprak Sorunları. Anadolu Tarım Bilimleri Dergisi, 25(3): 223-229.
- Cerrillo, R. M. N., Rodríguez, G. P., Rumbao, I. C., Lara, M. A., Bonet, F. J., Carrascosa, F. J. M. 2020. Modeling Major Rural Land-Use Changes Using the GIS-Based Cellular Automata Metronamica Model: The Case of Andalusia (Southern Spain). ISPRS International Journal of Geo-Information, 9(7): 458.
- Dengiz, O., Özyazıcı, M. A., Açıkbay, S., Başkan, O., Budak, M., Turan, N. 2019. Coğrafi Bilgi Sistemleri Analizi ile Hakkâri İli Meralarının Arazi ve Toprak Özelliklerinin İncelenmesi. Ispec Uluslararası Tarım ve Kırsal Kalkınma Kongresi. Tam Metin Kitabı, ISBN 978-605-7811-02-8, Ispec Yayınevi 10-12 Haziran 2019, Siirt/TÜRKİYE, 693-701.
- Dizdar, M. Y. 2003. Türkiye'nin Toprak Kaynakları. TMMOB Ziraat Mühendisleri Odası, Teknik Yayınlar Dizisi No: 2, Baskı: Kozan Ofset, Ankara, 317 sayfa.



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Elibüyük, M., Yılmaz, E. 2010. Türkiye'nin Coğrafi Bölge ve Bölümlerine Göre Yükselti Basamakları ve Eğitim Grupları. Coğrafi Bilimler Dergisi (CBD), 8(1): 27-56.

European Environment Agency (EEA), 2021. Copernicus Land Monitoring Service - Corine Land Cover, CLC 2018. Available from URL: <https://land.copernicus.eu/pan-european/corine-land-cover/clc2018/fetch-land-file?hash=4ecde146e6ca8dd7a42f68a9f5370153d9731a95> (Date of access: December 11, 2021).

Everest, T., Akbulak, C., Özcan, H. 2011. Arazi Kullanım Etkinliğinin Değerlendirilmesi: Edirne İli Havsa İlçesi Örneği. Anadolu Tarım Bilimleri Dergisi, 26(3): 251-257.

Mercan, Ç., Arpağ, S. 2020. Coğrafi Bilgi Sistem Analizleri Kullanılarak Toprak ve Arazi Özelliklerinin Değerlendirilmesi: Türkiye, Mardin İli Arazisi. Türkiye Tarımsal Araştırmalar Dergisi, 7(1): 23-33.

Özalp, A. Y., Akıncı, H., Temuçin, S. 2013. Artvin İli Arazisinin Topografik ve Bazı Fiziksel Özelliklerinin Tespiti ve Bu Özelliklerin Arazi Örtüsü ile İlişkisinin İncelenmesi. Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi, 14(2): 292-309.

Özyazıcı, M, A., Dengiz, O., Aydoğan, M., Bayraklı, B., Kesim, E., Urla, Ö., Yıldız, H., Ünal, E. 2016. Orta ve Doğu Karadeniz Bölgesi Tarım Topraklarının Temel Verimlilik Düzeyleri ve Alansal Dağılımları. Anadolu Tarım Bilimleri Dergisi, 31: 136-148.

Saykılı, İ., Birdal, A. C., Türk, T. 2017. En Uygun Arazi Kullanım Planlarının CBS ile İncelenmesi: Sivas İli Dikmencik Köyü Örneği. Geomatik Dergisi, 2(3): 126-134.

Şahin, H., Karatepe, Y. 2020. Gelibolu Yarımadası'nın Güneyinde Vegetasyon Yapısının Yetiştirme Ortamı Özelliklerine Göre Değişimi. Turkish Journal of Forestry, 21(3): 215-223.

Taş, B., Yakar, M. 2010. Afyonkarahisar İlinde Yükselti Basamaklarına Göre Arazi Kullanımı. Coğrafi Bilimler Dergisi (CBD), 8(1): 57-75.

Turoğlu, H. 2008. Coğrafi Bilgi Sistemlerinin Temel Esasları (Genişletilmiş 2. Baskı). Çantay Kitapevi, İstanbul, 341 sayfa.

Türker, H. B. 2021. Uşak İlının Arazi Örtüsü Değişiminin Corine Verileri Doğrultusunda İncelenmesi. Turkish Journal of Forest Science, 5(2): 634-650.



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USGS, 2021. DEM Data (SRTM 1 Arc-Second Global/~30 meters). Available from URL: <https://earthexplorer.usgs.gov/> (Date of access: November 26, 2021).

Yalçın, C., Yüce, M. 2020. Burdur’da Güneş Enerjisi Santrali (GES) Yatırımına Uygun Alanların CBS Tabanlı AHP Yöntemiyle Tespiti. Geomatik Dergisi, 5(1); 36-46

Yılmaz, G. 2006. Şehir Coğrafyası Açısından Şebinkarahisar. T.C. İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, Yüksek Lisans Tezi, İstanbul, 145 sayfa.



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**ARI SÜTÜ, ARI EKMEĞİ (PERGA) VE ARI ZEHİRİNİN *Sclerotinia sclereliorum* VE
Phytium SP. FİTOPATOJENLERİ ÜZERİNDEKİ ANTİFUNGAL
ETKİNLİKLERİNİN *IN VITRO* KOŞULLARDA DEĞERLENDİRİLMESİ**

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ÖZET

Bal, polen, arı sütü, arı zehri, arı ekmeği (perga) içeriğinde bulunan biyoaktif bileşenler nedeniyle kullanım potansiyeli olan bal arısı ürünleri arasındadır. Yapılan bu çalışmada arı sütü, arı ekmeği (perga) ve arı zehrinin *sclerotinia sclereliorum* ve *phytium* sp. fitopatojen fungusları üzerindeki antifungal etkinlikleri *in vitro* koşullarda 3 tekerrürlü olarak 10 farklı doz aralığında değerlendirilmiş ve fungus çap değerleri ölçülmüştür. Ölçülen çap değerleri ortalamaları istatistiksel olarak değerlendirilmiş ve yüzde engelleme inhibisyon değerleri hesaplanmıştır. Arı sütü ve arı ekmeği antifungal aktivite göstermemiş, arı zehrinde ise artan doz uygulamalarına bağlı olarak antifungal etki gözlemlenmiştir. 500 µl doz uygulamasında *sclerotinia sclereliorum* 59,3 ve *phytium* sp. 59,6 funguslarında çap ortalaması değerleri ile en iyi istatistiki değeri vermiştir. Doz uygulamalarında 15 µl, 20 µl, 25 µl, 50 µl ve 100 µl uygulamalarında antifungal etki gözlemlenemezken 200 µl, 300 µl, 400 µl ve 500 µl dozlarında arı zehri uygulamalarında doz artımına bağlı olarak fungus çaplarıyla azalmalar gözlemlenmiştir. Sonuç olarak, *in vitro* koşullarda yürütülen bu çalışmada arı zehrinin fungusların miseliyal gelişimi üzerine dozlara göre olan engelleyici etkisi % inhibisyon olarak değerlendirilmiştir. Elde edilen sonuçlar değerlendirildiğinde, arı sütü ve arı ekmeğinin antifungal aktiviteye sahip olmadığı, arı zehrinin ise funguslara karşı artan dozlarında miseliyal gelişimini düşürdüğü ve gelecekte fungusit ya da fungusidal olarak kullanılabilmesi için yapılacak olan çalışmalara doz değerlendirilmelerinde fikir verebileceği kanısına varılmıştır.

Anahtar Kelimeler: Arı sütü, arı zehri, arı ekmeği (perga), antifungal, biyolojik mücadele



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EVALUATION OF ANTIFUNGAL ACTIVITIES OF ROYAL JELLY, BEE BREAD (PERGA) AND BEE VENOM ON *SCLERETINIA SCLERELIUM* AND *PHYTIUM* SP. PHYTOPATHOGENS *IN VITRO* CONDITIONS

ABSTRACT

Honey, pollen, royal jelly, bee venom, bee bread (perga) are among the honey bee products with potential for use due to the bioactive components in their content. In this study, the effects of royal jelly, bee bread (perga) and bee venom on *scleretinia sclereliorum* and *phytium* sp. Antifungal activities on phytopathogenic fungi were evaluated in 10 different dose ranges with 3 replications under in vitro conditions and fungus diameter values were measured. Mean diameter values measured were statistically evaluated and percent inhibition values were calculated. Royal jelly and bee bread did not show antifungal activity, whereas in bee venom, antifungal effect was observed due to increasing dose applications. In 500 µl dose application, *scleretinia sclereliorum* 59.3 and *phytium* sp. It gave the best statistical value with the mean diameter values of 59.6 fungi. While no antifungal effect could be observed in 15 µl, 20 µl, 25 µl, 50 µl and 100 µl applications in dose applications, reductions with fungal diameters were observed in 200 µl, 300 µl, 400 µl and 500 µl doses of bee venom applications depending on the dose increase. In conclusion, the inhibitory effect of bee venom on mycelial growth of fungi was evaluated as % inhibition in this study carried out under in vitro conditions. When the results obtained were evaluated, it was concluded that royal jelly and bee bread do not have antifungal activity, and bee venom reduces mycelial growth in increasing doses against fungi, and can provide an idea for dose evaluations for future use as a fungicide or fungicidal.

Keywords: Royal jelly, bee venom, Bee bread (perga), Antifungal Activities, biological control



1. GİRİŞ

Arıcılık; genel anlamda arı ürünlerinin üretilmesi amacıyla arının, bitkisel kaynakların, işgücünün ve teknik bilginin kombinasyonu ile sosyo-ekonomik bir faaliyet olarak tanımlanmaktadır (Burucu ve Gülse Bal 2018). Kırsal alanda alternatif gelir kaynağı olması ve ekolojik dengeye sağladığı katkı ile oldukça önemli bir faaliyet alanıdır (Güler vd. 2018). Arı ürünleri içeriğinde bulunan biyoaktif bileşenler nedeni ile bu ürünlerin kullanım potansiyelini arttıran doğal ürünler arasındadır. Günümüzde doğal ürünlere olan rağbetin artması sonucunda bu ürünler ile ilgili literatür çalışmaları gün geçtikçe artmaktadır (Brown et al. 2016).

Önemli arı ürünlerinden biri olan arı sütü, genç bakıcı işçi arıların başında bulunan hipofarengial ve mandibular bezler tarafından üretilen ve beslenmede kullanılan kremi bir üründür (Vichai et al. 2002). Erkek ve işçi arılarda gelişimlerinin sadece ilk birkaç gününde kullanılmasına rağmen kraliçe arının ömrü boyunca temel besin maddesi olarak kullandığı üründür. Hafif keskin kokulu ve tada sahiptir. Rengi sarımsı beyaz olup salgılandıktan sonra hava ile temasında sararır. Arı sütü, jelatinimsi bir kıvama sahiptir ve çözünmemiş granüller varlığı nedeniyle genellikle homojen değildir. Yoğunluğu 1,1 g/mL ve pH 3.4-4.5 arasında olup oldukça asidik bir yapıya sahiptir (Sabatini et al. 2009; Lercker et al. 2003). Kompleks bir kimyasal yapıda olup proteinler, aminoasitler, şekerler, lipidler ve vitaminleri içinde barındırır. İçeriğinin %60'dan fazlasını su oluşturur. Mineraller olarak potasyum, magnezyum, kalsiyum, demir, fosfor, kükürt, manganez açısından zengindir. Kuru madde içeriği arı sütünün %0,8-3'ünü oluşturur (Garcia-Amoedo et al. 2007). Kuru maddenin ise %30'unu karbonhidratlar oluşturur. Ayrıca içeriğinde eser miktarda C vitamini olmak üzere B1, B2, B6 ve B5 vitaminleri de fazla miktarlarda bulunur (Bărnău et al. 2011). Kuru maddenin %50'sini oluşturan proteinler, içeriğinde birçok değerli bileşen ve biyolojik olarak aktif madde barındırır. Başlıca arı sütü proteinleri ve peptit antibiyotiklerin dahil olduğu küçük proteinleri içerir. Bu proteinlerin fizyolojik immun düzenleyici, alerjik reaksiyonları baskılayabileceği ancak antihipertansif özellikleri ve proliferasyonu uyardığı bilinmektedir (Šimúth et al. 2001). İçeriğinde bulunan proteinlerin %50'sini albümin oluşturur. Ayrıca royalisin, apimisin, jelleinler (I, II, III ve IV), apalbumin α içeriğinde bulunan diğer proteinlerdir. Arı sütünün antimikrobiyal aktiviteye sahip olduğu bilinmektedir buda içeriğindeki protein ve peptitlerden kaynaklanır. Bu protein ve peptitler, bakteri ve mantarlara karşı geniş spektrumlu bir antibiyoz aktivite gösterir. Antimikrobiyal peptiler yalnızca yüksek konsantrasyonlarda ($\geq 200 \mu\text{g/mL}$) S.



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aureus, *L. monocytogenes* ve *S. typhimurium* için antibakteriyel aktivite gösterdiği yapılan çalışmalarla anlaşılmıştır. Royalisin düşük konsantrasyonlarda gram pozitif bakterilere karşı antibakteriyel aktivite gösterdiği ancak gram negatif bakterilere karşı etkisiz olduğu bulunmuştur. Ayrıca bitkilerde de önemli bir hastalık olan *Botrytis cinerea* fungusuna karşı antifungal aktiviteye sahip olduğu anlaşılmıştır. İçerisinde yer alan biyoaktif maddelerden olan jelleinlerde antimikrobiyal aktivite gösteren proteinlerdendir (Fujiwara et al., 1990; Bıliková et al., 2002; Fontana et al., 2004).

Çalışmalarda yer alan diğer bir arı ürünü olan arı ekmeği (perga) erkek ve işçi arıların temel besin maddesidir. İşçi arılar tarafından çiçekli bitkilerden toplanan ve işçi arıların arka bacağındaki polen sepetinde depolanarak kovana getirilen polen taneciklerinden oluşturulur. Bu polen taneciklerinin arılar tarafından tüketilebilir hale getirilmesi için fermentasyon sürecinden geçirilerek petek gözlerinde depolanan polenleri işçi arılar sıkıştırır, üzerine sindirim içeriği ve bal ekledikten sonra petekleri balmumu ile kapatırlar (Kňazovická et al. 2019; Nagai et al. 2004). İşçi arıların sindirim enzimlerinden geçen mikroorganizmalar ile petek gözlerinde depolanan polenler iki hafta süre ile fermentasyon sürecini tamamlayıp olgunlaşarak arı tüketimine uygun hale gelmektedir (Nagai et al. 2004; Silici 2014). Bu şekilde petek gözlerinde depolanan ve fermentasyon sonucu olgunlaşan polenler ise ‘arı ekmeği’ ya da ‘perga’ olarak adlandırılmaktadır (Herbert Jr ve Shimanuki, 1978).

Arı ekmeğinin yapısında yağ asitleri, proteinler, steroller, aminoasitler, lipidler, enzimler, mineraller, vitaminler, fenolik maddeler bulunmaktadır. Bunlara ek olarak arı ekmeği içerisine eklenen baldan dolayı karbohidrat miktarı artar ayrıca bal arısından gelen hormonları da bünyesinde bulundurmaktadır (Silici, 2014; Bobiş et al. 2017). Arı ekmeğinin genel içeriğini esansiyel aminoasitler, H, E, C, B1, B2 vitaminleri, antosiyaninler ve karotenoid, sakkaraz, fosfataz ve amilaz enzimleri ve 25 farklı mineral oluşturmaktadır. Polene nazaran arı ekmeği 6 kat daha fazla laktik asit içerir ve bu özelliği ile kendini korur, polen kadar maya gelişimine açık olmamasını sağlar. Arı ekmeğinin tat özellikleri polene göre daha iyidir ve vücutta emilimi daha kolay olduğu belirtilmektedir (Mutsaers et al. 2005). Arı ekmeği yaklaşık %20 protein, %3 lipid, %24-35 karbonhidrat, %3 vitamin ve mineral içermektedir. İnsan vücudunun biyosentezleyemediği esansiyel aminoasitlerin tümü ile protein, C, B, B2, E, H,P, nikotinik asit, folik asit, pantotenik asit gibi vitaminler, pigmentler, sakkaroz, amilaz, fosfataz gibi enzimler, flavonoidler, karotenoidler ve hormonlar içermektedir (Haydak ve Vivino, 1950). Bu özellikleri dolayısıyla bazı antimikrobiyal çalışmalara konu olmuştur. Perga kullanılarak yapılan bir



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çalışmada Fas bölgesinden toplanan arı ekmeği ve arı poleni örneklerinin antibakteriyel aktivitesi araştırılmıştır. Çalışmada polen numuneleri hem kurutulmuş halde hem de taze olarak kullanılmış ve *E. coli*, *Staphylococcus aureus*, *Bacillus cereus* bakterilerinin arasında bulunduğu bakterilere karşı antibakteriyel aktivite testi yapılmıştır. Sonuç olarak taze arı poleni ve arı ekmeğinin kurutulmuş polen örneklerine nazaran daha yüksek antibakteriyel aktivite gösterdiği bildirilmiştir (Abouda et al., 2011). Diğer bir çalışmada ise arı ekmeği örneklerinin sıcak su, su ve etanol ekstraktları çıkarılmış ve bu ekstraktların fonksiyonel özellikleri belirlenmiştir. Suyun çözücü olarak kullanıldığı örneklerde antioksidan aktivitenin yüksek olduğunu bildiren araştırmacılar arı ekmeğinin bu antioksidatif etkisinden faydalanılabileceğini ve çalışmaların artırılması gerektiğini belirtmişlerdir (Nagai et al., 2004).

Antimikrobiyal etkinliği bilinen ve birçok çalışmada kullanılan önemli diğer bir arı ürünü olan arı zehri, işçi ve kraliçe arılar tarafından üretilen ve bilinen en doğal toksindir. Yaşamlarının ilk iki haftasında üretimi artar, kovan savunmasında ve yiyecek toplama arayışında maksimum seviyeye ulaşır. Arılar büyüdükçe zehir miktarı azalma meydana gelir. Kraliçe arıda, ortaya çıktığında en yüksek olup bu durum diğer kraliçelerle ani savaşlar için hazır olmasını sağlar. Bal arısı insanı soktuğunda, iğnesinin çengelli yapıda olması nedeniyle iç organlarının bir bölümünü kaybeder ve bu kayıp arılar için ölümcüldür. Oda sıcaklığında kuruyan şeffaf bir sıvıdır. Keskin kokulu ve acı tada sahip olup suda çözünür. Hava ile temas ettiği anda grimsi beyaz kristaller oluşur. Toplama sırasında kolayca kaybolabilecek uçucu bileşenler içerir. Ayrıca enzim, peptit ve biyojenik amin açısından zengindir (Eze et al., 2016). İçeriğinde bilinen yaklaşık olarak 18 madde mevcuttur. Peptitlerden mellitin, apamin, MCD peptit, sekapin, pamin, minimin, adolapin, proteaz inhibitörleri bulunur. En güçlü antienflamatuar ajanlardan biri olan mellitin en baskın bileşendir. Adolapin de güçlü bir antienflamatuardır. Proteaz inhibitörleri, antienflamatuar ajanlardan olup kanamayı durdurur. Enzimlerden fosfolipaz A2, fosfolipaz B, α -glukozidaz bulunur. Fosfolipaz A2, hücresel membranların fosfolipitlerini bozar, kan basıncını düşürür ve kanın pıhtılaşmasını engeller. Hiyaluronidaz kılcal damarların genişleyerek iltihabın yayılmasına yol açar. Biyojenik aminlerden histamin, dopamin, nöradrenalin, aminobitürik asit bulunur. Histamin arı zehrindeki alerjik yanıtın sebebidir. Şekerlerden glikoz, früktoz; kompleks eterler ve P, Ca ve Mg mineralleri de bulunur (Eze et al., 2016). Arı zehri ile yapılan bir çalışmada *Candida albicans*'a karşı antifungal aktivitesi araştırılmıştır. Bir antifungal ilaç olan anfoterisin B'nin gösterdiği etkiye eşdeğer bir etki



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gösterdiği saptanmıştır. Bu çalışmayla arı zehrinin antifungal ajan olarak kullanılabileceği anlaşılmaktadır (Lee et al., 2016).

Yapılan çalışmalar göz önüne alındığında bu ürünlerin fitopatojenler üzerinde de antifungal etkisini belirlemek amacıyla yürütülmüştür. Bitkiler üzerinde ürün kalitesi, ürün miktarı dolayısıyla ekonomik kayıplara sebebiyet veren *Sclerotinia sclerotiorum* ve *pythium* sp. fitopatojen fungusları kullanılmıştır. Çalışmada kullanılan funguslardan biri olan *S. sclerotiorum*, 78 bitki familyasından 408'den fazla bitki türünde hastalığa neden olan ve konukçu dizisi çok geniş olan ve bitkilerde farklı simptomlar oluşturan fungustur. İlk aşamada yapraklar suda haşlanmış simtomlar ve devamında yaprak sapı ve gövdede belirtiler meydana getirir. Bu hasarlı dokular nekrotik dokulara dönüşür ve beyaz kabarık şeklinde miselyum kitleleri belirir. Ayrıca bu etmen sağlıklı bitkilere temas yoluyla da bulaşabilmektedir (Bolton ve ark., 2006). Toprak kaynaklı olan *S. sclerotiorum* etmeninin neden olduğu hastalık ile mücadele oldukça güçtür. Çalışmada ki diğer fungus ise, toprak kökenli fungal bir etmen olan *Pythium* sp. çok geniş konukçu dizisine sahip kozmopolit bir patojendir. Birçok bitkide çökerten, fidelerde kök ve gövde çürüklüğü, tarlada ya da hasattan sonra depolama sırasında yumuşak çürüklüklere neden olmaktadır. Ürün yetiştirilen alanlarda oldukça yaygın görülen *Pythium* sp.'nin sebep olduğu hastalıklar kavite lekesi, köklerde geriye doğru ölüm ile kahverengi çürüklük ve çökerten hastalıklarıdır. Bu patojenlerle mücadele ise çoğunlukla kimyasal ve kültürel olarak yapılmaktadır. Fakat kültürel mücadelenin yetersiz kalması üreticilerin kimyasal mücadeleye yönlendirmesini desteklemektedir. Kimyasalların insan ve çevre sağlığını tehdit altına alması, gıdalarda kimyasal kalıntısı ve hastalıkların dayanıklılık oluşturmaları gibi problemlerden dolayı araştırmacılar, alternatif yöntemlere odaklanmıştır (Garg ve ark., 2012). Yapmış olduğumuz bu çalışma insan ve hayvan sağlığında kullanım alanı olan arı ürünlerinin tarım alanlarında da kullanımına uygunluğunu ve etkilerini literatüre kazandırılması amacıyla yürütülmüştür.

MATERYAL VE METOD

Çalışmada Kullanılan Fungus İzolatları

Çalışmada kullanılan fungal izolatlar Yüzüncü Yıl Üniversitesi Bitki Koruma bölümü fitopatoloji laboratuvarı fungal izolat kültür koleksiyonundan temin edilmiştir.



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Çalışmada Kullanılan Solüsyonların Hazırlanması

Çalışmada kullanılacak olan arı zehiri, arı ekmeği (perga) ve arı sütü Bingöl ili arıcılarından temin edilmiştir. 10 ml steril dH₂O içerisine 3 gr arı sütü, 10 ml steril dH₂O içerisine 10 gr arı ekmeği (perga) ve 10 ml steril dH₂O içerisine 3 gr arı zehri ilave edilerek vorteks yardımı ile iyice çözündürülmüş çalışma için hazır hale getirilmiştir.

Kültür Ortamlarının Hazırlanması

Patojen fungus izolatlarının saflaştırılması ve çoğaltılmasında funguslar için genel besiyeri olan Patates Dekstroz Agar (PDA) ve dH₂O kullanılmıştır. Hazırlanan besiyeri otoklavda 121°C’de 15 dk steril edilmiş ve steril 100 mm’lik cam petri kaplarına aktarılmıştır.

Uygulama gruplarında 15 µl, 20 µl, 25 µl, 50 µl, 100 µl, 200 µl, 300 µl, 400 µl ve 500 µl dozlarının uygulanabilmesi için steril edilmiş ve uygun sıcaklık aralığına (30-35 °C) getirilmiş PDA kültür ortamlarına eklemeleri yapılmış ve steril petri kaplarına dökümleri yapılarak çalışmaya hazır hale getirilmiştir.

İnokulum İçin Patojen Fungusun Hazırlanması

Çalışmada kullanılacak olan fitopatojen fungal izolatlar 90 mm’lik steril plastik petri kaplarında hazırlanan besiyerine inokulumu yapılmış ve 25 °C de 7 gün inkübasyona bırakılarak geliştirilmiştir. Antifungal aktiviteyi test etmek için kültürlerden 8 mm diskler fungus delici yardımıyla hazırlanmıştır.

Antifungal Aktivitenin Değerlendirilmesi

Her bir solüsyon için 2,39 g PDA tartılarak 60 ml dH₂O içerisine aktarılıp ve otoklavda 121°C’de 15 dk steril edilmiştir. Besiyeri 30°C’ye kadar soğutulduktan sonra arı zehiri, arı ekmeği (perga) ve arı sütü ile hazırlanan solüsyonlar her biri için 20 ml PDA ortamı içeren steril cam petrilere 15 µl, 20 µl, 25 µl, 50 µl, 100 µl, 200 µl, 300 µl, 400 µl ve 500 µl oranlarında homojen olarak eklemeler yapılarak katılaşmaya bırakılmıştır. Hazırlanmış olan 8 mm’lik fungal diskler hazırlanan PDA besi ortamlarının bulunduğu petrilerin tam ortasına, fungus besi ortamına temas edecek şekilde birer disk yerleştirilmiş ve petrilerin etrafı parafilm ile kaplanmıştır. Petriler 24±1°C’de 7 gün inkübasyona bırakılmıştır. Kontrol grubu olarak kullanılacak petrilere ise sadece PDA ortamı hazırlanmıştır. 7 gün sonunda fungal koloni çapları kumpas ile ölçümler yapılarak, elde edilen fungus çapları kaydedilmiştir. Fungal koloni çaplarının ölçümü koloni çaplarının birbirine dik ve ayrı yönde ölçülmesiyle yapılmıştır (Benjilali ve ark. 1984). Yapılan ölçümler doğrultusunda hazırlanan solüsyonların % engelleme



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oranları belirtilen formül yardımıyla hesaplanmıştır (Deans ve Svoboda 1990). Denemeler 3'er tekerrürlü olarak yürütülmüştür.

$$\text{Engelleme (\%)} = \frac{g_c - g_t}{g_c} \times 100$$

g_c = inokulum disk çapı çıkarılarak inkübasyon süresinden sonra kontrol setinde ölçülen miselyal koloninin çapı.

g_t = inokulum disk çapı çıkarılarak inkübasyon süresinden sonra ölçülen miselyal koloninin çapı.

İstatistiksel Analiz

Uygulanan solüsyonlar arası farklılıkları belirlemek için varyans analizi (ANOVA) kullanılmış, ortalamalar DUNCAN testi kullanılarak karşılaştırılmıştır.

TARTIŞMA VE SONUÇ

Yapılan bu çalışmada tarımsal üretim alanlarında ürün özellikleri ve kalitesi üzerinde ve ekonomik olarak önemli kayıplara sebebiyet veren *Sclerotinia sclerotiorum* ve *Phytium* sp. fitopatojenleri üzerinde arı sütü, arı ekmeği (perga) ve arı zehrinin antifungal etkinlikleri değerlendirilmiştir. Arı sütü ve arı ekmeği (perga) uygulama yapılan tüm dozlarda iki fungus üzerinde de herhangi bir antifungal aktivite göstermemiştir. Arı zehri ise artan doz uygulamalarına bağlı olarak her iki fungus üzerinde etki göstermeye başlamıştır. Diğer arı ürünleri hiçbir etki göstermediği için analizler yapılmamış sadece arı zehrinin antifungal etkinliği istatistiki olarak değerlendirilmiş ve tablo 1 de verilmiştir.

Tablo 1. Arı zehrinin *in vitro* koşullarda *Sclerotinia sclerotiorum* ve *Phytium* sp. fitopatojenleri üzerindeki antifungal etkinliği

Doz /Fungus	Fungus çapı ortalaması		
	Fungus		
Doz (µl)	<i>Sclerotinia sclerotiorum</i>	<i>Phytium</i> sp.	Genel ortalama
500	59,3±0,57a	59,6±1,15a	59,5±0,83
400	60,3±0,57a	61,3±1,52a	60,8±1,16
300	61±1,73a	61,3±1,52a	61,1±1,47
200	75,3±4,61b	75±5,00b	75,1±4,30
100	90±0,00c	90±0,00c	90±0,00
50	90±0,00c	90±0,00c	90±0,00
25	90±0,00c	90±0,00c	90±0,00
20	90±0,00c	90±0,00c	90±0,00
15	90±0,00c	90±0,00c	90±0,00
0	90±0,00c	90±0,00c	90±0,00
Genel ortalama	79,6±13,69	79,7±13,47	79,6±13,46

±: standard sapma, aynı sutunda farklı harflerle gösterilen ortalamalar arasındaki farklar istatistiki olarak önemlidir.



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Genel itibariyle tablo 1 incelendiğinde fungus ve doz uygulamasında fungus çap ortalaması 79,6 (µl) olarak hesaplanmıştır. *Sclerotinia sclerotiorum* fungusuna ait çap ortalaması 79,6, *Phytium* sp. fungusuna ait çap ortalaması ise 79,7 (µl) olarak belirlenmiştir. Funguslar itibariyle fungus çapı ortalaması değerleri arasındaki ilişki istatistiki olarak önemsiz çıkmıştır. Doz uygulamaları itibariyle fungus çapları ortalama değerleri arasında istatistiki olarak önemli bir ilişki bulunmuştur. 300, 400 ve 500 µl doz uygulamaları istatistiki olarak aynı grupta yer almış ve diğer doz uygulamalarına göre fungus çapını düşürmüştür. 200 µl doz uygulamasına kadar olan uygulamalarda fungus çapının değişmediği saptanmıştır.

Tablo 1. *In vitro* koşullarda arı zehrinin *Sclerotinia sclerotiorum* ve *Phytium* sp. fitopatogenleri üzerindeki % engelleme oranları

Doz (µl)	% Engelleme oranları	
	Fungus	
	<i>Sclerotinia sclerotiorum</i>	<i>Phytium</i> spp.
500	34,1	33,7
400	33,0	31,8
300	32,2	31,8
200	16,3	16,6
100	0	0
50	0	0
25	0	0
20	0	0
15	0	0
0	0	0

Çalışmanın % engelleme oranlarının yer aldığı tablo 2 değerlendirildiğinde *Sclerotinia sclerotiorum* ve *Phytium* sp. fitopatogenleri üzerindeki en iyi değeri 500 µl doz uygulaması en düşük değeri ise 15 µl doz uygulaması vermiştir. Her iki fungusta da 15 ve 100 µl doz uygulamaları 0 olan kontrol uygulaması ile aynı fungus gelişim oranlarını vererek etkisiz sonuç sergilemiştir. 200 µl ve artırılan doz uygulamalarında fungus gelişiminde azalmalar gözlemlenmiştir. % engelleme oranları en iyi değeri *Phytium* sp. patojeninin 500 µl uygulamasında %33,7 değeri ile *Sclerotinia sclerotiorum* patojeninde % 34,1 oranı ile değerlendirilmiştir. Çalışmamıza benzer çalışmalarda patojen funguslara karşı antifungal etkinlikleri değerlendirildiğinde genel itibari ile arı ekmeği (perga) kullanılan çalışmaların literatürde rastlanılmaması arı sütünün ise tek başına kullanımında değil de diğer arı ürünleri ile destekli kullanımında daha verimli olunabileceği kanısına varılmıştır. Bal, arı sütü, polen ve propolis kullanılarak yapılan bir çalışmada *Candida albicans*, *Candida glabrata*, *Candida*



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krusei ve *Trichosporon spp.*'nin 40 maya suşuna karşı antifungal aktiviteler açısından değerlendirilmiş, antifungal kontrol ajanı olarak flukonazol kullanılmıştır. Antifungal aktivite propolis başta olmak üzere sırasıyla polen, arı sütü ve balda bulunmuştur (Koç et al., 2011). İran'da yapılan bir çalışmada propolis ve arı sütünün *Rhizopus oryzae* ve *Candida albicans* karşı antifungal aktivitesi araştırılmıştır. Minimum inhibitör konsantrasyonu propolis için 0.1 mg/ml, arı sütü için 100 mg/ml, minimum fungusit konsantrasyonu propolis için 0.25 mg/ml, arı sütü için 133 mg/ml olduğu bulunmuştur. Elde edilen sonuçlar propolis ve arı sütünün kombinasyon halinde fungal hastalıklarla mücadele için kullanılabileceğini göstermektedir (Moghim et al., 2015). Bir çalışmada arı sütü ve propolisin tek başlarına ve kombinasyon halinde *Aspergillus parasiticus* gelişimi, aflatoksin üretimi ve *aflR* gen ekspresyonu üzerindeki inhibe edici etkisi olduğu anlaşılmıştır. Bu iki özütün gıdalarda kontaminasyona sebep olan funguslara karşı kimyasal koruyuculara alternatif olarak kullanılabilecek bir inhibitör ajan olabilir (Hamzeh Pour et al., 2020).

Arı zehri insan ve hayvanlarda çeşitli enfeksiyonlara yol açan en yaygın dermatofitlerden *Trichophyton mentagrophytes* ve *Trichophyton rubrum*' a karşı antifungal aktivitesi test edilmiştir. Arı zehri bu iki mantara karşı belirgin antifungal etki gösterdiği ve bu etkinin ticari antifungal ilaçlardan biri olan flukonazolden çok daha güçlü olduğu belirlenmiştir. Bu çalışma arı zehrinin bir mantar önleyici ilaç olarak kullanılabileceğini göstermektedir (Yu et al., 2012). Yapılan başka bir çalışmada arı zehrinin antifungal bileşenlerini tespit etmek için bütün ve ayrı formları *Trichophyton rubrum*'a karşı değerlendirilmiştir. Ham arı zehri, mellitin-apamin ve arı zehri spreyi uygulanarak 14 gün boyunca fungal gelişim takip edilmiştir. Arı zehri bütün halinde mantara karşı önemli ölçüde antifungal aktivite sergilediği, zehrin ayrı formları ise etkili olmadığı anlaşılmıştır (Park et al., 2018). Bir başka çalışmada arı zehri yaygın patojenlerden *Staphylococcus aureus*, *Salmonella typhimurium*, *Escherichia coli*, *Pseudomonas aeruginosa* bakterileri ve *Candida albicans*, *Trichophyton mentagrophytes* ve *Trichophyton rubrum* mantarlarına karşı antimikrobiyal etkisi araştırılmıştır. Kontrol olarak kloramfenikol, streptomisin ve penisilin antibiyotikleriyle, flukonazol ve amfoterisin B antifungalleri kullanılmıştır. Elde edilen sonuçlar arı zehrinin test edilen patojenlere karşı antibakteriyel ve antifungal aktivite sergilediğini ve antibiyotiklere tamamlayıcı olarak kullanılabileceğini göstermektedir (Farmanullah et al., 2020). Fitopatojen funguslara karşı yapılan bir çalışmada *Aspergillus flavus* patojenine arı zehri uygulanmış ve hücre morfolojisindeki değişikliklerin uyarılması, fungal membranın geçirgenliği ve hücre içi ROS



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birikiminden dolayı fungus gelişiminde azalmalar olduğunu bildirmişlerdir (Moore et al. 2019). *Penicillium digitatum* patojenine yapılan arı zehri uygulamasında da bizim çalışmamıza benzer olarak doza bağlı artışta antifungal etkinlik olduğu bildirilmiştir (Muñoz et al. 2006).

Sonuç olarak *in vitro* koşullarda arı sütü, arı ekmeği ve arı zehrinin *Sclerotinia sclerotiorum* ve *Phytium* sp. fitopatojenlerinde ki antifungal etkinliği belirlemek amacıyla yaptığımız bu çalışmada arı sütü ve arı ekmeğinin tek başına kullanımında herhangi bir etkisinin olmadığını yapılan diğer çalışmalar göz önüne alındığında antifungal etkisi olan maddeler takviye edildiğinde etkinliğinin arttırılabileceğini ve arı zehrinin ise artan dozlarında antifungal etkinliğinin olduğunu doğrulamaktadır.



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KAYNAKLAR

Abouda, Z., Zerdani, I., Kalalou, I., Faid M., Ahami, M.T., 2011. The antibacterial activity of moroccan bee bread and bee-pollen (fresh and dried) against pathogenic bacteria. *Res J Microbiol.*6, 376-384.

Bărnăuțiu, L. I., Mărghițaș, L. A., Dezmirean, D. S., Mihai, C. M., & Bobiș, O. (2011). Chemical composition and antimicrobial activity of Royal Jelly-REVIEW. *Scientific Papers Animal Science and Biotechnologies*, 44(2), 67-72.

Bíliková, K., Hanes, J., Nordhoff, E., Saenger, W., Klaudiny, J., & Šimúth, J. (2002). Apisimin, a new serine–valine-rich peptide from honeybee (*Apis mellifera* L.) royal jelly: purification and molecular characterization. *FEBS letters*, 528(1-3), 125-129.

Bobis, O., Dezmirean, D.S., Marghitas, L.A., Bonta, V., Margaoan, R., Pasca, C., Urcan, A., Bandhari, P.S., Beebread from *Apis mellifera* and *Apis dorsata*. Comparative Chemical Composition and Bioactivity, *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Animal Science and Biotechnologies*, 74 (2017) 43-50.

Bolton, M. D., Thomma, B. P., & Nelson, B. D. (2006). *Sclerotinia sclerotiorum* (Lib.) de Bary: biology and molecular traits of a cosmopolitan pathogen. *Molecular Plant Pathology*, 7(1), 1-16.

Brown, H. L., Roberts, A. E. L., Cooper, R., & Jenkins, R. (2016). A review of selected bee products as potential anti-bacterial, anti-fungal, and anti-viral agents.

Burucu, V., Gülse Bal, HS. 2018. Arıcılık İşletmelerinin Pazarlama Olanakları: Kastamonu İli Azdavay İlçesi Örneği. *TEAD* 4(1); 23-35.

Eze, O. B., Nwodo, O. F., & Ogugua, V. N. (2016). Therapeutic effect of honey bee venom. *Proteins (enzymes)*, 1(2).

Farmanullah, K. A., Azam, H. M., Mandokhail, N. U., Iqbal, F., Khan, F., Rafique, M. A., ... & Ahmad¹², J. (2020). Antimicrobial activities of scorpion and honey bee venom against some common selected pathogen. *Bull. Env. Pharmacol. Life Sci*, 9, 87-94.

Fontana, R., Mendes, M. A., De Souza, B. M., Konno, K., César, L. M. M., Malaspina, O., & Palma, M. S. (2004). Jelleines: a family of antimicrobial peptides from the Royal Jelly of honeybees (*Apis mellifera*). *Peptides*, 25(6), 919-928.

Fujiwara, S., Imai, J., Fujiwara, M., Yaeshima, T., Kawashima, T., & Kobayashi, K. (1990). A potent antibacterial protein in royal jelly. Purification and determination of the primary structure of royalisin. *Journal of biological chemistry*, 265(19), 11333-11337.



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Garcia-Amoedo, L. H., & Almeida-Muradian, L. B. D. (2007). Physicochemical composition of pure and adulterated royal jelly. *Química Nova*, 30, 257-259.

Garg, V. K., Suthar, S., & Yadav, A. (2012). Management of food industry waste employing vermicomposting technology. *Bioresource Technology*, 126, 437-443.

Güler, D., Engindeniz, S., Can Aydın, B., Saner, G. 2018. Türkiye'de Arıcılığın Çok Boyutlu Ölçekleme Analizi ile Değerlendirilmesi. 6. Uluslararası Muğla Arıcılık ve Çam Balı Kongresi 15-19 Ekim 2018, Muğla.

Hamzeh Pour, S., Khodavaissy, S., Mahmoudi, S., Vaziri, S., Soltan Dallal, M. M., Oliya, S., Rezaie, S. (2020). The effect of royal jelly and propolis alone and in combination on inhibition of *Aspergillus parasiticus* growth, aflatoxin production, and aflR gene expression. *Journal of Food Safety*, 40(4), e12815.

Haydak, M.H., Vivino, A.E., 1950. The changes in thiamine, riboflavin, niacin and pantothenic acid content in the food of female honeybees during growth with a note on the vitamin K activity of royal jelly and bee bread. *Ann. Entomol Soc. Amer.* 43, 361-367.

Herbert E.W., Shimanuki, Jr, H., Chemical Composition and Nutritive Value of BeeCollected and Bee-Stored Pollen, *Apidologie*, 9 (1978) 33-40.

Kňazovická, V., Mašková, Z., Vlková, E., Švejstl, R., Salmonová, H., Ivanišová, E., Gažarová, M., Gamráthová, I., Repková, M., Tokár, M., Pollen Can-Testing of Bee Pollen FermentationIn Model Conditions, *Journal of Microbiology, Biotechnology and Food Sciences*, 9 (2019) 805-811.

Koç, A. N., Silici, S., Kasap, F., Hörmet-Öz, H. T., Mavus-Buldu, H., & Ercal, B. D. (2011). Antifungal activity of the honeybee products against *Candida* spp. and *Trichosporon* spp. *Journal of medicinal food*, 14(1-2), 128-134.

Lee, S. B. (2016). Antifungal activity of bee venom and sweet bee venom against clinically isolated *Candida albicans*. *Journal of pharmacopuncture*, 19(1), 45.

Lercker, G., La gelatina reale: composizione, autenticita ed adulterazione, In Atti del Convegno „Strategie per la valorizzazione dei prodotti dell' alveare”. Università degli Studi del Molise; Campobasso; 2003, 67-81

Moghim, H., Taghipoor, S., Shahinfard, N., Kheiri, S., & Khabbazi, H. (2015). Comparative study on the antifungal activity of hydroalcoholic extract of Iranian Propolis and Royal jelly against *Rhizopus oryzae*. *Journal of Herbmmed Pharmacology*, 4(3), 89-92.



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Moore J, Rajasekaran K, Cary JW, Chlan C (2019) Mode of action of the antimicrobial peptide D4E1 on *Aspergillus flavus*. *Int J Pept Res Ther* 25:1135–1145.

Muñoz A, López-García B, Marcos JF (2006) Studies on the mode of action of the antifungal hexapeptide PAF26. *Antimicrob Agents Chemother* 50(11):3847–3855.

Mutsaers, M., Bee products: Properties, Processing and Marketing, Agromisa Foundation/Technical Centre for Agricultural and Rural Cooperation (2005).

Nagai, T., Nagashima, T., Myoda, T, Inoue, R., Preparation and Functional Properties of Extracts From Bee Bread, *Food/Nahrung*, 48 (2004) 226-229.

Nagai, T., Nagashima, T., Myoda, T., Inoue, R., 2004. Preparation and functional properties of extracts from beebread. *Nahrung/Food* 48(3),226-229.

Park, J., Kwon, O., An, H. J., & Park, K. K. (2018). Antifungal effects of bee venom components on *Trichophyton rubrum*: a novel approach of bee venom study for possible emerging antifungal agent. *Annals of dermatology*, 30(2), 202-210.

Sabatini., A. G., Marcazzan, L. G., Caboni., M. F., Bogdanov, S, Bicudo de Almeida-Muradian, L., Quality and Standardisation of Royal Jelly, *Journal of ApiProduct and ApiMedical Science*, 2009, 16-21

Silici, S., Arı Poleni Ve Arı Ekmeği, *Uludağ Arıcılık Dergisi*, 14,2 (2014) 99-105.

Šimúth, J. (2001). Some properties of the main protein of honeybee (*Apis mellifera*) royal jelly. *Apidologie*, 32(1), 69-80.

Vichai, W., Treetip, R., Seasonal Variation of Chemical Composition of Royal Jelly Produced in Thailand, *Thammasat Int. J. Sc. Tech*, 2002, 7, 23

Yu, A. R., Kim, J. J., Park, G. S., Oh, S. M., Han, C. S., & Lee, M. Y. (2012). The antifungal activity of bee venom against dermatophytes. *Journal of Applied Biological Chemistry*, 55(1), 7-11.



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KANATLI HAYVANLAR İÇİN BİYOGÜVENLİK UYGULAMALARI

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ÖZET

Kanatlı hayvancılığında biyogüvenlik, hastalık etkenlerinin giriş ve yayılma riskini azaltmak için uygulanan önlemlerdir. Evcil, yabani, egzotik ve tutsak kuşları ve bunların ürünlerini içeren kümes hayvanları ile ilişkili tüm faaliyetlerde, potansiyel sağlık risklerini azaltmak için geliştirilmiş biyogüvenlik ile ilgili tüm önlemlerin benimsenmesini ve uygulanmasını gerektiren kural ve uygulamaları içerir. 2021 yılı verilerine göre dünya genelinde tahmini 25,9 milyar tavuk vardır ve Türkiye 350 milyon civarında tavuk sayısı ile dünya genelinde tavuk eti üretiminde 10. Sırada yer almaktadır. Hayvansal üretimde önemli bir sektörü temsil eden kanatlı hayvancılığı özellikle gelişmekte olan ülkelerde, küçük aile işletmeleri olarak salma hayvancılık ile ve evlerin bahçelerinde yapılan yetiştiricilikle büyük bir üretim miktarını da kapsamaktadır. Evlerin bahçelerinde yetiştirilen salma sürüler, birçok gelişmekte olan ülkede kümes hayvanı stoklarının büyük bir bölümünü oluşturmaktadır ve genellikle aynı sürüde çeşitli türlerin karıştırıldığı çeşitli yaşlardaki serbest dolaşan yerli ırklardan oluşmaktadır. Kümes hayvanları, aynı evde yaşayan insanlarla, haşaratlarla, yırtıcı hayvanlarla, yabani kuşlar ve diğer çiftlik hayvanları ile yakından etkileşime girerler. Ev bahçeleri salma üretim yöntemleri, düşük biyogüvenlik önlemlerini de beraberinde getirmekte olup kümes ölümleri yaygın olarak görülebilmektedir. Kötü veya eksik hastalık kontrol stratejileri ve yetersiz biyogüvenlik yönetimi uygulamaları, kemirgenler, yırtıcı hayvanlar, yüksek patojenik Kuş Gribi (HPAI), Newcastle hastalığı, salmonellozis, Gumboro hastalığı veya kanatlı tifosu gibi bazıları zoonoz olan bulaşıcı hastalıklar nedenleriyle hem yüksek düzeyde kanatlı hayvan ölümlerine neden olurlar hem de toplum sağlığına olumsuz etki yaparlar. Hem yoğun ticari üretim sistemleri hem de küçük ölçekli aile işletmeleri ile hobi amaçlı kümes hayvanları üretim sahaları çok farklı özellikleri bir arada bulundurmaktadırlar. Bununla birlikte, hepsi aynı hastalıklara duyarlı hayvanları barındırırlar. Büyük ölçekli kanatlı üretimi için biyogüvenlik önlemlerinin kapsamı ve etkisi açık olsa da, küçük kanatlı işletmeleri için de önemi göz ardı edilmemelidir. Dünya çapında artan hayvan ve insan hareketi ile birlikte yoğun kanatlı üretimindeki hızlı büyümenin, HPAI A/H5N1 veya H9N2 gibi yeni zoonoz patojenlerin ortaya çıkmasına önemli ölçüde katkıda bulunduğu düşünülmektedir. Riskli üretim şartlarında biyogüvenliğin artırılması ve etkin uygulanması, genellikle hastalık giriş riskini en aza indirmenin en iyi yolu olarak kabul edilmektedir. Bu derleme makale kanatlı hayvan yetiştiriciliğinde hayvan ve insan sağlığı için hastalık önleyici tedbirlerin en başında yer alan biyogüvenlik uygulamalarının güncel bilgiler ile yeniden gözden geçirilmesi amacıyla hazırlanmıştır.

Anahtar Kelimeler: Biyogüvenlik, Enfeksiyon, Kanatlı Hayvan, Zoonoz.



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AVIAN BIOSECURITY PRACTICES

ABSTRACT

Biosecurity in poultry farming is the measures implemented to reduce the risk of entry and spread of disease agents. It includes rules and practices that require the adoption and implementation of all biosecurity-related measures developed to reduce potential health risks in all poultry-related activities involving domesticated, wild, exotic and captive birds and their products. According to 2021 data, there are an estimated 25.9 billion chickens worldwide and Turkey ranks 10th in the world in chicken meat production with around 350 million chickens. Poultry, which represents an important sector in animal production, especially in developing countries, includes small family enterprises, backyard farming and a large amount of production. Backyard poultry constitute the majority of poultry stocks in many developing countries and are usually made up of free-range endemic breeds of various ages, where several species are mixed in the same flock. Poultry interact closely with people living in the same household, vermin, predators, wild birds and other farm animals. Backyard poultry production bring with it low biosecurity measures poultry deaths are common. Poor or incomplete disease control strategies and inadequate biosecurity management practices result in both high levels of poultry mortality and morbidity from infectious diseases. Zoonoses such as highly pathogenic Avian Influenza (HPAI) salmonellosis, Newcastle disease and poultry typhoid, and other risk factors such as Gumboro disease, rodents and predators have adverse effects on both poultry and public health. Both intensive commercial production systems and small-scale family enterprises and hobby poultry production combine very different characteristics. However, they all harbor animals susceptible to the same diseases. While the scope and impact of biosecurity measures for large-scale poultry production is clear, its importance for small poultry enterprises should not be overlooked. The rapid growth in intensive poultry production combined with increased animal and human movement worldwide is thought to have contributed significantly to the emergence of new zoonotic pathogens such as avian influenza HPAI A/H5N1 or H9N2. Improving biosecurity and its effective implementation under risky production conditions is generally accepted as the best way to minimize the risk of disease entry. This review article has been prepared with the aim of reviewing the biosafety practices, which is at the top of the disease prevention measures for animal and human health in poultry farming, with current information.

Keywords: Biosecurity, Infection, Poultry, Zoonoses.



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1. GİRİŞ

Kanatlı hayvan yetiştiriciliği çok önemli bir hayvansal üretim türüdür (Conan vd., 2001, Sogut ve Tekelioglu, 2021). Kanatlı hayvanlar, yüksek kaliteli protein (yumurta ve et) üretiminde verimli ve ekonomiktir (Aiyedun vd., 2018). Kanatlı hayvan hastalıkları, kanatlı üretiminde başarısızlığın temel nedenleri olmaya devam etse de (Singla ve Gupta 2012). Başarılı bir kanatlı üretimi, etkili hastalık kontrol önlemi olarak ucuz ve en yaygın kullanılan iyi biyogüvenlik tekniklerinin benimsenmesini gerektirir (Van Limbergen vd, 2017; Wijesinghe vd., 2017). Kanatlılarda, biyogüvenlik, kanatlı sahalarında ve tesislerinde bulaşıcı hastalıkların girişini ve yayılmasını önlemek, kontrol etmek veya sınırlamak için alınan bir dizi önlem ve uygulamayı ifade eder (Eltholth vd., 2016; Scott vd., 2018). Biyogüvenlik programı ayak banyolarının kullanımı, araçların derin yıkaması (Aiyedun vd., 2018) ve çiftlik ekipmanlarının dezenfeksiyonu da dahil olmak üzere bulaşıcı hastalığa neden olan ajanların yayılmasını en aza indirmek veya girişini önlemek için tel örgü, çitler ve yönlendirilmiş eylemler gibi fiziksel engellerin bir kombinasyonunu kullanır. Biyogüvenlik önlemlerinin üç bileşeni izolasyon, giriş ve çıkış kontrolü ile sanitasyondur (Kouam vd., 2018; Van Limbergen vd., 2017; Sasaki vd. 2019).

2. BİYOGÜVENLİK

Biyogüvenlik, yapısal, kavramsal ve operasyonel çerçevelerden oluşur (Maduka vd., 2016). Yapısal; yabani kuşların ve yırtıcı hayvanların girişine karşı koruma sağlamak için bina tasarımı ve tesislerin kapsanması. Kavramsal kategori şunları içerir; çiftliklerin yeri, ve operasyonel, çiftlik çalışanlarının ve ziyaretçilerin izlediği rutin dezenfeksiyon, sanitasyon ve çalışma prosedürlerini kapsar (Shane, 1997). Kuşların performansı, çiftliklerin biyogüvenlik önlemlerinden etkilenir (Wijesinghe vd., 2017; Ismael vd., 2021). Üç stratejik hedefe ulaşmak için bir biyogüvenlik planı uygulanabilir (CSHB, 2010). Birincisi, hayvancılık sahalarına yeni bir patojenin girmesini önlemek için geliştirilen politikalar olan harici biyogüvenlik veya biyo-kovmadır. İkincisi, hastalıkların tesisler veya tavuklar arasında yayılmasını azaltmak için geliştirilmiş bir biyogüvenlik stratejisi olan dahili biyogüvenlik veya biyo-yönetimdir. Ve sonuncusu, başka bir hayvan popülasyonuna yayılmasını önlemek için kümes hayvancılığı tesislerinde halihazırda mevcut olan patojenlerin yayılmasını önlemek için geliştirilmiş bir biyogüvenlik stratejisi olan biyo-önlemedir.



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UN- FAO (Birleşmiş Milletler Gıda ve Tarım Örgütü) ve OIE (Dünya Hayvan Sağlığı Örgütü) biyogüvenliği, hastalık etkenlerinin giriş ve yayılma riskini azaltmak için önlemlerin uygulanması olarak tanımlamaktadır (FAO, 2008). Biyo-kovma ve biyo-önleme ile ilgili aynı temel prensipler (Charisis, 2008) şu yollarla uygulanmaktadır; bulaşıcı hastalıklara karşı bariyerleri yükseltmek için ayırma, temizlik ve dezenfeksiyonun sağlanmasıdır (FAO, AVSF, DAH, 2005). Bu iki ilke, izolasyon, giriş-çıkış kontrolü ve sanitasyonu içerir (Msami, 2008). Biyogüvenlik önlemlerini tanımlamak için standart bir sınıflandırma mevcut değildir. FAO belgelerinde bulunan sınıflandırmaya dayalı olarak, biyogüvenlik şu kategoriler kullanılarak sınıflandırılır; sürü yönetimi, yem ve su, ticaret ve stok, sağlık yönetimi ve insanlara yönelik riskler. Önerilen bir hayvancılık önlemi, gelen hayvanların kontrolüdür (CSHB, 2010). Biyogüvenlik, çiftliğin fiziksel yerleşimi ve üretim döngüsü ile başlar. Üretim yerleri diğer üretim tesislerinden izole edilmelidir. Dinlenme periyoduyla birlikte "hepsi içeri - hepsi dışarı" tekniği, enfeksiyonun bir sürüden diğerine taşınmasını başarılı bir şekilde durdurabilir ve bu yöntemle çalışan kapalı sistem çiftliklerin açılara oranla daha yüksek biyogüvenliğe sahip oldukları bildirilmiştir (Mahmoud vd., 2014). Bir kümesteki sürüler diğer kümeslerden gelen sürülerle temas etmemelidir. Sadece tek yaştaki sürüler bir arada tutulmalıdır. Stok, sağlık durumu bilinen sürülerden temin edilmelidir.

3. DAMIZLIK SÜRÜLERDE BİYOĞÜVENLİK

Yumurta toplama, kuşların taşıma ve yem teslimi biyolojik olarak güvenli bir süreç olmalıdır. Taşıma kasaları kullanımdan sonra yıkanmalı ve dezenfekte edilmeli, uygun personel düzenli aralıklarla denetim yapmalı, çiftlikler arasında ekipman ve personel paylaşımından kaçınılmalıdır (Permin ve Detmer, 2007). Ancak FAO, çoğu köylü kendi tüketimleri için serbest dolaşan kümes hayvanları yetiştirdiğinden, gelişmekte olan ülkelerde yaş ayrımının uygulanabilir olmayacağını kabul etmektedir. İlk olarak, tüm hayvanların sabit bir yaşta satışı, yıl boyunca et üretimini sağlamak için birkaç yaş tutan çiftçiler tarafından uygulanmamaktadır (Alhaji ve Odetokun, 2001). İkinci olarak, çiftçiler yumurta tavuklarını sürüleri yenilemek için kullanırlar (Olwande vd., 2010), böylece civciv üretimi yıl boyunca devam edebilir. Türleri izole etmek ve serbest yayılmayı sınırlamak için engeller oluşturmak önemli bir tavsiyedir. Bir yandan, yerel malzemeleri kullanabildikleri için bu önlemin çiftçiler için nispeten ucuz olduğu düşünülmektedir (Hamilton-West vd., 2012). Ayrıca kümes hayvanlarının çitle çevrilmesi, sürünün günlük ek gıda ihtiyacını artırır (Singh ve Fotsa, 2011). Kapalı alanda yetiştirme de



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önerilmektedir ve tüm dünyada arka bahçe tavukçuluğu çiftçiler tarafından talep görmektedir. Gelişmekte olan ülkelerde bu önlemin uygulanmasındaki zorlukları gözlemlerken (Barennes vd., 2007), araştırmacılar hala kümes hayvanlarını en azından geceleri kapalı mekanlarda tutmayı tavsiye etmektedirler (Lukman vd., 2011). İlginç bir şekilde, önerilerin izlendiği birçok pozisyonda, çiftçiler biyogüvenlikle ilgili olmayan faktörler tarafından yönlendirilmiştir, örn. hırsızlığı önlemek, eve pislik girmesini veya kuşların kaybolmasını önlemek için uygulanan çitlerle sınırlama (Harvey vd., 2003). Ek olarak, Nijerya'da yürütülen bir araştırmanın gösterdiği gibi, biyogüvenliğin basit ilkelerini bilmeden sürüleri içeride tutmak, insanları gerçekten kanatlı hayvanlarla sık temasa maruz bırakarak HPAI A/H5N1 enfeksiyonu riskinin artmasına neden olabilir (Alhaji ve Odetokun, 2011).

4. KAYIT TUTMA

Kanatlı hayvan yetiştiriciliğiyle ilgili bir başka FAO önerisi, sürü geçmişinin iyi bir kaydını tutmayı içerir. Bu hayvan gözlemi, çiftçinin sürülerdeki herhangi bir sapmayı tespit etmesini sağlar. Ayrıca, inceleme durumunda, sürü geçmişi biliniyorsa olayların yorumlanması daha kolay olacaktır (Burns vd., 2011). FAO, gıda ve su yönetimini kümes hayvanları için bir biyogüvenlik tehlikesi olarak kabul eder, bu nedenle bunu hesaba katma ihtiyacı vardır, bu nedenle (mümkünse) tavsiyeler, takviye edilmiş gıda sağlamayı veya gıda ve su için temiz kaplar sağlamayı içerir (Harvey vd., 2003). Tavsiye edilen diğer bir hayvancılık önlemi, giren ve çıkan materyalin kontrolüdür. Temizlik ve dezenfeksiyon, bir biyogüvenlik programının önemli parçalarıdır. Çöp ve diğer kontamine materyallerin sık sık çıkarılması gerekir. Canlı aşılar kontaminasyondan arındırılmış olmalıdır. Hijyenik önlemler, ilaç uygulaması ve aşının doğruluğu, lokal reaksiyonların, enfeksiyonların yayılmasının ve hastalık indüklenmesinin azaltılmasında çok önemlidir (Cargill, 1999; Corbanie, 2007). Aşıların uygulanmasıyla ilgili sorunların ileri eğitimlerle önlenmesi gerekmektedir. Yem hijyenik bir şekilde üretilmeli ve kuşlara teslim edilene kadar biyogüvenli tutulmalıdır. Yeni altlığın bir enfeksiyon kaynağı olarak görülmesi gerekir. Üzeri örtülmeli, yerde veya dışarıda tutulmamalı ve torbalarda saklanmalıdır (Permin ve Detmer, 2007).



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5. SALGIN HASTALIKLARIN YÖNETİMİ VE BİYOGÜVENLİK

Sağlık yönetimi, salgınların yönetimini ve çöp kullanımını içerir. Sürüde bir enfeksiyon patlaması olduğunda, bulaşıcı hastalıkların yayılması için olası bir risk olabileceğinden, hastalıklı kuşlar izole edilmelidir (Msami ,2008). Çiftçiler tarafından hasta hayvanların itlaf edilmesi genel olarak ciddi bir önlem olarak önerilmiştir, ancak birçok çiftçinin tüm sürüyü kaybetmeye dayanamadığı gelişmekte olan ülkelerde daha zor uygulanabilir bir yöntem olarak kabul edilmektedir. HPAI A/H5N1 tehdidi göz önüne alındığında, gelişmiş ülkelerde ortak uygulama olarak ölü kuşların yakılması veya gömülmesi konusunda güçlü ve açıkça belirtilen bir referans vardır (Zheng vd., 2010, Hamilton-West vd., 2012; Yakhshilikov vd., 2009). Bununla birlikte, gelişmekte olan ülkelerdeki birçok köylü ölü veya hasta kuşları satmaya devam ederken, uygun olmayan uygulama ND enfeksiyonu riskini artırabilir (Musa vd., 2010). Gübre olarak işlenmemiş kanatlı gübresinin kullanımı ciddi bir enfeksiyon yayılması riski oluşturur, bu, gübrenin sürü alanı dışında kompostlanmasıyla çözülebilir, bu etkili ancak pek çok gelişmekte olan ülkenin köylü çiftçileri arasında iyi bilinmeyen bir önlemdir (Zheng vd., 2010). Kanatlı hayvan ticareti genellikle ND veya HPAI için veya sürüde ve köyde bir risk faktörü olarak görülür. Bu nedenle, arka bahçedeki kümes hayvanı çiftçileri, canlı kuş pazarlarını veya diğer ticaret yerlerini ziyaret etmemeye yönlendirilmektedir (Burns vd., 2011). Ancak bu uygulama birçok gelişmekte olan ülkede devam etmektedir. Kanatlı çiftçileri de kanatlı tedarik kaynağının hastalıksız olmasını sağlamaya yönelik önlemler almaktadır (Nyaga, 2009). Bu tavsiyeleri uygulama yolları, örneğin, çiftçilerin canlı kuş pazarlarından ziyade komşuları gibi düzenli ve bilinen bir stok kaynağından - sürünün hastalıksız olması koşuluyla - satın almaya başvurduğu Myanmar'da yapılan bir çalışmada fark edilmiştir (Henning vd., 2006). Bu ilke özellikle, Yeni Zelanda veya Kuzey Amerika'da arka bahçedeki kümes hayvanı sahiplerinin kendi yumurtalarını kuluçkalamalarının veya aynı kümes hayvanlarının bir veya birkaçından civciv (veya aynı yaştaki genç yetişkin kuşları) satın almanın yaygın olduğu gelişmiş ülkelerde iyi anlaşılmıştır. (Garber vd., 2007). Kuşlar başka bir arka bahçe sürüsünden getirildiğinde HPAI A/H5N1 bulaşma riskinin aslında arttığı gerçeği göz önüne alındığında, bir sonraki önemli tavsiye, herhangi bir hastalığın kendini göstermesi için zaman tanıma açısından yeni tanıtılan kuşların sürüye katılmadan önce iki hafta karantinaya alınması gerektiğidir (Burns vd., 2011). Son olarak, insanlara yönelik riski sınırlamak için önerilerde bulunulmuştur. Bu, kümes hayvanlarını çocuklardan ayırmayı ve kümes hayvanlarını tutarken veya el yıkarken eldiven takmak gibi kişisel hijyen önlemlerini içerir (Ismail ve Ahmed, 2010). Yukarıdaki



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önerilerin tümü farklı prosedürlerde listelenmiştir. Bu belgeler, biyogüvenlik ilkelerini tanıtmakta ve arka bahçedeki sürülerden veteriner hekimlere ve hayvancılıkla ilgili işlerin profesyonellerine kadar değişen farklı kapsamdaki uygulamalar için yukarıda açıklanan önlemlerin bir listesini sunmaktadır (Alders ve Spradbrow, 2001).

6. ÜRETİMDE BİYOGÜVENLİK

Üretim aşamasında dört biyogüvenlik ilkesi vardır. Bunlardan ilki “izolasyon” uygulamasıdır (Pierson 2001). Bu, üretim tesisini diğer tüm çiftlik süreçlerinden uzağa yerleştirmeyi; haşere yönetimi, diğer hayvanların ve çiftlik hayvanlarının kontrolü ve çiftlikteki ve çiftlik dışındaki trafiğin kontrolüdür. İkinci ilke, kümesin temizliği ve dezenfeksiyonunu içeren 'iyi hijyen'dir ve çalışanların kişisel ve kıyafetlerinin hijyenini kapsar. Üçüncü ilke, "sürü sağlık ve izleme" uygulamasıdır. Son ilke ise “iyi yönetim uygulamaları”dır. Bu ilkeler, Permin ve Detmer (2007) tarafından belirlenen adımları güçlendirmekte ve diğer çalışmalar tarafından tanıtılan izolasyon ilkesini vurgulamaktadır (Nyaga, 2007a; Guèye, 2002). Butcher ve Yegani (2008), bir çiftliğe hastalık bulaştırabilecek veya çiftlikler arasında veya içinde enfeksiyon yayabilecek farklı yöntem veya kaynaklara vurgu yapmaktadır. Bunlar şunları içerir; sürü içindeki taşıyıcı kuşlar, havadan iletim, yakın zamanda bir dış sürüden getirilen kuşlar ve insanlar (ziyaretçiler; çalışanlar). Diğerleri şunları içerir; kemirgenler, evcil hayvanlar ve böcekler; arka bahçedeki evcil kümes hayvanları ve diğer yabani kuşlar, canlı kuş pazarları, enfekte damızlık sürülerinden gelen yumurtalar, kontamine aşılarda ve kontamine yem ve su. Enfeksiyon kaynakları listesi, belirlenmiş biyogüvenlik ilkelerinin ihlalini yansıtır ve ilkelerin uygulanması sırasında faaliyetlere dönüştürülebilir.

7. SONUÇ ve TARTIŞMA

Başarılı bir biyogüvenlik programı uygularken yapılacak ilk iş, potansiyel bulaşıcı hastalık etkenlerinin rezervuarlarını/kaynaklarını ve vektörlerini belirlemek ve ardından bunların sürüler ve çiftlikle temasını kısıtlamak veya önlemek olmalıdır (deGraft-Henson, 2002). Ayrıca, yeterli havalandırma, soğutma ve ısıtma sağlamak gibi iyi tarım uygulamalarının günlük uygulaması olmalıdır. Kaliteli yem ve su sunulması, belirli hastalıklar için aşılama, (gerektiğinde) uygun ilaç kullanmak, ölü kuşları hızlı bir şekilde çıkarmak, ölü kuşların kompostlanması veya başka bir şekilde yetkin bir şekilde imha edilmesi, derin toprak altına



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gömerek imha veya gübreleme ve biyolojik atık haline getirmek ve genel olarak stressiz bir ortam sağlamak çok önemlidir.

Sonuç olarak kanatlı yayvan yetiştiriciliğinde biyogüvenlik ilkelerinin, uygulandığında hastalık etkenlerinin bir çiftliğe girmesini veya hastalık etkeninin enfekte olmuş bölgelerden çıkmasını önleyen basit uygulamaları ve prosedürleri içermesi gerekmektedir (Nyaga 2007b). Bu süreç, temiz sürülerin hastalık etkenlerinin girişinden uzak kalmasını ve hastalık etkenlerinin enfekte sürülerde sınırlı kalmasını ve diğer alanlara yayılmamasını sağlamak için manevralar, uygulamalar ve protokoller içerebilir. Kişilerin, stokların, ürünlerin ve ekipmanın temiz çiftliğe ve enfekte olmuş sitelerin dışına hareketini kontrol etmeyi içerir ve son olarak, sanitasyon olarak adlandırılan, çiftliğin sürekli bir temizlik durumunda kalmasını sağlayan prosedürleri içerir. Ulusal tavuk sektörü için üç biyogüvenlik ilkesinin zorunlu olduğunu bilinmektedir. Bunlar izolasyon, giriş ve çıkışta hayvan, insan ve araç trafiğin kontrol etme ve sanitasyondur (Nyaga 2007b). Biyogüvenlik önlemlerinin amacının sırasıyla temiz sürülerin enfeksiyonunu önlemek ve hastalığın enfekte bölgelerden yayılmasını önlemek için bulaşıcı ajanların hem biyolojik olarak dışlanması hem de biyolojik olarak tutulmasını sağlamak olduğunu belirtmek doğru olacaktır.

2021 yılı verilerine göre dünya genelinde tahmini 25,9 milyar tavuk vardır ve Türkiye 350 milyon civarında tavuk sayısı ile dünya genelinde tavuk eti üretiminde 10. Sırada yer almaktadır (Sogut ve Tekelioglu 2021, Statista 2021, Türk Tarım 2021, TÜİK 2021, ZMO 2021). Kanatlı hayvan eti dünyada en çok üretilen et olmuştur ve yakın gelecekte de en çok üretilen et olmaya devam edecektir (FAO a ve b, 2021, Sogut ve Tekelioglu, 2021). Hayvansal üretimde önemli bir sektörü temsil eden kanatlı hayvancılığı özellikle gelişmekte olan ülkelerde, küçük aile işletmeleri olarak salma hayvancılık ile ve evlerin bahçelerinde yapılan yetiştiricilikle büyük bir üretim miktarını da kapsamaktadır. Evlerin bahçelerinde yetiştirilen salma sürüler, birçok gelişmekte olan ülkede kümes hayvanı stoklarının büyük bir bölümünü oluşturmaktadır ve genellikle aynı sürüde çeşitli türlerin karıştırıldığı çeşitli yaşlardaki serbest dolaşan yerli ırklardan oluşmaktadır. Kümes hayvanları, aynı evde yaşayan insanlarla, haşaratlarla, yırtıcı hayvanlarla, yabani kuşlar ve diğer çiftlik hayvanları ile yakından etkileşime girerler. Ev bahçeleri salma üretim yöntemleri, düşük biyogüvenlik önlemlerini de beraberinde getirmekte olup kümes ölümleri yaygın olarak görülebilmektedir. Kötü veya eksik hastalık kontrol stratejileri ve yetersiz biyogüvenlik yönetimi uygulamaları, kemirgenler, yırtıcı hayvanlar, yüksek patojenik Kuş Gribi (HPAI), Newcastle hastalığı, salmonellozis, Gumboro hastalığı



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veya kanatlı tifosu gibi bazıları zoonoz olan bulaşıcı hastalıklar nedenleriyle hem yüksek düzeyde kanatlı hayvan ölümlerine neden olurlar hem de toplum sağlığına olumsuz etki yaparlar. Dünya çapında artan hayvan ve insan hareketi ile birlikte yoğun kanatlı üretimindeki hızlı büyümenin, HPAI A/H5N1 veya H9N2 gibi yeni zoonoz patojenlerin ortaya çıkmasına önemli ölçüde katkıda bulunduğu düşünülmektedir. Riskli üretim şartlarında biyogüvenliğin artırılması ve etkin uygulanması, genellikle hastalık giriş riskini en aza indirmenin en iyi yolu olarak kabul edilmektedir.

8. TEŞEKKÜR

Bu çalışma Çukurova Üniversitesi BAP Koordinasyon Birimi tarafından desteklenmiştir. Teşekkür ederiz.



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KAYNAKLAR

Aiyedun, J.O, Oludairo, O.O., Olorunsola, I.D., Daodu, O.B. and Furo, N.A. (2018). “Effectiveness of biosecurity measures in some selected farms in Kwara state, Nigeria,” *Journal of Research in Forestry, Wildlife & Environment*, vol. 10, no. 2, pp. 17–23.

Alders, R. and Spradbrow, P. (2001). Controlling Newcastle Disease in village chickens. A field manual. Bruce, ACT: Australian Centre for International Agriculture Research (ACIAR).

Alhaji N.B and Odetokun I.A (2011). Assessment of biosecurity measures against Highly Pathogenic Avian Influenza risks in small-scale commercial farms and free-range poultry flocks in the Northcentral Nigeria. *Transbound Emerg Dis.*58(2):157–161.

Barennes, H., Martinez-Aussel, B., Vongprachanh, P., Strobel M.(2007). Avian Influenza risk perceptions, Laos. *Emerg Infect Dis.* 13(7):1126–1128.

Burns, T.E., Kelton, D., Ribble, C. and Stephen, C.(2011). Preliminary investigation of bird and human movements and disease-management practices in noncommercial poultry flocks in southwestern British Columbia. *Avian Dis*, 55(3):350–357.

Butcher, G. and Yegani, M. (2008). Biosecurity for the poultry industry *Veterinary Medicine-Large Animal Clinical Sciences Department, Florida Cooperative Extension Service, Institute of*

Canadian Swine Health Board (CSHB) (2010). National swine farm-level biosecurity standard. Canadian Swine Health Board, Technical Committee on Biosecurity. [Accessed 16th March 2012] http://www.swinehealth.ca/CSHB_Biosecurity_StandardE.pdf

Cargill, P.W. (1999). Vaccine administration in poultry. *In Practice* (21): 323-328

Charisis N. (2008). Avian influenza biosecurity: a key for animal and human protection. *Vet Ital* .44(4):657–669.

Conan, A., Goutard, F. L., Sorn, S. and. Vong, S. (2012). “Biosecurity measures for backyard poultry in developing countries: a systematic review,” *BMC Veterinary Research*, vol. 8, no. 1, p. 240.

Corbanie, E. (2007). Development of a dry powder vaccine for mass vaccination An unpublished PhD thesis, Faculty of Pharmaceutical Sciences, Ghent University

Cristalli, A and Capua, I. (2007). Practical problems in controlling H5N1 high pathogenicity avian influenza at village level in Vietnam and introduction of biosecurity measures. *Avian Dis*, 51(1 Suppl): 461–462.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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DeGraf-Hanson, J. (2002). Biosecurity for the poultry industry Extension Service, West Virginia University

Eltholth, M., Mohamed, R., Elgohary, F. and Elfadl, E. (2016). “Assessment of biosecurity practices in broiler chicken farms in Gharbia Governorate, Egypt,” Alexandria Journal of Veterinary Sciences, vol. 49, no. 1, pp. 68–77.

FAO (2008). Biosecurity for highly pathogenic avian influenza: issues and options. Rome: FAO.

FAO, AVSF, DAH (2005). Prevention and control of Avian flu in small scale poultry. A guide for veterinary paraprofessionals in Vietnam. Rome: FAO, AVSF, DAH.

FAO^a (2021). Meat market review. <http://www.fao.org/3/cb3700en/cb3700en.pdf>.

FAO^b (2021). Poultry production. <http://www.fao.org/poultry-production-products/production>

Food and Agricultural Sciences, University of Florida, VM176 [Accessed 1/4/2012] from <http://edis.ifas.ufl.edu>

Garber, L., Hill, G., Rodriguez, J., Gregory, G. and Voelker, L.(2007). Non-commercial poultry industries: surveys of backyard and gamefowl breeder flocks in the United States. *Prev Vet Med*, 80(2–3):120–128.

Guèye, E.F. (2002). Newcastle disease in family poultry: Prospects for its control through ethnoveterinary medicine, *Livestock Research for Rural Development* 14 (5). Retrieved from <http://www.cipav.org.co/lrrd/lrrd14/5/guey145.htm> on 21st August 2011

Hamilton-West, C., Rojas, H., Pinto, J., Orozco, J., Herve-Claude , L.P. and Urcelay, S.(2012). Characterization of backyard poultry production systems and disease risk in the central zone of Chile. *Res Vet Sci* ,93(1):121–124.

Harvey, S.A., Winch, P.J., Leontsini, E., Torres Gayoso, C. , Lopez Romero, S., Gilman, R.H. and Oberhelman, R.A.(2003). Domestic poultry-raising practices in a Peruvian shantytown: implications for control of *Campylobacter jejuni*-associated diarrhea. *Acta Trop*, 86(1):41–54.

Henning, J. , Khin, A. , Hla, T. and Meers, J.(2006). Husbandry and trade of indigenous chickens in Myanmar—results of a participatory rural appraisal in the Yangon and the Mandalay divisions. *Trop Anim Health Prod*. 38(7–8):611–618.



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on AGRICULTURE, ANIMAL SCIENCES
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BINGOL, TURKEY**



Ismael, A., Abdella, A., Shimelis, S., Tesfaye, A. and Muktar, Y. (2021). Assessment of Biosecurity Status in Commercial Chicken Farms Found in Bishoftu Town, Oromia Regional State, Ethiopia. *Veterinary Medicine International* Volume 2021, Article ID 5591932, 9 pages <https://doi.org/10.1155/2021/5591932>

Ismail, N.A. and Ahmed H.A. (2010). Knowledge, attitudes and practices related to Avian Influenza among a rural community in Egypt. *J Egypt Public Health Assoc*, 85(1– 2):73–96.

Kouam, M.K., Jacouba, M., Nsangou, I. N. and Tegua, A. (2018). “Assessment of biosecurity level in small-scale broiler farms in the Western highlands of Cameroon (Central Africa),” *Tropical Animal Health and Production*, vol. 50, no. 7, pp. 1529–1538.

Lukman D, Ridwan Y, Wibowo B, Basri C, Sudarnika E, Sugama A, Hermans P, Nell A. (2011). Biosecurity practices in village poultry in Cipunagara Subdistrict, Subang District, West Java: Case study. In *Proceedings of 1st International Congress of South East Asia Veterinary School Association: 20-22July 2010 2011*. Bogor, Indonesia: SEAVSA.

Maduka, C. V., Igbokwe, I. O. and Atsanda, N. N. (2016). “Appraisal of chicken production with associated biosecurity practices in commercial poultry farms located in Jos, Nigeria,” *Scientifica*, vol. 2016, Article ID 1914692, 9 pages.

Mahmoud, M. A., Abdelgadir, A.E., and Ismail, H.M. (2014). Evaluation of biosecurity measures on broiler farms in Khartoum, Sudan. *Journal of Veterinary Medicine and Animal Health*. 6. 138-144. 10.5897/JVMAH2014.0276.

Msami H. (2008). Good biosecurity practices in non- integrated commercial and in scavenging production systems in Tanzania. Rome: FAO.

Musa, O.I., Aderibigbe, S.A., Salaudeen, G.A., Oluwole, F.A. and Samuel S.O. (2010). Community awareness of bird flu and the practice of backyard poultry in a North-Central state of Nigeria. *J Prev Med Hyg* 51(4):146–151.

Nyaga P (2009). Poultry Sector Analysis: Biosecurity Review and Improved poultry husbandry systems for sectors 3 and 4 to prevent HPAI infection in Uganda. Rome: FAO.

Nyaga, P. (2007a). The structure, marketing and importance of the commercial and village poultry industry: An analysis of the poultry sector in Kenya. Rome, Food and Agriculture Organization (FAO) of the United Nations

Nyaga, P. (2007b). Good biosecurity practices in small scale commercial and scavenging production systems in Kenya. Rome, Food and Agriculture Organization (FAO) of the United Nations



**ISPEC 8th INTERNATIONAL CONFERENCE
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and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



Olwande, P.O, Ogara W.O , Okuthe, S.O., Muchemi, G. , Okoth, E. , Odindo, M.O., Adhiambo, R.F. (2010). Assessing the productivity of indigenous chickens in an extensive management system in southern Nyanza, Kenya. *Trop Anim Health Prod.* 42(2):283–288.

Permin, A. and Detmer, A. (2007). Improvement of management and biosecurity practices in smallholder producers Rome: Food and Agricultural Organization of the United Nations.

Pierson, F.W. (2001). Biosecurity: Principles and practices in the commercial poultry industry. Center for Molecular Medicine and Infectious Diseases Virginia-Maryland Regional College of Veterinary Medicine Virginia Polytechnic Institute and State University Blacksburg, Virginia 24061

Poultry Statistics. (2021). <https://www.statista.com/statistics/263962/number-of-chickens-worldwide-since-1990/>. Accessed Date: 19.10.2021

Sasaki,Y., Furutani,A., Furuichi, T. *et al.*, (2019). “Development of a biosecurity assessment tool and the assessment of biosecurity levels by this tool on Japanese commercial swine farms,” *Preventive Veterinary Medicine*, vol. 175, Article ID 104848.

Scott, A. B., Singh, M., Groves, P. *et al.*,(2018). “Biosecurity practices on Australian commercial layer and meat chicken farms: performance and perceptions of farmers,” *PLoS One*, vol. 13, no. 4, Article ID e0195582.

Shane, S.(1997). *Poultry Industry Handbook*, American Soybean Association-South East Asia, Singapore.

Singh, D.P. and Fotsa, J.C. (2011). Opportunities of poultry breeding programmes for family production in developing countries: The bird for the poor. In E-conference of the International Network for Family Poultry Development 24 Jan-18 Feb, 2011:1–18.

Singla, L. D. and Gupta, S. K. (2012). “Advances in diagnosis of coccidiosis in poultry,” in *Veterinary Diagnostics, Current Trends*, R. P Gupta, S. R Garg, V. Nehra, and D. Lather, Eds.,pp. 615–628, Satish Serial Publishing House, Delhi, India.

Sogut, M., and Tekelioglu, B.K. (2021). Avian Herpesviruses And Their Potential Impacts On Poultry Health. XII International Scientific Agriculture Symposium“AGROSYM 2021”, Jahorina, Bosnia and Herzegovina, 1189-1195.

Statist (2021). Poultry meat statistics. <https://www.statista.com/statistics/237597/leading-10-countries-worldwide-in-poultry-meat-production-in-2007/>Accessed 10.07.2021

TÜİK (2021). Türkiye İstatistik Kurumu Raporu. <https://data.tuik.gov.tr/Search/Search?text=tavuk> Accessed 10.07.2021



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
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Türktarım (2021). Türkiye’de kanatlı sektörü. <http://www.turktarim.gov.tr/Haber/401/turkiyede-kanatli-sektoru-her-yil-yuzde-8-buyuyor> Accessed 10.07.2021

Van Limbergen, T., Dewulf, J., Klinkenberg, M. *et al.* (2017). “Scoring biosecurity in European conventional broiler production,” *Poultry Science*, vol. 97, no. 1, pp. 74–83.

Wijesinghe, W. M. J. B., De Silva, P. G. J. C. and Gunaratne, S. P. (2017). “Evaluation of biosecurity status in commercial broiler farms in Sri Lanka,” *International Journal of Scientific and Research Publications*, vol. 7, no. 4, pp. 114–119.

Yakhshilikov, Y., Tiongco, M., Narrod, C. and Friedman, J. (2009). Knowledge and practices of Indonesian rural communities and poultry farmers toward avian flu. *HPAI Research Brief* 17:9.

Zheng, T, Adlam, B., Rawdon, T.G., Stanislawek, W.L., Cork, S.C., Hope, V., Buddle, B.M., Grimwood, K., Baker, M.G., O’Keefe, J.S. and Huang Q.S. (2010). A cross-sectional survey of influenza A infection and management practices in small rural backyard poultry flocks in New Zealand. *N. Z. Vet. J.* 58(2): 74–80.

Zheng, T, Adlam, B., Rawdon, T.G., Stanislawek, W.L., Cork, S.C., Hope, V., Buddle, B.M., Grimwood, K., Baker, M.G., O’Keefe, J.S. and Huang Q.S. (2010). A cross-sectional survey of influenza A infection and management practices in small rural backyard poultry flocks in New Zealand. *N Z Vet J*, 58(2):74–80.

ZMO (2021). Türkiye Beyaz Et Sektörü. https://www.zmo.org.tr/resimler/ekler/d24d7c78bb96fc2_ek.pdf Accessed 10.07.2021



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ÖZET

Coronavirüsler (CoV'ler), memeliler ve kanatlı hayvanlar arasında şiddeti değişken hastalıklar oluştururlar ve sürekli dolaşımda olan virüslerdir. İnsanlar, çiftlik hayvanları, evcil ve vahşi hayvanlar genelinde potansiyel zoonoz hastalıklar olarak tehdit oluşturan, tek sarmallı RNA genomuna sahip, büyük bir zarflı virüs grubunu kapsamaktadır. Kanatlı hayvan türleri arasında dolaşımda olan CoV'ler, gama ve delta coronavirüs cinslerinde sınıflandırılır. Gamma-CoV'lerin en fazla bilinenlerinden birisi kuş koronavirüsüdür ve taksonomik olarak tavuklarda bulaşıcı bronşit virüslerini (IBV'ler) ve diğer evcil ve yabani kuşları enfekte eden benzer virüsleri içerir, bu da yabani kuşların evcil ve serbest dolaşan kuşlar arasında potansiyel olarak koronavirüs vektörleri olabileceğini düşündürmektedir. IBV enfeksiyonunun tanısında konvansiyonel ve gelişmiş yöntemler kullanılmaktadır ve bunlar doğrudan tanı, virüs izolasyonu gibi dolaylı tanı ve serolojik tanı yöntemleri olarak tanımlanabilirler. Bir testin diğerine tercih edilmesi, numunenin türüne, test materyallerinin ve işletmelerin laboratuvar imkanlarına, test raporlama süresine, testin amacına ve testin sahada mı yoksa laboratuvarda mı gerçekleştirildiğine göre yönlendirilmektedir. IBV enfeksiyonunun tanısında kullanılan konvansiyonel yöntemler olan serolojik ve virüs izolasyonu yöntemleri zaman içerisinde yerlerini moleküler tanı gibi alternatif ve gelişmiş yöntemlere bırakmışlardır. Ters transkripsiyon polimeraz zincir reaksiyonu (RT-PCR), Kısıtlama fragman uzunluk polimorfizmi (RFLP) ve dizileme tekniklerinin, yeni viral suşların makul bir sürede genotiplenmesini sağlayan hassas, hızlı ve güvenilir tanısal sonuçlar sağladığı kabul edilmektedir. Farklı kanatlı türlerinde CoV'lerin saptanması için kullanılan yöntemler temel olarak 3'UTR veya 5'UTR içindeki virüse özgü koruyucu bölgelerin, viral replikaz ve nükleokapsid genlerinin saptanmasına dayanır. Tek başına hayvanların, sürülerin veya daha büyük popülasyonların bulaşıcılık durumunun doğru şekilde anlaşılabilmesi için genellikle birden fazla testin kombinasyonu önerilmekte olup hiçbir testin sonucunun kesin sonuç olarak kabul edilmemesi önerilmektedir. IBV tanısında standart bir tanı yönteminden ziyade, işletmelerin taleplerine ve özelliklerine en uygun olanına vaka bazında karar vermek ve uygulamak en doğru tanı yaklaşımı olacaktır. Bu makale, IBV enfeksiyonunun tanı yöntemleri hakkında güncel bilgileri derlemeyi ve sunmayı amaçlamıştır.

Anahtar Kelimeler: Avian Coronavirus, Tavukların Enfeksiyöz Bronşit Virüsü, Enfeksiyon, Tanı Yöntemleri.



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**DIAGNOSTIC METHODS OF AVIAN INFECTIOUS BRONCHITIS VIRUS
DISEASE**

ABSTRACT

Coronaviruses (CoVs) are a large group of enveloped viruses with a single-stranded RNA genome that circulate continuously amongst poultry and mammals and threaten specifically as zoonotic diseases to humans, livestock, domesticated and wild animals. CoVs circulating among poultry species are classified in the gamma and delta coronavirus genera. One of the most prominent of the Gamma-CoVs is avian coronavirus taxonomically includes infectious bronchitis viruses (IBVs) in chickens and similar viruses that infect other domesticated and wild birds suggesting that wild birds can potentially be vectors of coronaviruses between domesticated and free range birds. Conventional and advanced methods are used in the diagnosis of IBV infection and these can be defined as direct diagnosis, indirect diagnosis such as virus isolation and serological diagnosis. As a general practice, the preference of one test over the other is determined by the purpose of the test, the speed and possibilities of transporting the morbid substance to the laboratory, the access to the test materials, the test reporting period, and the availability of laboratory facilities depending on whether the test is performed in the field or in the laboratory. Serological and virus isolation as conventional methods, which are used in the diagnosis of IBV infection, replaced with alternative and advanced methods such as molecular diagnosis over time. It is accepted that reverse transcription polymerase chain reaction (RT-PCR), Restriction fragment length polymorphism (RFLP) and sequencing techniques provide sensitive, fast and reliable diagnostic results which allows to genotype the new viral strains in a reasonable time. The methods used for the detection of CoVs amongst poultry species are mainly based on the detection of virus-specific conservative regions within the 3'UTR or 5'UTR, viral replicase and nucleocapsid genes. No technique on its own can be considered completely conclusive, which often requires a combination of more than one test to obtain a complete diagnosis of the infectious status of individual animals, herds, or larger populations. In the diagnosis of IBV, rather than a standard diagnosis method, it will be the best diagnostic approach to decide and apply the most appropriate one to suit the demands and characteristics of the enterprises on a case-by-case basis. This article aimed to compile and present up-to-date information on the diagnostic methods of IBV infection.

Keywords: Avian Coronavirus, Avian Infectious Bronchitis Virus, Infection, Diagnostic Methods.



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1. GİRİŞ

Coronavirüsler (CoV'ler), kuşlarda ve memelilerde şiddeti değişken hastalıklar oluşturlar ve sürekli dolaşımda olan virüslerdir. İnsanlar, evcil hayvanlar ve çiftlik hayvanları için tehdit oluşturan, tek zincirli RNA genomuna sahip büyük bir zarflı virüs grubudur. Kuş türleri tarafından barındırılan CoV'ler, gama ve deltakoronavirüs cinslerine göre sınıflandırılır. Gama-CoV'ler içinde ana temsilci, tavuklarda yüksek derecede bulaşıcı bulaşıcı bronşit virüslerini (IBV'ler) ve hindi, beç tavuğu veya bıldırcın (Milek ve Blicharz-Domanska, 2018) gibi diğer evcil kuşlara bulaşan benzer virüsleri içeren taksonomik bir isim olan kanatlı hayvan (Avian) coronavirüsüdür. Zooteknik parametreler ve semptomların varlığı Enfeksiyöz Bronşit (IB) salgınlarının ön kanıtı olarak faydalı olsa da, IBV'nin neden olduğu belirtiler patognomonik değildir. Bu nedenle, IBV suşlarını saptamak ve karakterize etmek için laboratuvar tahlilleri zorunludur. IBV enfeksiyonunun tanısında konvansiyonel ve gelişmiş yöntemler kullanılmaktadır ve bunlar doğrudan tanı, virüs izolasyonu gibi dolaylı tanı ve serolojik tanı yöntemleri olarak tanımlanabilirler. En çok kullanılan tanı testleri viral izolasyon, serolojik ve moleküler testleri içerir. Bir testin diğerine tercih edilmesi, numunenin türüne, test materyallerinin ve tesislerinin mevcudiyetine, test raporlama süresine, testin amacına ve testin sahada mı yoksa laboratuvarda mı gerçekleştirildiğine göre yönlendirilir (Bande vd., 2016). IBV tanısına yönelik farklı test prosedürleri bu derlemede sunulmaktadır.

2. VİRÜS İZOLASYONU

Saha virüslerinin izolasyonu sırasında, IB İLE uyumlu bulgular ilk gözlemlendiğinde, enfeksiyondan sonraki ilk hafta, muhtemelen klinik belirtilerden önce numuneler anında toplanmalıdır (Jackwood ve de wit., 2013). Tercih edilen örnek, özellikle akut fazda trakeal dokular veya sürüntülerdir, ancak yumurta kanalı veya böbrekler de, özellikle lezyonların varlığında uygun bölgelerdir. Çekal tonsiller ve kloakal sürüntüler de izolasyon için kullanılabilir, ancak viral geri kazanım oranı daha düşük görünmektedir (Jackwood ve de wit., 2013). Sürü veya çiftlik düzeyinde IBV varlığının araştırılması için, hem semptomatik hem de sağlıklı hayvanlardan havuzlanmış örnekler alınmalıdır. Örnekler buz üzerinde dikkatlice saklanmalı ve virüs canlılığını korumak için hızla laboratuvara gönderilmelidir. Spesifik patojen içermeyen (SPF) tavuklardan alınan embriyonlu yumurtaların trakeal organ kültürleri (TOC'ler) veya allantoik boşluğu hücre kültüründen daha etkili olarak kabul edilir (Darbyshire vd., 1975). IBV embriyonlu yumurtalarda kültürlendiğinde bodurluk, kıvrılma, mezonefroza ürat birikintileri ve embriyonik ölüme neden olur ve TOK'larda siliostaza neden olur. Lezyonlar



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genellikle embriyonlu yumurtalar kullanılırken üçüncü pasajda gözlenirken, TOC'lerde siliostasis genellikle ilk pasajdan sonra meydana gelir (Cavanagh ve Gelb, 2008). Her iki durumda da, bu belirtilerin varlığı IBV varlığının yerine getirilmesine izin vermez. İzole edilen suşun kanıtlanması ve ilave karakterize edilmesi için biyomoleküler veya serolojik yöntemler kullanılmalıdır (OIE, 2020). Bu günlerde, viral izolasyon, uzun zaman alması ve kritik gereksinimleri nedeniyle tanısal çalışma için rutin olarak yapılmamaktadır, ancak yine de aşı üretimi, patojenite testleri, tüm genom dizilemesinden önce numune zenginleştirme ve aşılarda virulent zorluklara karşı sağladığı korumanın değerlendirilmesi gibi diğer alanlar için yararlı ve gereklidir.

3. ELEKTRON MİKROSKOPİSİ

Elektron mikroskobu, coronavirüslerinin morfolojik özelliklerine dayalı olarak biyolojik örneklerde IBV'yi saptamak ve tanımlamak için doğrudan bir yol sağlar. Pozitif kültürler, fosfotungstik asit ile negatif boyamanın ardından sivri çıkıntılı coronavirüs benzeri pleomorfik yapıların varlığına dayalı olarak doğrulanır. Önemli olarak, teşhis kararları verilirken virüsün şekli ve çapı (120 nm) dikkate alınır. Negatif boyama yönteminin yanı sıra, transmisyon elektron mikroskobu (TEM), enfekte hücrelerde virüs benzeri parçacıkların görüntülenmesini sağlayan kullanışlı bir araçtır (Arshad, 1993; Patterson ve Bingham, 1976). Bununla birlikte, bu yöntem genellikle viral bağlanmayı ve hücreye girişi anlamak için uygulanır ancak spesifik bir tanı testi değildir (Arshad vd., 2002).

4. İMMÜNOHİSTOKİMYA

İmmünoperoksidaz ve immünofloresan, enfekte doku ve/veya hücrelerden IBV antijeninin saptanması ve doğrulanması için iki önemli histokimya yöntemidir. Bu yöntemler antijen-antikor reaksiyonlarına dayalı olarak çalışır (Bezuidenhout vd., 2011; Arshad ve Al-Salihi, 2002). Avidin-biotin kompleksi (ABC) gibi immünoperoksidaz yöntemleri, doku örneklerinde IBV antijenini lokalize etmek için başarılı bir şekilde kullanılmıştır (Abdel-Moneim vd., 2009). Benzer şekilde, dolaylı immünofloresan tahlili en sık kullanılan floresan tekniğidir (Yagyu ve Ohta, 1990).

5. SEROLOJİ

Hemagglütinasyon inhibisyonu (HI) ve virüs nötralizasyonu (VN) gibi serolojik testler, geçmişte IBV suşlarının saptanması ve serotiplenmesi için yaygın olarak kullanılıyordu. Bu testler ayrıca aşılamayı takiben sürü korumasını ölçmek için de kullanılmıştır (King ve Cavanagh, 1991). HI testi daha az güvenilir olarak bildirilmiş olsa da, serotipe özgü antikorlar genellikle HI



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kullanılarak saptanır (OIE, 2008). Öte yandan, ELISA testleri, maruziyet veya aşılamanın ardından saha kullanımı ve gözlem antikor yanıtı için kolayca uygulanır ve daha duyarlıdır. Bununla birlikte, yaygın olarak bulunan antiserumlarla çapraz reaksiyona girmeyen farklı IBV serotiplerinin ortaya çıkması, genel olarak serolojik testleri sonuçsuz hale getirmiştir ve ortaya çıkan veya yeni IBV izolatlarının sınıflandırılmasında daha az uygulanabilir hale gelmiştir (Cavanagh vd., 1992; Kant vd., 1992).

6. MOLEKÜLER TANI YÖNTEMLERİ

Moleküler laboratuvar tanısı konvansiyonel PCR, Real Time PCR (RT-PCR), Reverse transcription polymerase chain reaction (RT-PCR), Quantitative PCR (qPCR), ve nested PCR ile yapılabilir. Canlı atenüe veya inaktive aşılardan yaygın olarak kullanılması, aşı antikorları ve yabancı orijin virüslerin sürekli olarak ayırt edilemediğinden serolojik yöntemlerle tanıyı karıştırmaktadır. Canlı bir virüs aşısının kalıcılığı, saha suşu etken virüsün izolasyon testlerini de karmaşıktırabilir. Dolaşımdaki viral IBV suşları kısmen veya hiç tanımlanmamıştır, bu da sahada aşılama başarısızlıklarına neden olur. Alanda varyant antijenik suşların görünümü, geleneksel aşılardan indüklenen bağışıklığın etkisizliğini tanımlayabilir. RT-PCR genotiplendirmesi, vahşi tip suşların karakterini belirlemek için serotiplemenin yerini büyük ölçüde seroneötralizasyon (SN) ve inhibisyon hemagglütinasyon (IHA) almıştır. Genin nükleotidini sıralayarak, spike proteinini (S) veya daha spesifik olarak, en fazla sayıda epitopun nötralize edici antikorlar tarafından tanımlandığı S proteininin S1 alt birimini kodlayan geni kodlayan antijenik varyasyonun moleküler bazları test edilebilmektedir. IHA veya SN'nin sonuçlarıyla, farklı genotipler, yalnızca mevcut serum nötralizasyonu ile açıkça ayırt edilebilen diğer virüslerin S1 alt biriminin amino asit dizilerinde genel olarak büyük farklılıklar (%20-50%) sergiliyorsa kesin bir korelasyon gözlemlenmez (Alvarado vd., 2005). Bununla birlikte, sero-nötralizasyon ile tanımlanan serotipe kıyasla S1 sekansı ile elde edilen sonuçlar, sekanslama tarafından sağlanan veriler temelinde aşı suşlarının seçilmesini mümkün kılar. Moleküler prosedürlerin ana avantajı, kullanılan testlere ve hızlarına göre çok çeşitli genotipleri tespit edebilmeleridir. Restriksiyon fragmanı polimorfizmi (RFLP)-bağlı reverse transkripsiyon polimeraz zincir reaksiyonu (RT-PCR), RT-PCR amplifikasyonundan sonra S1'in enzimatik sindirimi ile elde edilen kısıtlama fragmanlarının elektroforezi ile elde edilen benzersiz bant profilleri temelinde farklı IBV serotiplerini ayırt edebilir. RFLP RT-PCR yöntemi, klinik örneklerle aşılanmış yumurtalardan toplanan sıvılarda IBV'yi ilk olarak saptamak için biyotin etiketli bir prob ile birlikte kullanılabilir ve S1 genotipine özgü RT-PCR,



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tüm IBV serotiplerini tanımlayabilir. Massachusetts (Mass), Connecticut ve Arkansas serotipleri için S1 gen primerleri spesifiktir ve tüm IBV serotiplerini tanımlayabilen bir çift evrensel primer ile kombinasyon halinde kullanılır. Diğer varyant serotipler, geleneksel primerler kullanılarak IBV olarak tanınabilir, ancak serotip belirlenemez. Birkaç IBV serotipinden kaynaklanan çoklu enfeksiyonlar teşhis edilebilir. S1 geninin tanısasal olarak anlamlı bir parçasının nükleotid dizilemesi, IBV suşlarını ayırt etmek için en yararlı prosedürdür ve birçok laboratuvarında tercih edilen yöntem haline gelmiştir. Dizileme ayrıca, IBV suşları arasında sıklıkla rekombinasyonun meydana geldiği gözlemlenmiştir. Daha önce IBV olarak tanınan izolatları veya vahşi tip varyantları tanımlamak için RT-PCR ürününün (S1'in hiper değişken terminal kısmı) dizilimini kullanmak mümkündür. Akrabalık derecelerini doğrulamak için varyantların ve bilinmeyen yabancı izolatların sekanslarının referans suşlarla analizi ve karşılaştırılması, sekanslamanın önemli avantajlarıdır (Khataby vd., 2020).

7. SONUÇ

IBV enfeksiyonunun tanısında konvansiyonel ve moleküler teknikler gibi gelişmiş yöntemler kullanılmaktadır ve bunlar doğrudan tanı, virüs izolasyonu gibi dolaylı tanı ve serolojik tanı yöntemleri olarak tanımlanabilirler. Bir testin diğerine tercih edilmesi, numunenin türüne, test materyallerinin ve işletmelerin laboratuvar imkanlarına, test raporlama süresine, testin amacına ve testin sahada mı yoksa laboratuvarında mı gerçekleştirildiğine göre yönlendirilmektedir. IBV enfeksiyonunun tanısında kullanılan konvansiyonel yöntemler olan serolojik ve virüs izolasyonu yöntemleri zaman içerisinde yerlerini moleküler tanı gibi alternatif ve gelişmiş yöntemlere bırakmışlardır. IBV tanısında standart bir tanı yönteminden ziyade, işletmelerin taleplerine ve özelliklerine en uygun olanına vaka bazında karar vermek ve uygulamak en doğru tanı yaklaşımı olacaktır.

8. TEŞEKKÜR

Bu çalışma Çukurova Üniversitesi BAP Koordinasyon Birimi tarafından desteklenmiştir. Teşekkür ederiz.



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KAYNAKLAR

Abdel-Moneim, A. S.; Zlotowski, P.; Veits, J.; Keil, G. M. and Teifke, J. P. (2009). "Immunohistochemistry for detection of avian infectious bronchitis virus strain M41 in the proventriculus and nervous system of experimentally infected chicken embryos," *Virology Journal*, vol. 6, article 15.

Alvarado, I.; Villegas, P.; Mossos, N. and Jackwood, M.(2005). Molecular characterization of avian infectious bronchitis virus strains isolated in Colombia during 2003. *Avian Dis.* (49): 494_499.

Arshad, S.; Al-Salihi, K. and Noordin,M. (2002). "Ultrastructural pathology of trachea in chicken experimentally infected with infectious bronchitis Virus-MH-5365/95," *Annals of Microscopy*, vol. 3, pp. (43–47).

Arshad, S. S. and Al-Salihi, K. A. (2002). "Immunohistochemical detection of infectious bronchitis virus antigen in chicken respiratory and kidney tissues," in Proceedings of the 12th Federation of Asian Veterinary Associations Congress/14th Veterinary Association Malaysia Scientific Congress, p. 51.

Arshad, S. S. (1993). A study on two malaysian isolates of infectious bronchitis virus [Ph.D. thesis], Universiti Pertanian Malaysia.

Bande, F. ; Arshad ,Siti S. ; Omar, A. ; Hair, M. B. ; Salisu, M. A and Abba, Y. (2016). Pathogenesis and Diagnostic Approaches of Avian Infectious Bronchitis.(review article). *Advances in Virology*. Volume 2016. 11 Pages.

Bezuidenhout,A.; Mondal, S. P. and Buckles, E.L.(2011). "Histopathological and immunohistochemical study of air sac lesions induced by two strains of infectious bronchitis virus," *Journal of Comparative Pathology*, vol. 145, no. 4, pp. (319–326).

Cavanagh, D. and Gelb, J., Jr. (2008). Infectious bronchitis. In *Diseases of Poultry*, 12th ed.; Blackwell Publishing: Ames, IA, USA. pp. (117–135).

Cavanagh, D.; Davis,P.J and J. K. Cook, J.K. (1992). "Infectious bronchitis virus: evidence for recombination within the Massachusetts serotype," *Avian Pathology*. Vol. (21): no. 3, pp. (401–40).

Darbyshire, J.H.; Cook, J.K.A. and Peters, R.W. (1975). Comparative growth kinetic studies on avian infectious bronchitis virus in different systems. *J. Comp. Pathol.*, (85): 623–630.

Jackwood, M.W. and deWit, J.J. (2013). Infectious bronchitis. In *Diseases of Poultry*, 13th ed.; Blackwell Publishing: Ames, IA, USA, pp. (139–160).



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Kant,A.; Koch, G.; Van Roozelaar,D.J.; Kusters, N J. G.; Poelwijk, F. A. J. and Van der Zeijst, B. A. M. (1992). "Location of antigenic sites defined by neutralizing monoclonal antibodies on the S1 avian infectious bronchitis virus glycopolyptide," *Journal of General Virology*, vol. 73, no. 3, pp. (591–596).

Khataby,K.; Yassine, K.; Amal, S.; , Chafiq, L. and Moulay ,M. E.(2020). 33. Avian Coronavirus: Case of Infectious Bronchitis Virus Pathogenesis, Diagnostic Approaches, and Phylogenetic Relationship among Emerging Strains in Middle East and North Africa Regions. *Emerging and Reemerging Viral Pathogens*. Elsevier Inc. Pages : (729-737).

King,D. and D. Cavanagh, D.(1991). "Infectious bronchitis," *Diseases of Poultry*. Vol. (9),pp: (471–484).

Milek,J. and Blicharz-Domanska, K. (2018) . Coronaviruses in avian species – review with focus on epidemiology and diagnosis in wild birds. (Review article). *J.Vet. Res.* (62): 249-255.

OIE (2008).Avian Infectious Bronchitis, chapter 2. 3. 2.

Patterson,S. and Bingham, R.W.(1976). "Electron microscope observations on the entry of avian infectious bronchitis virus into susceptible cells," *Archives of Virology*, vol. 52, no. 3, pp. (191–200).

World Organization for Animal Health. Avian Infectious Bronchitis. In *OIE Terrestrial Manual 2018*.Available online:www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.03.02_AIB.pdf. (Accessed on 18 June 2020).

Yagyu, K. and Ohta, S. (1990). "Detection of infectious bronchitis virus antigen from experimentally infected chickens by indirect immunofluorescent assay with monoclonal antibody," *Avian Diseases*, vol. 34, no. 2, pp. (246–252).



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**REYHAN ESANSİYEL YAĞININ FARKLI KONSANTRASYONLARDA *Phytium* SP.
VE *Alternaria solani* FUNGUSLARINA KARŞI MİSELİYAL GELİŞİMİ İNHİBİSYON
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ÖZET

Reyhan, *Ocimum basilicum*, gıda endüstrisinde ve parfümeride, diş ve ağız ürünlerinde geniş bir uygulama alanı olan en popüler aromatik bitkilerden biridir. Ayrıca geleneksel tıpta baş ağrısı, öksürük, soğuk algınlığı, sakinleştirici, ishal, kabızlık, siğiller, solucanların tedavisinde ve toksinlerin giderilmesinde kullanılmıştır. Bu biyoaktivite dikkate alınarak, bu çalışmada reyhan esansiyel yağının sürdürülebilir tarım açısından önemli olan iki fitopatojen *Phytium* sp. ve *Alternaria solani* funguslarına karşı inhibisyon aktivitesi araştırılmıştır. Esansiyel yağın altı farklı konsantrasyonu (7 µl, 8 µl, 9 µl, 10 µl, 20 µl, 30 µl, 40 µl, 50, 60 µl, 70 µl ve 80 µl) ayrı PDA besi ortamına ilave edilerek antimitotik aktiviteleri istatistiki olarak değerlendirilmiştir. Ayrıca miseliyal çaplar ölçülerek yüzde inhibisyon hesaplanmıştır. Reyhan esansiyel yağının artan doza bağlı konsantrasyonlarında denemeye alınan fungusların miseliyal gelişimine engel olduğu tespit edilmiştir. Reyhan esansiyel yağının iki fungus üzerine yüzde inhibisyon etkinliği en düşük dozda 40 µl iken, en yüksek dozda 7 µl olarak belirlenmiştir. Fungusların kontrol grubu ile 7 µl uygulaması arasında istatistiksel olarak bir fark belirlenmemiştir. Bu çalışmada; reyhan esansiyel yağının minimum dozlarda kültür bitkilerinin iki kritik etmenine karşı engelleyici etkisinin olduğu rapor edilmiştir. Bu kapsamda; kök çürüklüğü ve erken yanıklık hastalıklarını kontrol altına almak için, reyhan esansiyel yağı kullanılarak fungusit geliştirilmesi amacıyla ümitvar olarak belirlenmiştir.

Anahtar Kelimeler: Reyhan esansiyel yağı, yüzde inhibisyon, Fitopatojen fungus



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**MYCELIAL GROWTH INHIBITION ACTIVITY OF BASIL ESSENTIAL OIL AT
DIFFERENT CONCENTRATIONS AGAINST *PHYTIUM* AND *ALTERNARIA
SOLANI***

ABSTRACT

Basil leaves (*Ocimum basilicum*) is one of the most popular aromatic herbs used in a wide application in the food industry and perfumery, as well as in dental and oral products. It has also been used in traditional medicine for the treatment of headaches, coughs, colds, sedatives, diarrhea, constipation, warts, worms, and removal of toxins. Considering this bioactivity, in this study, basil essential oil was found to be two phytopathogens, *Phytium* sp. and *Alternaria solani* fungi were investigated. Six different concentrations of essential oil (7 μ l, 8 μ l, 9 μ l, 10 μ l, 20 μ l, 30 μ l, 40 μ l, 50, 60 μ l, 70 μ l and 80 μ l) were added to separate PDA medium and their antimycelial activities were statistically evaluated. In addition, percent inhibition was calculated by measuring mycelial diameters. It was determined that the increased dose-dependent concentrations of basil essential oil prevented the mycelial growth of the fungi included in the experiment. While the percent inhibition efficiency of basil essential oil on two fungi was 40 μ l at the lowest dose, it was determined as 7 μ l at the highest dose. There was no statistical difference between the control group and 7 μ l application of the fungi. In this study, negative effects of basil essential oil against two critical factors of cultivated plants were reported at minimum doses. In this context, basil essential oil is promising for the development of various fungicides to control root rot and early blight diseases.

Keywords: Basil essential oil, percent inhibition, Phytopathogen Fungus



GİRİŞ

Fesleğen olarak da bilinen reyhan (*Ocimum basilicum* L., Lamiaceae) Asya, Afrika ve Güney Amerika'nın tropikal ve subtropikal bölgelerinde yetişen yıllık bir bitkidir. Kendine özgü aroması sayesinde yaygın olarak gıda katkısı şeklinde kullanılan aromatik bir bitkinin yaprakları taze veya kurutulmuş olarak baharat olarak kullanılabilir ya da farklı içecek çeşitlerinin hazırlanmasında yararlanılabilir. *Ocimum* cinsinin 150'den fazla türü arasında, fesleğen (*O. basilicum*) dünya çapında başlıca esansiyel yağ bitkisidir ve birçok ülkede ticari olarak yetiştirilmektedir. Reyhan esansiyel yağları bitkinin yaprak ve çiçek rengi, aroması ve bitkinin kökenine bağlı olarak geniş ve çeşitli kimyasal bileşik içerir (Da-Silva et al. 2003; Sajjadi 2006). Taze yaprak ve çiçeklerden elde edilen uçucu yağlar, gıda aroması katkı maddeleri olarak, farmasötik, parfümeri ve kozmetikte kullanılabilir (Javanmardi et al.2002). Yanı sıra geleneksel olarak fesleğen baş ağrısı, öksürük, ishal, kabızlık, siğiller, solucan ve böbrek fonksiyon bozukluklarının tedavisinde tıbbi bir bitki olarak kullanılmıştır (Simon et al. 1999).

Reyhan bitkisindeki başlıca uçucu yağ bileşenleri arasında estragol, linalool ve öjenol yer alır (Omidbaigi et al. 2003; Hussain et al. 2008). Bassole' et al. (2010), reyhandaki ana bileşiklerden linalool'ün %57 ve öjenolün %19.2 oranında olduğunu rapor etmiştir. Literatürdeki çalışmalar, bir monoterpen olan linalool'ün antibakteriyel aktiviteden sorumlu ana bileşen olduğunu göstermektedir (Ravid et al. 1997). Öte yandan uçucu yağda bulunan feniletal alkol, kafur, izolelen, globulol ve leolene alkol gibi daha düşük miktarlarda bulunan bileşenler de bu yağın antibakteriyel aktivitesine katkıda bulunmaktadır (El-Sakhawy et al. 1998; Lago et al. 2004; Sartoratto et al. 2004; Deba et al. 2008). Minör bileşenlerin diğer aktif bileşiklerle bir tür sinerjizm içerisinde yer aldığı düşünülmektedir (Marino et al.2001).

Reyhan uçucu yağlarının antibakteriyel aktivitesi ile ilişkili farklı bakteriyel türler üzerinde farklı inhibisyon oranları belirlenmiştir. Reyhan uçucu yağı, *Staphylococcus aureus*, *E. faecalis*, *L. monocytogenes*, *E. aerogenes*, *E. coli*, *S. enteric* ve *S. typhimurium* suşlarına karşı antibakteriyel aktivite gösterdiği raporlar arasında yer almaktadır (Bassole' ve ark. 2010). Viviane ve ark. (2016) tarafından yürütülen diğer bir çalışmada, söz konusu esansiyel yağ klinik öneme sahip infeksiyöz bakteriler *S. aureus* ve *Pseudomonas aeruginosa* bakterilerine karşı *in vitro* koşullarda test edilmiştir. Çalışma sonucunda mevcut antibiyotiklerle birlikte bu esansiyel yağın antibakteriyel etkinliği artırabileceği tespit edilmiştir. Diğer yandan reyhan uçucu yağı gıda kaynaklı patojen bakterilere karşı da test edilmiştir. Çalışmada reyhan uçucu yağının



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seyreltik solüsyonu (10 µL/ disk 1:5, v/v metanol ile seyreltme) ve metanol ekstraktları (300 µg/disk) *Bacillus cereus*, *B. subtilis*, *B. megaterium*, *S. aureus*, *Listeria monocytogenes*, *E. coli*, *Shigella boydii*, *Sdysenteriae*, *Vibrio parahaemolyticus*, *V. mimicus* ve *Salmonella typhi* bakterilerine karşı büyük bir antibakteriyel aktivite potansiyeli sergiledi (Hossain et al., 2010). Uçucu yağdaki farklı bileşiklerin antibakteriyel aktiviteleri farklı çalışmalarda da rapor edilmiştir (Saxena ve Sharma, 1999; Sartoratto et al. 2004; Inouye et al. 2006; Deba et al. 2008). Reyhan yağının çeşitli bitki ve hayvan kökenli fungal etmenlere karşı olan antifungal aktivitesi de bilimsel literatürde geniş kapsama alanı oluşturmıştır (Reuveni et al.1984; Omidbaigi et al. 2003; El-Soud et al. 2015). Tarımsal açıdan önemli olan iki fungal etmen *Pythium* ve *Alternaria solani* birçok ekonomik üründe kalite ve kandıte kaybına neden olmaktadır. *Pythium* cinsleri, Chromista aleminde yer alan ekonomik açıdan önemli birçok patojen türü içerir. Bununla birlikte, *Pythium*'un çeşitli mikoparazitik ve entomopatojenik türleri sırasıyla diğer bitki patojenik fungusları ve sivrisinekler dahil zararlı böcekleri başarılı bir şekilde kontrol etmek için kullanılırken, diğerleri eczacılık ve gıda endüstrisi için değerli kimyasallar üretmek için kullanılmaktadır (Ho 2018). *Pythium* türleri öncelikle tek çenekli otsu bitkilere saldırırken, bazıları balıklarda, kırmızı alglerde ve insanlar dahil memelilerde farklı sorunlara yol açmaktadır. Yanı sıra bitkinin sukkulent dokularını hedef alarak gövde çürüklükleri ve çökerten gibi geri dönüşümsüz zararlara yol açar (Hendrix 1973). Diğer bir patojen *A. solani* ise başta domates olmak üzere solanaceae familyasındaki birçok bitkide erken yaprak yanıklığı enfeksiyonunun sorumlusudur. Organizma havadan bulaşır, toprakta yaşar ve yoğun çiy, sık yağış ve yüksek nemli bölgelerde yetiştirilen bitkilerde sıklıkla karşılaşılır (Agrios 2005; Rahmatzai et al. 2016). Bu çalışmada, reyhan (*Ocimum basilicum* L.) uçucu yağının antibakteriel ve antifungal özelliklerinden yola çıkarak *Pythium* ve *A. solani*'nin miseliyal gelişimi üzerindeki etkileri bir dizi artan konsantrasyon kullanılarak değerlendirilmiştir.

MATERYAL VE YÖNTEM

Bitki Materyali

Denemede kullanılan Reyhan (*Ocimum basilicum*) bitkisinin esansiyel yağı ticari özel bir firmadan temin edilmiştir.



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Çalışmada Kullanılan Fungal İzolat

Bitki patojeni funguslar *Alternaria solani* ve *Pythium* sp. Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi Bitki Koruma Bölümü fungal kültür koleksiyonundan alınmıştır.

Kültür Ortamlarının Hazırlanması

Fitopatojen fungal izolatların çoğaltılması için funguslarda genel besi yeri olarak kullanılan Patates Dekstroza Agar (PDA) ve dH₂O kullanılmıştır. Hazır hale getirilen besi yeri otoklavda 121°C’de 15 dk steril edilmiştir. Ardından steril 90 mm’lik steril plastik petri kaplarına eşit şekilde aktarılmıştır. Uygulama grubu, reyhan (*Ocimum basilicum*) esansiyel yağları 7 µl, 8 µl, 9 µl, 10 µl, 20 µl, 30 µl, 40 µl, 50, 60 µl, 70 µl ve 80 µl oranlarında steril edilmiş ortamlara eklemeleri yapılarak oluşturulmuştur.

İnokulum İçin Patojen Fungusların Hazırlanması

Patojen fungal izolatların 90 mm’lik steril plastik petri kaplarına hazırlanmış olan katı besiyerine inokulumları yapılmış ve 25°C de 7 gün inkübasyona bırakılarak geliştirilmiştir. Antifungal aktiviteyi test etmek için kültürlerden 8 mm diskler fungus delici yardımıyla hazırlanmıştır.

Antifungal Aktivitenin değerlendirilmesi

Sterilizasyon için PDA 121°C’de 15 dakika otoklavlanıp uygun sıcaklık aralığına getirildikten sonra reyhan uçucu yağı 7 µl, 8 µl, 9 µl, 10 µl, 20 µl, 30 µl, 40 µl, 50 µl, 60 µl, 70 µl, 80 µl oranlarında ilave edilmiştir. Sterilize edilen karışımdan her bir steril petriye (90 mm çap) 20 ml dökülmüştür. 8 mm’lik fungal diskler hazırlanmış olan PDA besi ortamlarının bulunduğu petrilerin tam ortasına, fungusun besi ortamına temas edecek şekilde yerleştirilmiş ve petrilerin etrafı parafilm ile kaplanmıştır. Petriler 24±1°C’de 7 gün inkübasyona bırakılmıştır. Kontrol grubu olarak kullanılacak petrilere ise sadece PDA ortamına aktarımı yapılmıştır. Çalışmadan 7 gün sonra fungal koloni çaplarının kumpas ile koloni çaplarının birbirine dik ve ayrı yönde ölçülmesiyle yapılmış, elde edilen fungus çapları kaydedilmiştir (Benjlali ve ark. 1984). Hazırlanan solüsyonların % engelleme oranları belirtilen formül yardımıyla hesaplanmıştır (Deans ve Svoboda 1990). Denemeler 3’er tekerrürlü olarak yapılmıştır.

$$\text{Engelleme (\%)} = \frac{g_c - g_t}{g_c} \times 100$$



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g_c = inokulum disk çapı çıkarılarak inkübasyon süresinden sonra kontrol setinde ölçülen miselyal koloninin çapı.

g_t = inokulum disk çapı çıkarılarak inkübasyon süresinden sonra ölçülen miselyal koloninin çapı.

İstatistik Analiz

Uygulanan solüsyonlar arası farklılıkları belirlemek için varyans analizi (ANOVA) kullanılmış, verilerin varyanslarının homojen olup olmadığı test edilmiş ve test sonucunda varyansların homojen olduğu ve parametrik testlerin uygulanabilir olduğu sonucuna varılmıştır. Ortalamalar DUNCAN testi kullanılarak karşılaştırılmıştır.

SONUÇLAR VE TARTIŞMA

Bu çalışma, *O. basilicum* L. uçucu yağının *Pythium* ve *A. solani* funguslarının misel gelişimine karşı antifungal özelliklerini doğrulamaktadır. Test edilen uçucu yağ, kullanılan yağ konsantrasyonuna bağlı olarak önemli antifungal aktivite göstermiştir ve sonuçlar tablo 1 de verilmiştir.

Tablo 1. *Ocimum basilicum* (reyhan) yağının *Pythium* sp. ve *Alternaria solani* patojenleri üzerinde ki fungus çap ortalama değerleri

Doz /Fungus	Fungus çapı ortalamaları		
	Fungus		
Doz (µl)	<i>A. solani</i>	<i>Pythium</i>	Genel ortalama
0	36,33±0,577	75,00±1,732	55,67±21,210e
7	36,33±0,577	75,00±1,732	55,67±21,210e
8	34,00±16,462	58,67±4,933	40,33±22,836d
9	33,00±1,000	41,33±6,351	37,17±6,113d
10	28,33±1,155	26,67±0,577	27,50±1,225c
20	16,67±12,702	21,67±0,577	19,17±8,495b
30	13,33±9,815	14,00±10,440	13,67±9,070ab
40	7,67±5,774	8,33±6,429	8,00±5,477a
50	8,00±0,000	8,00±0,000	8,00±0,000a
60	8,00±0,000	8,00±0,000	8,00±0,000a
70	8,00±0,000	8,00±0,000	8,00±0,000a
80	8,00±0,000	8,00±0,000	8,00±0,000a
Genel ortalama	17,21±12,185	25,24±22,942	21,23±18,670

±: standard sapma, aynı sütunda farklı harflerle gösterilen ortalamalar arasındaki farklar istatistiki olarak önemlidir.

Fungus çap ortalamalarında *in vitro* koşullarda reyhan yağı uygulamasında *A. solani* ve *Pythium* sp. funguslarında 7 µl doz uygulaması kontrol grubu 0 µl doz uygulaması ile aynı değerleri vererek iki patojen üzerinde de etkisiz olarak değerlendirilmiş ve istatistiki olarak aynı grupta



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yer almıştır. Doz arttırımına bağlı olarak her iki funfusunda misel gelişiminde azalmalar meydana gelmiş ve 40 µl doz uygulamasından itibaren bariz sonuçlar verip 50 µl doz uygulamasından itibaren hiçbir misel gelişim gözlemlenmemiştir. Ve en iyi uygulama doz uygulaması 50 µl itibari ile daha fazlasına gerek kalmadan düşük dozlarla tarımsal açıdan ekonomik olarak zararlı kabul edilen funguslarla mücadele için uygun bir fungusidal olarak değerlendirilmiş ve sonuçlar tablo 1’de verilmiştir. Yüzde engelleme oranları ise tablo 2’de verilmiştir.

Tablo 2. *Ocimum basilicum* (reyhan) yağının *Phytium* sp. ve *Alternaria solani* patojenleri üzerindeki % engelleme oranları

Doz (µl)	Yüzde Engelleme oranı (%)*	
	<i>A. solani</i>	<i>Phytium</i>
0	0	0
7	0	0
8	6,41	27,83
9	9,16	44,89
10	22,02	64,44
20	54,11	71,10
30	63,30	81,33
40	78,88	88,89
50	77,97	89,33
60	77,97	89,33
70	77,97	89,33
80	77,97	89,33

Tablo 2 incelendiğinde 40 µl doz uygulaması itibariyle 40,50,60,70 ve 80 µl doz uygulamaları en yüksek engelleme yüzde oranlarını vermiştir ve her iki fungusta da fungal gelişimi durdurmuştur. Yürütmüş olduğumuz bu çalışma diğer çalışmalara paralel bir sonuç vermiştir. Reyhan esansiyel yağının güçlü antifungal etkisi hakkında birçok çalışma dünya çapında rapor edilmiştir. Sadece esansiyel yağ değil aynı zamanda bitkinin ekstraktlarını fungal biyoaktiviteleri ile ilgili yürütülen çalışmalarda da benzer sonuçlar elde edilmiştir. Farklı bir reyhan türü (*O. sanctum*) ile gerçekleştirilen testlerde bitkinin ekstraktları üç pirinç patojeninin *in vitro* koşullarda gelişimini inhibe ettiğini gösterilmiştir (Tewari ve Najak 1991). Benzer şekilde *O. gratissimum* ekstraktları 50 ila 500 ppm arasındaki konsantrasyonlarda *Colletotrichum capsici* ve *Sclerotium rolfsii*’nin gelişiminde %100 inhibisyon sergilediği saptanmıştır (Khanna et al. 1991). Daha önce yürütülen araştırmalar, reyhan ekstraktlarının ve uçucu yağın başlıca antimikrobiyal ve antifungal bileşenleri olarak linalol, estragol, öjenol ve



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metil sinamatı kullanılarak ele alınmıştır (Reuveni et al. 1984). Bazı çalışmalar *Aspergillus niger*, *A. ochraceus* ve *Fusarium culmorum*'un gelişimi üzerine ana bileşen olarak estragol içeren uçucu yağın güçlü antifungal etkisine işaret ederken (71.0 -%94.76 arasında inhibisyon) (Özkan ve Erkmen 2001), diğerleri ise linalol ve estragol'ün öjenol ile karşılaştırıldığında (%38.1 inhibisyon) *R. nigricans*'a karşı daha etkili olduğunu tespit etti (%100 inhibisyon) (Alpsoy 2010). Öjenol'ün *F. oxysporum*'a karşı daha güçlü inhibisyon (inhibisyonun %100'ü) sergilerken, linalool ve estragol'ün inhibisyon değerleri sırasıyla %26.4 ve %30.3 olarak tespit edildi (Tanackov et al. 2011). Oxenham et al. (2005) tarafından yürütülen çalışmada reyhan esansiyel yağındaki iki temel bileşenin fungusit ve fungusidal etkileri, bir dizi *in vitro* ve *in vivo* denemelerle incelenmiştir. Fitopatojen fungus *Botrytis fabae*'nin misel büyümesi, hem metil kavikol hem de linalol kemotip yağı tarafından önemli ölçüde azaltıldığı belirlenmiştir.

Doube ve ark. (1989), agar plaka yöntemini kullanarak, 1.5 ml/l'lik bir konsantrasyonda reyhan yağının, aflatoksijenik suşlar olan *Aspergillus parasiticus* ve *A. flavus* dahil olmak üzere 22 küf fungus türünün gelişimini tamamen engellediğini gösterdi. *Candida albicans* ve *A. flavus* üzerinde yapılan bir başka çalışmada, reyhan esansiyel yağının, mikrodilüsyon yöntemi kullanılarak 7 günlük inkübasyon süresince 5000 ppm konsantrasyonda bu organizmaların büyümesini tamamen engellediği bildirilmiştir (Zollo et al. 1998). Soliman ve Badeaa, (2002), 2000 ppm konsantrasyonda bu uçucu yağın *F. verticillioide*s'e karşı fungistatik bir ajan olarak ve 3000 ppm konsantrasyonda bir fungusit ajan olarak etki ettiğini bulmuşlardır. Etmenin tam gelişimi 2,7 µL/mL'den yüksek konsantrasyonlarda tamamen inhibe edilmiştir (Fandohan et al. 2004). Reyhan bitkisinin su ekstraktlarının etkinliği, *in vitro* olarak *S. rolfssii*'nin misel büyüme inhibisyonunun ölçülmesiyle ve *in vivo* domates fidelerindeki hastalık insidansının yüzdesinin hesaplanması ile belirlendi. Sulu ekstraktlar fungusun gelişimini *in vitro* şartlarda engellerken (%33.35), *in vivo* koşullardaki performansı etkisiz olarak kabul edilmiştir (Nugroho et al. 2019). Usanmaz Bozhüyük ve Kordali (2019) tarafından reyhan esansiyel yağı laboratuvar koşullarında altı *Fusarium* türü, *Rhizoctonia solani*, *A. solani* ve *Verticillium dahliae* fitopatojenik funguslarına karşı test edilmiştir. Yağın 5, 10, 15 ve 20 µL petri⁻¹ uygulama serileri tüm fungusların gelişimini %23-100 oranında inhibe etmiştir. Adıgüzel et al. (2005), reyhan esansiyel yağının heksan, metanol ve etanol ekstraktlarının *Agrobacterium*, *Bacillus*, *Erwinia*, *Escherichia*, *Pseudomonas*, *Ralstonia*, *Salmonella*, *Staphylococcus*, *Streptococcus* ve *Xanthomonas* olmak üzere 29 bakteri türüne karşı yüksek antibakteriyel aktivite gösterdiğini,



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ancak bu ekstraktların hiçbirinin *Alternaria alternata*, *A. flavus*, *F. oxysporum* ve *Penicillium* spp.'ye karşı antifungal aktiviteye sahip olmadığını tespit etmişlerdir.

O. basilicum' un 2 çeşit fungus üzerinde farklı düzeylerde engelleyici etkiye sahip olduğu belirlenmiştir. Uçucu yağın on farklı konsantrasyonu da (7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80 µL petri-1) fungusların misel gelişimini kontrole göre istatistiki olarak engellemiştir. Yapılan değerlendirmeler sonucunda *O. basilicum* uçucu yağının antifungal aktivitesinin etkileri Tablo 1' de verilmiştir. Reyhan uçucu yağının *A. Solani* fungusunu yüzde engelleme oranları % 0 ile % 78,88 arasında tespit edilmiştir. Bu fungus için en yüksek engelleme oranı 40 µL petri -1 'lik konsantrasyonda (%78, 88) belirlenirken, bu konsantrasyonu 50 µL, 60 µL, 70 µL, 80 µL (%77,97) ve 30 µL (63,30), 20 µL (54,11), 10 µL (22,02), 9 µL (9,16) ve 8 µL (6,41) petri -1 'lik konsantrasyonlar takip etmiştir. 7 µL petri -1 'lik konsantrasyonda ise hiç engelleme olmamıştır. Reyhan uçucu yağının *Pythium* fungusunu yüzde engelleme oranları % 0 ile % 89,33 arasında tespit edilmiştir. Bu fungus için en yüksek engelleme oranı 50 µL, 60 µL, 70 µL, 80 µL petri -1 'lik konsantrasyonlarındada (%89, 33) belirlenirken, bu konsantrasyonu 40 µL (88,89), 30 µL (81,33) , 20 µL (71,10), 10 µL (%64,44), 9 µL (44,89) ve 8 µL (27,83) petri -1 'lik konsantrasyonlar takip etmiştir. 7 µL petri -1 'lik konsantrasyonda ise hiç engelleme olmamıştır. Kontrol uygulamasının yüzde engelleme oranı her iki fungus içi; 7 µL petri -1 'lik konsantrasyonlar hariç diğer tüm test edilen konsantrasyonlardan istatistiki olarak ($p \leq 0.01$) farklı bulunmuştur.

Sonuç olarak, yürütülen bu çalışmadan elde edilen sonuçlar, reyhan esansiyel yağının antifungal aktivitelerini ve mikotik enfeksiyonları tedavi etmenin yanı sıra her iki fungusun gelişimini inhibe etmesinden hareketle koruyucu olarak potansiyel kullanımını doğrulamaktadır.



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KAYNAKLAR

- Agrios, G. N. (2005). Plant Pathology. 5th. New York: Elsevier.
- Alpsoy L. (2010). Inhibitory effect of essential oil on aflatoxin activities. Afr J Biotechnol.; 9(17): 2474-2481.
- Bassole' IHN, Lamien-Meda A, Bayala B (2010). Composition and antimicrobial activities of *Lippia multiflora* moldenke, mentha x piperita l. and *Ocimum basilicum* L. essential oils and their major monoterpene alcohols alone and in combination. Molecules 15:7825–7839.
- Da-Silva F, Santos RHS, Diniz ER (2003). Content and composition of basil essential oil at two different hours in the day and two seasons. Braz J Med Plants. 6:33–38.
- Deba F, Xuan TD, Yasuda M, Tawata S (2008). Chemical composition and antioxidant, antibacterial and antifungal activities of the essential oils from *Bidens pilosa* Linn. var. *radiata*. Food Control 19: 346–352.
- Doube S, Upadhyay PD, Tripathi SC. (1989). Antifungal, physicochemical, and insect repelling activity of the essential oil of *Ocimum basilicum*. Can J Bot.; 67: 2085-2087.
- El-Sakhawy FS, El-Tantawy ME, Ross SA, El-Sohly MA (1998). Composition and antimicrobial activity of the essential oil of *Murraya exotica* L. Flavour Frag J 13: 59–62.
- El-Soud NH, Deabes M, El-Kassem LA, Khalil M. (2015). Chemical Composition and Antifungal Activity of *Ocimum basilicum* L. Essential Oil. Open Access Maced J Med Sci.;3(3):374-379. doi:10.3889/oamjms.2015.082
- Fandohan P, Gbenou JD, Gnonlonfin B, Hell K, Marasas WFO, Wingfield M J. (2004). Effect of essential oils on the growth of *Fusarium verticillioides* and fumonisin contamination in corn. J Agr Food Chem.; 52: 6824-6829.
- Hendrix FF, Campbell WA (1973). Pythium as plant pathogens. Annu Rev Phytopathol 11: 77-98.
- Ho HH. (2018). The taxonomy and biology of Phytophthora and Pythium. J Bacteriol Mycol Open Access. 6(1):40-45.
- Hossain, M. A., Kabir, M. J., Salehuddin, S. M., Rahman, S. M. M., Das, A. K., Singha, S. K., Alam K., Rahman, A. (2010). Antibacterial properties of essential oils and methanol extracts of sweet basil *Ocimum basilicum* occurring in Bangladesh. Pharmaceutical Biology, 48(5), 504–511.
- Hussain AI, Anwar F, Sherazi STH, Przybylski R. (2008). Chemical composition, antioxidant and antimicrobial activities of basil (*Ocimum basilicum*) essential oils depends on



**ISPEC 8th INTERNATIONAL CONFERENCE
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Inouye S, Uchida K, Takizawa T, Yamaguchi H, Abe S (2006): Evaluation of the effect of terpenoid quinones on *Trichophyton mentagrophytes* by solution and vapor contact. J Infect Chemother 12: 100–104.

Javanmardi J, Khalighi A, Kashi A, et al. (2002). Chemical characterization of basil (*Ocimum basilicum* L.) found in local accessions and used in traditional medicines in Iran. J Agric Food Chem. 50: 5878–5883.

Khanna R, Johri JK, Srivastava KM, Khanna S. (1991) Screening for alternative biocides amongst plant-based essential oils. Natl Acad Sci Lett 14:3–6.

Lago JHG, de Ávila P Jr, de Aquino EM, Moreno PRH, Ohara MT, Limberger RP, Apel MA, Henriques AT (2004). Volatile oils from leaves and stem barks of *Cedrela fissilis* (Meliaceae): Chemical composition and antibacterial activities. Flavour Frag J 19: 448–451.

Marino M, Bersani C, Comi G (2001). Impedance measurements to study the antimicrobial activity of essential oils from Lamiaceae and Compositae. Int J Food Microbiol 67: 187–195.

Nugroho, C., Mirnia, E., Cumagun, CJ. (2019). Antifungal Activities of Sweet Basil (*Ocimum basilicum* .L) Aqueous Extract Against *Sclerotium rolfsii*, Causal Agent of Damping-Off on Tomato Seedling. AGRIVITA Journal of Agricultural Science. 41. 10.17503/agrivita.v41i1.1920.

Omidbaigi R, Hassani A, Sefidkon F. (2003). Essential oil content and composition of sweet basil (*Ocimum basilicum*) at different irrigation regimes. J Essent Oil Bearing Plants. 6:104–108.

Oxenham, S. K., Svoboda, K. P., & Walters, D. R. (2005). Antifungal Activity of the Essential Oil of Basil (*Ocimum basilicum*). Journal of Phytopathology, 153(3), 174–180.

Özkan M, Erkmén O. (2001). Antimicrobial activity of the essential oils of Turkish plant spices. Eur Food Res Technol.; 212: 658-660.

Rahmatzai, N., Zaitoun, A., Madkour, M., Ahmady, A., Zainullah, H., Mousa, M. (2016). Morphological, Pathogenic, Cultural And Physiological Variability of The Isolates of *Alternaria solani* Causing Early Blight of Tomato. International Journal of Advanced Research. 4. 2320-5407.

Ravid U, Putievsky E, Katzir I, Lewinsohn E. (1997). Enantiomeric composition of linalool in the essential oils of *Ocimum* species and in commercial basil oils. Flavour Fragr J. 12:293–296.



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Reuveni R, Fleisher A, Putievsky E. Fungistatic activity of essential oils from *Ocimum basilicum* chemotypes. *Phytopath.* 1984;110: 20-22.

Sajjadi SE (2006). Analysis of the essential oils of two cultivated basil (*Ocimum basilicum* L.) from Iran. *DARU* 14: 128–130.

Sartoratto A, Machado ALM, Delarmelina C, Figueira GM, Duarte Marta CTV, Rehder LG (2004). Composition and antimicrobial activity of essential oils from aromatic plants used in Brazil. *Braz J Microbiol* 35: 275–280.

Saxena VK, Sharma RN (1999). Antimicrobial activity of the essential oil of *Toddalia asiatica*. *Fitoterapia* 70: 64–66.

Simon JE, Morales MR, Phippen WB, Vieira, R., Hao, Z. (1999). A source of aroma compounds and a popular culinary and ornamental herb. In: Janick J, editor. *Perspectives on new crops and new uses*. Alexandria, VA: ASHS Press. p. 499–505.

Soliman, KM, Badeaa RI. (2002). Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi. *Food Chem. Toxicol.*; 40:1669-1675.

Tanackov S, Dimić G, Lević J, Tanackov I, Tuco D. (2011). Antifungal activities of basil (*Ocimum basilicum* L.) extract on *Fusarium* species. *African Journal of Biotechnology*.;10(50): 10188-10195.

Tewari SN, Najak M. (1991). Activity of four plant leaf extracts against three fungal pathogens of rice. *Trop Agric* 68:373–375.

Usanmaz Bozhüyük A., Kordali Ş. (2019). *Ocimum basilicum* L. Uçucu Yağının Fitopatojenik Funguslar Üzerine Antifungal Etkileri. *Erciyes Tarım ve Hayvan Bilimleri Dergisi*. 2 (1): 45-57.

Viviane AS, Janiere PS, Hilzeth LFP, Andrea FRF, Henrique DMC, Larissa BNA, Edeltrudes OL. (2016). *Ocimum basilicum*: Antibacterial activity and association study with antibiotics against bacteria of clinical importance, *Pharmaceutical Biology*, 54:5, 863-867

Zollo PHA, Biyiti L, Tchoumboungang F, Menut C, Lamaty G, Bouchet P. (1998). Aromatic plants of tropical Central Africa. Part XXXII. Chemical composition and antifungal activity of thirteen essential oils from aromatic plants of Cameroon. *Flavour Fragr J.* 13:107-114.



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**BALIK BESLEMENİN BALIKETİNİN YAĞ MİKTARI VE YAĞ ASİDİ
PROFİLİNE ETKİSİ**

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ÖZET

Son yıllarda önemi giderek artan en önemli gıda kaynaklarından birisi balıktır. Balıklar çok önemli bir protein kaynağı olduğu gibi içerdiği yağın miktarı ve bu yağların yağ asidi profili açısından da oldukça önemlidir. Özellikle insan sağlığı için esansiyel olan doymamış yağ asitlerinin en temel kaynağı balıklardır. Balık yağı insanlar için gerekli olan en önemli organik maddelerden biridir. Bu organik maddeler yüksek enerji kaynağı olmalarının yanında, proteinlerle birleşerek lipoproteinleri oluşturur, metabolik aktivitelerde görev alırlar ve yağda eriyen vitaminlerin kaynağı olarak vücutta önemli görevler üstlenirler. Yağ asitleri ise vücutta enerjinin depolanması ve taşınması ve gen fonksiyonlarının düzenlenmesi gibi metabolizmada önemli rol oynayan önemli yapısal bileşenlerdir. Hücre boyunca hem serbest hem de kompleks lipidlerin bir parçası olarak bulunabilir. Günümüzde mikroorganizma, bitki ve hayvanlarda bulunan yağlarda 1000' in üzerinde yağ asidi tanımlanmıştır. Ancak bunlardan yaklaşık 20 tanesi doğada yaygın olarak bulunmaktadır. Balıkların yağ miktarı ve yağ yağ asidi profilleri, balıkların türlerine, yaşadığı suyun suyun biyolojik, fiziksel ve kimyasal özelliklerine, balığın cinsiyetine, avlandığı mevsime, beslendiği ortamın besin içeriğine, balıkların demersal ve pelajik olmalarına, göç yapan bir tür olup olmaması gibi bir çok faktörden etkilenir. Balıkların enerji kaynağı olarak aldıkları yağlar, balığın farklı dokularında farklı oranlarda depolandığı gibi yağ asidi kompozisyonunda önemli önemli ölçüde farklılık gösterdiği bilinmektedir.

Anahtar Kelimeler: Yağ asidi profili, balık yağı, balık beslenme



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**THE EFFECT OF FISH NUTRITION ON FAT AMOUNT AND FATTY ACID
PROFILE OF FISH MEAT**

ABSTRACT

Fish is one of the most important food sources, whose importance has been increasing in recent years. As fish is a very important source of protein, it is also very important in terms of the amount of fat it contains and the fatty acid profile of these oils. The main source of unsaturated fatty acids, which are essential for human health, is fish. Fish oil is one of the most important organic substances necessary for humans. In addition to being a high energy source, these organic substances combine with proteins to form lipoproteins, take part in metabolic activities and take on important tasks in the body as a source of fat-soluble vitamins. Fatty acids are important structural components that play an important role in metabolism, such as the storage and transport of energy in the body and the regulation of gene functions. It can be found throughout the cell as part of both free and complex lipids. Today, more than 1000 fatty acids have been identified in oils found in microorganisms, plants and animals. However, about 20 of them are widely found in nature. The amount of oil and fatty acid profiles of fish are affected by many factors such as the species of the fish, the biological, physical and chemical properties of the water in which they live, the sex of the fish, the season in which they are caught, the nutrient content of the environment, whether the fish are demersal and pelagic, whether they are a migratory species or not. . It is known that the oils taken by fish as energy sources are stored at different rates in different tissues of the fish and differ significantly in fatty acid composition.

Keywords: Fatty acid profile, fish oil, fish nutrition



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GİRİŞ

Yapılan araştırmalar, insanların sağlığını koruyabilmeleri için en önemli unsurların başında beslenmenin geldiğini göstermektedir. Beslenme açısından önemi bilinen n-3 yağ asitlerini düzenli olarak vücuda alabilmek için ya düzenli olarak balık tüketmek ya da balık yağlarını gıda takviyesi olarak almaları gerekmektedir. Araştırmacılar günde 3 grama kadar n-3 alınmasıyla sağlıklı gıdaların vücutta oluşturabileceği istenmeyen etkilerin önüne geçilebildiği gibi, birçok olumlu fayda sağlanacağını bildirmektedir (Mol, 2008). Bazı araştırmalarda da ω -3 PUFA'nın meme, kolon, prostat, karaciğer ve pankreas kanseri dâhil olmak üzere çoğu kanser gelişimini baskılamada olumlu bir rol oynadığı bildirilmiştir. Yağlı balıklar EPA ve DHA'nın en önemli doğal kaynağı olduğundan, son yıllarda balık tüketiminde önemli talep artışları olmuştur (Uçak ve ark., 2019).

Balıkların çok önemli bir protein kaynağı olmasının yanında çok önemli bir yağ kaynağı da olduğu bilinmelidir. İnsan sağlığı açısından çok önemli olan uzun zincirli yağ asitlerinin temel kaynağını balıklar oluşturur.

n-3 serisine ait çoklu doymamış yağ asitleri (PUFA); uskumru, ringa balığı, sardalye, alabalık ve somon gibi yağlı balıklarda bol bulunur. Alfa-linolenik asit (ALA) ise soya yağı, kanola yağı, kenevir tohumu yağı, keten tohumu, kabak çekirdeği, ceviz, semizotu, baklagiller ve kolza da bulunur (Öz ve ark.2021).

İnsan sağlığı için esansiyel olan yağ asitlerinin temel kaynağının balıklar olması bir çok araştırmacının bu konuya yönelmesine sebep olmuştur. Özellikle balıkların türsel ve mevsimsel olarak yağ asitlerinde ve içerdiği yağ miktarında farklılık olması balıkların beslenmesi ile ilgili farklılıkların incelenmesi gereğini ortaya çıkarmıştır.

Balık Beslemenin Yağ Asidi Profili ve Yağ Miktarına Etkisi

Balıkların besin içeriklerinin, özellikle de ham yağ içeriğinin bilinmesi işleme ve pişirme tekniğinin seçiminde önemlidir (Öksüz ve ark. 2019). Balıklar yağ içeriğine göre yağsız, az yağlı, orta yağlı ve çok yağlı balıklar olarak sınıflandırılır. Eğer balığın yağ oranı %2 den az ise yağsız, %2-4 arasında yağ içeriyorsa az yağlı, %4-8 arasında yağ içeriyorsa orta yağlı ve yağ oranı % 8'den yüksek olan balıklar çok yağlı balıklar olarak gruplandırılır (Ackman, 1990). Suda yaşayan türlerde vücut ve dokuların kimyasal bileşimindeki farklılıklar yaş, cinsiyet, büyüklük gibi iç faktörlere ve su kalitesi, mevsim ve coğrafi bölge gibi dış faktörlere bağlı olsa da, ana neden genellikle beslenmeden kaynaklanmaktadır (Shearer, 1994). Suda yaşayan türlerin dokularındaki yağ asitleri bileşimleri, diyetlerindeki yağ asitlerinin profilini yansıtır



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(Matani Bour, Esmaeili ve Abedian Kenari, 2018; Roohani ve diğerkleri, 2019; Tazikeh, Abedian Kenari ve Esmaeili, 2020). Filetodaki protein ve esansiyel amino asitlerin oranları türler arasında benzer olsa da fileto nemi ve lipit yüzdellerinde önemli farklılıklar vardır. Bu farklılıklar, filetodaki kırmızı ve beyaz kas miktarlarına ve belirli bir türün kasta depo lipidi biriktirme derecesine bağlıdır. Kasta lipit depolanmasının derecesi, Triasilgliserol (TAG)'ler ve yapısal fosfolipitler arasındaki dengeyi de etkiler. TAG'lerin yağ asidi bileşimi genellikle yeminkini yansıttığından, depolama lipidlerinin yağ asidi bileşimini diyet araçlarıyla manipüle etmek mümkündür (Jobling, M. 2001).

SONUÇ

Balıkların yağ miktarı ve yağ yağ asidi profilleri, balıkların türlerine, yaşadığı suyun suyun biyolojik, fiziksel ve kimyasal özelliklerine, balığın cinsiyetine, avlandığı mevsime, beslendiği ortamın besin içeriğine, balıkların demersal ve pelajik olmalarına, göç yapan bir tür olup olmaması gibi bir çok faktörden etkilenir. Balıkların enerji kaynağı olarak aldıkları yağlar, balığın farklı dokularında farklı oranlarda depolandığı gibi yağ asidi kompozisyonda önemli önemli ölçüde farklılık gösterdiği bilinmektedir.



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KAYNAKLAR

Ackman, R.G. (1990). Seafood lipids and fatty acids. *Food Reviews International*, 6(4), 617-646. <https://doi.org/10.1080/87559129009540896>.

Ghosi Mobaraki MR, Abedian Kenari A, Bahrami Gorji S, Esmaeili M. Effect of dietary fish and vegetable oil on the growth performance, body composition, fatty acids profile, reproductive performance and larval resistance in pearl gourami (*Trichogaster leeri*). *Aquacult Nutr*. 2020;26:894–907. <https://doi.org/10.1111/anu.13048>

Jobling, M. (2001). Nutrient partitioning and the influence of feed composition on body composition. *Food intake in fish*, 25(4), 354-375.

Matani Bour, H., Esmaeili, M., & Abedian Kenari, A. (2018). Growth performance, muscle and liver composition, blood traits, digestibility and gut bacteria of beluga (*Huso huso*) juvenile fed different levels of soy-bean meal and lactic acid. *Aquaculture Nutrition*, 24(4), 1361–1368.

Mol, S. (2008). Balık yağı tüketimi ve insan sağlığı üzerine etkileri. *Journal of Fisheries Science*, 2(4), 601e607.

Öksüz, A., Dikmen, M., Alkan, Ş.B., Yaylalı, O., Kaplan, T., Demirtaş, S. (2019). Beyşehir gölünden avlanan sazan ve sudak balıklarının besin veya asidi bileşenlerinin karşılaştırılması. *Aquatic Research*, 2(4), 174-181. <https://doi.org/10.3153/AR19016>.

Öz, M., Ucak, I., & Nayik, G.A. (2021). (2019). PUFA and MUFA. *Nutraceuticals and Health Care*. (pp. 199-215). Academic Press.

Roohani, A. M., Abedian Kenari, A., Fallahi Kapoorchali, M., Borani, M. S., Zoriezahra, S. J., Smiley, A. H., ... Rombenso, A. N. (2019). Effect of spirulina *Spirulina platensis* as a complementary ingredient to reduce dietary fish meal on the growth performance, whole-body composition, fatty acid and amino acid profiles, and pigmentation of Caspian brown trout (*Salmo trutta caspius*) juveniles. *Aquaculture Nutrition*, 25(3), 633–645.

Shearer, K. D. (1994). Factors affecting the proximate composition of cultured fishes with emphasis on salmonids. *Aquaculture*, 119(1), 63–88



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Tazikeh, T., Abedian Kenari, A., & Esmaeili, M. (2020). Effects of fish meal replacement by meat and bone meal supplemented with garlic (*Allium sativum*) powder on biological indices, feeding, muscle composition, fatty acids and amino acids profile of whiteleg shrimp (*Litopenaeus vannamei*). *Aquaculture Research*, 51(2), 647–686.

Ucak, I., Öz, M., & Maqsood, S. (2019). Products based on omega-3 polyunsaturated fatty acids and health effects. In C. M. Galanakis (Ed.), *The role of alternative and innovative food ingredients and products in consumer wellness* (pp. 197e212). Academic Press.



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ÖZET

Dünya genelinde yetiştiriciliği yapılan balık türleri incelendiğinde en fazla yetiştirilen beş balık türünden dört tanesinin sazan türlerinden olduğu ve ilk sırada da ot sazanı (*Ctenopharyngodon idella*, Valenciennes 1844) olduğu görülmektedir. FAO verilerine göre 2018 yılında dünya toplam su ürünleri üretimi yaklaşık 82 milyon ton olarak gerçekleşmiş ve üretimin 54.279 bin tonu akuakültürden elde edilmiştir. 2018 yılında 5 milyon 704 bin tonu ot sazanı yetiştirilmiş ve bu oran toplam dünya su ürünleri yetiştiriciliğinin %10.5'ini oluşturmaktadır. Ot sazanı 0 ile 33 °C arasında değişen su sıcaklıklarını tolere edebildiği için çok geniş bir coğrafyada dağılım gösterir. Bu balık türünün birçok ülkede tanıtımı yapılmış ve sucul ekosistemlerde bitki örtüsünün kontrolü için yetiştirilmesi tavsiye edilmiştir. Tarımsal faaliyetlerde yoğun olarak kullanılan gübrelerin ve endüstriyel atıkların sulak alanlara ulaşması ötrofikasyona neden olmaktadır. Sulak alanlarda aşırı büyüyen bitkilerle kimyasal yolla ve mekanik yöntemlerle mücadele etmek çok olası olmadığı için ot sazanı gibi balıklar biyolojik mücadele için çok önemlidir. Ot sazanları beslendikleri bitki türlerini seçerken oldukça seçicidir. Başlangıçta yumuşak yapraklı ve su altındaki bitkileri tercih ederler. En çok tercih ettiği bitki türlerini tamamen bitirene kadar başka türlere yönelmez ve sucul ortamlarında ilk önce sevdiği bitki türlerini tüketir. Sucul ortamda makrofit arzının düşük olması durumunda yetişkin ot sazanı bentos, zooplankton, su böcekleri gibi diğer besin kaynaklarını kullanabilir. Ot sazanı ülkemizde sadece balıklandırma çalışmalarında kullanılmak amacıyla yetiştirilmektedir. Beslenme şeklinin sürdürülebilir yetiştiricilik için çok uygun olması sebebiyle gelecekte yetiştiricilik açısından da daha önemli olması kaçınılmazdır. Sonuç olarak; Ot sazanı, su rezervuarlarındaki su bitkilerinin kontrolü için en uygun türlerden biridir

Anahtar Kelimeler: Ot sazanı (*Ctenopharyngodon idella*), su bitkileri, sulak alan



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**THE IMPORTANCE OF GRASS CARP (*CTENOPHARYNGODON IDELLA*,
VALENCIENNES 1844) IN MANAGEMENT OF WETLANDS**

ABSTRACT

When the fish species farmed in the world are examined, it is seen that four of the five most commonly grown fish species are carp species, and grass carp (*Ctenopharyngodon idella*, Valenciennes 1844) comes first. According to FAO data, world total aquaculture production was approximately 82 million tons in 2018 and 54,279 thousand tons of production was obtained from aquaculture. In 2018, 5 million 704 thousand tons of grass carp were grown and this rate constitutes 10.5% of the total world aquaculture. Grass carp is widely distributed, as it can tolerate water temperatures ranging from 0 to 33 °C. This fish species has been promoted in many countries and it has been recommended to be raised for vegetation control in aquatic ecosystems. The arrival of fertilizers and industrial wastes, which are used extensively in agricultural activities, to wetlands causes eutrophication. Fish such as grass carp are very important for biological control, as it is not very possible to control overgrowing plants in wetlands with chemical and mechanical methods. Grass carp are very picky when choosing the types of plants they feed on. Initially, they prefer soft-leaved and submerged plants. It does not turn to other species until it has completely finished the plant species it prefers most and consumes the plant species it loves first in its aquatic environments. If the macrophyte supply is low in the aquatic environment, adult grass carp may use other food sources such as benthos, zooplankton, aquatic insects. Grass carp is grown in our country only for use in fisheries. Since the diet is very suitable for sustainable aquaculture, it is inevitable that it will be more important in terms of aquaculture in the future. As a result; Grass carp is one of the most suitable species for the control of aquatic plants in water reservoirs.

Keywords: Grass carp (*Ctenopharyngodon idella*), aquatic plants, wetland



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GİRİŞ

Ot Sazanı (*Ctenopharyngodon Idella*), sucul alanlarda bulunan yabancı otların aşırı büyümesini kontrol altında tutmak ve onları yok etmek için araştırmacılar ve devlet kurumları tarafından 1960'lı yıllarda Çin'den Amerika Birleşik Devletleri'ne kadar bir çok bölgeye götürülmüş ve bu amaçla yetiştirilmeye başlanmıştır. Balıklandırma çalışmalarında ot sazanının kontrolsüz şekilde üremesinin önüne geçmek amacıyla Amerika birleşik devletlerinde triploid stoklar oluşturulmuş ve güney Amerika'dan kuzey Amerika'ya kadar çok geniş bir alana yayılmıştır (Zhao ve ark., 2020).

Sucul alanlarda su bitkilerini kontrol altında tutmak amacıyla araştırma ünitelerinde başlayan ot sazanı yetiştiriciliği daha sonraları sofralık balık amacıyla yapılmaya başlamıştır. Ticari olarak yetiştiriciliği yapılan balık türleri arasına 1950'li yıllarda giren ot sazanı özellikle son 20-25 yılda çok hızlı bir şekilde artış göstermiş ve 2018 yılı FAO verilerine göre dünyada en fazla yetiştiriciliği yapılan balık türü haline gelmiştir. 2018 yılında yaklaşık 82 milyon ton olan dünya su ürünleri yetiştiriciliğinin 5 milyon 704 bin tonu ot sazanı olmuştur (Öz ve Üstüner 2021).

Ot sazanının, doğal yaşam alanı olarak Rusya-Çin sınırındaki Amur Nehri'nden güneye doğru Doğu Asya'nın büyük nehir sistemleridir. Fakat daha sonraları balıklandırma çalışmalarında kullanılmaya başlamış, Asya ve Kuzey Amerika gibi diğer bölgelere ve 1945'ten beri neredeyse tüm Avrupa'ya yayılmıştır (Kırkağaç ve Demir, 2006). Ot sazanı 1972 yılında Devlet Su İşleri Genel Müdürlüğü tarafından Romanya'dan Türkiye'ye getirilmiş ve tanıtılmıştır. 1980 yılından itibaren Sucul bitki örtüsü kontrolünde kullanılan kimyasal maddelerin yan etkilerinin belirlenmesinden sonra, su bitkilerinin kontrol altında tutulması için biyolojik kontrol ajanı olarak ot sazanı oldukça önemli bir konuma gelmiştir (Kırkağaç, 2011).

Ot Sazanının Özellikleri

Ot sazanı uzun yapılı ve büyük pullarla kaplı bir bedene sahiptir. Yüzgeçleri kısa ve kuvvetlidir. Vücut uzunluğu, eninin 3.8-4.8 katı kadar olabilmekte ve boyu 1 metreden daha uzun olanlarına rastlanılabilmektedir. Akarsularda 30-40 kg'a kadar büyüyenleri görülmüştür (Alpbaz, 2005). Bazı kaynaklarda da 50 kg a kadar büyüdüğü rapor edilmiştir (Chilton and Muoneke 1992). Çok büyük boylara ulaşsa da ortalama ağırlığı 4-5 kg kadardır. Yaklaşık 7 yaşında ve 7-8 kg canlı ağırlığa sahip ve 76 cm uzunluktaki bir dişi ot sazanından 816.000 adet balık yumurtası alınabileceği bildirilmektedir. Ot sazanı yumurtaları pelajiktir (Alpbaz, 2005). Ot Sazanı yaklaşık 0 ile 33 °C arasında değişen su sıcaklıkları tolere eder ve 38 °C'nin üzerindeki



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sıcaklıklar yetişkinler için ölümcül olmaktadır (Fedorenko and Fraser 1978). Düşük sıcaklıklar yavrular için kalıcı denge kaybına neden olmaktadır (Chilton and Muoneke 1992). 18 °C'nin altındaki su sıcaklığında yumurtaların hayatta kalma oranı düşüktür (Stott and Cross 1973). Sudaki çözünmüş oksijen miktarının 3mg/l altına düşmesi ot sazanında strese neden olsa da 0.2 mg/l kadar düşük oksijen konsantrasyonlarını tolere edebilmektedir (Shireman and Smith 1983). Ot Sazanlarının ortalama olarak 5 ila 11 yıl yaşadığı bildirilse de bazı bireylerin 15 yaşına kadar yaşayabildiği rapor edilmiştir. Bazı kaynaklarda da Amerika Birleşik Devletinde Kuzey Dakota'da 33 yaşından büyük ot sazanı bulunmuştur (USGS 2021; Shireman and Smith 1983). Çoğu türde olduğu gibi Ot Sazanının büyümesi yaş, beslenme, sıcaklık ve oksijen gibi abiyotik faktörlere bağlı olarak değişmektedir (Chilton and Muoneke 1992).

Ot Sazan'ının Sucul alanların yönetiminde kullanımı

Dünya su ürünleri üretiminin yaklaşık %60'lık kısmını karşılayan Çin, sazan üretiminde ve özellikle de ot sazanı (*Ctenopharyngodon idella*) üretiminde Dünya'da lider konumdadır (Newton ve ark., 2021). Sudaki yabani otlar doğal su kütlelerinden toplanabilir. Organik gübre ile gölet setinde karasal otlar yetiştirilebilir (FAO, 2021 Alpbaz, 2005).

Ot sazanının yaşı, boyu, bağırsak uzunluğu, su sıcaklığı, bitki türlerinin mevcudiyeti, su yüksekliği ve havuzlardaki stok yoğunluğu gibi faktörler ot sazanının besleme stratejilerini etkileyen etkenlerdir (Opuszynski and Shireman 1995). Aktif beslenme 7-8 °C'de başlarken, yoğun besleme su sıcaklığı en az 20 °C olduğunda gerçekleşir (NatureServe 2021). Yumurtadan çıktıktan üç veya dört gün sonra, ot sazanı larvaları rotiferler ve protozoalar ile beslenmeye başlar. Daha sonra ise (11-15 gün sonra) daha büyük cladoceranlara geçerler (Opuszynski and Shireman 1995; Fedorenko and Fraser 1978). Yumurtadan çıktıktan iki hafta sonra ve 12-17 mm uzunluğunda Ot sazanı, Daphnia ve böcek larvaları gibi daha büyük su canlıları ile beslenir (Fedorenko and Fraser 1978; Opuszynski and Shireman 1995).

Ot sazanları beslendikleri bitki türlerini seçerken oldukça seçicidir. Başlangıçta yumuşak yapraklı ve su altındaki bitkileri tercih ederler (Bain et al. 1990; Pine and Anderson 1991). En çok tercih ettiği bitki türlerini tamamen bitirene kadar başka türlere yönelmez ve sucul ortamlarında ilk önce sevdiği bitki türlerini tüketir (Bain 1993).

Ot sazanlarının en çok tercih ettiği su bitkilerinden bazıları; *Elodea Canadensis*, *Ceratophyllum demersum*, *Chara spp.*, *Lemna minor* ve *Potamogeton natans*'tir (Opuszynski and Shireman 1995). İpliksi algler ve daha sıkı yapraklı makrofitler gibi diğer bitki türleri, mevcut tek tür olduklarında tüketilir (Opuszynski and Shireman 1995). Makrofit arzı düşük olduğunda,



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yetişkin ot sazanı bentos, zooplankton, su böcekleri gibi diğer besin kaynaklarını kullanabilir (NatureServe 2021).

SONUÇ

Sulak alanlarda bitkilerin aşırı büyümesini önlemek amacıyla dünyanın bir çok bölgesinde en fazla tercih edilen biyolojik mücadele yöntemlerinin başında ot sazanı ile yapılan balıklandırma faaliyetleri gelmektedir. Ot sazanı ülkemizde sadece balıklandırma çalışmaları amacıyla yetiştirilmektedir. Beslenme şeklinin sürdürülebilir yetiştiricilik için çok uygun olması sebebiyle gelecekte sofralık balık yetiştiriciliği içinde düşünülebilir.



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KAYNAKLAR

- Alpaz A (2005). Su Ürünleri Yetiştiriciliği, Alp Yayınları.
- Bain, Mark B, David H Webb, Michael D Tangedal, and Larry N Mangum. 1990. 'Movements and habitat use by grass carp in a large mainstream reservoir', *Transactions of the American Fisheries Society*, 119: 553-61.
- Bain, Mark B. 1993. 'Assessing impacts of introduced aquatic species: grass carp in large systems', *Environmental Management*, 17: 211-24.
- Chilton, Earl W, and Maurice I Muoneke. 1992. 'Biology and management of grass carp (*Ctenopharyngodon idella*, Cyprinidae) for vegetation control: a North American perspective', *Reviews in fish biology and fisheries*, 2: 283-320.
- FAO. 2021. 'Cultured Aquatic Species Information Programme *Ctenopharyngodon idellus* (Valenciennes, 1844)'.
http://www.fao.org/fishery/culturedspecies/Ctenopharyngodon_idellus/en.
- Federenko, AY, and FJ Fraser. 1978. "Review of GC biology. Interagency Committee on Transplants and Introductions of Fish and Aquatic Invertebrates in British Columbia." In.: British Columbia: Department of Fisheries and Environment, Fisheries Marine Service
- Fedorenko, AY, and FJ Fraser. 1978. "Review of grass carp biology. Interagency Committee on transplants and introductions of fish and aquatic invertebrates in British Columbia. British Columbia, Department of Fisheries and Environment, Fisheries and Marine Service." In.: Technical Report.
- Kırkağaç M. U, Demir N (2006). The effects of grass carp (*Ctenopharyngodon idella* Val., 1844) on water quality, plankton, macrophytes and benthic macroinvertebrates in a spring pond. *T J Fish Aquat Sci*, 6, 7-15
- Kırkağaç, M. U. (2011). The status of grass carp (*Ctenopharyngodon idella*, Valenciennes 1844) in Turkey. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, 58(3), 217-221.
- NatureServe. 2021. ' An online encyclopedia of life. Version 1.8. NatureServe, Arlington, Virginia'. <http://www.natureserve.org/explorer>.
- Newton, R., Zhang, W., Xian, Z., McAdam, B., & Little, D. C. (2021). Intensification, regulation and diversification: the changing face of inland aquaculture in China. *Ambio*, 1-18.



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Opuszynski, K, and JV Shireman. 1995. "Herbivorous fishes: culture and use for weed management. In cooperation with James E. Weaver, Director of the United States Fish and Wildlife Service's National Fisheries Research Center." In.: CRC Press, Boca Raton, Florida.

Öz, M., Üstüner, E. (2021). Ot Sazanı (*Ctenopharyngodon Idella*, Valenciennes 1844) Yetiştiriciliği. İlman İklim Balıkları Yetiştiriciliği. Editör, Suat DİKEL. Akademisyen kitabevi, ISBN: 978-625-7275-63-7, DOI: 10.37609/akya.559.

Pine, RT, and LWJ Anderson. 1991. 'Effect of triploid grass carp on submersed aquatic plants in northern California ponds', *California Fish and Game*, 77: 27-35.

Shireman, Jerome V, and Charles R Smith. 1983. *Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844)* (Food & Agriculture Org.).

Stott, B, and DG Cross. 1973. 'A note on the effect of lowered temperatures on the survival of eggs and fry of the grass carp *Ctenopharyngodon idella* (Valenciennes)', *Journal of Fish Biology*, 5: 649-58.

USGS. 2021. 'Nonindigenous Aquatic Species Database'. <https://nas.er.usgs.gov/>.

Zhao, Y., Zhang, L., Wang, C., & Xie, C. (2020). Biology and Ecology of Grass Carp in China: A Review and Synthesis. *North American Journal of Fisheries Management*, 40(6), 1379-1399.



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**BİNGÖL İLİNDE SÜTÇÜLÜĞÜN MEVCUT DURUMU VE GELECEK
POTANSİYELİ**

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ÖZET

2020 yılı TÜİK verilerine göre Bingöl ilinde; inek, koyun, keçi ve mandadan elde edilen toplam süt üretim miktarı 2019 yılında 165.490,594 ton/yıl olup Bingöl, Türkiye’de 81 il arasında 54. sırada yer almaktadır. Bu süt miktarı Türkiye’de 2019 yılında üretilen toplam süt miktarının (22.960.379 ton/yıl) % 0,72’lik kısmını oluşturmaktadır. Türkiye’nin toplam süt ve süt ürünleri üretiminde ise Bingöl’ün payı %1’den azdır. Bingöl’de iklim ve doğa koşulları hayvancılığa elverişli olmasına rağmen, süt üretim miktarı bakımından diğer illere göre çok geride kalmıştır. Ancak, günümüze kadar küçük aile işletmeciliği şeklinde yapılan hayvancılık faaliyetlerinin, SÜTAŞ Entegre tesislerinin faaliyeti ile çok daha gelişeceği beklenmektedir. Bingöl, geleneksel peynirlerimizden olan Tulum peyniri üretiminde önemli bir konumdadır. Çünkü Tulum peynirleri Bingöl ilimiz gibi küçükbaş hayvancılığın yaygın yapıldığı yörelerde üretilmektedir. Yarı sert karakterdeki bu peynir; Bingöl, Elazığ, Erzincan, Erzurum, Tunceli illeri yaylalarında çiğ koyun sütünden geleneksel yöntemlerle üretilmekte ve 3 ay ile 1 yıl gibi uzun bir olgunlaşma dönemi içinde tüketilmektedir. Peynir orijinal olarak genellikle Şavak aşireti tarafından koyun sütünden üretilmekte ve keçi derisinden hazırlanan tulumlarda orijinalde mağaralarda, günümüzde ise daha çok soğuk hava depolarında olgunlaştırılmaktadır. Tulum peyniri önceden yöresel olarak ve küçük çapta üretilmesine karşın, besin değerinin çok yüksek olması ve her kesim tüketicinin beğenisini kazanması sonucu daha çok miktarlarda üretilen, günümüzde tereyağına eşit veya daha yüksek fiyatlarda satılan peynir çeşidimizdir. Türkiye’de son 15 yıl içinde Tulum peyniri ile ilgili çok sayıda proje yürütülmüş, bilimsel makale yayınlanmış (Hayaloğlu ve ark., 2007; Çakır ve ark., 2016; Çakır ve Çakmakçı, 2018; Çakır ve Çakmakçı, 2020), çalıştaylar ve diğer etkinlikler yapılmıştır. Bu sunuda, Bingöl ilimizin mevcut süt ve ürünlerinin üretim/tüketim ve pazarlama durumu ile gelecekte bu konulardaki değişim potansiyeli ele alınacaktır.

Anahtar Kelimeler: Türkiye, Bingöl, Süt ve Süt Ürünleri, Tulum Peyniri



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**THE FUTURE POTENTIAL AND CURRENT STATUS OF DAIRYING IN BİNGÖL
PROVINCE**

ABSTRACT

According to TSI (Turkish Statistical Institute) data for 2020; in Bingöl province; the total milk production amount obtained from cows, sheeps, goats and buffaloes is 165,490,594 tons/year in 2019, and Bingöl ranks 54th among 81 provinces in Turkey. This milk amount constitutes 0.72% of the total milk amount produced in 2019 in Turkey (22.960.379 tons/year). The share of Bingöl in the production of total milk and dairy products of Turkey is less than 1%. Although the climate and nature conditions in Bingöl are suitable for livestock, it lags far behind compared to other provinces in terms of milk production amount. However, it is expected that the livestock activities made in the form small family businesses until today, will develop much more with the activities of SÜTAŞ Integrated facilities. Bingöl is in an important position in the production of Tulum cheese, which is one of our traditional cheeses. Because, Tulum cheeses are produced in regions such as our Bingöl province, where sheep and goat farming is common. This cheese in semi-hard character; it is produced from raw sheep's milk by traditional methods in the plateaus of Bingöl, Elazığ, Erzincan, Erzurum and Tunceli provinces and is consumed within a long ripening period such as 3 months to 1 year. The cheese is originally produced from sheep's milk by the Şavak tribe and is ripened in tulums made from goat skin, originally in caves, and nowadays mostly in cold storage. Although Tulum cheese was previously produced locally and on a small scale, it is our cheese variety that is produced in larger quantities as a result of having very high nutritional value and gaining appreciated by all segments of consumers, and is sold at prices equal to or higher than butter today. In the last 15 years, many projects have been carried out, scientific articles have been published (Hayaloglu et al., 2007; Cakir et al., 2016; Cakir and Cakmakci, 2018; Cakir and Cakmakci, 2020), workshops and other activities related to Tulum cheese have been carried out in Turkey. In this presentation, the production/consumption and marketing situation of current milk and products of our Bingöl province, and the change potential in these subjects in the future will be discussed.

Keywords: Turkey, Bingöl, Milk and Dairy Products, Tulum Cheese



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1. GİRİŞ

Süt, insan beslenmesinde doğumdan başlayarak insan yaşamının her döneminde gerekli olan ve önemli makro ve mikro besin öğelerini yeterli miktarda içeren en temel gıdadır. Süt ve süt ürünleri, özellikle kalsiyum ve fosfor başta olmak üzere bazı önemli mineraller, biyolojik değeri yüksek proteinler, süt yağı ve riboflavin (B₂), B₁₂ ve A ve/veya β karoten gibi vitaminlerin çok önemli bir kaynağıdır. Bu nedenle süt ve süt ürünleri insanların beslenme ve sağlığı açısından hayati önemde görevlere sahip gıda grubudur (Çakmakçı, 2019). Özellikle çocukluk, gebelik-emziliklik ve yaşlılık dönemlerinde kemik ve diş sağlığı açısından önemlidir. Ayrıca, kalsiyum emilimi ve bağışıklık sistemini artırdığı, kan basıncı (hipertansiyon), kanser, kalp-damar ve obezite gibi kronik hastalıkların riskini azalttığı, vücut ağırlığını kontrol altında tuttuğu ve diş çürümelerini önlediği belirtilmektedir (Ünal ve Besler, 2012).

Ülkemizde sütçülük durumuna bakacak olursak; 2019 ve 2020 yıllarında sırasıyla toplam 22.960.379 ve 24.217.584 ton süt üretilmiştir. 2019 yılındaki süt üretiminin %90,4'ü (20.782.374 ton) inek sütünden, %9,2'si (2.098.664 ton) koyun-keçi sütünden, %0,3'ü (79.341 ton) ise manda sütünden oluşmaktadır. Türkiye'de sağılan hayvan sayısı her yıl düzenli olarak artmıştır. Toplam sağılan hayvan sayısı 2019 yılında 2018 yılına göre %4,6 artarak 31.968.157 baş olmuştur. Sağılan sığır sayısı 2019 yılında 2018 yılına göre %3,8 oranında artarak 6.580.753 baş, sağılan koyun-keçi sayısı %4,8 oranında artarak 25.308.071 baş, sağılan manda sayısı ise %4,5 oranında artarak 79.333 baş olmuştur. 2019 yılında, sağılan toplam 31.968.157 baş hayvandan toplam 22.960.379 ton süt elde edilmiştir. Sağılan toplam 6.580.753 baş sığırdan 20.782.374 ton, sağılan toplam 25.308.071 baş koyun-keçiden 2.098.664 ton, sağılan toplam 79.333 baş mandadan da 79.341 ton süt elde edilmiştir. Sağılan inek başına verim 2016-2019 yılları arasında sırasıyla 3,09-3,14-3,16-3,16 ton/baş/yıl, sağılan koyun-keçi başına verim 2016-2019 yılları arasında 0,08 ton/baş/yıl, sağılan manda başına verim 2016-2019 yılları arasında 1,00 ton/baş/yıl olarak tespit edilmiştir (TÜİK, TEPGE Hesapları a/Tahmin, 2021).

2019 yılında Bingöl'de toplam büyükbaş hayvan sayısı 140.289 baş (140.244 sığır + 45 manda), toplam küçükbaş hayvan sayısı 635.603 baş (467.117 koyun + 168.486 keçi) olarak kayıtlara geçmiştir. Bingöl'de küçükbaş hayvancılık yapılan yerlerde küçükbaş hayvan işletmeleri süt üretimine yönelik değildir. Bu nedenle süt üretiminde en önemli rol büyükbaş hayvancılık ile uğraşan süt üretimi yapan işletmelere aittir (TÜİK, 2020). Bingöl'de sütçülük durumuna bakılacak olursa; Bingöl, inek, koyun, keçi ve mandadan elde edilen toplam süt üretimi miktarı bakımından 2019 yılında 165.490,594 ton/yıl ile Türkiye'de 81 il arasında 54. sırada yer



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almaktadır. Bingöl’de üretilen bu süt miktarı Türkiye’de 2019 yılında üretilen süt miktarının (22.960.379 ton) % 0,72’lik kısmını oluşturmaktadır. Bingöl’de 2018-2019 yılında sağılan hayvan sayıları; süt sığırları (Saf Kültür) 12.452-11.129 baş, süt sığırları (Kültür Melezi) 33.654-38.452 baş, süt sığırları (Yerli): 5.724-7.756, Manda 68-63 baş, Koyun (Yerli ve diğerleri) 206.540-274.251 baş, Keçi (Kıl keçisi ve diğerleri) 74.839-92.345 baş olarak belirlenmiştir. Büyükbaş ırkları arasında en fazla süt verimi kültür melezinde olduğundan dolayı sağılan büyükbaş hayvan sayıları arasında da en büyük artış kültür melezi sığır sayısında yaşanmıştır. 2019 yılında Bingöl süt üretiminin hayvan ırklarına göre dağılımı incelendiğinde; kültür melezi sığır sütü toplam süt üretiminin %56’sını (92.284,27 ton), saf kültür sığır sütü %20’sini (33.109,70 ton), yerli sığır ırkı sütü %6’sını (9.571,15 ton), koyun sütü % 12’sini (20.568,81 ton), keçi sütü ise %6’sını (9880,95 ton), manda sütü, %0’ını (73,10) oluşturmaktadır. Bingöl’de süt üretiminde en büyük pay kültür melezi süt sığırlarına ait olup, sırasıyla kültür ve yerli sığırlar gelmektedir. Büyükbaş hayvanlar süt üretiminin büyük çoğunluğunu oluşturmaktadırlar (TÜİK, 2020).

Bingöl’de 2019 yılında üretilen (165.490,594 ton) süt miktarı Türkiye’de 2019 yılında üretilen süt miktarının (22.960.379 ton) % 0,72’lik kısmını oluşturmaktadır. Bu oran Bingöl gibi iklim ve doğa koşulları hayvancılığa elverişli olan bir bölge için kabul edilemez seviyedir. Bu seviye ile Bingöl Ülkemizin diğer illerine göre sütçülükte çok geride kalmıştır. Bingöl 2019 yılında 165.490,594 ton/yıl süt üretimi ile Türkiye’de 81 il arasında 54. sırada yer almaktadır. Ayrıca, Türkiye’de inek başına verim yılda ortalama 3 ton süt, Bingöl’de ise inek başına verim yılda ortalama 2,35 ton süt üretilirken, hem Türkiye hem de Bingöl’de koyun-keçi başına yılda ortalama 0,08 ton süt, manda başına yılda 1 ton süt üretimi yapılmıştır (TÜİK, 2020).

Ülkemizde, 2020 yılında içme sütü üretimi toplam 1.613.198 ton, peynir üretimi toplam 767.141 ton, yağsız süt tozu üretimi toplam 69.470 ton, yoğurt, ayran ve kefir üretimi toplam 1.701.607 ton, tereyağı üretimi toplam 78.610 ton olarak tespit edilmiştir (TÜİK, TEPGE Hesapları a/Tahmin, 2021). Ülkemizdeki toplam süt ve süt ürünlerinin üretiminde Bingöl İlinin payı % 1’den daha azdır. Bu sonuçlara göre, Bingöl Ülkemizin diğer illerine göre toplam süt üretiminin yanında süt ürünleri üretiminde de çok geride kalmıştır. Bu durumun nedeni; bugüne kadar Bingöl gibi iklim ve doğa koşullarının hayvancılığa çok uygun olduğu bir yerde hayvancılık faaliyetlerinin küçük aile işletmeciliği şeklinde yapılması ve Bingöl’de yeteri kadar süt işletmesinin olmamasıdır. Ancak, Bingöl’de kurulan SÜTAŞ Entegre tesisleri sayesinde Bingöl’de sütçülük faaliyetlerinin gelişmekte olduğu ve çok gelişeceği beklenmektedir.



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Bingöl, önemli geleneksel peynirlerimizden olan Tulum peyniri üretiminde önemli konumdadır. Çünkü Tulum peynirleri Bingöl ilimiz gibi küçükbaş hayvancılığın yaygın yapıldığı yörelerde üretilmektedir. Tulum peyniri; Bingöl, Elazığ, Erzincan, Erzurum, Tunceli illeri yaylalarında çiğ koyun sütünden geleneksel yöntemlerle üretilmekte ve 3 ay ile 1 yıla kadar olgunlaştırılarak tüketilmektedir. Orijinal olarak genellikle Şavak aşireti tarafından çiğ koyun sütünden yapılmakta ve keçi derisinden hazırlanan tulumlarda mağaralarda, günümüzde ise daha çok plastik ambalajlarda buzdolabı sıcaklığındaki soğuk hava depolarında olgunlaştırılmaktadır (Çakmakçı, 2011).

2. BİNGÖL İLİNDE SÜTÇÜLÜĞÜN DURUMU

Bingöl'de 2018-2019 yılında sağılan hayvan sayıları; süt sığırları (Saf Kültür) 12.452-11.129 baş, süt sığırları (Kültür Melezi) 33.654-38.452 baş, süt sığırları (Yerli): 5.724-7.756, Manda 68-63 baş, Koyun (Yerli ve diğerleri) 206.540-274.251 baş, Keçi (Kıl keçisi ve diğerleri) 74.839-92.345 baş olarak belirlenmiştir. 2019 yılında Bingöl süt üretiminin hayvan ırklarına göre dağılımı incelendiğinde; kültür melezi sığır sütü toplam süt üretiminin %56'sını (92.284,27 ton), saf kültür sığır sütü %20'sini (33.109,70 ton), yerli sığır ırkı sütü %6'sını (9.571,15 ton), koyun sütü % 12'sini (20.568,81 ton), keçi sütü ise %6'sını (9880,95 ton), manda sütü , %0'ını (73,10) oluşturmaktadır. Bingöl'de süt üretiminde en büyük pay kültür melezi süt sığırlarına ait olup, sırasıyla kültür ve yerli sığırları gelmektedir. Büyükbaş hayvanlar süt üretiminin büyük çoğunluğunu oluşturduğundan ırklar arasında süt üretim oranları çok önemlidir. Büyükbaş ırkları arasında en fazla süt verimi kültür melezinde olduğundan dolayı sağılan büyükbaş hayvan sayıları arasında da en büyük artış kültür melezi sığır sayısında yaşanmıştır. Ayrıca, Bingöl'de küçükbaş hayvancılık yapılan yerlerde küçükbaş hayvan işletmeleri süt üretimine yönelik değildir. Bu nedenle süt üretiminde en önemli rol büyükbaş hayvancılık ile uğraşan süt üretimi yapan işletmelere aittir (TÜİK, 2020).

Bingöl'de 2019 yılında inek, koyun, keçi ve mandadan elde edilen toplam süt üretimi miktarı 165.490,594 ton/yıl ile Türkiye'de 81 il arasında 54. sırada yer almaktadır. Bingöl'de üretilen bu toplam süt miktarı Türkiye'de 2019 yılında üretilen toplam süt miktarının (22.960.379 ton) % 0,72'lik kısmını oluşturmaktadır (TÜİK, 2020). Bingöl iklim koşulları ve coğrafi şekiller bağlamında çok önemli bir potansiyele sahip olmasına rağmen önemli yapısal ve organizasyon eksikliklerinden dolayı ticarete ve sanayiye konu olan sütün toplam üretimdeki oranı çok düşük olmaktadır. Bu nedenle, Bingöl'de süt üretimi ekonomik anlamda olması gereken seviyede bir



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katma değere dönüşememektedir. Ancak, Bingöl'de SÜTAŞ Entegre tesislerinin sütçülük faaliyetlerini çok geliştireceği beklenmektedir.

Ülkemizde inek (sığır), koyun-keçi ve mandadan elde edilen toplam süt üretimi miktarı 2019 yılında 2018 yılına göre %3,8 oranında artmış ve 22.960.379 ton olarak belirlenmiştir (TÜİK, TEPGE Hesapları a/Tahmin, 2021). Bingöl'de 2019 yılında inek, koyun, keçi ve mandadan elde edilen toplam süt miktarı yılda 165.490,594 ton ile Türkiye'de 81 il arasında 54. sırada yer almaktadır. Bingöl'de üretilen bu süt miktarı Türkiye'de 2019 yılında üretilen süt miktarının (22.960.379 ton) % 0,72'lik kısmını oluşturmaktadır (TÜİK, 2020). Bu bilgiler ışığında Bingöl'de üretilen süt ve süt ürünleri miktarlarının da Türkiye'de üretilen süt ve süt ürünleri miktarlarının %1'inden daha az olacağı ifade edilmektedir. Bingöl iklim ve doğa koşullarının hayvancılığa elverişli olmasına rağmen Türkiye'nin diğer illerine göre süt ve süt ürünleri üretiminde de çok geride kalmıştır. Bunun sebebi olarak; Bingöl'de günümüze kadar hayvancılık faaliyetlerinin küçük aile işletmeciliği şeklinde yapılması ve Bingöl'de yeterince ticari süt işletmesinin bulunmaması gösterilebilir. Ancak, Bingöl'de SÜTAŞ Entegre tesislerinin faaliyetiyle beraber hayvancılık faaliyetlerinin bölge halkı tarafından çok daha aktif hale getirilerek hem toplam süt üretimi miktarı hem de süt ürünlerinin üretim miktarlarının çok daha fazla artacağı beklenmektedir. Böylece Bingöl ilimiz süt ve süt ürünlerinin üretim miktarı bakımından Türkiye'deki çoğu ilin önüne geçmiş olacaktır. Ayrıca, Bingöl'deki sütçülük faaliyetlerinin artması ekonomik olarak hem bölge halkına hem de Türkiye'ye önemli bir katkı sunacaktır.

3. BİNGÖL'DE TULUM PEYNİRİ

Tulum peyniri, beyaz ve krem renkte, kurumadde ve yağ oranı yüksek, kolay dağılmayan (plastik özellikte), ağza alındığında eriyerek kendine özgü tereyağı aroması kolaylıkla hissedilen, yarı sert, homojen yapıda, belirgin asidik ve ransit tatlı olan bir peynir çeşidimizdir. Türkiye'ye özgü geleneksel peynir çeşitlerinden biri olan Tulum peyniri orijinal olarak; Bingöl, Elazığ, Erzincan, Erzurum, Tunceli gibi küçükbaş hayvancılığın yaygın yapıldığı yörelerin yaylalarında çiğ koyun sütünden geleneksel yöntemlerle üretilmektedir (Çakmakçı, 2011). Tulum peyniri önceden yöresel olarak ve küçük çapta üretilmesine karşın, besin değerinin çok yüksek olması ve her kesim tüketicinin beğenisini kazanması sonucu daha çok miktarlarda üretilen, günümüzde tereyağına eşit veya daha yüksek fiyatlarda satılan ve ihracata uygun peynirler arasında gösterilmektedir (Çakmakçı, 2010). İfade edilen bu özellikleri Tulum



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peynirini, Türkiye ve özellikle küçükbaş hayvancılığın yapıldığı Bingöl ve civarı illeri için ekonomik olarak önemli hale getirmektedir. Ekonomik değeri çok yüksek olan Tulum peyniri, küçükbaş hayvancılığın yaygın olarak yapıldığı Bingöl ve civarı illerinde halkın geçim kaynağı olarak da değerlendirilebilecektir. Bu nedenle, orijinal olarak küçükbaş hayvancılığın yaygın olarak yapıldığı Bingöl ve komşu illerin yaylalarında çiğ koyun sütünden geleneksel yöntemlerle üretilen Tulum peynirimizin orijinal haline sahip çıkmalıyız. Örneğin; Fransa, İtalya, Hollanda gibi peynir çeşidi ve üretimi çok fazla olan ülkeler, orijinal peynirlerini belirli bitki florasında, hep aynı yerde, orijinalliğine zarar vermeden üretirlerken çok doğru olan bu ilke bizde yok edilmemelidir. Aksi halde, bu orijinal Tulum peynirimize, birçok gıdada olduğu gibi başkaları sahip çıkabilir (Çakmakçı ve ark., 2009).

Bingöl SÜTAŞ Entegre Tesisleri sayesinde, İlin coğrafi şartlarının getirdiği küçükbaş hayvancılık avantajıyla Tulum peyniri üretiminin başarıyla sürdürülebileceği öngörülmektedir.

4. SONUÇ VE ÖNERİLER

Türkiye’de her yıl sağılan hayvan sayısı ile süt ve süt ürünleri üretimi miktarları düzenli olarak artmaktadır. Bingöl ilimizin, iklim ve doğa koşullarının hayvancılığa çok uygun olmasına rağmen sütçülük faaliyetlerinin Türkiye’deki oranı %1’in altında kalarak Türkiye’deki diğer illerin çok gerisinde kaldığı tespit edilmiştir. Bunun nedenleri arasında, Bingöl’de günümüze kadar hayvancılık faaliyetlerinin küçük aile işletmeciliği şeklinde yapılması ve Bingöl’de yeterince ticari süt işletmesinin bulunmaması gösterilebilir. Ancak, Bingöl’de kurulan SÜTAŞ Entegre tesislerinin bölgede hayvancılık faaliyetleri ile beraber sütçülük faaliyetlerine de ivme kazandırması beklenmektedir.

SÜTAŞ grubu tarafından Bingöl’de “Doğu-Güneydoğu Anadolu Sütçülük Projesi Bingöl Entegre Tesisleri” yatırımı kapsamında; süt hayvancılığı eğitim merkezi ve uygulamalı eğitim çiftliği, damızlık süt sığırcı çiftlikleri, düve yetiştirme çiftliği, besi çiftliği, yem bitkileri tarımı, yem fabrikası, süt ürünleri fabrikası, anaerobik arıtma, biyogaz elektrik üretim tesisi ve organomineral gübre tesisi bulunmaktadır. Ayrıca, hayvan sağlığı ve genomik seleksiyon ve embriyo çalışmaları (nesil ıslah) konularına odaklanacak bir Ar-ge merkezi yer almaktadır. Bingöl’de kurulan SÜTAŞ Entegre tesisleri günlük 1.063 ton süt işleme kapasiteli bir fabrika olup; SÜTAŞ bu sütün 250 tonunu kendisi karşılarken, 750 tonunu Bingöl ve çevre illerden karşılayacaktır. Süt gelmeden önce Bingöl’de günlük toplam süt üretim miktarı 70-80 ton iken, şimdi günlük toplam süt üretim miktarı 170-180 tona kadar yükselmiştir. SÜTAŞ Entegre



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tesislerinin bu yatırımı 1.012 kişiye doğrudan iş imkanı sağlayacağı belirtilmektedir. Buda, çarpanları ile dolaylı olarak yaklaşık 8.000 aileye olumlu etki sağlayacaktır. Bingöl’de SÜTAŞ Entegre tesislerinin bölgede tarım, hayvancılığın gelişmesinin yanı sıra Bingöl’ün gıda sektörünün ve sanayisinin gelişmesinde çok önemli katkıları olacaktır. Ayrıca, bölgede inşaat, sağım sistemleri, süt toplama, yem, hammadde temini ve sevkiyatı, nakliye, ambalaj malzemeleri, bakım onarım yan sanayi, mesleki eğitim gibi birçok alana ivme kazandıracaktır. SÜTAŞ Entegre tesislerinin Bingöl ve çevre illere yıllık 3 milyar liralık ekonomik katkı sağlaması beklenmektedir. Bingöl’de kurulan bu Entegre tesis ile SÜTAŞ, Türkiye’deki üretim kapasitesini % 30 oranında arttırmayı hedeflemektedir. Buda hem Bingöl hem de Türkiye’nin ekonomisine çok katkı sağlayacaktır.

Ek olarak, Bingöl Üniversitesi, "Bölgesel Kalkınma Odaklı Misyon Farklılaşması ve İhtisaslaşması" programı kapsamında "Tarım-Havza Bazlı Kalkınma" alanında pilot üniversite olarak seçilmiştir. Daha önceleri bal ve diğer arı ürünlerinin analizi için çevre illere gidilmekteydi. Pilot üniversite projesi sayesinde bal ve diğer arı ürünlerinin analizleri yapılabilmektedir. Bingöl’ün balı ve sütü yurt içinde, yurt dışında Erzincan Tulum peyniri ve Maraş dondurmasında olduğu gibi her yerde tanıtılmak ve markalaştırılmak istenmektedir. Bu nedenle Üniversitemizde arı ürünleri özellikle bal ve sütle ilgili ürün geliştirme üzerine çalışmalar yapılmaktadır. Bu çalışmalar ile hem Bingöl hem de Ülkemiz kazanacaktır.

Bingöl, önemli geleneksel peynirlerimizden olan Tulum peyniri üretiminde önemli sırada yer almaktadır. Çünkü Tulum peyniri Bingöl, Elazığ, Erzincan, Erzurum, Tunceli illeri yaylalarında çiğ koyun sütünden geleneksel yöntemlerle üretilmektedir. Tulum peyniri önceden yöresel olarak ve küçük çapta üretilmesine karşın, besin değerinin çok yüksek olması ve her kesim tüketicinin beğenisini kazanması sonucu daha çok miktarlarda üretilen, günümüzde tereyağına eşit veya daha yüksek fiyatlarda satılan ve ihracata uygun peynirler arasında gösterilmektedir. Bu nedenlerle, ekonomik değeri çok yüksek olan Tulum peynirimizin orijinalliğine zarar vermeden üreterek orijinal haline sahip çıkmalıyız.



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KAYNAKLAR

Cakir, Y. and Cakmakci, S. (2018), “ Some microbiological, physicochemical and ripening properties of Erzincan Tulum cheese produced with added black cumin (*Nigella sativa* L.) ”, Journal of Food Science and Technology, 55(4):1435-1443.

Cakir, Y. and Cakmakci, S. (2020), “ Comparison of some quality properties of Erzincan Tulum cheeses produced from raw and pasteurized Akkaraman sheep milk”, Turkish Journal of Agricultural and Natural Sciences, 7(4):972-982.

Cakir, Y., Cakmakci, S., Hayaloglu, A.A. (2016), “ The effect of addition of black cumin (*Nigella sativa* L.) and ripening period on proteolysis, sensory properties and volatile profiles of Erzincan Tulum (Savak) cheese made from raw Akkaraman sheep’s milk”, Small Ruminant Research, 134:65-73.

Çakmakçı, S. (2010), “Erzincan Tulum peyniri (Şavak peyniri) ”, (s: 71-73). 1. Uluslararası “Adriyatikten Kafkaslar’a Geleneksel Gıdalar Sempozyumu, 15-17 Nisan 2010, Tekirdağ.

Çakmakçı, S. (2011), “Türkiye Peynirleri”, (19. Bölüm: 585-614). In: Peynir Biliminin Temelleri. (Editörler: A.A. Hayaloğlu ve B. Özer), ISBN: 978-605-87976-1-1, SİDAS Medya Ltd. Şti., İzmir, 643 s.

Çakmakçı, (2019), “Süt Fizik ve Kimyası Ders Notları”, Atatürk Üniversitesi, Gıda Mühendisliği Bölümü, Erzurum.

Çakmakçı, S., Hayaloglu, A. A. ve Kolçak, M. (2009), “Her yönüyle Erzincan Tulum Peyniri”, II. Geleneksel Gıdalar Sempozyumu, s: 750-753, 27-29 Mayıs 2009, Van.

Hayaloglu, A.A., Cakmakci, S., Brechany, E.Y., Deegan, K.C., McSweeney, P.L.H. (2007), “Microbiology, biochemistry, and volatile composition of Tulum Cheese ripened in goats skin or plastic bags”, J. Dairy Sci., 90:1102-1121.

SÜT VE SÜT ÜRÜNLERİ Durum Tahmin Raporu, (2021), “Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü (TEPGE) ”, Hazırlayan: Dr. Zeliha YASAN ATASEVEN, ISBN: 978-605-7599-70-4, TEPGE YAYIN NO: 331, Ankara, 41s.

TÜİK, (2020), “Türkiye İstatistik Kurumu Verileri”, www.tuik.gov.tr (Erişim Tarihi: 15.12.2021).



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TÜİK, (2021), “Türkiye İstatistik Kurumu Verileri”, www.tuik.gov.tr (Erişim Tarihi: 15.12.2021).

Ünal, R.N., Besler, T. (2012), “Beslenmede Sütün Önemi. Hacettepe Üniversitesi”, Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümü, Sağlık Bakanlığı Yayın No: 727, Ankara, 40s.



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ÇİFTLİKLERDE İYİ HAYVAN REFAHI VE GÜVENLİ GIDA ÜRETİMİ İLİŞKİSİ

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ÖZET

Bir hayvan sağlıklıysa, rahatsa, iyi besleniyorsa, güvendeyse, türe özgü davranışlarını ifade edebiliyorsa ve acı, korku, endişe gibi hoş olmayan durumlara maruz kalmıyorsa iyi bir refaha sahip demektir. Refahı iyi olan hayvanlar daha uzun, daha sağlıklı ve daha verimli bir hayat yaşarlar. Hayvan refahının sağlanması hayvanlara uygun barınma, yönetim, beslenme, hastalık önleme ve tedavi ile insancıl muamele göstererek refahın tüm yönlerinin dikkate alınmasını içeren insani bir sorumluluktur. Ayrıca sadece yüksek refaha sahip hayvanlarla güvenli gıda üretimi söz konusudur. 'Çiftlikten çatala' yaklaşımı, tüketicilerin gıda güvenliği algısının yalnızca gıda kalitesi tarafından değil, aynı zamanda üretildiği hayvanın refah durumu tarafından da belirlendiğini kabul etmektedir. Bu nedenle hayvan refahı, "gıda kalitesi kavramının" ayrılmaz bir parçası olarak görülmektedir. Çiftlik hayvanlarının yaşam kalitesinin iyileştirilmesi üretkenliği ve ürün kalitesini artırmakta ve böylece yetiştiriciler hem sürdürülebilir hem de kârlı bir üretim yapabilmektedirler. Bu çalışmada güvenli gıda üretimi açısından çiftlik hayvanlarında iyi refahın önemi ele alınmıştır.

Anahtar Kelimeler: Hayvan Refahı, Güvenli Gıda, Çiftlik Hayvanları, Sağlık, Davranış



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**THE RELATIONSHIP OF GOOD ANIMAL WELFARE ON-FARM AND SAFE
FOOD PRODUCTION**

ABSTRACT

An animal is in a good state of welfare if it is healthy, comfortable, well-nourished, safe, able to express innate behavior, and if it is not suffering from unpleasant states such as pain, fear, and distress. High welfare animals live longer, healthier, and more productive lives. Ensuring animal welfare is a human responsibility that includes consideration for all aspects of animal well-being, including proper housing, management, nutrition, disease prevention and treatment, and humane handling. In addition, there is only safe food production with well-being animals. The 'farm to fork' approach recognizes that consumers' perceptions of food safety are determined not only by the quality of the food but also by the welfare status of the animal from which it is produced. For this reason, animal welfare is seen as an integral part of the concept of "food quality." Improving the quality of life of farm animals increases productivity and product quality so that breeders can produce both sustainable and profitable. This study discusses the importance of good welfare of farm animals in terms of safe food production.

Keywords: Animal Welfare, Safe Food, Farm Animals, Health, Behavior



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GİRİŞ

Tüketicilerin, hayvancılık endüstrilerindeki entansifleşme nedeniyle hayvansal ürünlerin sürdürülebilirliği ve bunun çevreye, insan sağlığına ve hayvan refahına olası zararları konusuna yönelik endişeleri artmaktadır. Bu eğilim, özellikle gelişmiş ülkelerde tüketici satın alma kararlarını etkilemektedir. Ancak diğer yandan talebi karşılamak için et üretim hacmini ve verimliliğini artırma baskısı önümüzdeki yıllarda çok daha yüksek olacaktır (Montossi ve ark. 2013). 2050 yılına kadar tarım sektörü, dünyayı beslemek için üretimini %60'dan fazla artırma zorunluluğuyla karşı karşıyadır (FAO 2012). Bu senaryoda, insan beslenmesinde stratejik bir protein kaynağı olan et tüketiminin önemli ölçüde artması beklenmektedir. Bu nedenle hayvancılık, iklim değişikliğinin hafifletilmesi ve 2050'de hayatta olacağı tahmin edilen 11 milyar insanın beslenme taleplerini karşılamak için daha verimli ve daha sürdürülebilir bir şekilde yoğun hâle gelme baskısı altındadır (Garnett ve ark. 2013).

Çiftlik hayvanlarının refahı için uygun olan yönetim koşullarının sağlanması, yalnızca tüketicilerden ve genel olarak toplumdan gelen taleplerden dolayı değil aynı zamanda yeterli düzeyde üretim yapabilme potansiyeline sahip olma ve kârlılık düzeylerinin artmasıyla da ilgilidir. Hayvan refahı verimli, üretken ve sürdürülebilir yetiştiricilik sistemlerinin temel direklerinden biridir (Nedeva 2020). Başka bir ifadeyle hayvan refahı ayrılmaz bir şekilde hem hayvan sağlığı hem de insan sağlığı ve refahı ile de bağlantılıdır. Çiftlik hayvanlarında stres ve kötü refah, bir dizi zoonoz hastalığın bulaşmasını artırmaktadır. Bununla birlikte çiftlik hayvanlarında antimikrobiyal kullanımının, insan sağlığı için önemli olan ilaçlara karşı antimikrobiyal direncin artmasına katkıda bulunduğu dair endişeler devam etmektedir (Cox ve Bridgers 2021).

Çiftlik hayvanları hem entansif hem de ekstansif yetiştiricilik koşullarında refahlarını ve doğal davranışlarını etkileyen bir dizi stres faktörüne sürekli olarak maruz kalırlar (Rushen, 2003; Goddard, 2006). Entansif yetiştiricilikte, barınakta hayvan başına ayrılan alan, zemin yapısı, altlık durumu, kastrasyon, kuyruk kesimi, tırnak kesimi ve boynuz köreltme gibi yönetimsel uygulamalar, barınak içi mikro klima koşulları, yanlış ve yetersiz besleme, nakil ve yetiştiricinin olumsuz davranışları olarak sıralanabilir (Hughes ve Curtis 1997). Ekstansif yetiştiricilikte ise ekstrem iklim koşulları, mera ot kalitesi ve miktarındaki mevsimsel değişiklikler ve paraziter enfeksiyonlar refahı olumsuz etkileyen önemli faktörler arasındadır (Sevi ve ark. 2009).



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Hayvan refahı ve verimli yetiştiricilik arasındaki ilişkinin öneminin, hayvan refahını iyileştirmenin hem topluma hem de yetiştiricilere getirebileceği finansal faydalar gösterilerek anlaşılması sağlanabilir. Bu faydalar; azalan ölüm oranı, sağlığın iyileştirilmesi, ürün kalitesinin artırılması, hastalık direncinin artırılması ve ilaç kullanımının azaltılması, zoonoz ve gıda kaynaklı hastalık riskinin daha düşük olması, tüketicilerden daha yüksek fiyatlar talep edebilme gücü ve yetiştiricinin iş tatmini ve topluma katkıları olarak sıralanabilir (Dawkins 2017).

Hayvan Refahı Kavramı

Hayvan refahı, genelde beş temel özgürlük kavramı üstüne oturtulmuştur. Bu beş özgürlük; hayvanlar aç, susuz ve kötü beslenmeye maruz bırakılmamalı, hayvanlar hiçbir şekilde rahatsız edilmemeli, hayvanlar ağrı, yara ve hastalıklardan korunmalı, hayvanlar normal davranışlarını gösterebilmeli ve hayvanlar, korku ve stres yaratan ortamlarda bulundurulmamalıdır şeklinde sıralanabilir (Broom 1991). Beş özgürlük, hayvan refahı ile ilgili birçok kanunun ve refahın değerlendirmesine yönelik protokollerin geliştirilmesinin arka planında yer alan, hayvan refahı analizi için mantıklı ve kapsamlı bir çerçeve oluşturmada hem ayrı ayrı hem de birlikte değerlendirilmesi gereken kavramları içermektedir (McCulloch 2013; Llonch ve ark. 2015; von Keyserlingk ve Yorgun 2017). Bununla birlikte beş özgürlük kavramı, yetiştirme koşullarının değerlendirilmesine ve farklı yetiştiricilik sistemlerinde hayvan refahının karşılaştırılmasına olanak tanımakta ancak bir hayvanın sağlıklı olup olmadığını söylemek için yeterli olmamaktadır. Örneğin, Sevi ve ark. (2009), süt koyunu yetiştiriciliği için ekstansif ve yarı ekstansif olmak üzere iki farklı yetiştiricilik sisteminde refah açısından kritik noktaları belirlemek için beş özgürlük kavramını kullanmışlardır. Ekstansif sistemde koyunların ani iklim değişiklikleri, termal rahatsızlık, meradaki ot miktarı ve kalitesinde değişiklikler ve refahlarını tehdit eden parazitlerin varlığı gibi çeşitli faktörlere maruz kaldığını bulmuşlardır. Diğer yandan yarı-ekstansif sistemde mikro iklim koşullarının, çok sayıda hayvanın bir arada bulunması nedeniyle artan agresif davranışların, barınak içinde artan çevre kirliliğinin ve kötü meme sağlığının sorun olarak ortaya çıktığını bildirmişlerdir. 2008 yılında, Avrupa Çiftlik Hayvanları Refahı Kalitesi komisyonu beş özgürlük kavramını revize ederek “iyi beslenme”, “iyi çevre”, “iyi sağlık” ve “türe özgü davranış” olarak 4 ana refah alanı tanımlamıştır (Veissier ve ark. 2011). Başlangıçta, araştırmacılar tarafından hayvanların duyguları ya da talepleri olabileceği düşünülmendiğinden refah değerlendirilirken sağlık veya biyolojik duruma odaklanılmış ve tanımlar da hep bu çerçeve dahilinde yapılmıştır. Bunun da temelinde hayvan



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refahı değerlendirmesi için kullanılan sağlık parametrelerinin hayvanlardaki acı çekme düzeyi ile güçlü bir şekilde ilişkili olmasıdır (Rushen 2003). Hemsworth ve ark. (2015) hayvan refahının, vücutta dinamik olarak birbiriyle ilişkili olan ve bir bütün olarak hareket eden biyolojik işleyiş, doğal davranışlar ve duygusal durumlar olarak bilinen üç yaklaşımın entegrasyonu yoluyla değerlendirilmesi gerektiğini ifade etmişlerdir. Daha sonra, bu dört ana alan, her biri kilit refah konularına karşılık gelen on iki bağımsız kritere bölünmüştür (Blokhuys ve ark. 2010; Rushen ve ark. 2011). Bu 12 kriter; uzun süreli açlığın olmaması, uzun süreli susuzluğun olmaması, dinlenme sırasında rahatlık, termal konfor, hareket kolaylığı, yaralanmaların olmaması, hastalık olmaması, yönetim prosedürlerinin neden olduğu ağrının olmaması, sosyal davranışın ifadesi, diğer doğal davranışların ifadesi, iyi insan-hayvan ilişkileri ve olumlu duygusal durum olarak sıralanabilir (Welfare Quality® 2009). Broom (2017) hayvan refahının fizyoloji, genetik, beslenme, sosyoloji, etoloji gibi çeşitli disiplinler yaklaşımlara tabi olan uygulamalı bir bilim alanı olduğunu ifade etmiştir. Hayvan refahı sorunlarının çözümüne yönelik temel bilimsel yaklaşımın, davranışsal tepkilerin araştırılması olduğu vurgulanmıştır. Daha sonraki dönemlerde hayvan refahı ile ilgili çalışmalar, iyi bir fiziksel ve ruhsal sağlıkla bağlantılı olarak hayvanların yaşam standartlarının iyileştirilmesi, verimliliklerinin artırılması ve değişen çevre koşulları ile başa çıkma yeteneklerine odaklanmıştır. Hayvanların iyi olma durumlarını inceleyen bir bilim dalı olan hayvan refahı, insan davranışlarının hayvanlar üzerindeki etkisini onların bakış açısından ele alır. Etik, insanların hayvanlar üzerindeki etkisi açısından hayvan refahı ile ilgilenir. Mevzuat açısından ise hayvan refahı, yalnızca insanların hayvanlarla ilişkisi söz konusu olduğunda önemlidir (Nedeva 2020). Avrupa Gıda Güvenliği Komisyonu, çiftlik düzeyinde hayvan refahının yeterli şekilde değerlendirilmesinin ancak hayvanlara dayalı tedbirlerin uygulanması ile mümkün olacağını ifade etmiştir (EFSA 2012). Bu göstergelerin hayvanların sağlık, davranış, insanlarla ve çevre ile etkileşimleri hakkında doğrudan bilgi sağlayarak hayvan refahının daha doğru bir şekilde değerlendirmesine olanak sağlayacağını belirtmişlerdir. Çiftliklerde refahın değerlendirilmesi, çeşitli yetiştirme koşullarının etkilerinin belirlenmesinde ve ayrıca sertifikasyon sistemi veya danışmanlık uygulamaları gibi yasal gereksinimlerin geliştirilmesinde kullanılabilir (Caroprese ve ark. 2009).

Çiftlikte İyi Hayvan Refahının Önemi

Dawkins (2008) “iyi refahı” en basit şekliyle hayvanın sağlıklı olması ve ihtiyaçlarının karşılanması olarak tanımlamıştır. Hayvanlarının ihtiyaçlarının karşılanmasını sağlayacak olan



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yetiştirici ve hayvanlar arasındaki etkileşiminin hayvanların refahını ve üretkenliğini nasıl etkilediği yapılan çalışmalarla ortaya konulmuştur (Hemsworth 2003; Lensink ve ark. 2000). İnsanlar ve çiftlik hayvanları arasındaki ilişkinin hem hayvanlar hem de insanlar üzerinde yansımaları vardır. İnsan-hayvan ilişkisi hayvanın verimliliğini, sağlığını ve refahını etkileyen kritik öneme sahiptir (Hemsworth ve Coleman 2011; Zulkifli, 2013). Özellikle insan-hayvan ilişkisinin yönü hayvanların duyduğu korku ya da güven duygusu bakımından önem taşımakta ve çiftlikteki hayvan refahının değerlendirilmesinde bir ölçüt olarak kullanılabilir (Burton ve ark. 2012). Hayvanların çiftlikte sürü yönetiminin rutin uygulamaları esnasında yetiştiriciye karşı duyduğu korku önemli bir stres kaynağıdır. Örneğin yetiştiricilerin olumsuz davranışları süt veriminin düşmesine neden olmaktadır (Waiblinger ve ark. 2002). İyi hayvan refahı için iyi bir yetiştirici şarttır. İnsanlarla hayvanlar arasında çiftlikteki rutin uygulamalar sırasında (yemleme, sağım, aşılama ve kırkım gibi) vurma, dokunma ve okşama gibi eller ile fiziksel temas ya da ses tonu, vücut hareketleri ve kokusu ve hayvana yaklaşırken çıkardığı gürültü gibi fiziksel olmayan pek çok etkileşim söz konusudur (Seabrook ve Bartle 1992). Yetiştiricinin hayvanlara karşı olumsuz fiziksel teması insanlardan korkmalarına ve uzak durmalarına yol açmaktadır. Bu durum insanın hayvanla temasının zorunlu olduğu aşı-tedavi uygulamaları sırasında hayvanların direnmesi ve zorluk çıkarması nedeniyle daha da önem kazanmaktadır (Hemsworth ve ark. 1986). Yetiştiricinin hayvana olumlu fiziksel teması ise insanlara yaklaşma eğilimini artırmaktadır (Hosey 2008). Hayvandaki davranış değişiklikleri, doğrudan gözlem yoluyla en kolay değerlendirilen refah göstergeleridir (Schmied ve ark. 2008). Süt sığırlarının boynunun ventral bölgesini okşamanın kalp atış hızını azalttığı ve sığırlarda rahat vücut duruşları ve insanlara daha fazla yaklaşma ile sonuçlandığı bildirilmiştir (Bertenshaw ve ark. 2008; Westerath ve ark. 2014). Süt sığırlarıyla ve koyunlarla konuşma ile okşamanın yüksek frekanslı kalp hızı değişkenliğini arttırdığı belirtilmiştir (Hemsworth ve ark. 2018; Lange ve ark. 2020). Yetiştiricinin bilgisi, becerileri ve tutumu, bir çiftlikteki hayvanların refah standartlarını belirler. Yetiştirici tarafından hayvanın dış görünüşündeki (deri, göz ve duruş vb.) ya da sosyal etkileşimdeki (oyun oynama, hareketlilik vb.) değişikliklerin fark edilmesi ve performanslarının düzenli takibi refah noktasında kilit öneme sahiptir (Dockès ve Kling-Eveillaard 2006; Hubbard ve Scott 2011). İyi yetiştiricilik, hayvanlara karşı empati geliştirilmesi ile hayvanların ihtiyaçlarını anında tespit etme ve bunlara yanıt verme yeteneğidir. Hayvan davranışları ve iyi hayvan yönetimi konusunda bilgili, yetenekli ve deneyimli olan yetiştirici refah sorunlarını erkenden tespit ederek hayvanların sağlık ve verimlerinin



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sürekliliğini sağlayacaktır (Hemsworth ve Coleman 2011). Bununla birlikte hayvanlarla olumlu ilişkisi yetiştiricinin çiftçilikle ilgili stresini hafifletebilir, iş memnuniyetini ve üretkenliğini artırabilir (Hemsworth ve ark. 2002; Kielland ve ark. 2010). Hayvanlar, biyolojik ihtiyaçları yeterince karşılandığında, hastalık, acı ve yaralanmalarının yanı sıra stresleri de önlendiğinde veya en aza indirildiğinde refahları iyi durumda olacaktır. Hayvan refahı bu şartlarda güvence altına alındığında, hayvanlar hem sağlıklı hem de yetiştiricinin bakış açısından tatmin edici bir şekilde yaşamlarını sürdüreceklerdir. Bu nedenle, hayvanların refahına iyi bakmak yetiştirici açısından hem ekonomik olarak mantıklıdır hem de başarılı bir yetiştirici olmanın en önemli parçasıdır (Hemsworth 2003).

Hastalıklar, hayvanların üreme performanslarını ve üretkenliklerini etkileyen ve sınırlayan en önemli faktörlerden biridir (Anonim 2011). Hayvanların hastalık ve yaralanmalardan korunarak sağlıklı kalmaları refahlarının iyi olmasına katkıda bulunurken yetiştiriciye de ekonomik katkı sağlamaktadır. Sağlıklı hayvanlarda ilaç kullanımı ve koruyucu hekimlik giderleri azaldığı için yetiştirici hem işgücü hem de maliyet bakımından fayda sağlamaktadır (Bruijnis ve ark. 2010). Hayvanlarda ağrı olması da potansiyel olarak yetersiz hayvan refahının kanıtı olan fiziksel ve davranışsal değişiklikleri tetikleyebilmektedir. Ağrı, yalnızca doku hasarının şiddetine değil, aynı zamanda hayvanların ağrılı bir uyarana maruz kalma süresine de bağlıdır (Fitzpatrick ve ark. 2006). Hayvanlar çiftlikte genellikle ağrılı uygulamalar olarak aşılama, küpeleme, kastrasyon gibi çeşitli zooteknik prosedürlere maruz kalmakta ve bu uygulamalar refahlarını olumsuz etkileyebilmektedir. Ayrıca hayvanlar mastitis ve topallık gibi farklı hastalıklardan dolayı da ağrı çekebilmektedir (McLennam 2018). Topallık hayvanların keyifsiz olmasına, hareketlerinin kısıtlanmasına neden olan önemli bir refah sorunudur. Phythian ve ark. (2016) sürekli olarak sıkıntılı bir ruh haline sahip hayvanların bulunduğu çiftliklerde topallıkların yüksek düzeyde görüldüğünü bildirmişlerdir. Topal hayvanların topal olmayanlara göre daha sıkıntılı ve kederli olduklarını, bunun da topallığın ve bunun altında yatan ağrının hayvanların duygusal durumu üzerinde daha zararlı bir etkisi olduğunu ifade etmişlerdir. Mastitis kontrol programlarının yaygın olarak uygulanmasına rağmen, geniş kapsamlı etkileri ve sonuçları ile süt endüstrisinde en yaygın ve en maliyetli hastalıklardan biridir. Mastitisli hayvanlarda ağrı ve rahatsızlık ile ilgili davranışsal tepkiler aktivite, yürüyüş, beslenme davranışı ve kendi kendini temizlemedeki değişiklikleri içermektedir. Mastitisin hayvan refahı üzerinde uzun vadeli zararlı etkileri olduğundan, bu hastalığı erken evrelerde teşhis etmek çok önemlidir (Petersson-Wolfe ve ark. 2018). Hayvanların herhangi bir nedenle strese girmeleri bağışıklık sistemlerinin



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baskılanmasına ve hastalığa karşı savunmasızlığın artmasına neden olmaktadır (Broom 1991). Çiftlik hayvanlarının bulunduğu ortamlardaki su ve yem yetersizliği, analarından ayrılarak farklı çevrelere götürülmeleri gibi faktörler stres kaynağıdır. Stresin kronik hale gelip uzun sürmesi hayvanlarda stereotipik davranışlar ortaya çıkmasına yol açmakta bu durum refah düzeyindeki azalmanın bir göstergesi olarak kabul edilmektedir (Casamassima ve ark. 2006; Hamadeh ve ark. 2006). Sürü yönetimindeki eksiklikler ve olumsuz çevre koşulları birçok fizyolojik yan etkilere, yavru ölümlerine, ekonomik kayıplara ve dolayısıyla üretimde gerilemelere yol açmaktadır (Nowak ve ark. 2000). Yetersiz barındırma koşulları da hayvanlar için stres faktörüdür (Hughes ve Curtis 1997). Hayvanların sürekli bağlı tutulmaları, barınak içinde uygun olmayan mikro klima koşulları, yetersiz ışık, yetersiz altlık, düşük kalitede yem verilmesi sonucu yaşadıkları stres hayvanın bağışıklık sistemini zayıflatarak hastalıkların artmasına neden olmaktadır (Costa ve ark. 1992). Çiftliklerde refah ve verimliliğin el ele gitmesinin en bariz yolu ölümlerin azaltılmasıdır. Hayvanlarda yaşama gücünün artırılması için hayatta kalma olasılıklarının daha yüksek olduğu koşullarda tutulmaları refahlarında iyileşmeler sağlayacaktır. Örneğin, yeni doğan ölümleri genellikle soğuk ve yağışlı koşullardan kaynaklanan hipotermi, ana ile yavru ilişkisinin kurulamaması, yaralanma, ishal ve solunum yolu hastalıklarından kaynaklanmaktadır ve yetiştiriciler için büyük ekonomik kayıplara yol açmaktadır (Mellor ve Stafford 2004; Windeyer ve ark. 2014). Dolayısıyla çiftlikte ölüm oranlarının azaltılması doğrudan hem verimliliğe katkıda bulunacak hem de refahı iyileştirecektir.

Hayvan sağlığı insan sağlığını doğrudan etkilemektedir (Tomley ve Shirley 2009). 'Kuş gribi' ve 'domuz gribi' insan sağlığı üzerinde potansiyel olarak yıkıcı etkilere ve aynı zamanda büyük ekonomik maliyetlere sahiptir (Beach ve ark. 2007). *Campylobacter* ve *Salmonella* gibi gıda kaynaklı bakteriyel hastalıklar ya da toksoplazma gibi paraziter zoonotik hastalıklar da insan sağlığı için büyük bir tehdit oluşturmaktadır (Torgerson ve Macpherson 2011; Platts-Mills ve Kosek 2014). Bu nedenle hayvanın sağlıklı olması, optimum performans göstermesi ve refahının iyi olarak değerlendirilmesi oldukça önemlidir. Sadece sağlıklı hayvanlardan güvenli ürünler elde etmek mümkün olduğundan hastalıkların önlenmesi herhangi bir başarılı işletme programının temel unsurudur. Bir diğer ifadeyle sağlıklı, refahı iyi olan hayvanlar yüksek kaliteli gıda üretiminin ayrılmaz bir parçasıdır. Bu bağlamda hastalıkların çıkışını ve yayılışını en aza indirmek için bazı koruyucu tedbirlerin alınması gerekmektedir (Mundan ve Memiş 2011, Yener ve ark. 2013). Bu koruyucu tedbirler “biyogüvenlik” önlemleri ya da uygulamaları



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şeklinde ifade edilmektedir. Biyogüvenlik uygulamaları çiftlik düzeyinde hayvanları bulaşıcı hastalıklardan korumak için tasarlanmış önlemler dizisidir. Çiftlik düzeyinde sürüye hastalık girişinin ve yayılmasının önlenmesinin sağlanması yetiştiricinin sistematik bir yaklaşım içinde olmasını gerektirmektedir. Bu noktada, hastalıkların bulunmadığı bölgelere veya sürülere hastalık girişini ya da yayılmasını önlemek için ortaya çıkabilecek risklerin önceden dikkatli bir biçimde değerlendirilmesi ve bu riskleri ortadan kaldıracak önlemlerin alınması gerekmektedir (Anonim 2011). Hayvancılık işletmelerinde biyogüvenliğin sağlanması sayesinde sağlıklı ve refahı yüksek hayvanlarla güvenli bir üretim yapma olanağı mümkün olacak, dolayısıyla çiftlikte verimlilik ve kârlılık arttırılacaktır.

Sonuç olarak hangi türde yetiştiricilik yapılıyor olursa olsun refahın söz konusu olabilmesi için hayvanların biyolojik ihtiyaçlarının eksiksiz olarak karşılanması gerekmektedir. Hayvan refahını değerlendirmek için hangi tanımın kullanılacağına bakılmaksızın, hayvanlar için olumsuzdan olumluya değişen bir refah sürekliliği olduğunu kabul etmek önemlidir. Hayvan refahı hem ekonomik sonuçları olan etik hem de ahlaki ağırlık taşıyan ekonomik bir itici güçtür. Bu, onu gelecek için sürdürülebilir gıda üretiminin güçlü ve gerekli bir bileşeni yapmaktadır. Hayvan refahının iyileştirilmesi, hayvanın deneyimlerinin olabildiğince olumlu olmasını sağlamak anlamına gelir. Bu da hayvanların bakımlarından sorumlu kişiler tarafından altyapı ve uygulamalarda değişiklik yapılmasını ve personelin iyi hayvan refahı konusunda eğitilmesini gerektirir. Hayvanların iyi sağlık ve refah koşullarında yaşamasını sağlamak için yetiştiricilik sistemlerinin iyileştirilmesi, hastalıkların görülme sıklığını ve antimikrobiyal kullanımını azaltabilir ve bu da daha iyi insan sağlığı ve refahı ile sonuçlanabilir.



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KAYNAKLAR

Anonim 2011. Farm level biosecurity measures for sheep and goats farms. Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). Technical bulletin, No.45, January 2011. http://www.esgPIP.org/PDF/Technical_Bulletin_45.pdf. (Erişim tarihi: 17.11.2021).

Beach RH, Poules C, Pattandyak SK. 2007. Farm economics of bird flu. Can. J. Agric. Econ., 55: 471-483.

Bertenshaw C, Rowlinson P, Edge H, Douglas S, Shiel R. 2008. The effect of different degrees of 'positive' human-animal interaction during rearing on the welfare and subsequent production of commercial dairy heifers. Appl. Anim. Behav. Sci., 114: 65-75.

Blokhuis HJ, Veissier I, Miele M, Jones B. 2010. The Welfare Quality® project and beyond: Safeguarding farm animal wellbeing. Acta Agric. Scand. Anim. Sci., 60: 129-140.

Broom DM. 1991. Animal Welfare: Concepts and Measurement. J. Anim. Sci., 69: 4167-4175.

Broom DM. 2017. Welfare of animals: behavior as a basis for decisions. In: Reference module in life science. Elsevier, ISBN: 978-0-12-809633-8.

Bruijnjs MRN, Hogeveen H, Stassen EN. 2010. Assessing economic consequences of foot disorders in cattle using a dynamic stochastic simulation. J. Dairy Sci., 93: 2419-2432.

Burton RJF, Peoples S, Cooper MH. 2012. Building 'cowshed cultures': A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. J. Rural Stud., 28: 174-187.

Caroprese M, Casamassima D, Rassu SPG, Napolitano F, Sevi A. 2009. Monitoring the on-farm welfare of sheep and goats. Ital. J. Anim. Sci., 8(1): 343-354.

Casamassima D, Pizzo R, Palazzo M, Quaranta A, D'Alessandro AG, Martemucci G. 2006. Effect of water restriction on production performance and on some blood parameters in intensively reared Comisana sheep. In: Proc. 14th Int. Congr. FeMeSPRum, Santiago de Compostela, Spain, 477-478.

Costa MJRP, Siva R, Souza RC. 1992. Effect of air temperature and humidity on ingestive behaviour of sheep. Int. J. Biometereol., 36: 218-222.

Cox J, Bridgers J. 2021. Issue No. 34: Why is Animal Welfare Important for Sustainable Consumption and Production? <https://apo.org.au/sites/default/files/resource-files/2019-03/apo-nid22521.pdf> (Erişim Tarihi: 17.10.2021).



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- Dawkins MS. 2008. The science of animal suffering. *Ethol.*, 114: 937-945.
- Dawkins MS. 2017. Animal welfare and efficient farming: is conflict inevitable? *Anim. Prod. Sci.*, 57: 201-208.
- Dockès AC, Kling Eveillard F. 2006. Farmers' and advisers' representations of animal and animal welfare. *Livest. Sci.*, 103: 243-249.
- EFSA (European Food Safety Authority). 2012. Statement on the use of animal-based measures to assess the welfare of animals. Panel on animal health and welfare (AHAW), *EFSA Journal*, 10(6): 2767-2796.
- FAO (Food and Agriculture Organization of the United Nations). 2012. OECD-FAO agricultural outlook 2012-2021.
- https://www.fao.org/fileadmin/templates/est/COMM_MARKETS_MONITORING/Oilcrops/Documents/OECD_Reports/Ch5StatAnnex.pdf (Erişim tarihi: 17.10.2021).
- Fitzpatrick J, Scott M, Nolan A. 2006. Assessment of pain and welfare of sheep. *Small Rumin. Res.*, 62: 55-61.
- Garnett T, Appleby MC, Balmford A, Bateman IJ, Benton TG, Bloomers P, Burlingame M, Dawkins M, Dolan L, Fraser D, Herrero M, Hoffman I, Smith P, Thornton PK, Toulmin C, Vermeulen SJ, Godfray HCJ. 2013. Sustainable intensification in agriculture: premises and policies. *Science*, 341: 33-34.
- Goddard P, Waterhouse T, Dwyer C, Stott A. 2006. The perception of the welfare of sheep in extensive systems. *Small Rumin. Res.*, 62: 215-225.
- Hamadeh SK, Rawda N, Jaber LS, Habre A, Abi Said M, Barbour EK. 2006. Physiological response to water restriction in dry and lactating Awassi ewes. *Livest. Prod. Sci.*, 101: 101-109.
- Hemsworth PH, Barnett JL, Hansen C. 1986. The influence of handling by humans on the behaviour, reproduction and corticosteroids of male and female pigs. *Appl. Anim. Behav. Sci.*, 15: 303-314.
- Hemsworth P, Coleman G, Barnett J, Borg S, Dowling S. 2002. The effects of cognitive behavioural intervention on the attitude and behaviour of stockpersons and the behaviour and productivity of commercial dairy cows. *J. Anim. Sci.*, 80: 68-78.
- Hemsworth PH. 2003. Human-animal interactions in livestock production. *Appl. Anim. Behav. Sci.*, 81: 185-198.



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Hemsworth PH, Coleman GJ. 2011. Human-livestock interactions: The stockperson and the productivity and welfare of intensively farmed animals. (2nd ed.) CABI, ISBN-9781845936730, 194p.

Hemsworth PH, Mellor DJ, Cronin G, Tilbrook A. 2015. Scientific assessment of animal welfare. New Zeal. Vet. J., 63: 24-30.

Hemsworth P, Sherwen S, Coleman G. 2018. Human contact. Anim. Welf., 3: 294-314.

Hosey G. 2008. A preliminary model of human-animal relationships in the zoo. Appl. Anim. Behav. Sci., 109: 105-127.

Hubbard H, Scott K. 2011. Do farmers and scientists differ in their understanding and assessment of farm animal welfare? Anim. Welf., 20: 79-98.

Hughes BO, Curtis PE. 1997. Health and disease. In: Animal Welfare. M.C. Appleby and B.O. 109-125.

Kielland C, Skjerve E, Østerås O, Zanella A. 2010. Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. J. Dairy Sci., 93: 2998-3006.

Lange A, Bauer L, Futschik A, Waiblinger S, Lürzel S. 2020. Talking to cows: Reactions to different auditory stimuli during gentle human-animal interactions. Front. Psychol., 11(2690): 1-14.

Lensink BJ, Boivin X, Pradel P, Neindre PL, Veissier I. 2000. Reducing veal calves' reactivity to people by providing additional human contact. J. Anim. Sci., 78: 1213-1218.

Llonch P, King EM, Clarke KA, Downes JM, Green LE. 2015. A systematic review of animal based indicators of sheep welfare on farm, at market and during transport, and qualitative appraisal of their validity and feasibility for use in UK abattoirs. Vet. J., 206: 289-297.

Mellor DJ, Stafford KJ. 2004. Animal welfare implications of neonatal mortality and morbidity in farm animals. Vet. J., 168: 118-133.

McCulloch SP. 2013. A critique of FAWC's five freedoms as a framework for the analysis of animal welfare. J. Agric. Environ. Ethics., 26: 959-975.

McLennam, K. 2018. Why pain is still a welfare issue for farm animals, and how facial expression could be the answer. Agriculture, 8: 127.



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Montossi F, Furnols MF, del Campo M, San Julián R, Brito G, Sañudo C. 2013. Sustainable sheep production and consumer preference trends: Compatibilities, contradictions, and unresolved dilemmas. *Meat Sci.*, 95: 772-789.

Mundan D, Memiş H. 2011. Avrupa Birliği ile müzakere sürecinde Türkiye’de hayvancılık sektörünün koruyucu hekimlik açısından değerlendirilmesi, *Akademik Araştırmalar ve Çalışmalar Dergisi*, 3(4): 99-110.

Nedeva I. 2020. Primary factors influencing sheep welfare in intensive and extensive farming systems – a review article. *Bulg. J. Agric. Sci.*, 26(1): 97-106.

Nowak R, Porter RH, Levy F, Orgeur P, Schaai B. 2000. Role of mother-young interactions in the survival of offspring in domestic mammals. *Reviews Reprod.*, 5: 153-163.

Petersson-Wolfe CS, Leslie KE, Swartz TH. 2018. An update on the effect of clinical mastitis on the welfare of dairy cows and potential therapies. *Clin. North Am. Food Anim.*, 34(3): 525-535.

Phythiana CJ, Michalopoulou E, Cripps PJ, Duncan JS, Wemelsfelder F. 2016. On-farm qualitative behaviour assessment in sheep: Repeated measurements across time, and association with physical indicators of flock health and welfare. *Appl. Anim. Behav. Sci.*, 175: 23-31.

Platts-Mills JA, Kosek M. 2014. Update on the burden of *Campylobacter* in developing countries. *Curr. Opin. Infect. Dis.*, 27: 444-450.

Rushen J. 2003. Changing concepts of farm animal welfare: bridging the gap between applied and basic research. *Appl. Anim. Behav. Sci.*, 81: 199-214.

Rushen J, Butterworth A, Swanson JC. 2011. Animal behavior and well-being symposium. Farm animal welfare assurance: Science and application. *J. Anim. Sci.*, 89: 1219-1228.

Schmied C, Waiblinger S, Scharl T, Leisch F, Boivin X. 2008. Stroking of different body regions by a human: Effects on behaviour and heart rate of dairy cows. *Appl. Anim. Behav. Sci.*, 109: 25-38.

Seabrook MF, Bartle NC, 1992. Environmental factors influencing the production and welfare of farm animals –humans factors. In: Phillips, C.J.C., Piggins, D. (ed.) *Farm animals and the environment*. CAB International, Wallingford, UK, 111-130.

Sevi A, Casamassima D, Pulina G, Pazzona A. 2009. Factors of welfare reduction in dairy sheep and goats. *Ital. J. Anim. Sci.* 8(1): 81-101.



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and RURAL DEVELOPMENT
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Tomley FM, Shirley MW. 2009. Livestock infectious diseases and zoonoses. Philosophical Transactions of the Royal Society of London. Series B, Biol. Sci., 364: 2637-2642.

Torgerson P, Macpherson NL. 2011. The socioeconomic burden of parasitic zoonoses: global trends. Vet. Parasitol., 182: 79-95.

Veissier I, Jensen KK, Botreau R, Sandøe P. 2011. Highlighting ethical decisions underlying the scoring of animal welfare in the Welfare Quality scheme. Anim. Welf., 20: 89-101.

von Keyserlingk MAG, Weary DM. 2017. A 100-year review: Animal welfare in the Journal of Dairy Science - The first 100 years. J Dairy Sci., 100(12):10432-10444.

Waiblinger S, Menke C, Coleman G. 2002. The relationship between attitudes, personal characteristics and behavior of stockpeople and subsequent behavior and production of dairy cows. Appl. Anim. Behav. Sci., 79: 195-219.

Welfare Quality® 2009. An Overview of the Development of the Welfare Quality Assessment Systems Welfare Quality Reports No. 12, Cardiff University, <http://www.welfarequalitynetwork.net/media/1120/wqr12.pdf> (Erişim Tarihi: 17.10.2021).

Westerath HS, Gygax L, Hillmann E. 2014. Are special feed and being brushed judged as positive by calves? Appl. Anim. Behav. Sci., 156: 12-21.

Windeyer MC, Leslie KE, Goddin SM, Hodgins DC, Lissemore KD, LeBlanc SJ. 2014. Factors associated with morbidity and mortality in young dairy cattle. Vet. Med., 113: 231-240.

Yener H, Atalar B, Munda D. 2013. Şanlıurfa ilindeki sığırcılık işletmelerinin biyogüvenlik ve hayvan refahı açısından değerlendirilmesi. Harran Üniv. Vet. Fak. Derg., 2(2): 87-93.

Zulkifli I. 2013. Review of human-animal interactions and their impact on animal productivity and welfare. J. Anim. Sci. Biotechnol., 4(25): 1-7.



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**TÜRKİYE’DE ORGANİK TARIMSAL VE HAYVANSAL ÜRÜNLERİN
ÜRETİMİNDE GÜNCEL DURUM**

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ÖZET

Günümüzde, tarımsal üretimi arttırmak ve zararlı organizmaları yok etmek için kullanılan kimyasallar, pestisitler ve tarım ilaçları tarım ürünlerinde ve hayvansal ürünlerde istenmeyen sağlığa zararlı kimyasal kirliliğe yol açmaktadır. Yine aynı şekilde hayvanlarda hastalıkları önlemek veya hayvanları tedavi etmek için kullanılan antibiyotik gibi ilaçlar ve diğer kimyasallar da hayvansal ürünler de doğallığı bozmaktadır. Bu tarz kimyasallar kullanılmadan üretilen bitkisel ve hayvansal ürünler organik olarak adlandırılır. Bu kimyasalların insan sağlığı üzerindeki olumsuz etkilerinden dolayı kimyasallar ve ilaçlar kullanılmadan üretilen bitkisel ve hayvansal ürünler insanlar tarafından daha fazla rağbet görmeye başlamıştır. Gıda güvenliğini sağlama, sağlıklı beslenme ve çevreyi koruma gibi amaçlarla organik ürünler daha fazla talep edilmektedir. Buna bağlı olarak organik tarım ve hayvancılık yapılarak elde edilen ürün miktarı talebe bağlı olarak birçok ülkede giderek artmaktadır. Organik ürünlere olan talep ve organik ürünlerin üretimi, tüm dünyada olduğu gibi Türkiye’de de artmış durumdadır. Organik meyve ve sebze gibi bitkisel ürünlerin yanı sıra organik süt, organik peynir, organik yoğurt, organik bal ve organik yumurta gibi organik hayvansal ürünler de artan talebe bağlı olarak Türkiye’de daha fazla üretilmeye başlanmıştır. Türkiye, verimli tarım alanlarının fazla olması, hayvancılığın yaygın olması ve artan nüfusundan dolayı organik ürünlerin üretiminde büyük bir potansiyele sahiptir. Bu derlemede, organik bitkisel ve hayvansal ürünün tanımı, Türkiye’nin organik tarım ve hayvancılıktaki potansiyeli, Türkiye’de organik tarım ve hayvancılığın güncel durumu, organik bitkisel ve hayvansal ürünlerin üretimindeki iyileşmeler ve Türkiye’de organik tarım ve hayvancılığın geleceği hakkında bahsedilmiştir. Türkiye’de organik ürünlere olan talep önceki yıllara göre artış göstermiştir. Organik bitkisel ve hayvansal ürünlerin üretimi önceki yıllara göre artmıştır. Organik üretime yapılacak desteklerle Türkiye’de organik ürünlerin üretimi daha da arttırılabilir.

Anahtar Kelimeler: Türkiye, Organik Ürün, Hayvansal Ürün, Bitkisel Ürün



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**CURRENT STATUS IN THE PRODUCTION OF ORGANIC AGRICULTURAL AND
ANIMAL PRODUCTS IN TURKEY**

ABSTRACT

Today, chemicals, pesticides used to increase agricultural production and destroy harmful organisms cause undesirable chemical pollution in agricultural and animal products. Likewise, drugs such as antibiotics and other chemicals used to prevent diseases in animals and animal products spoil the naturalness of the products. Plant and animal products produced without the use of such chemicals are called organic. Due to the negative effects of these chemicals on human health, herbal and animal products produced without the use of chemicals and drugs have become more popular. Organic products are more demanded for purposes such as ensuring food safety, healthy nutrition and protecting the environment. Accordingly, the amount of products obtained by organic agriculture and animal husbandry is increasing gradually depending on the demand in various countries. The demand for organic products and the production of organic products have increased in Turkey as well as all over the world. In addition to plant products such as organic fruits and vegetables, organic animal products such as organic milk, organic cheese, organic yogurt, organic honey and organic egg have started to be produced more due to the increasing demand in Turkey. Turkey has a great potential in the production of organic products due to the abundance of fertile agricultural lands, widespread animal husbandry and increasing population. In this review, the definition of organic plant and animal products, Turkey's potential in organic agriculture and animal husbandry, the current situation of organic agriculture and animal husbandry, improvements in the production of organic plant and animal products and the future of organic agriculture and animal husbandry in Turkey were mentioned. Demand for organic products in Turkey has increased compared to previous years. Production of organic plant and animal products has increased compared to previous years. With the support for organic production, the production of organic products may be increased even more in Turkey.

Keywords: Turkey, Organic Product, Animal Product, Plant Product



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1. GİRİŞ

Tarımda ya da hayvancılıkta bitkisel ya da hayvansal ürünler üretirken sentetik gübre, kimyasal ilaçlar, destekleyici hormonlar, antibiyotikler gibi maddeler kullanılmadan yapılan üretime organik üretim denir (Ozbilge, 2007). Organik tarım ise sentetik gübre ve pestisit kullanımından kaçınarak çevre dostu üretime yönelik bir dizi yönetim uygulamasını içermektedir (FIBL and IFOAM, 2011). Organik tarımın, çiftlik düzeyinde üretimden ürünlerin pazarlanmasına kadar kendine özgü ilke ve uygulamaları vardır. Ayrıca, organik tarım uygulamaları, gelişmiş ve gelişmekte olan ülkelerde yıldan yıla hızlı bir şekilde olağan hale gelmektedir (Demiryurek et al., 2008).

Türkiye'de organik tarım 1984 yılında Avrupa ülkelerinin organik ürünlerle ilgili talebiyle başlamıştır (Ak, 2013). Türkiye, geniş tarım alanları ve hayvancılığın yaygın olması sebebiyle organik ürünlerin üretiminde büyük bir potansiyele sahiptir. Ayrıca Türkiye, önemli bir organik ürün pazarıdır. Türkiye'de de organik tarım ve hayvancılık ürünlerinin üretimi ve bu ürünlere olan talep yıldan yıla artmaktadır. Türkiye, organik üretimle uğraşan tüm ülkeler arasında organik alan açısından 33. (120 ülke arasında) ve üretici sayısı açısından 16. sıradadır (Willer and Yusefi, 2007; Ak, 2013).

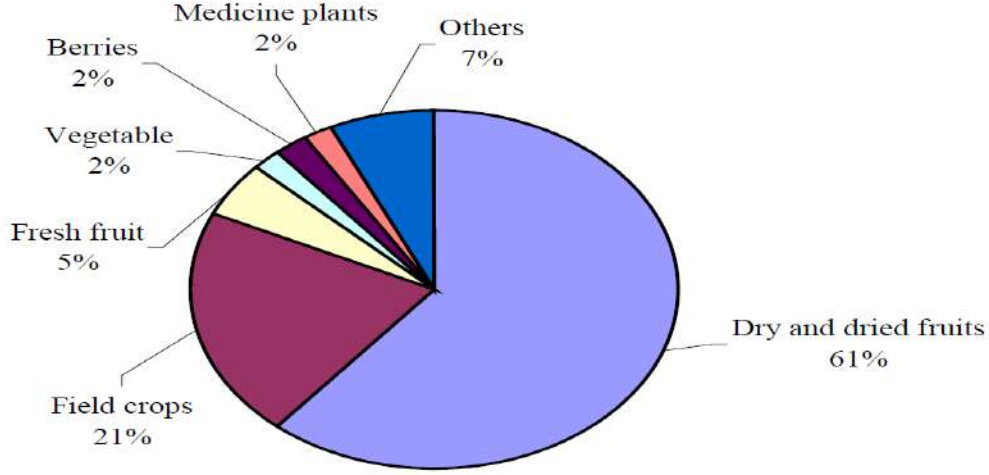
Türkiye, dünya organik pazarında tipik bir gelişmekte olan ülkedir. Türkiye'de üretilen organik ürünler ülke içinde tüketildiği gibi yurt dışına da gönderilmektedir. Buna bağlı olarak Türkiye'nin bu durumu, organik üretimde benzer olan ülkelerdeki politika programlarının, pazar geliştirmenin, ihracatın ve araştırma faaliyetlerinin tanımlanması ve iyileştirilmesi için kullanılabilir (Demiryurek et al., 2008; Babadogan and Koc, 2004).

2. TÜRKİYE'DE ORGANİK ÜRÜN ÇEŞİTLİLİĞİ

Şekil 1'de görüldüğü üzere Türkiye'de çeşitli organik ürünler üretilmektedir. En fazla oranda kuru ve yaş meyve ürünleri üretilmektedir. İkinci olarak en fazla organik tarla bitkileri üretilmektedir. Taze meyveler, sebzeler, tıbbi bitkiler, çilek ve diğer organik ürünler belli oranlarda üretilmektedir.



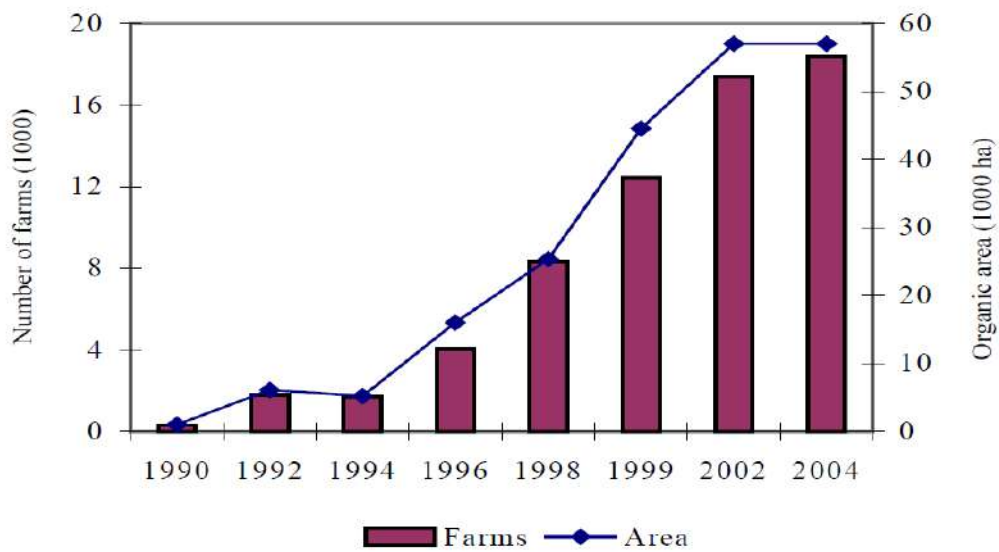
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Şekil 1. Türkiye’de Organik Ürünlerin Dağılımı (Guler, 2006).

3. ORGANİK ÜRETİM YAPILAN TARIM ALANLARININ VE ORGANİK TARIM ÜRÜNLERİNİN DURUMU

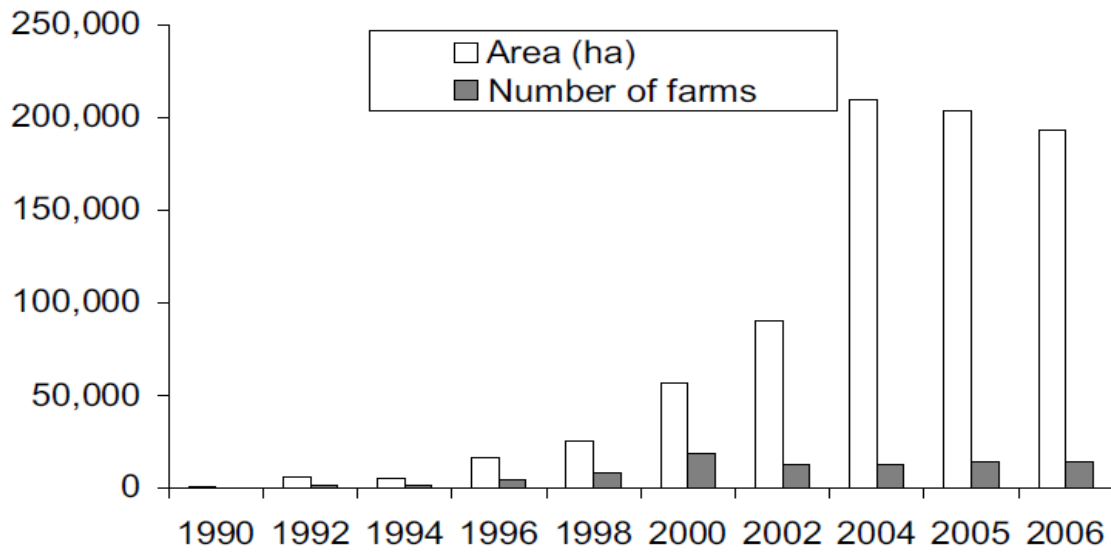
Şekil 2 ve Şekil 3’e göre Türkiye’de organik üretim yapan çiftliklerin sayısı 1990-2006 yılları arasında artış göstermiştir. Aynı şekilde organik üretim için kullanılan alanların miktarında da artış gerçekleşmiştir. Bu grafik Türkiye’de organik tarımsal üretiminin yıldan yıla gitgide arttığını göstermektedir.



Şekil 2. Türkiye’de Organik Üretim Yapılan Tarım Arazilerinin ve Çiftliklerinin Sayısının 1990-2004 Yılları Arasındaki Değişimi (Guler, 2006).



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Şekil 3. Türkiye’de Organik Üretici ve Alanlarının Yıllara Göre Değişimi (Demiryurek et al., 2008).

Tablo 1’e göre Türkiye’de 1990-2006 yılları arasında organik üretim yapılan alanların miktarı arttığı gibi organik üretim yapan çiftçilerin de sayısı artmıştır. Benzer olarak organik olarak üretilen tarım ürünlerinin de sayısında önemli oranda bir artış gerçekleşmiştir.

Tablo 1. Organik Üretimin Türkiye’de 1990-2006 Yılları Arasındaki Değişimi

Year	Number of organic products	Number of organic farmers	Organic area (ha)
1990	8	313	1,037
1992	23	1,780	6,077
1994	20	1,690	5,196
1996	37	4,039	16,000
1998	65	8,302	25,303
2000	95	18,385	59,985
2001	98	15,795	111,324
2002	147	12,428	89,826
2003	176	13,044	103,190
2004	174	12,806	*209,573
2005	205	14,401	*203,811
2006	210	14,256	*192,789

*Includes conversion areas.

Source: TÜGEM (2008).

Kaynak: (Demiryurek et al., 2008).



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Türkiye’de organik sebze üretim miktarı da üretici sayısı ile beraber yıldan yıla genel olarak artış göstermektedir (Koc, 2003; Guler, 2006). Tablo 2’de görüleceği üzere Türkiye’de 2002-2012 yılları arasında organik olarak üretilen sebzelerin toplam miktarı, organik üretim yapılan alanların miktarı ve organik üretim yapan üreticilerin sayısı yıldan yıla artmıştır. Organik olarak üretilen sebze çeşidi sayısı yıllara göre değişiklik gösterse de genel olarak artmıştır.

Tablo 2. Türkiye’de Organik Sebze Üretim Miktarının ve Alanlarının 2002-2012 Yılları Arasındaki Değişimi

Years	Varieties of organic products	Number of organic producers	Organic area (ha)	Production amount (kg)
2002	150	12,428	57,365	310,125
2003	179	14,798	73,368	323,981
2004	174	12,806	108,598	378,803
2005	205	14,401	93,134	421,934
2006	203	14,256	100,275	458,095
2007	201	16,276	124,263	568,128
2008	247	14,926	109,387	530,225
2009	212	35,565	325,831	983,715
2010	216	42,097	383,782	1,343,737
2011	225	42,460	614,618	1,659,543
2012	204	54,635	702,909	1,750,127

Kaynak: (Kayhan and Olmez, 2014).

Türkiye, geniş tarım arazileri ve çiftçilikle uğraşan insan sayısının fazla olması sebebiyle tarımsal üretim ve verimliliğinde büyük bir potansiyele sahiptir (Merdan ve Kaya, 2013). Tablo 3’de görüldüğü üzere farklı organik tarım ürünleri her yıl değişen miktarlarda üretilmektedir.



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Tablo 3. Türkiye’de Üretilen Organik Tarım Ürünleri (Ton)

Ürünler	2001	2002	2003	2004	2005	2006	2007	2008	2010*
Pamuk	19511	21793	34877	30268	10032	63960	55534	68310	18042
Elma	45040	69187	71928	52670	49915	28393	50810	32134	17263
Buğday	31139	19752	21379	31194	13756	26515	43915	48681	23984
Domates	90472	82809	26493	22897	25125	15512	21437	19909	12183
Üzüm	12894	10469	9505	13988	14485	16687	15510	22012	25665
Zeytin	7343	10744	6456	10997	10531	13109	12096	21574	18151
Mercimek	5862	17012	11781	9135	6093	19050	10071	10228	8334
Fındık	6965	7667	5994	4821	3670	6402	8355	11143	7935
Kayısı	13634	5940	13278	9019	9628	6491	7767	14925	13564
Çilek	3353	3293	3497	4098	4604	4571	7234	9008	3395
İncir	8293	9473	8112	15793	6821	7563	5938	7891	9644
Vişne	3769	6580	5994	4020	1874	2939	5733	4661	3935
Biber	3202	3355	3309	2643	2565	4399	4629	4022	2641
Nohut	3691	7667	5662	4085	4660	4867	2901	4140	5644
Kiraz	1375	1335	1830	1348	1088	1632	2239	2674	1277
Soğan	2680	388	1020	1412	430	1320	996	4220	3899
Antepfıstığı	-	2005	4789	6827	460	1135	616	859	760

Kaynak: (Merdan ve Kaya, 2013).

4. ORGANİK HAYVANCILIĞIN DURUMU

Türkiye’de organik hayvansal ürünlerin üretimi de organik üretimin ilk başladığı zamanlara göre önemli oranda artmıştır. Tablo 4’e göre Türkiye’de 2006-2016 yılları arasında organik üretim yapan üreticilerin sayısının genel olarak arttığı gözlemlenmektedir. Benzer olarak organik hayvan sayısında genel olarak artış gerçekleşmiştir. 2015 yılında sayılar kısmen düşse de 2016 yılında tekrar artış gözlemlenmiştir. Organik et, süt ve yumurta üretimi yıllara göre değişkenlik gösterse de toplamda artış göstermiştir.

Tablo 4. Türkiye’de 2006-2016 Yılları Arasındaki Organik Hayvan ve Hayvan Ürünlerinin Üretimi

Years	Number of producers	Number of animals	Milk production (ton)	Meat production (ton)	Egg production (x1000 pcs)
2006	6	14.407	2.875	12	241.940
2007	16	42.192	-	-	-
2008	31	38.942	8.711	554	4.424
2009	38	129.737	12.994	377	11.767
2010	105	387.984	11.604	6.803	17.890
2011	137	453.513	14.794	1.359	26.237
2012	151	253.783	17.627	481	36.106
2013	163	1.021.382	54.781	4.970	48.041
2014	216	1.121.159	15.510	2.107	64.899
2015	179	997.707	19.739	2.606	58.939
2016	188	1.215.632	21.431	1.609	147.600

Source: TUIK 2017

Kaynak: (Ak, 2017).



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Türkiye organik tavuk ve tavuk üretiminde de önemli bir yere sahiptir. Organik tavukçuluk bazı illerimizde gelişme göstermiştir. Buna bağlı olarak organik tavuk ve tavuk ürünlerinin üretiminde önemli bir artış sağlanmıştır (Balevi et al., 2016). Tablo 5 ve 6'ya göre organik tavukçuluk yapılan şehir sayısı 2007-2010 yılları arasında 4'ten 9'a çıkmıştır. Üretici sayısı 4'ten 14'e yükselmiştir. İlden ile organik tavuk ve yumurta üretimi değişkenlik göstermektedir. Toplam organik yumurtlayan tavuk ve organik yumurta üretim miktarında önemli oranda artış sağlanmıştır. Bu durum organik tavuk ürünlerine olan talebin de arttığını göstermektedir.

Tablo 5. Organik Tavukçuluğun Türkiye’de 2007-2010 Yılları Arasındaki Değişimi

	Years			
	2007	2008	2009	2010
City number	4	7	8	9
Producer number	4	7	9	14
Laying hens number	18.847	21.928	42.610	68.219
Organic eggs number	No data	4.424.000	11.767.400	17.898.804

Kaynak: (Balevi et al., 2016).

Tablo 6. Türkiye’nin Bazı İllerinde Organik Tavuk ve Tavuk Ürünleri Üretimi

İller	İşletme Sayısı	Verim Yönü	Tavuk Sayısı (adet)	Tavuk Eti Üretimi (ton)	Yumurta (adet)
Samsun	1	Broiler	249.600	500	
		Yumurtacı	20.000		6.000.000
Bolu	2	Broiler	24.310	50	
		Yumurtacı	4.600		1.350.000
Bursa	1	Yumurtacı	1.970		471.300
Elazığ	4	Yumurtacı	11.700		2.720.000
İzmir	3	Yumurtacı	6.500		1.100.000
Kırklareli	1	Yumurtacı	6.000		1.752.000
Konya	2	Yumurtacı	5.800		1.095.000
Manisa	1	Yumurtacı	11.649		3.401.508
Toplam	15		342.129	550	17.889.808

Kaynak: (Öztürk ve Türkoğlu, 2012).

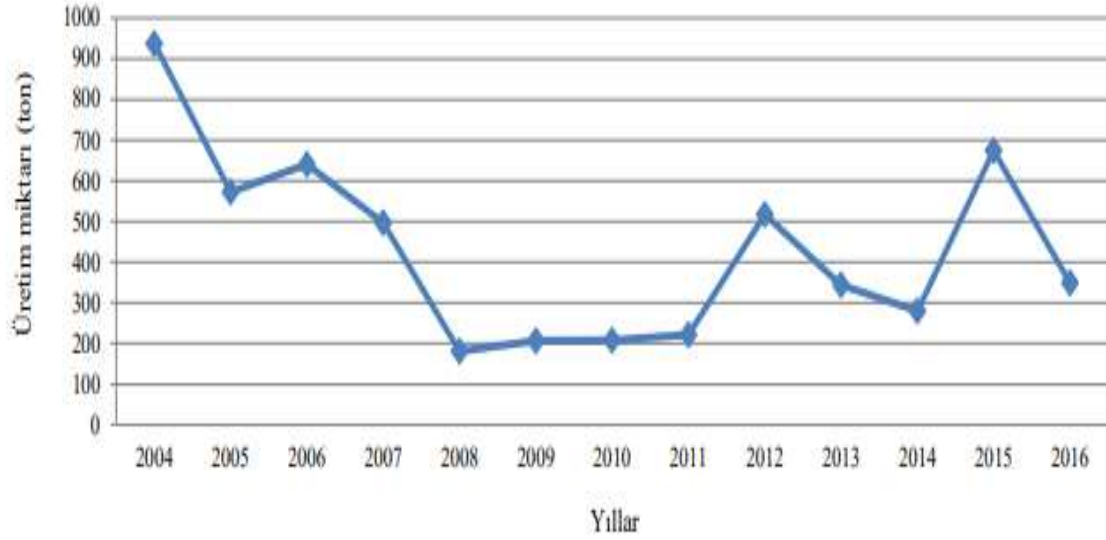
Türkiye’de organik bal üretimi yıllara göre değişkenlik gösterse de yıldan yıla arılı kovan sayısı artmakta ve çok miktarda organik bal üretilip yurt dışına satılmaktadır (Merdan ve Kaya, 2013; Çelik ve ark., 2018). Şekil 4’te görüldüğü üzere organik bal üretimi arılı kovan sayısından



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bağımsız olarak bazı yıllar artış gösterirken bazı yıllar azalış göstermiştir. Bu grafik Türkiye'nin organik bal üretiminde büyük bir potansiyele sahip olduğunu göstermektedir.



Şekil 4. Türkiye’de 2004-2016 Yılları Arasında Organik Bal Üretim Miktarı (Çelik ve ark., 2018).

5. SONUÇ VE ÖNERİLER

Türkiye, organik tarım ve hayvancılıkta büyük bir potansiyele sahiptir. Türkiye, geniş tarım arazilerinin çokluğu ve tarımla uğraşan çiftçi sayısının fazla olması sebebiyle organik olarak üretilen tarımsal ürünlerinin miktarını yıldan yıla arttırmaktadır. Artan talebe bağlı olarak organik tarımla uğraşan kişi sayısı da artış göstermiştir. Organik hayvansal ürünlerin üretimi de bazı illerimizde artış göstermiştir. Bu iller gibi Bingöl ilimizde de geniş mera arazilerinin fazla olması, tarımsal üretim yapılabilecek arazilerin az olması ve sert iklimi sebebiyle hayvancılık yerel halkın temel geçim kaynağıdır. Organik hayvansal ürünlerin üretimi için verilen destek miktarı arttırılırsa bazı illerimizde olduğu gibi Bingöl ilinde de toplam üretilen organik hayvansal ürünlerin miktarında önemli oranda artış gerçekleşecektir.



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KAYNAKLAR

- Ak, İ. (2013), Türkiye’de Organik Hayvancılık, Türkiye II. Organik Hayvancılık Kongresi, 24-26 Ekim, Bursa, 27-39.
- Ak, I. (2017), Organic Livestock in Turkey, The Euresian Agriculture and Natural Sciences Congress, 23-27 September, Bishkek, Kyrgyzstan, 190-192.
- Babadogan, G, and Koc, D. (2004). Organic Agriculture in Turkey, Country Reports: Turkey, Organic-Europe, FiBL.
- Balevi, T., Coskun, B., Gurbuz, E. (2016), The development of organic egg production in Turkey, Eurasian Journal of Veterinary Science, 32(1):36-40.
- Çelik, S., Şengül, T., Söğüt, B., Şengül, Y.A. (2018), Türkiye’de Organik Bal Üretiminin Yıllara Göre Değişiminin Regresyon Analizi ile İncelenmesi Üzerine Bir Çalışma, Türk Tarım -Gıda Bilim ve Teknoloji Dergisi, 6(11):1507-1510.
- Demiryurek, K., Stopes, C., Guzel, A. (2008), Organic agriculture: the case of Turkey, Outlook on Agriculture, 37(4):261-267.
- FiBL, and IFOAM, (2011), The World of Organic Agriculture, Statistics and Emerging Trends.
- Guler, S. (2006), Organic Agriculture in Turkey Journal of Faculty of Agriculture, OMU, 21(2):238-242.
- Kayhan, M.H., Olmez, M. (2014), Aquaculture and Organic Aquaculture in Turkey, Journal of Aquaculture, Research and Development, 5, 259.
- Koc, D. (2003) Marketing of organic agricultural products in Turkey, CIHEAM, 125-132.
- Merdan, K., Kaya, V. (2013), Türkiye’deki Organik Tarımın Ekonomik Analizi, Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 17(3), 239-252.
- Öztürk, K.A., Türkoğlu, M. (2012), Türkiye’de Organik Tavukçuluk, Lalahan Hayvancılık Araştırma Enstitüsü Dergisi, 52(1):41-50.
- Ozbilge, Z. (2007), An Analysis of Organic Agriculture in Turkey: The Current Situation and Basic Constraints, Journal of Central European Agriculture, 8(2):213-222.
- Willer, H., Yussefi, M. (2007), The World of Organic Agriculture – Statistics and Emerging Trends, International Federation of Organic Agriculture Movements (IFOAM), Bonn, and Research Institute of Organic Agriculture, FiBL, Frick.



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**CHEMICAL COMPOSITION OF *EQUISETUM ARVENSE*
AND *CYMBOPOGON MARTINII* OIL**

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ABSTRACT

Equisetum arvense L. (Equisetaceae, subgenus Equisetum) – horsetail – is a well-known and widespread pteridophyte distributed in the northern hemisphere. In various countries the plant is used for medicines such as a possessed antioxidant, an anticancer, an antimicrobial, a smooth muscle relaxant with effects on the vessels and ileum, as an anticonvulsant, a sedative, an anti-anxiety, a dermatological an immunological, an antinociceptive, an anti-inflammatory, an antidiabetic, a diuretic, as an inhibitor of platelet aggregation, for promotion of osteoblastic response, as an anti-leishmanial, and many other effects. *Cymbopogon martinii* was among the ethnobotanically reported aromatic plants and previous study has reported antimicrobial activity of its essential oil. The essential oil of *C. martinii* has shown broad-spectrum antibacterial, antifungal, anti-yeast, insecticidal and insect repellent activities, and potency against a wide range of organisms. Therapeutical activities were found including anti-inflammatory, anticancer, allelopathic, free radical scavenging effects and therefore it may be used in the treatment of several diseases, including cancers, and in applications of industrial importance particularly with food packaging. In this study, chemical composition of the seeds' oils is determined with GC MS, which is a rarely found study. The mass analysis was conducted for two samples from an organic oil supplier using an Agilent 5977A Series GC/MSD instrument. The obtained data were evaluated with the WILEY library. *Equisetum arvense* oil is found rich with crown ethers, alcohols also terpenes, and fatty aldehydes. The main components are found for *Cymbopogon martinii* oil as also crown ethers, terpenes such as geraniol, limonene, linalool, amines, and fatty aldehydes. Since the horsetail is very popular in traditional medicine and palmarosa is a rarely found oil in the Turkish market and these oils are becoming popular, further studies need to be done about the oil properties and compounds. In addition, the changes in the components of these oils during storage and transportation can be followed by GC-MS analysis.

Keywords: *Equisetum arvense*, *Cymbopogon martinii*, organic oils, GC-MS



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INTRODUCTION

Equisetum arvense (horsetail) belongs to the *Equisetaceae* family and is distributed in Asia, Europe, and Northern America. The plant contains chemicals such as carbohydrate, proteins, alkaloids, saponins, amino acids, alkaloids, phytosterols, vitamins, minerals, sterols, ascorbic acid, silicic acid, phenols, thiaminase, tannin flavonoids, quercetin, kaempferol, luteolin, oleanolic acid, ursolic acid, betulinic acid, apigenin and triterpenoids (Faheem et al., 2022; Nagai, Myoda, & Nagashima, 2005; Rajput, Wairkar, & Gaud, 2018). *Equisetum arvense* is used for treatments of the liver, kidney, urination system, teeth, appetite problems, venereal diseases, jaundice, cancer, hypertension, diabetes, obesity, wound healing, infections, epilepsy, osteoporosis (Ali, Chen, & Sargsyan, 2014; Aumeeruddy & Mahomoodally, 2020, 2021; Bordes et al., 2020; Dhiman, Nanda, & Ahmad, 2016; Fazil & Nikhat, 2020; Güneş, Savran, Paksoy, Koşar, & Çakılcıoğlu, 2017; Hamza et al., 2019; Rajput et al., 2018; Rezaei, Farzadfard, Amirahmadi, Alemi, & Khademi, 2015; Sargin, 2021) and is also preferred in cosmeceuticals containing lipid nanoparticles such as eye essences or ampoules (Pardeike, Hommoss, & Müller, 2009). The 10% concentration of *E. arvense* was found effective against fungal pathogen of tomatoes root such as *Rhizoctonia solani* and *Candida* (Lengai, Muthomi, & Mbega, 2020; Zida, Bamba, Yacouba, Ouedraogo-Traore, & Guiguemdé, 2017) and biogenic silica nanoparticles of horsetail can be used as biocide (Mattos, Rojas, & Magalhães, 2017). In fermentation processes *Equisetum arvense* extract (isoquercetin) mitigated methane by 14% in in-vitro studies of ruminants (Olagaray & Bradford, 2019).

The genus *Cymbopogon* belongs to the *Poaceae* family and includes 140 species. The plant is found mostly in India and Turkey. Morphological characteristics and essential oil compositions of the *Cymbopogon* species may vary in a wide range. *Cymbopogon martinii* is known as palmarosa, Indian rosha or motia as well as Turkish geranium. It is a perennial and a tall grass about 5-8 feet tall with a rose smell and its color is defined as a pale yellow. The plant has white, hairy star-like spiked flowers. *Cymbopogon* species are used and found to be effective in different applications of pharmaceuticals and cosmeceuticals. Its applications are reported in traditional and modern medicine as antioxidant, anti-inflammatory, antimicrobial, anthelmintic, analgesic, pesticidal, mosquito repellent, antifungal against major microbial pathogens and herpes simplex. Different applications of *Cymbopogon martinii* are also reported as sustainable phytoremediation material for industrial wastes and biogenic nanoparticles. The major constituents of oil linalool, β -caryophyllene and E, Z-farnesol. The yield of essential oil from



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distinct parts of the plant such as inflorescence, leaf sheath is varying between the range of 0.33-2%. monoterpenes, sesquiterpenes, geraniol, terpinene, caryophyllene, humulene, myrcene, selinenes, linalool, nerolidol, limonene, geranylacetate, geranial, fatty acid, E,Z-farnesol (Buckle, 2003; Das et al., 2020; Ghosh, Bhagwat, Chopade, & Webster, 2021; Jain & Sharma, 2017; Kabir et al., 2020; Lawrence, Lawrence, Parihar, Srivastava, & Charan, 2012; Pandey & Bajpai, 2018; Sandermann, 1962).

In this study, the chemical composition of *Equisetum arvense* and *Cymbopogon martinii* essential oils are evaluated by GC-MS. The samples were chosen from the Turkish market for organic commercial products which have not, to our knowledge, been studied earlier.

MATERIALS AND METHODS

The horsetail and the palmarosa oil samples used in this study were provided from an organic oil supplier in 20mL dark brown bottles and refrigerated until the analysis was performed. To analyze constituent elements, a capillary column (HP-INNOWAX, 0.25 μ m film, 0.320 mm diameter and 60 m length) using a gas chromatograph 7890 B joined to a mass spectrometer series MSD 5977 A (Agilent Technologies) was employed. The carrier helium gas flow rate was 0.7 mL / min. The temperature program for the GC was as follows; 50 °C initial temperature, 240 °C being held for 1 min with 4 °C /min, and then a programmed rise in the temperature was at 260 °C with 10 °C/min being held for 2 min. The injection was carried out in the split mode (1:50). The injection volume was 1.0 μ L. The GC-MS interface was heated at 250 °C with the actual temperature reaching 180 °C in MS source and 150 °C in MS-quadrupole. The electron impact energy was set at 70 eV and resultant data were collected in the range of 50-500 atomic mass units (amu). The identification of the compounds was based on mass spectra by comparison with the Wiley MS spectra database Wiley Registry 12th Edition / NIST 2020 Mass Spectral Library and the final integrations were performed with Agilent Technologies MassHunter software. Results are given in this study for triplicate analysis. All the reagents were obtained from J.T. Baker, Riedel-de Haën and they are either chromatographic or analytical grade.



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RESULTS and DISCUSSION

In the study 54 different components are isolated from *Equisetum arvense* oil sample, and 45 components are isolated in *Cymbopogon martinii* essential oil. The main component in horsetail oil was found as alpha-pinene, oleic acid, ethers, crown ethers (12-crown-4, 15-crown-5, 18-crown-6), 9-hexadecenoic acid, palmitoleic acid methyl ester, nervonic acid methyl ester trans,trans-2,4-decadien-1-al, petroselinic acid, hexenal, butanamide, palmitic acid ethyl ester (Table 1). The results are similar for some components with the studies of Nagai et. Al (2005), Faheem et al., (2022) and Rajput et al. (2018), but some other components analysed in the essential oil are different. This can be result of the origin of the oil, the horsetail plant growing, storage, transportation or extraction conditions.

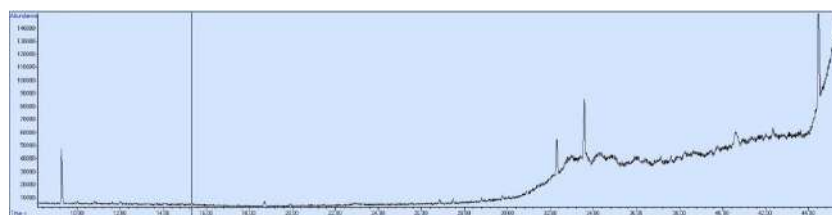


Figure 1. Horsetail oil chromatogram

Table 1. *Equisetum arvense* (horsetail) oil components

Formula	Name	Retention Time (min)	Area Percent (%)
C ₈ H ₁₄ O	Cis-9-oxabicyclo[6.1.0]nonane	32.0833	0.30
C ₁₀ H ₁₆	(1r)-(+)-alpha-pinene	9.2622	2.02
C ₁₀ H ₁₆	Alpha-pinene	9.2646	0.97
C ₅ H ₁₃ NO	2-Isopropoxy-ethylamine	10.0129	0.11
C ₃ H ₃ D ₃	Propene (3,3,3-d3)	10.7991	0.10
C ₃ H ₄ O ₃	Pyruvic acid	10.8097	0.11
C ₄ H ₈ O ₂	2-(Vinylxy)ethanol	11.6169	0.27
C ₇ H ₁₆ O ₂	4-isopropoxybutanol	14.0691	0.20
C ₄ H ₉ D	N-butane-1-d1	14.8512	0.18
C ₆ H ₁₂ O ₂	4-Oxa-6-heptene-2-ol	18.6947	0.34
C ₁₅ H ₃₃ N	1-aminopentadecane	18.7084	0.24
C ₆ H ₁₂ O ₂	Glycidyl isopropyl ether	19.9220	0.18



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$C_3H_8N_2$	Allylhydrazine	21.4735	0.09
$C_{15}H_{24}$	(-)-Alpha-copaene	22.8732	0.09
$C_4H_{10}O$	2-butanol	22.9985	0.07
$C_{10}H_{20}O_5$	15-crown-5	27.4590	1.94
$C_{10}H_{20}O_2$	1,5-dimethylhexyl acetate	28.4660	0.14
$C_4H_{10}O_2$	1,3-butanediol	28.7989	0.28
$C_6H_{12}O_3$	Paraldehyde	29.5058	0.02
$C_2H_4O_3$	Glycolic acid	29.5218	0.27
$C_6H_{14}O_2$	1-propoxy-2-propanol	29.7397	0.62
$C_4H_9NO_3$	2(2-hydroxyethoxy)acetamide	29.7450	0.36
$C_6H_{14}O_3$	Diethylene glycol monoethyl ether	29.8573	0.22
$C_6H_{14}O$	2-hexanol	30.0271	0.29
$C_8H_{18}O$	Dl-2-octanol	30.5288	0.03
$C_6H_{12}O_3$	Dl-leucic acid	30.7535	0.07
$C_{11}H_{24}O$	2-undecanol	30.7714	0.13
$C_{12}H_{26}O$	2-dodecanol	31.0845	1.01
$C_8H_{18}O_{13}$	Triethylene glycol monoethyl ether	31.1372	1.51
$C_{13}H_{28}O$	2-tridecanol	31.2833	1.99
$C_{19}H_{40}O$	2-nonadecanol	31.4509	0.28
$C_8H_{16}O_4$	12-crown-4	31.5808	2.56
$C_{12}H_{26}O_2$	1-Nonanol, 3-(2-methoxyethyl)-	31.9204	1.36
$C_{18}H_{34}O_2$	Oleic acid	32.4869	37.92
$C_{16}H_{30}O_2$	9-Hexadecenoic acid	32.7549	1.19
$C_{17}H_{32}O_2$	Palmitoleic acid methyl ester	32.9350	1.31
$C_{25}H_{48}O_2$	Nervonic acid methyl ester	33.0703	1.26
$C_{10}H_{16}O$	Trans,trans-2,4-Decadien-1-al	33.5756	6.27
$C_{18}H_{34}O_2$	Petroselinic acid	33.9387	2.18
$C_{19}H_{36}O_2$	Elaidic acid methyl ester	34.0919	0.96
$C_6H_{10}O$	Trans-2-hexenal	34.2615	2.26
$C_{18}H_{34}O_2$	Elaidic acid	34.3025	0.86
$C_{19}H_{36}O_5$	Methyl 9-octadecenoate	35.9261	2.12
$C_{12}H_{24}O_6$	18-crown-6	38.1636	7.39
$C_{14}H_{30}O_6$	3,6,9,12,15-pentaoxanonadecan-1-ol	38.3006	0.75
C_8H_8	Benzocyclobutene	38.4623	1.00
$C_{24}H_{50}O_7$	Hexaethylene glycol monododecyl ether	38.6701	1.08
$C_6H_{12}O_2S$	Ethanol, 2-[2-(ethenylthio)ethoxy]-	39.1142	0.73
$C_{20}H_{36}O_6$	Cis-anti-cis-dicyclohexano-18-crown-6	39.2573	1.82
$C_4H_9NO_3$	Butanamide, N,3-dihydroxy-	40.6269	3.06
$C_{16}H_{34}O$	2-hexadecanol	40.9574	0.64
$C_6H_{12}O_3$	1,4,7-trioxonane	42.3261	2.27
$C_9H_{20}O_4$	Isopropyl triglycol	43.1793	0.33
$C_{18}H_{36}O_2$	Palmitic acid ethyl ester	44.4568	6.14



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The main component in palmarosa oil was found as, geraniol, linalool, crown ether 18-crown-6, beta-caryophyllene, geranyl acetate, geranyl butyrate, linoleic acid, farnesol and stearic acid (Table 2). The results were similar with some other studies especially for geraniol and linalool, (Buckle, 2003; Das et al., 2020; Jain & Sharma, 2017; Kabir et al., 2020; Lawrence et al., 2012; Oils, 2009) . Different components were also analysed in the palmarosa oil which can be related with the process or planting conditions and some applications related with commercialization.

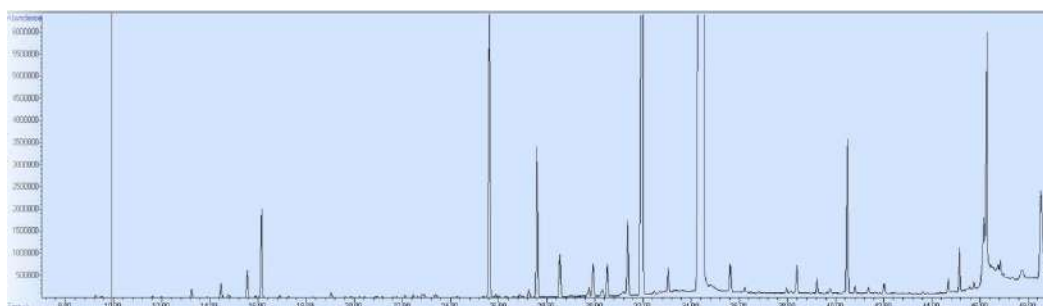


Figure 2. Palmarosa oil chromatogram

Table 2. *Cymbopogon martinii* (*palmarosa*) oil components

Formula	Name	Retention Time (min)	Area Percent (%)
C ₁₀ H ₁₆	Myrcene	13.2443	0.07
C ₁₀ H ₁₆	Dl-limonene	14.4670	0.14
C ₁₀ H ₁₆	(E)-3,7-dimethylocta-1,3,6-triene	15.5649	0.25
C ₁₀ H ₁₆	Ocimene mixture of isomers	16.1511	0.82
C ₈ H ₁₄ O	6-Methyl-5-hepten-2-one	19.0515	0.05
C ₂ H ₄ O ₂	Acetic acid	22.8287	0.02
C ₁₀ H ₁₈ O	Isomenthone	23.3746	0.04
C ₁₀ H ₁₈ O	Linalool	25.6171	2.92
C ₈ H ₁₈ O	1-octanol	25.8894	0.03
C ₁₅ H ₂₄	(-)-Isocaryophyllene	26.8809	0.03
C ₁₅ H ₂₄	Beta-elemene	27.2542	0.09
C ₁₅ H ₂₄	Beta-caryophyllene	27.6056	1.53
C ₁₀ H ₂₀ O	Dl-menthol	28.5461	0.42



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$C_{15}H_{24}$	Alpha-caryophyllene	29.7594	0.11
$C_{10}H_{16}O$	(Z)-3,7-dimethylocta-2,6-dienal	29.9363	0.33
$C_{11}H_{18}O_2$	Geranyl formate	30.5206	0.30
$C_{15}H_{24}$	Valencene	31.1478	0.04
$C_{15}H_{24}$	B-selinene	31.2137	0.04
$C_{10}H_{16}O$	Trans-Citral = trans-3,7-Dimethyl-octa-2,6-dien-1-al	31.3648	0.78
$C_{12}H_{20}O_2$	Geranyl acetate	31.9666	1.35
$C_{15}H_{24}$	Alpha-panasinsene	32.4699	0.03
$C_{18}H_{34}O_2$	Oleic acid	32.6774	0.05
$C_{10}H_{18}O$	Nerol	33.0515	0.27
$C_{18}H_{34}O_2$	Elaidic acid	33.2864	0.01
$C_{10}H_{18}O$	Geraniol	34.4956	70.14
$C_{18}H_{34}O_2$	Oleic acid	34.8073	0.14
$C_{14}H_{24}O_2$	Geranyl butyrate	35.6250	0.25
$C_{12}H_{20}O_2$	Neryl acetate	36.2330	0.04
$C_{10}H_{18}O$	Dihydrocarveol	37.9745	0.06
$C_{15}H_{24}O$	Caryophyllene oxide	38.3957	0.29
$C_{15}H_{26}O$	Nerolidol	39.2305	0.14
$C_{15}H_{26}O$	Cis-nerolidol	39.2308	0.14
$C_8H_{16}O_2$	Octanoic acid	39.7732	0.06
$C_{14}H_{24}O_2$	Geranyl butyrate	40.4854	1.43
$C_{18}H_{36}O$	Fitone	41.3658	0.05
$C_{15}H_{26}O$	Farnesol	42.0210	0.09
$C_{14}H_{24}O_2$	Geranyl butyrate	45.1572	0.34
$C_{12}H_{24}O_6$	18-crown-6	45.4778	0.29
$C_8H_8O_2$	O-Toluic acid	45.5811	0.03
$C_5H_{10}O_2$	2-Methyl-m-dioxane	45.7505	0.07
$C_{18}H_{32}O_2$	Linoleic acid	46.1592	1.65
$C_{15}H_{26}O$	(E,e)-farnesol	46.2785	2.21
$C_9H_{18}O$	(E)-non-6-en-1-ol	46.7559	0.24
$C_{16}H_{32}O_2$	Palmitic acid	48.5401	0.25
$C_{18}H_{36}O_2$	Stearic acid	48.5901	1.29



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CONCLUSION

The horsetail (*Equisetum arvense*) and palmarosa (*Cymbopogon martinii*) plants have been used for a wide variety of applications such as pharmaceuticals, cosmetics, food preservation, biocidal. The earlier studies are focused on different parts of these two plants. The researches had been conducted about pure essential oils in lab scales. In this study, chemical composition of the commercial essential oils is determined for the first time (to the best of our knowledge) by using the GC/MSD instrument. The WILEY library is used to identify the components. The results showed that both the oils are rich in different components. Since these two oils are becoming popular for cosmeceutical applications in the Turkish market, further studies are needed for the characterization and determining the quality control parameters of the oils.



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and RURAL DEVELOPMENT
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REFERENCES

- Ali, P., Chen, Y. F., & Sargsyan, E. (2014). *Bioactive Molecules of Herbal Extracts with Anti-Infective and Wound Healing Properties. Microbiology for Surgical Infections: Diagnosis, Prognosis and Treatment*. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-411629-0.00012-X>
- Aumeeruddy, M. Z., & Mahomoodally, M. F. (2020). Traditional herbal therapies for hypertension: A systematic review of global ethnobotanical field studies. *South African Journal of Botany*, 135, 451–464. <https://doi.org/10.1016/j.sajb.2020.09.008>
- Aumeeruddy, M. Z., & Mahomoodally, M. F. (2021). Global documentation of traditionally used medicinal plants in cancer management: A systematic review. *South African Journal of Botany*, 138, 424–494. <https://doi.org/10.1016/j.sajb.2021.01.006>
- Bordes, C., Leguelinel-Blache, G., Lavigne, J. P., Mauboussin, J. M., Laureillard, D., Faure, H., ... Loubet, P. (2020). Interactions between antiretroviral therapy and complementary and alternative medicine: a narrative review. *Clinical Microbiology and Infection*, 26(9), 1161–1170. <https://doi.org/10.1016/j.cmi.2020.04.019>
- Buckle, J. (2003). *Clinical Aromatherapy Essential Oils in Practice*. (J. Buckle, Ed.) (Second). Elsevier Science Publishing.
- Das, S., Chaudhari, A. K., Singh, A., Deepika, Singh, V. K., Dwivedy, A. K., & Dubey, N. K. (2020). Foodborne microbial toxins and their inhibition by plant-based chemicals. In B. Prakash (Ed.), *Functional and Preservative Properties of Phytochemicals* (Vol. 5, pp. 165–207). Elsevier. <https://doi.org/10.1016/B978-0-12-818593-3.00006-3>
- Dhiman, A., Nanda, A., & Ahmad, S. (2016). A quest for staunch effects of flavonoids: Utopian protection against hepatic ailments. *Arabian Journal of Chemistry*, 9, S1813–S1823. <https://doi.org/10.1016/j.arabjc.2012.05.001>
- Faheem, M., Ameer, S., Khan, A. W., Haseeb, M., Raza, Q., Ali Shah, F., Alsiwiehri, N. O. (2022). A comprehensive review on antiepileptic properties of medicinal plants. *Arabian Journal of Chemistry*, 15(1), 103478. <https://doi.org/10.1016/j.arabjc.2021.103478>
- Fazil, M., & Nikhat, S. (2020). Topical medicines for wound healing: A systematic review of Unani literature with recent advances. *Journal of Ethnopharmacology*, 257(March), 112878. <https://doi.org/10.1016/j.jep.2020.112878>
- Ghosh, S., Bhagwat, T., Chopade, B. A., & Webster, T. J. (2021). *Patents, technology transfer, and commercialization aspects of biogenic nanoparticles. Nanobiotechnology*. Elsevier Inc. <https://doi.org/10.1016/b978-0-12-822878-4.00020-1>



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and RURAL DEVELOPMENT
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Güneş, S., Savran, A., Paksoy, M. Y., Koşar, M., & Çakılcıoğlu, U. (2017). Ethnopharmacological survey of medicinal plants in Karaisalı and its surrounding (Adana-Turkey). *Journal of Herbal Medicine*, 8(March 2016), 68–75. <https://doi.org/10.1016/j.hermed.2017.04.002>

Hamza, N., Berke, B., Umar, A., Cheze, C., Gin, H., & Moore, N. (2019). A review of Algerian medicinal plants used in the treatment of diabetes. *Journal of Ethnopharmacology*, 238(March), 111841. <https://doi.org/10.1016/j.jep.2019.111841>

Jain, N., & Sharma, M. (2017). Chemical Composition of the Leaf Oil of *Cymbopogon martinii* var. *sofia* Collected from Udaipur, Rajasthan and their Screening Against Fungi Causing Dermatophytosis in Human Beings. *Journal of Essential Oil-Bearing Plants*, 20(3), 801–808. <https://doi.org/10.1080/0972060X.2017.1341344>

Kabir, A., Cacciagrano, F., Tartaglia, A., Lipsi, M., Ulusoy, H. I., & Locatelli, M. (2020). Analysis of monoterpenes and monoterpenoids. In *Recent Advances in Natural Products Analysis* (pp. 274–286). Elsevier Inc. <https://doi.org/10.1016/b978-0-12-816455-6.00007-x>

Lawrence, K., Lawrence, R., Parihar, D., Srivastava, R., & Charan, A. (2012). Antioxidant activity of palmarosa essential oil (*Cymbopogon martinii*) grown in north indian plains. *Asian Pacific Journal of Tropical Disease*, 2(SUPPL2), S765–S768. [https://doi.org/10.1016/S2222-1808\(12\)60261-8](https://doi.org/10.1016/S2222-1808(12)60261-8)

Lengai, G. M. W., Muthomi, J. W., & Mbega, E. R. (2020). Phytochemical activity and role of botanical pesticides in pest management for sustainable agricultural crop production. *Scientific African*, 7, e00239. <https://doi.org/10.1016/j.sciaf.2019.e00239>

Mattos, B. D., Rojas, O. J., & Magalhães, W. L. E. (2017). Biogenic silica nanoparticles loaded with neem bark extract as green, slow-release biocide. *Journal of Cleaner Production*, 142, 4206–4213. <https://doi.org/10.1016/j.jclepro.2016.11.183>

Nagai, T., Myoda, T., & Nagashima, T. (2005). Antioxidative activities of water extract and ethanol extract from field horsetail (*tsukushi*) *Equisetum arvense* L. *Food Chemistry*, 91(3), 389–394. <https://doi.org/10.1016/j.foodchem.2004.04.016>

Oils, V. (2009). Volatile oils and resins. *Trease and Evans' Pharmacognosy: Sixteenth Edition*, 263–303. <https://doi.org/10.1016/B978-0-7020-2933-2.00022-8>



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



Olagaray, K. E., & Bradford, B. J. (2019). Plant flavonoids to improve productivity of ruminants – A review. *Animal Feed Science and Technology*, 251(January), 21–36. <https://doi.org/10.1016/j.anifeedsci.2019.02.004>

Pandey, V. C., & Bajpai, O. (2018). *Phytoremediation: From Theory Toward Practice. Phytomanagement of Polluted Sites: Market Opportunities in Sustainable Phytoremediation*. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-813912-7.00001-6>

Pardeike, J., Hommoss, A., & Müller, R. H. (2009). Lipid nanoparticles (SLN, NLC) in cosmetic and pharmaceutical dermal products. *International Journal of Pharmaceutics*, 366(1–2), 170–184. <https://doi.org/10.1016/j.ijpharm.2008.10.003>

Rajput, R., Wairkar, S., & Gaud, R. (2018). Nutraceuticals for better management of osteoporosis: An overview. *Journal of Functional Foods*, 47(June), 480–490. <https://doi.org/10.1016/j.jff.2018.06.013>

Rezaei, A., Farzadfard, A., Amirahmadi, A., Alemi, M., & Khademi, M. (2015). Diabetes mellitus and its management with medicinal plants: A perspective based on Iranian research. *Journal of Ethnopharmacology*, 175, 567–616. <https://doi.org/10.1016/j.jep.2015.08.010>

Sandermann, W. (1962). *Terpenoids: Structure and Distribution. Comparative Biochemistry*. ACADEMIC PRESS, INC. <https://doi.org/10.1016/b978-0-12-395544-9.50021-2>

Sargin, S. A. (2021). Plants used against obesity in Turkish folk medicine: A review. *Journal of Ethnopharmacology*, 270(December 2020), 113841. <https://doi.org/10.1016/j.jep.2021.113841>

Zida, A., Bamba, S., Yacouba, A., Ouedraogo-Traore, R., & Guiguemdé, R. T. (2017). Substances naturelles actives sur *Candida albicans*, sources de nouveaux médicaments antifongiques : revue de la littérature. *Journal de Mycologie Médicale*, 27(1), 1–19. <https://doi.org/10.1016/j.mycmed.2016.10.002>



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**KOYUNLARDA ÖSTRÜS SENKRONİZASYONU BAŞARISI ÜZERİNE ETKİLİ
FAKTÖRLERE GÜNCEL BAKIŞ**

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ÖZET

Türkiye, özellikle koyun sütü üretiminde (dünyada 1.), koyun (dünyada 7.) ve küçükbaş (Avrupa'da 1.) popülasyonu (2020) dünya çapında söz sahibi olan bir ülkedir. Ancak, ülkemizdeki küçükbaş hayvan yetiştiriciliğinde, birim hayvan başına verim (et-süt, kuzu/oğlak ve yapağı/tiftik) istenilen düzeyde değildir. Dolayısıyla, sunulan derlemede, koyunlarda üreme, suni tohumlama ve özellikle östrüs senkronizasyonu (sosyal, hormonal ve besinsel yollar) hakkında kısaca bilgi verilmiştir. Kuzey yarımkürede yer alan ülkemiz koşullarında, mevsime bağlı poliöstrüs gösteren koyunların özellikle yaz sonu (Batı Anadolu) veya sonbahar aylarında (Doğu Anadolu) üreme sezonuna girdikleri görülmektedir. Koyunlarda fizyolojik olarak ortalama östrüs siklusu 16-17 gün, östrüs süresi 20-36 saat ve ovulasyon ise kızgınlık sonunda (24-26. saat) oluşur. Koyunculukta suni tohumlama yerine daha çok doğal aşım tercih edilir. Bunun en önemli sebepleri arasında, serviks anatomisinin kıvrımlı yapısının intrauterin tohumlamada çıkardığı güçlüklerle birlikte, koç spermasının dondurma işlemlerine karşı diğer türlere göre nispeten hassas olması yer alır. Östrüs senkronizasyonu amacıyla sezon öncesi koç etkisi, sezon-içinde (GnRH, Progesteron, Prostaglandin ve PMSG) veya -dışında (Melatonin, Progesteron ve PMSG) hormon ve özellikle koç katım dönemi flushing (enerji ağırlıklı) uygulamaları yapılmaktadır. Öte yandan, sahada çoğunlukla doğal aşım sonucu şekillenen gebelik (ortalama 5 ay) sonrası normal kuzulama döneminin özellikle kış (Batı bölgeleri) veya bahar (Doğu bölgeleri) aylarında olduğu bilinmektedir. Kısacası, anılan fizyo-anatomik yapı ve ülkemizdeki koyunculuk uygulamaları ışığında bazı güncel değerlendirmeler yapılabilir: Koyunlarda östrüs senkronizasyonu amacıyla sadece bir protokolün kullanımının değil, multidisipliner yaklaşımla birden fazla protokolün kombine edilmesinin düşük maliyetle yüksek kazançlı sonuçlar almak için daha doğru olacağı kuşkusuzdur. Bununla birlikte, sürü popülasyon büyüklüğü, ırk, coğrafi bölge, mevsim, yem-arazi, yetiştirme tipi, bakım-besleme ve işgücü gibi diğer faktörler de protokol seçiminde dikkate alınmalıdır. Ayrıca, sahada en pratik ve ucuz olabilecek senkronizasyon yönteminin sırasıyla, koç etkisi, hormon kullanımı,



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flushing (enerji ağırlıklı) ve ışık kısıtlaması olduğu değerlendirilmektedir. Ülkemizin hayvansal ürün ihtiyacının önemli bir kısmının koyunculuktan karşılanmasına rağmen, halen ağırlıklı olarak meraya dayalı bakım-besleme yapılmaktadır. Sonuç olarak, özellikle gelişmekte olan bölgelerde (Doğu ve Güneydoğu Anadolu gibi) Veteriner Hekim ve yetiştiricilerin kazançlı bir koyunculuk için östrüs senkronizasyonu uygulamasına bütüncül bir yaklaşımla ve daha geniş olarak yer vermesi gerektiği kanısına varılmıştır.

Anahtar Kelimeler: Koyun, Östrüs Senkronizasyonu, Sezon, Koç Etkisi, Hormon, Flushing



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**RECENT OVERVIEW OF FACTORS AFFECTING THE SUCCESS OF OESTRUS
SYNCHRONISATION IN SHEEP**

ABSTRACT

Turkey is a country that has a global saying especially in sheep milk production (1st in the world), sheep (7th in the world) and small ruminant (1st in Europe) population (2020). However, the yield per unit animal (meat-milk, lamb/kid and fleece/angora) is not at the desired level in sheep and goat breeding in our country. Therefore, in the presented review, brief information is given about reproduction, artificial insemination (AI) and especially oestrus synchronisation (social, hormonal and nutritional pathways) in ewes. In the conditions of our country, which is located in the northern hemisphere, it is seen that the ewes showing seasonal polyoestrus enter the breeding season especially in late summer (Western Anatolia) or autumn (Eastern Anatolia). Physiologically, the average oestrus cycle in ewes is 16-17 days, oestrus period is 20-36 hours, and ovulation occurs at the end of oestrus (24-26 hours). In sheep breeding, natural breeding is preferred rather than AI. Among the most important reasons for this is the difficulty in intrauterine insemination caused by the curved structure of the cervix anatomy, and the relative sensitivity of ram semen to freezing processes compared to other species. For oestrus synchronisation, pre-season ram effect, in- (GnRH, Progesterone, Prostaglandin and PMSG) or off-season (Melatonin, Progesterone and PMSG) hormone and especially peri-mating flushing (enriched energy) applications are performed. On the other hand, it is known that the normal lambing period, after pregnancy (average 5 months) which is mostly formed as a result of natural breeding in the field, is especially in winter (Western regions) or spring (Eastern regions). Briefly, some up-to-date evaluations can be made in the light of the aforementioned physio-anatomical structure and sheep breeding practice in our country: Undoubtedly, not only one protocol but also combining more than one protocol with a multidisciplinary approach should be used for oestrus synchronisation in ewes, to obtain high profit results at low cost. However, other factors such as flock population size, breed, geographic region, season, forage-land, rearing type, management-feeding and labour should also be considered in protocol selection. In addition, it is considered that the most practical and affordable synchronisation method in the field is ram effect, hormone use, flushing (enriched energy) and light restriction, respectively. Despite the fact that a major part of our country's need for animal products is met from sheep breeding, management-feeding is still mainly based on pasture. Consequently, it has been concluded that veterinarians and breeders, especially in developing regions (such as Eastern and South-eastern Anatolia), should include the oestrus synchronisation practice with a holistic and wider approach for a profitable sheep breeding.

Keywords: Sheep, Oestrus Synchronisation, Season, Ram Effect, Hormone, Flushing



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1. GİRİŞ

Dünyadaki sayıları bir milyardan üzerinde olan koyunlar, çiftlik hayvanları içerisinde büyük bir yer tutmaktadır. Koyunculukun hayvansal üretim, dolayısıyla tarımsal üretim ve ülkelerin ekonomilerinde önemli bir yeri bulunmaktadır. Koyunlardan elde edilen et, süt, yapağı ve deri gibi verimler insanların önemli ihtiyaçlarını karşıladığı gibi, koyun gübresi de tarla-bahçe tarımı için büyük değer taşır. Bu hayvanlar, birçok çiftlik hayvan türünün faydalanamadığı yem kaynaklarını değerlendirebilmektedir. Anılan nedenlerle, dünyanın her yerinde koyun yetiştiriciliği yapılmaktadır.

Koyun yetiştiriciliğinde verimliliği etkileyen en önemli etmenin yavru verimi olduğu bilinmektedir. Son yıllarda, bu alanda yapılan araştırmaların sayısal artışı konuya verilen önemi ortaya koymaktadır.

Günümüzde, koyun sayısında hızlı bir azalma olmaktadır. Bu azalmayı gidermek amacıyla, düşük kaliteli meraları daha iyi değerlendirebilmek, bakım ve beslenmeyi daha iyi yapabilmek, kaliteli yem bitkileri üretimine önem vermekle birlikte elde bulunan koyunlarda yavru verimini artırmak büyük önem taşımaktadır.

2. GENEL BİLGİLER

Dünyada, artan nüfusa paralel olarak koyun varlığının yetersiz kalması, Türkiye’de de hayvancılık açısından sorunlara yol açmaktadır. Bu sorunlardan biri olan koyun popülasyonundaki yetersizlik veya azalma, daha organize bir hayvancılık politikasıyla birlikte bilimsel yöntemlerin etkinlikle kullanılması ihtiyacını doğurmuştur. Her ne kadar, ülkemiz koyun sütünde dünya 1.si, ve küçükbaş toplam popülasyonunda Avrupa 1.si konumda (TÜDKİYEB 2020; TÜİK, 2020) ise de, maalesef birim hayvan başına verim (et, süt, kuzu/oğlak, yapağı/tiftik) yeterli seviyede değildir.

Daha verimli bir üretim için; bilgi, beceri ve teknolojiye dayanarak modern ve verimli bir yetiştiriciliğin yapılması amaçlanmaktadır. Bu doğrultuda, koyun ve keçi yetiştiriciliğinde öncelikli olarak masrafları artırmadan veya az masrafla daha iyi bir verimlilik elde etmek ve hayvanların üreme performanslarının üst seviyelere çıkmasını sağlamak hedeflenir. Bunun için, teknolojik yeniliklere ek olarak doğal yöntemler ve çeşitli hormonlar kullanılarak koyunların hem üreme süreci kontrol altına alınabilmekte hem de üreme performansları artırılabilir. Bu yöntemlerle, koyunlarda östrüs ve ovulasyonun senkronizasyonları yapılarak yavru



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veriminde artışlar sağlanabilmektedir (Özyurtlu ve Bademkiran, 2010; Uslu ve ark., 2012; Dönmez ve ark., 2016; Uçar ve Uslu, 2021).

2.1. Koyunlarda seksüel siklusun hormonal mekanizması

Koyunlarda, seksüel sikluslar günlerin kısalmasıyla başlar. Bu olaylar, epifiz bezinden (pineal bez) salgılanan melatonin tarafından kontrol edilir (Kalkan ve Horoz 1997). Seksüel siklusu kontrol eden hormonal mekanizma, aşım ve anöstrüs sezonlarında farklılık gösterir. Fotoperiyot, koyunlarda yıllık aşım sezonu ve anöstrüs evrelerini kontrol eden en önemli çevresel faktördür. Bu yüzden, mevsimsel üreme ile ilgili esas hormonal yanıt fotoperiyot tarafından uyarılmaktadır. LH salgısı üzerine östradiol'ün negatif feedback etkisi, mevsimsel olarak belirgin bir farklılık göstermektedir. Anöstrüs döneminde östradiol, LH salgısı üzerine güçlü bir inhibitör etkiye sahip iken aşım sezonunda bu inhibitör etki ortadan kalkmaktadır (Thimonier ve Ortavant, 1985; Baştan, 1995; Kaya, 1996; Kaya ve ark., 1998).

2.1.1. Aşım sezonunda hormonal mekanizma

Mevsimsel değişimler ve diğer çevresel faktörlerin hipotalamusu etkilemesiyle salgılanan GnRH'nın hipofiz ön lobundan FSH ve LH salınımını uyarması ile folliküler gelişme kontrol edilmektedir (Hunter, 1980; Haresign ve ark., 1985; McDonald ve Pineda, 1989; Kaya, 1996; Alaçam, 1997).

FSH, ovaryumları etkileyerek folliküler gelişmeyi uyarmakta ve gelişen bu folliküllerden artan miktarlarda östrojen salgılanmaktadır (Hunter, 1980; Kaya, 1996; Kalkan ve Horoz, 1997). Östrojen artışı östrüs davranışlarının ortaya çıkmasını sağlamakla birlikte, yoğunluğu belirli bir düzeye ulaşınca LH salınımını uyarmaktadır (Kaya, 1996). Aşım sezonu içinde periferik plazma östradiol yoğunluğunu, lüteolizisten sonra artarak LH pikini oluşturmaktadır (Baştan, 1995). LH pikinden 18-24 saat sonra ovulasyon şekillenmektedir. Follikül gelişimi sırasında östrojenin yanı sıra inhibin hormonu da salgılanmaktadır. İnhibin, FSH salınımını baskılayarak sekonder ve tersiyer folliküllerin gelişimini önlemekte ve ovulasyon oranının sınırlandırılmasını sağlamaktadır (Kaya, 1996).

Kandaki düşük östrojen düzeyleri, hipofiz bezine negatif feedback etki yaparak gonadotropin salınımını baskılamakta ve ovaryumlarda yeni folliküllerin gelişimini engellemektedir. Kandaki yüksek östrojen düzeyinin hipotalamus-hipofiz sistemi üzerine pozitif feedback etkisiyle 2-10 ng/ml olan LH, 100-200 ng/ml düzeyine yükselmektedir. Ovulasyondan sonra LH ve östradiol seviyeleri hızla düşmektedir (McDonald ve Pineda, 1989; Kaya, 1996).



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LH etkisi altında, ovulasyon çukurunun kanla dolması sonucu corpus haemorrhagicum ve daha sonra corpus luteum şekillenerek lüteal faz başlar (Hunter, 1980; Kaya, 1996; Kalkan ve Horoz, 1997). Corpus haemorrhagicum, 4-5 gün içerisinde corpus luteum periodicum'a dönüşerek, siklusun 9-13. günlerinde progesteron salgısının maksimum düzeye erişmesini sağlar. Progesteronun yüksek düzeyleri, hipofizden salınan gonadotropinler üzerine inhibitör etki ederek folliküler gelişmeyi sınırlandırmaktadır. Gebelik şekillenmediği takdirde, siklusun 13. gününden sonra uterus endometriyumundan salgılanan PGF_{2α} etkisi ile corpus luteum küçülmeye başlar. Progesteron salgısının azalmasıyla da bu hormonun hipofiz bezi üzerinde olan baskısı ortadan kalmakta ve yeni bir siklus başlamaktadır. Progesteron düzeyi östrüs anında 0.5 ng/ml'ye kadar düşmektedir (Kaya, 1996).

2.1.2 Anöstrüs sezonunda hormonal mekanizma

Bu dönemde, koyunların ovaryumları tamamen inaktif olmayıp, folliküler aktivite düşük düzeyde de olsa devam etmektedir (Hunter, 1980; Kaya, 1996). Gonadotropinlerin hipofiz ve kan dolaşımındaki yoğunlukları, siklusun luteal dönemindekine benzer düzeyde hatta daha düşük seyretmektedir. FSH ve LH, folliküler gelişmeyi bu dönemde sağlayamadığı için, östrüs ve ovulasyonu sağlayacak LH pikine yol açan östradiol sekresyonunda da artış görülmemektedir. Fertilitedeki mevsimsel değişiklik pulsatil olarak salınan GnRH'daki mevsimsel değişiklikler tarafından yönlendirilmektedir. Erken postpartum dönemde, yüksek düzeyde salgılanan prolaktin, gonadotropinlerin salınımını baskılayarak koyunlarda laktasyon anöstrüsüne neden olmaktadır. Anöstrüs döneminde yüksek olan prolaktin düzeyi, aşım sezonuna geçişte hızla düşmekte, sezon boyunca düşük düzeylerde kalmakta ve anöstrüse geçişte tekrar yükselmektedir. Ancak, mevsimsel üremenin kontrolünde prolaktinin rolü tam olarak aydınlatılamamıştır.

Anöstrüsten aşım sezonuna geçiş döneminde, gonadotropin düzeyinde görülen yükselme follikül gelişimini ve olgunlaşmasını uyarmakta, ancak östrüs ve ovulasyonu yeterince şekillendirememektedir. Dolayısıyla, aşım sezonu başlangıcındaki ilk ovulasyonlu östrüsler sakın geçmekte ve ovulasyon sonrası oluşan corpus luteum normalden daha kısa sürede regresyona uğramaktadır (Kaya, 1996).

LH'nın sinirsel inhibisyonundan sorumlu birçok neurotransmitter madde bulunmaktadır. Ancak, aşım sezonunda tonik LH salgısını kontrol eden endojen opioid peptidlerin primer neurotransmitterler olduğu düşünülmektedir. Yapılan çalışmalarda, opioid antagonistlerinin üreme sezonunda LH salgısını önemli derecede artırdığı belirtilmiştir. Kateşolaminerjik



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neuronların anöstrüs döneminde östradiolün negatif feedback etkisini yönlendirdiği ileri sürülmektedir. Östradiolün hipotalamustan GnRH salınımını baskılamasında kateşolaminler de rol oynamaktadır (Kaya, 1996).

3. KOYUNLARDA ÖSTRÜS SENKRONİZASYONU

Günümüzde, gelişmiş teknoloji ile koyunları istediğimiz dönem ve kondisyonda gebe bırakma olanağı sayesinde doğumlar belli bir süreye sıkıştırılabilir ve pratikte güvenli bir şekilde yapılabilir. Bu olaya ‘östrüs senkronizasyonu’ denilir. Bu konuyla ilgili çok sayıda araştırma yapılmış ve başarılı sonuçlar alınmıştır (Esen ve Bozkurt, 2001).

Koyunlarda üremenin denetlenmesi çerçevesinde; a) genç hayvanlardan erken yaşta yavru alınması, b) ovulasyon şansı ve ikizlik oranının yükseltilmesi, c) gebelik süresinin kısaltılması ve d) östrüsün senkronizasyonu işlemleri ile yapılabilmektedir.

Senkronizasyonun avantajları arasında şu hususlar yer alır:

- 1) östrüs izleme ve tespiti için zaman kaybının önlenmesi,
- 2) östrüslerin kısa bir süreç içine toplanabilmesi,
- 3) ovulasyonun kontrolüne bağlı olarak eş zamanlı tohumlama olanağı sağlanması,
- 4) ilk tohumlamada gebe kalmayan koyunların takibinin kolaylaşması,
- 5) hayvanlara gruplar halinde bakım, besleme ve idari program uygulanmasına olanak vermesi,
- 6) embriyo transferi çalışmalarında alıcı ve verici hayvanların senkronizasyonunu sağlayarak embriyo naklini kolaylaştırması,
- 7) doğumları istenen bir süre içinde toplayarak kontrol altında yaptırmaya olanak vermesi,
- 8) yavruların grup halinde doğmasına ve homojen bir sürü oluşmasına yardımcı olması ve pazarlamada kolaylık sağlamaı,
- 9) doğan kuzuların hastalıklarıyla daha kolay mücadele edilebilmesi ve aşılamaalarının topluca yapılabilmesi,
- 10) ikizlik oranını indükleyerek yavru veriminde artış sağlamaı,
- 11) sürüde bir-örnek gençleştirmenin sağlanması,
- 12) kuzulama mevsiminin değiştirilmesi,
- 13) anöstrüs döneminde östrüsü uyarak iki sene içinde üç kez doğum yaptırılabilmesi,
- 14) koyun sütüne önem verilen yerlerde yıl boyunca süt veriminde devamlılık sağlanabilmesi,
- 15) bilimsel çalışmalar için aynı yaşta yeterli sayıda materyal elde edilmesi,



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16) kuzu besisi yapan işletmeler için benzer yaşta ve ağırlıkta bir örnek besi materyali sağlanabilmesi,

17) kuzuların daha erken yaşta cinsel olgunluğa erişmesi ve yavru veriminin sağlanması,

18) çiftliklere geliş ve gidiş azalacağından suni tohumlama ve ulaşım masrafları ile zamandan tasarruf sağlanması,

yer alır (Alaçam, 1997; Kalkan ve Horoz, 1997; İleri ve ark., 1998; Kaya ve Çoyan, 1998).

Senkronizasyonun dezavantajları arasında şu hususlar yer alır:

1) elde edilecek reproduktif performansın büyük oranda farklılıklar göstermesi,

2) tedbir alınmazsa doğumların yoğunlaştığı dönemde gerekli bakım ve iş gücünün karşılanamaması,

3) doğumların kısa bir süre içinde yoğunlaşması nedeniyle barınak eksikliği gibi fiziki yetersizliklerin oluşmasına neden olabilmesi,

4) meraya dayalı yetiştiricilikte tüm kuzuların elverişsiz koşullarda doğabilmeleri,

5) senkronize edilen sürülerde çiftleşme için çok sayıda koça gereksinim duyulması,

6) uygulanan vaginal gereçlerin vaginitise yol açması,

bulunmaktadır (Greyling ve Westhuysen, 1980; Güler, 1988; Aldemir, 1988; Keskin 1989).

Koyunlarda östrüs senkronizasyonu için anöstrüs döneminde, aşım sezonuna girişte ve aşım sezonunda hormonal veya hormonal olmayan farklı uygulamalar önerilmektedir.

3.1. Mevsime Girişte Yapılan Uygulamalar:

3.1.1. Koç etkisi

Koç etkisi; koçlar tarafından salgılanan feromonlar ve davranışsal uyarılar sonucunda ortaya çıkmakta ve koyunlar bu uyarıları koku alma, görme, işitme ve temasla algılamaktadır. Maksimum etki için bu işaretlerin hepsinin birlikte bulunması ve sinerjik etki göstermesi gerekmektedir (Signoret, 1991; Rosa ve ark., 2002). Ayrıca, bu tarz olumlu etki için, hormonal (örneğin progesteron) etkiyle birlikte kullanılması önerilmektedir (Dönmez ve ark., 2016).

Koç etkisinin ortaya çıkmasında, koçun ırkı, yaşı ve seksüel deneyimi önemli faktörlerdendir. Erginler gençlerden, yüksek libidolu ve seksüel deneyimi fazla olanlar olmayanlardan daha iyi bir performans ve daha yüksek östrüs oranı gösterirler. Bununla birlikte, koçlarda seksüel aktivite, beslenme yetersizliği, iç parazitler ve hastalık gibi faktörlerden ise olumsuz yönde etkilenmektedir (Yıldız ve ark., 2001; Uçar ve ark., 2008; Uçar ve Uslu, 2021).

Hayvanlar arasındaki erkek-erkek, dişi-dişi, erkek-dişi etkileşimleri üreme olayının birçok safhasını etkileyebilir. Koyunlarda, bu etkileşimler bütün seksüel grup ilişkilerinde tespit



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edilmiştir. Bunlardan; erkek-erkek etkileşimi, dişilerden ayrı büyütülen koçlarda belirgin olarak gözlenir. Koçların erkek grubu içerisinde büyütülmesi, erkekler arası sosyal ilişkiyi geliştirirken, dişilere karşı olan seksüel ilginin azalmasına neden olmaktadır. Erkek uyarısının koçların reproduktif performansları üzerinde de doğrudan bir etkisi vardır. Örneğin, yakın zamanda çiftleşmiş bir koçun diğer koçlara gösterilmesi onların reproduktif davranışlarını artırabilir (Rosa ve Bryant, 2002).

Bir başka etkileşim şekli olan dişi-dişi etkileşimi ile koyunlar birbirlerini uyarırlar. Anöstrüs dönemindeki koyunların içerisinde, östrüs gösteren koyunların katılması veya sürüde kızgın koyunların bulunması, koyunlarda ovulasyonun uyarılması ve senkronize edilmesine yol açabilir. Bu durum, dişiden yayılan uyarılar ile sağlandığından buna ‘dişi-dişi etkisi’ denmektedir (Wright ve ark., 1994; Rosa ve Bryant, 2002).

Erkek-dişi etkileşimiyle ise hem koyunlar hem de koçlar uyarılmaktadır. Bir grup koçun aniden, östrüsteki koyunların arasına katılması, bu koçların davranışlarında ve hormonal dengelerinde, “dişi etkisi” olarak da bilinen belirgin değişiklikler meydana getirmektedir. Dişilerin varlığı, koçların testosteron yoğunluğunda ve libidoda artışa neden olur. Buna bağlı olarak feromon üretimi de artar (Rosa ve ark., 2000).

Koçlar, östrüsün başlamasını uyararak ve ‘feromon’ olarak bilinen kimyasal bir madde üretirler. Daha çok koçların yapağlarında yer alan bu feromonlar, koyunlardaki olfaktorik reseptörleri uyararak ovulasyonun başlamasında etkili rol alırlar (Knight ve Lynch, 1980). Koyunlarda, koku dışında fiziksel ve görsel temas gibi diğer uyarıcı işaretlerin de koçlara yanıt vermede etkili olduğu tespit edilmiştir (Dobson ve ark., 1999; Abecia ve ark., 2002).

Koçların koyunlara gösterilmesi, koyunların reproduktif fizyolojilerini akut veya kronik olarak iki şekilde uyarabilir. Akut etki “koç etkisi” olarak bilinir ve koyunlara koçların gösterilmesinden sonraki 50-65 saat içinde ovulasyona yol açan hormonal olayların başlamasına neden olur. Bu yanıt prepubertal, laktasyon ve mevsimsel anöstrüs dönemindeki koyunlarda tespit edilmiştir. Kronik etki ise daha erken yaşlardaki koyunlarda kendini gösterir. Ovulasyonun 1.5-2 ay öncesinden itibaren koçlarla yakın mesafede tutulan dişi kuzularda ilk ovulasyonun çok daha erken ortaya çıkması, kronik etkiye bir örnek olarak gösterilebilir (Rosa ve ark., 2000).

Koç etkisinden yararlanabilmek için koçların uygun zamanda koyunlardan uzaklaştırılması, belli bir süre ayrı tutulması ve sonrasında sürüye katılması gerekir (Dönmez ve ark., 2016). Bu takvim basitçe şöyle özetlenebilir (Mc Dougall, 2001):



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- 28. günde; Koçlar koyunlardan uzaklaştırılır,
- 0. günde; Sürüye arama koçları katılır,
- 6. günde; Bazı koyunlar sessiz östrüs gösterir,
- 16. günde; Arama koçları çıkarılır, fertil koçlar katılır,
- 17. günde; %30-40 oranında tohumlama gerçekleşir,
- 23. günde; Kalan koyunlar tohumlanır.

3.1.2. Beslenme

Evcil hayvanlar arasında, yavru verimi bakımından çevre etmenleri ve özellikle beslenmeye en bağımlı hayvan koyundur. Hayvanın vücut kondisyonu skoruna (VKS) göre, koç katımına bir ay veya 20 gün kala ilave yem verilerek koyunda canlı ağırlık artışı sağlanmalı ve iyi bir kondisyona ulaştırılıp, koça verilmelidir. Bu durumda, hem sürüdeki kısırılık oranı azaltılacak hem de süperovulasyon oluşarak birden fazla yavru elde etme olasılığı bulunacaktır. Böyle bir yaklaşım, gebeliğin ilk ayları ve doğuma yakın dönemde de uygulanmalıdır. ‘Flushing’ (rasyonda enerji + protein ağırlıklı zenginleştirme) olayının, süperovulasyon şansını artırma mekanizması, gittikçe düzelen VKS’nin hormonal yollarla hipofiz ön lobunda stimülasyona yol açıp, FSH (ve dolayısıyla LH) sekresyonunu artırmasından ileri geldiği tarzında açıklanmaktadır (Esen ve Bozkurt, 2001).

Flushing uygulanacak damızlık koyunlar düşük VKS’de olmalı ve bunların iyi bir VKS düzeyine getirilmesi gerekir. Yağlı koyunlarda ise, ekstra flushing uygulanması yavru verimini olumsuz etkilemektedir (Esen ve Bozkurt, 2001).

Yapılan bazı çalışmalarda, sıfat öncesi farklı beslenen koyunlarda yavru verimi özellikleri yönünden önemli bir farkın olmadığı, fakat özellikle ikiz gebelik oranının yaklaşık %20-30 oranında yükseldiğini bildiren yazarların yanında, kuzu veriminin %50 oranında arttığını bildiren yazarlar da vardır (Esen ve Bozkurt, 2001).

Öte yandan, VKS iyi durumdaki (ortalama 3 ünite, 1-5 skalası) koyunlarda kuzulama ve ikizlik oranlarının olumlu yönde etkilendiği, tersine düşük VKS (kaşeksi) durumunda ise östrüs oranı ve kuzu sayısının azaldığı unutulmamalıdır (Uçar ve ark., 2008). Ayrıca, östrüs esnasında ölçülen kan mineral ve iz elementlerinden özellikle bakır ve çinko düzeylerinin düşük olmasının gebelik oranını önemli düzeyde olumsuz yönde etkilediği bildirilmiştir (Uslu ve ark., 2017).

3.2. Mevsim İçi Uygulamalar:

Üreme sezonunda koyunlarda siklik ovaryum faaliyetleri olduğundan, östrüs senkronizasyonu amacıyla hem progestagenlerden hem de PGF_{2α} analoglarından yararlanılabileceği



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bildirilmektedir (Alaçam ve ark., 1986, 1987; Alaçam ve ark., 1988; Güler, 1988; Gökçen ve ark., 1992; Alaçam, 1994; Doğan ve Nur, 2006).

3.2.1. Progesteron kullanımı

Progestagenler, koyunlarda aşım döneminde, vaginal sünger ve rasyon başta olmak üzere değişik uygulama yol ve formlarında 8-14 gün süreyle verilerek östrüs senkronizasyonu elde edilebildiği birçok araştırmacı tarafından ortaya konmuştur (Greyling ve Westhuysen, 1980; Alaçam ve ark., 1986, 1987, 1988; Gökçen ve ark., 1992; Alaçam, 1994; Knights ve ark., 2001). Progestagenlerle östrüs senkronizasyonu temel olarak progesteronların hipotalamusu bloke edici ve luteal dönemi uzatıcı etkisi ile yapılabilmektedir (Alaçam, 1994).

Koyunlarda progesteron bileşikler 4 farklı yolla kullanılabilmektedir:

- 1) *Oral kullanım*; bu yolla premiks, tablet, kapsül ve solüsyon formundaki progestagenler kullanılmaktadır. Chlormadinone acetate (CAP) ve Medroxyprogesteron acetate (MAP)'ın östrüs ve ovulasyonu inhibe edebilecek minimum günlük dozu 1 mg'dır (Hunter, 1980; McDonald, 1986; Jainudeen ve Hafez, 1987; McDonald ve Pineda 1989; Lindsay, 1991).
- 2) *Enjeksiyon*; enjeksiyonlar her gün veya iki günde bir yapılabilmektedir. En başarılı senkronizasyon sonuçlarının günlük 12 mg progesteronun 12-18 gün süreyle kas-içi olarak verilmesiyle alındığı bildirilmektedir (Hunter, 1980; McDonald, 1986; Jainudeen ve Hafez, 1987; McDonald ve Pineda, 1989; Lindsay, 1991).
- 3) *Deri altı implantlar*; kulak ya da koltuk-altı bölgesinde deri altına 10-12 gün süreyle uygulanmaktadır. İmplantların çıkarılmasından 24-36 saat sonra östrüslerin görüldüğü kaydedilmektedir (Hunter, 1980; Jainudeen ve Hafez, 1987; McDonald ve Pineda, 1989). Bu uygulama sonucunda östrüslerin daha erken ortaya çıkması önemli bir özelliktir (Uslu ve ark., 2012).
- 4) *İntravaginal uygulama*; progesteron içeren sünger, spiral veya silikon gibi maddelerin vaginal duvarlara temas edecek şekilde 10-14 gün süreyle yerleştirilmesini içermektedir. Pratik ve kontrolü kolay olan bu uygulamanın diğer yöntemlere tercih edildiği bildirilmektedir (Nett ve Nisvender, 1982; McLeod ve ark., 1983; Quirke ve Hanrahan, 1985; Hafez, 1987). İntravaginal yolla 40-60 mg MAP, 30-40 mg Fluorogestone acetate (FGA) ve 50 mg Megestrole acetate (MA) içeren süngerler yaygın olarak kullanılmaktadır (McLeod ve ark., 1983; Thimonier ve Ortavant, 1985; Roche ve ark., 1985; Hafez, 1987; Signoret, 1991; Dönmez ve ark., 2016).

3.2.2. PGF_{2α} kullanımı



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Üreme mevsiminde östrüs senkronizasyonu için PGF_{2α} analogları 9 gün arayla iki enjeksiyon şeklinde kullanılarak, östrüs senkronizasyonu yapılabilir (Güler, 1988; Claus ve ark., 1990; Lindsay, 1991; Baştan, 1995; Kaya, 1996).

3.3. Mevsim Dışı Uygulamalar:

Anöstrüs döneminde, koyunlarda ovaryum fonksiyonlarının kontrolü ve uyarılması amacıyla progestagenler, melatonin, suni ışık ve koç etkisinden yararlanılabileceği bildirilmektedir (Güler, 1988; Claus ve ark., 1990; Lindsay, 1991; Baştan, 1995; Kaya, 1996). Gordon, (1999) koyunlarda anöstrüs döneminde PGF_{2α} kullanımının östrüs senkronizasyonu için uygun olmadığını bildirmektedir.

3.3.1. Progesteron

Koyunlarda, anöstrüs sezonunda senkronize östrüs elde etmek için en yaygın kullanılan yöntemin progesteron içeren vaginal sünger uygulaması olduğu belirtilmektedir (Gabriella, 2010). Koyunlarda gerek üreme mevsimi içinde ve gerekse anöstrüs döneminde östrüs senkronizasyonu elde etmek için kullanılan vaginal süngerlerin progesteron bileşiği olan 30 ya da 40 mg flurogestone acetate veya 60 mg Medroksiprogesteron acetate içerdiği bildirilmektedir (Alaçam, 1994; Aköz ve ark., 2006; Gabriella, 2010; Dönmez ve ark., 2016). Anöstrüs döneminde progesteron kullanımı açısından progesteron uygulanış biçimi östrüs dönemine göre farklılık göstermektedir.

Östrüs dönemine geçişte (Dönmez ve ark., 2016) ve anöstrüs döneminde koyunlarda östrüs senkronizasyonu için uygulanan vaginal süngerin 10-14 gün vaginada tutulması gerektiği bildirilmektedir (Neils, 1997, Gabriella, 2010).

Anöstrüs döneminde, progesteron uygulamaları (Uslu ve ark., 2012) FSH karakterinde hormonlarla (örneğin eCG) kombine edilerek (Uslu ve ark., 2012; Dönmez ve ark., 2016) ikizliğin uyarımı da sağlanabilir. Bu amaçla, uygulamanın son 24 saati içinde 500-800 IU PMSG ile senkronizasyon ve ikizlik uyarımı yapılan koyunlara tohumlamalar sırasında da GnRH enjeksiyonları ile % 80'in üzerinde başarı sağlanabildiği belirtilmektedir. PMSG dozu, uygulamanın dönemine, ırkın kalıtsal ikizlik özelliklerine ve hedeflenen ovulasyon (ikizlik) sayısına göre değişir (Gökçen ve ark., 1992b).

Koyunlarda östrüs senkronizasyonu elde etmek için, vaginal sünger yerine kulak implantı daha yüksek başarıyla kullanılabilir (Uslu ve ark., 2012). Ayrıca, kontrollü ilaç salgılayan cihaz (CIDR) uygulamasının vaginal sünger uygulamasına kıyasla, yapısında sentetik progesteron olmaması ve uygulamadan sonra vaginal süngerde olduğu gibi vaginal irritasyondan



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kaynaklanan akıntı görülmemesi gibi avantajları olduğu bildirilmektedir (Knights ve ark., 2001; Dönmez ve ark., 2016).

3.3.2. GnRH

Anöstrüs döneminde GnRH'nın 48 saat süreyle düşük dozlarda tekrarlanan enjeksiyonu veya sürekli infüzyon şeklinde uygulanmasının koyunlarda östrüs ve ovulasyonu uyarabildiği bildirilmektedir (Güler, 1988; Kaya, 1996). Ancak, bu uygulamadan sonra meydana gelen korpus luteumların kısa ömürlü olduğu bildirilmektedir (Lindsay, 1991). GnRH uygulamaları sonucu şekillenen korpus luteumların kısa ömürlü olması LH'nın yetersiz salgılanması ile açıklanmaktadır (Lindsay, 1991). Bu olumsuzluğun ortadan kaldırılması için, GnRH uygulamalarından önce progesteron verilmesi gerektiği bildirilmektedir (Güler, 1988; Lindsay, 1991; Kaya, 1996). GnRH'nın deri altı yolla karboksimetilsellüloz ya da kapsül içine depo olarak verilmesi, enjeksiyonla verilmesine göre daha fazla LH salınımını uyarmaktadır. GnRH ile ovaryumların uyarılmasından elde edilen düşük başarı nedeniyle GnRH'nın senkronizasyon amacıyla tek başına kullanımı sınırlı kalmıştır.

3.3.3. Işık

Gün uzunluğunun, sonbahardakine benzer şekilde suni olarak 14 saatin altına indirilirse ovaryum aktivitesinin uyarılabildiği bildirilmektedir (Doney ve ark., 1982; Aytuğ ve Karaman, 1996). Kontrollü ışık uygulamaları için, gün uzunluğu ayarlamasının kademeli olarak yapılabileceği gibi, istenen süreyle kısaltılıp östrüsler gözleninceye kadar da sürdürülebilir. Kontrollü ışık uygulanan koyunlarda östrüsler oldukça geç gözlenebilmektedir. Ayrıca, a) bireysel farklılıklar nedeniyle östrüslerin senkronize olmaması, b) kapalı barınaklara ihtiyaç duyulması, c) havalandırma sorunu ve d) artan yem maliyeti gibi dezavantajlarından dolayı bu yöntemin uygulanması sınırlı kalmıştır. Ancak, ışık rejimi ile melatoninin kombine edilmesiyle bu güçlüklerin ortadan kaldırılabilmesi belirtilmektedir. Anöstrüs döneminde, ışık programlarından başarılı sonuç alabilmek için 16 saat karanlık uygulaması gerektiği bildirilmiştir (Gökçen ve ark., 1992). Sınırlı ışık uygulamaları, kısa günlerdeki benzer şekilde etki ederek, melatonin düzeylerini arttırmakta ve ovaryum aktivitelerini uyarmaktadır. Ayrıca, aşırı sıcak ve kurak iklimlerin erkeklerde libido ve sperma üretimi, dişilerde ise östrüs ve fertilite üzerine olumsuz etkileri olduğu unutulmamalıdır (Uçar ve Uslu, 2021).

3.3.4. Melatonin

Melatonin, karanlıkta pineal bezden (epifiz) ritmik olarak salınan doğal bir otakoid hormondur. Sonbaharda, günlerin kısalmasıyla birlikte artan melatoninin koyunlarda hipotalamusa etki



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ederek GnRH salınımını uyardığı bildirilmektedir (Doney ve ark., 1982; Baştan, 1995; Emrelli ve ark., 2003). Anöstrüs döneminde, gece salgılanan sınırlı düzeydeki melatonine ek olarak, implant, rumen bolu, enjeksiyon, vaginal sünger veya oral yolla dışarıdan melatonin verildiğinde prolaktin salınımını baskıladığı ve gonadotropinlerin serbest kalmasına öncülük ederek, koyunların 6-8 hafta içerisinde fertil östrüs gösterdiği bildirilmektedir (Gökçen ve ark., 1992; Emrelli ve ark., 2003; Uslu ve ark., 2012). Koyunlara öğleden sonraları günlük olarak oral ya da enjeksiyon tarzında melatonin verilmesi, plazma melatonin düzeyini 7 saate kadar yükselterek, östrüsün uyarılması için gerekli endojen melatonin seviyelerini sağlamaktadır (Baştan, 1995). Melatonin uygulamasının başarısı, doza ve verilme biçimine bağlıdır. Melatonin içeren implant uygulaması, a) daha pratik olması b) fizyolojik duruma benzer sonuçlar vermesi, ve c) melatonin düzeyini uzun süre 39-99 ng/ml seviyesinde tutması gibi özellikleriyle önemli avantajlar sağlamaktadır. Ayrıca, geçiş dönemindeki uygulamaların daha başarılı olduğu bildirilmektedir (Doney ve ark., 1982; Gökçen ve ark., 1992; Baştan, 1995). Senkronizasyon programının tamamlanması için, melatonin uygulaması ile koç katımı arasında 30 gün ve koç katımından sonra çiftleşmelerin tamamlanması için de 20-30 gün olmak üzere toplam 50-60 günlük bir süre gerekmektedir (Uslu ve ark., 2012). Aşımları erkene almak için melatonin, normal aşım sezonundan 60 gün öncesinde uygulanmalıdır. Bu süre korunmadığı takdirde, hormon ve kontrol gruplarındaki koyunlar arasında östrüslerin başlaması açısından önemli bir fark olmadığı, ancak çiftleşme döneminin, melatonin uygulananlarda daha kısa olduğu bildirilmiştir (Doney ve ark., 1982).

Melatonin uygulamalarında başarının, laktasyon, beslenme ve koç katımı gibi faktörlerden de etkilendiği vurgulanmaktadır. Melatoninin, a) aşım sezonunu daha erken başlatması, b) homojen bir çiftleşme döneminin sağlanması, ve c) ovulasyon ve ikizlik oranının arttırılması gibi avantajlar sağladığı kaydedilmektedir (Uslu ve ark., 2012). Melatonin implantının diğer bir avantajı, ilk çiftleşmede gebe kalma oranının yüksek olmasıdır (Gökçen ve ark., 1992; Uslu ve ark., 2012). Gebe kalmayan koyunlar ise periyodik olarak östrüs sergilemektedir.

Ek olarak, anöstrüs dönemindeki koyunlara tek taraflı melatonin implant takılırken, benzer şekilde koçlara ise çift taraflı implant takılması, damızlık verimlerinin (sürdürülebilir aşım, kaliteli sperma üretimi ve döl verimi) olumlu yönde etkilenmesine katkı sağlar (Uslu ve ark., 2012).



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4. SONUÇ

Sunulan bilgiler ışığında; aşağıdaki değerlendirmeler yapılabilir:

- 1) Koyunlarda östrüs senkronizasyonu amacıyla sadece bir protokolün kullanımının değil, multidisipliner yaklaşımla birden fazla protokolün kombine edilmesinin düşük maliyetle yüksek kazançlı sonuçlar almak için daha doğru olacağı kuşkusuzdur.
- 2) Bununla birlikte, sürü popülasyon büyüklüğü, ırk, coğrafi bölge, mevsim, yem-arazi, yetiştirme tipi, bakım-besleme ve işgücü gibi diğer faktörler de protokol seçiminde dikkate alınmalıdır.
- 3) Sahada en pratik ve ucuz olabilecek senkronizasyon yönteminin sırasıyla, koç etkisi, hormon kullanımı, flushing (enerji ağırlıklı) ve ışık kısıtlaması olduğu değerlendirilmektedir.
- 4) Ülkemizin hayvansal ürün ihtiyacının önemli bir kısmının koyunculuktan karşılanmasına rağmen, halen ağırlıklı olarak meraya dayalı bakım-beslemenin uygulanageldiği Doğu ve Güneydoğu Anadolu Bölgelerimizde, modern ve karlı hayvancılık yöntemlerinden biri olan östrüs senkronizasyonu uygulamasına Veteriner Hekimler tarafından bir an önce hayata geçirilmesi gerektiği kanısına varılmıştır.



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5. KAYNAKÇA

Aköz M, Bülbül B, Ataman MB, Dere S (2006). Induction of multiple births in Akkaraman cross-breed sheep synchronized with short duration and different doses of progesterone treatment combined with PMSG outside the breeding season. Bull. Vet. Inst. Pulawy, 50: 97-100.

Alaçam E (1994). Evcil Hayvanlarda Reprodüksiyon Sun'ı Tohumlama Doğum ve İnfertilite, 81-88, Medisan, Ankara.

Alaçam E (1997). Koyunculukta modern üretme yöntemleri. Koyun Yetiştiriciliği ve Hastalıkları Sempozyumu, 32-39, Kuzucular Ofset, Konya.

Alaçam E, Güler M, Dinç DA, Eröz S, Sezer AN (1986-1987). Anöstrüs dönemindeki koyunlarda ovariel aktivitenin medroksiprogesteron asetat (MAP) ve PMSG hormonu ile kontrol altına alınması üzerine çalışma, U. Ü. Vet. Fak. Derg., 5-6 (1-2-3): 103-110.

Alaçam E, Güler M, Dinç DA, Eröz S, Sezer AN (1988). Anöstrüs döneminde progestagenler (MAP), PMSG ve GnRH ile senkronize edilen koyunlarda radioimmunoassay (RIA) yöntemi ile erken gebelik tanısı üzerine çalışma, S. Ü. Vet. Fak. Derg., 4(1): 91-98.

Aldemir N (1988). Koyunlarda östrüs senkronizasyonu ve fertilitede etkisinin araştırılması. Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, Ankara.

Baştan A (1995). Akkaraman ırkı koyunlarda melatonin ve progesteron uygulamalarının reproduktif performans üzerine etkileri, A. Ü. Sağlık Bilimleri Enstitüsü, Doktora Tezi, Ankara.

Claus R, Over R, Dehnhard M (1990). Effect of male odour on LH secretion and the induction of ovulation in seasonally anoestrus goats. Anim. Repr. Sci., 22: 27-38.

Danko GN (2010). Some practical and biotechnological methods for improving reproduction traits in sheep. <http://www.date.hu/kiadvany/acta/2003-11i/novotnine.pdf>. Erişim: 02.05.2014.

Doğan İ, Nur Z (2006). Different estrus induction methods during the nonbreeding season in Kivircik ewes. Veterinarni Medicina, 51(4): 133-138.

Doney JM, Gunn RG, Horak F (1982). Reproduction, In World Animal Science. Sheep and Goat Production, Editor, LE. Coop, p 57-80, Elsevier, New York.

Dönmez A, Uslu BA, Uçar Ö (2016). The effects of ram introduction or estrus synchronisation by MAP, FGA and CIDR-G on reproductive parameters in Awassi ewes during transition period. Proceedings of the 20th Annual Conference of the European Society for Domestic Animal Reproduction (ESDAR) and the 13th Conference of the Spanish Association



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for Animal Reproduction (AERA). 27-29 October. Lisbon, PORTUGAL. (Reprod. Dom. Anim.) 51, S2- Special Issue (Poster no: P71), pp. 88-89.

Emrelli AZ, Horoz H, Tek Ç (2003). Merinos ırkı koyunlarda mevsim dışı melatonin ve progesterone uygulamalarının östrüs siklusunun uyarılması ve dölverimine etkisi. İ.Ü. Vet. Fak. Derg. 29(2): 267-275.

Esen F, Bozkurt T (2001). Akkaraman ırkı koyunlarda flushing ve östrus senkronizasyonu uygulamasının dölverimi üzerine etkisi, Turk J. Vet. Anim. Sci. 25: 365-368.

Gordon I (1999). Controlled Reproduction in Sheep and Goat. CAB International, ISBN: 0851991157.

Gökçen H, Tümen H, Soylu MK (1992). Anöstrüs dönemindeki koyunlarda östrüs senkronizasyonu ve dölverimi, U. Ü. Vet. Fak. Derg., 3(11): 35-39.

Gökçen H, Tümen H, Soylu MK, Doğan İ, Deligözoğlu F, Bilgin B (1992). İthal kökenli koyunlarda kızgınlığın uyarılması ve suni tohumlama üzerinde bir araştırma, U. Ü. Vet. Fak. Derg., 11(3): 143-147.

Greyling JPC, Westhuysen JM (1980). The synchronisation of oestrus in sheep. 3. The use of intravaginal progestagen and prostaglandin. S. Afr. J. Anim. Sci., 10: 65-68.

Güler M (1988). Anöstrüsteki koyunlarda ovariyal aktivitenin Medroxyprogesteron Asetate (MAP) ve GnRH uygulamaları ile uyarılması üzerine çalışma. Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, Ankara.

Hafez ESE (1987). Reproductive cycles. In 'Reproduction in Farm Animals', Editor, E.S.E. Hafez, 5. Ed., 107-129, Lea & Febiger, Philadelphia.

Haresign W, McLeod BJ, Webster GM, Worthy K (1985). Endocrine basis of seasonal anestrus in sheep, in Endocrine Causes of Seasonal and Lactational Anestrus in Farm Animals, Editors, F. Ellendorf and F. Elsaesser, pp.6-18, Martinus Nijhoff Publishers, Boston.

Hunter RHF (1980). Physiology and Technology of Reproduction in Female Domestic Animals, Academic Press, London.

İleri İK, Pabuççuoğlu S, Birler S (1998). Koyunlarda reproduksiyon ve sun'i tohumlama. In Evcil Hayvanlarda Reprüdiksiyon ve Suni Tohumlama, sf.189-205, İstanbul Üniversitesi Veteriner Fakültesi Yayınları, İstanbul.

Jainudeen MR, Hafez ESE (1987). Sheep and goats. In Reproduction in Farm Animals, Editor, E.S.E. Hafez, 5. Edition, pp.315-319, Lea & Febiger, Philadelphia.



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BINGOL, TURKEY**



Kalkan C, Horoz H (1997). Pubertas ve seksüel sikluslar. (alıntı). In Evcil Hayvanlarda Doğum ve İnfertilite, E. Alaçam (ed.), 59-68, Medisan, Ankara.

Kaya A (1996). Anöstrüs dönemindeki koyunlarda melatonin ve koç etkisi uygulamalarının bazı üreme parametrelerine etkisi. S.Ü. Sağlık Bilimleri Enstitüsü, Doktora Tezi, Konya.

Kaya A, Ataman MB, Karaca F, Yıldız C, Çoyan K, Aksoy M, Ergin A (1998). Konya merinosu koyunlarında melatonin, progesterone – PMSG ve koç etkisi uygulamalarının erken anöstrüs döneminde bazı üreme parametrelerine etkileri, Hay. Arş. Enst. Derg., 8: 1-2, 5-10.

Keskin O (1989). Dölerme hormonları. Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Seminer, Ankara.

Knight TW, Lynch PR (1980). Source of ram pheromones that stimulate ovulation in the ewe. Anim. Reprod. Sci. 13: 74-76.

Knights M, Hoehn T, Lewis PE, Inskeep EK (2001). Effectiveness of intravaginal progesterone inserts and FSH for inducing synchronized estrus and increasing lambing rate in anestrus ewes. J. Anim. Sci. 79: 1120-1131.

Lindsay DR (1991). Reproduction in the sheep and goat. In Reproduction in Domestic Animals, Editor, P. T. Cups, 491-501, Academic Press, New York.

McDonald LE, Pineda MH (1989). Veterinary Endocrinology and Reproduction, 4., Lea Febiger, Boston.

McLeod BJ, Hareisgn W, Lamming GE (1983). Induction of ovulation in seasonally anestrus ewes by continuous infusion of low doses of GnRH. J. Reprod. Fert., 68: 489-495.

Nails PC (1997). Compendium of Animal Reproduction. Intervet International B. V. ISBN:9080188654.

Nett TM, Nisvender GD (1982). Influence of exogenous melatonin on seasonality of reproduction in sheep. Theriogenology, 17(6): 645-653.

Özyurtlu N, Bademkiran S (2010). Koyunlarda östrüs senkronizasyonu ve östrüsü uyarma yöntemleri. Dicle Üni. Vet.Fak. Derg., 3: 17-22.

Quirke JF, Hanrahan JP (1985). Breed differences in the breeding season in sheep. In Endocrine Causes of Seasonal and Lactational Anestrus in Farm Animals. Editor, F. Ellendorf, F. Elsaesser, 29-43, Martinus Nijhoff Publishers, Boston.

Roche JF, Hanrahan JP, Quirke JF, Ronayne E (1985). Effect of melatonin on the time of onset of the breeding season in different breeds of sheep. In Endocrine Causes of Seasonal



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on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



and Lactational Anestrus in Farm Animals. Editor, F. Ellendorf, F. Elsaesser, 35-65, Martinus Nijhoff Publishers, Boston.

Rosa HJD, Bryant MJ (2002). The 'ram effect' as a way of modifying the reproductive activity in the ewe. *Small Rumin. Res.* 45: 1-16.

Rosa HJD, Juniper DT, Bryant MJ (2000). The effect of exposure to estrous ewes on rams' sexual behavior, plasma testosterone concentration and ability to stimulate ovulation in seasonally anoestrous ewes. *App. Anim. Behav. Sci.* 67: 293- 305.

Signoret JP (1991). Sexual pheromones in the domestic sheep, importance and limits in the regulation of reproductive physiology, *J. Steroid Biochem. Molec. Biol.*, 39: 639-645.

Thimonier J, Ortavant R (1985). Light control of reproduction in the ewe, in *Endocrine Causes of Seasonal and Lactational Anestrus in Farm Animals*, Editors, F. Ellendorf and F. Elsaesser, pp.44-54. Martinus Nijhoff Publishers, Boston.

TÜDKİYEB, 2020. Türkiye koyun sütü üretiminde ilk sıraya yükseldi. Haber 11.08.2020 (Erişim: 19.11.2020). <https://www.hurriyet.com.tr/ekonomi/turkiye-koyun-sutu-uretiminde-ilk-siraya-yukseldi-41584484>

TÜİK, 2020. Hayvansal Üretim İstatistikleri (Haziran sonu itibariyle). Erişim: 28.12.2020. <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=33874#>

Uçar Ö, Uslu BA (2021). Causes and remedies for non-infectious infertility in sheep and goats. EDUVET (Uluslararası Veteriner Bilimleri Kongresi) - 2021 (Virtual presentation), 25-27 June. Samsun-TÜRKİYE. pp.63-64.

Uçar Ö, Çenesiz M, Kaya M, Yıldız S (2008). Koyunlarda Vücut Kondisyon Skorunun üreme üzerine etkileri (Derleme). *Bültendif Veteriner Bülten* 29 (Nisan): sf.2-5.

Uslu BA, Mis L, Gülyüz F, Comba B, Comba A, Kosal V, Sendag S, Ucar O (2017). Is there a relationship between serum minerals (Ca, Mg) and trace elements (Cu, Fe, Mn, Zn) at mating and pregnancy rates in fat-tailed Morkaraman sheep?. *Indian J. Anim. Res.*, 51(2): 256-262.

Uslu BA, Tasal I, Gulyuz F, Sendag S, Ucar O, Goericke-Pesch S, Wehrend A (2012). Effects of oestrus synchronisation using melatonin and norgestomet implants followed by eCG injection upon reproductive traits of fat-tailed Morkaraman ewes in anoestrus season. *Small Rumin. Res.* 108(1-3): 102-106.



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BINGOL, TURKEY**



Wright IA, Rhind, SM, Smith AJ, Whyte TK (1994). Female-female influences on the duration of the post-partum anoestrous period in beef cows. *Animal Prod.* 59: 49-53.

Yıldız S, Uzun M, Cenesiz M, Ucar O, Kaya M, Onder F (2002). Effects of sexually activated rams or ewes on pulsatile LH secretion in anoestrous sheep. *Acta Vet. Brno* 71: 297-302.



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**DIŞİ SIÇANLARIN AKCİĞER DOKUSUNDA NUCB2/NESFATİN-1'İN
İMMÜNOHİSTOKİMYASAL DAĞILIMI**

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ÖZET

Bir nükleobindin2 (NUCB2) derivesi doymuş nöropeptid olan nesfatin-1, ilk olarak 2006 yılında sıçan hipotalamusunda keşfedilmiştir. 82 amino asitlik bir peptit olan NUCB2/nesfatin-1, merkezi olarak etkili bir anoreksijenik peptit olarak tanımlanmıştır. Merkezi ekspresyonu ve eylemlerinin yanı sıra, NUCB2/nesfatin-1'in daha sonra ağırlıklı olarak perifer dokularda da eksprese edildiği ve çeşitli periferel etkiler uyguladığı ifade edilmiştir. Farelerin akciğer dokusunda periferel NUCB2 mRNA ekspresyonunun yaygın dağılımı olduğu öne sürülmüştür. Mevcut çalışmada, dişi sıçanların akciğer dokusunda NUCB2/nesfatin-1'in immünohistokimyasal dağılımının incelenmesi amaçlandı. Bu amaçla çalışmada 3-4 aylık, 6 adet yetişkin Sprague-Dawley cinsi dişi sıçan kullanıldı. Sıçanlar çalışma süresince standart laboratuvar koşullarında (% 40-60 nem, 24±3 °C sıcaklık, 12 saat aydınlık: 12 saat karanlık döngüsü) barındırıldı. Sıçanlara yem ve su ad libitum olarak verildi. Sıçanlar üzerinde uygulanan işlemler Yerel Etik Kurul tarafından onaylanan Etik Kurul onayı ile gerçekleştirildi. Sıçanlar dekapite edildikten sonra hızlı bir şekilde laparotomi işlemleri yapıldı ve akciğer dokuları alınarak %10 tamponlu nötral formalin solüsyonu içerisinde tespit edildi. Rutin histolojik adımlar izlenerek doku kesitlerine immünohistokimya (İHK) prosedürü uygulandı. Avidin-biotin-peroksidaz kompleks yöntemine göre İHK boyama prosedürü uygulandı. Tavşan poliklonal Nesfatin-1 antikor, birincil antikor olarak uygulandı. Diğer adımlar için uygulanan İHK kiti tedarik edilen şirketin talimatlarına göre kullanıldı. 3-amino-9-etilkarbazol (AEC) kromojen kullanılarak boyama tamamlandı. Kesitler Mayer hematoksilen ile zıt boyandı ve medium ile kaplandı. Işık mikroskobu altında akciğer kesitlerindeki immünoaktivite, yarı kantitatif olarak değerlendirildi ve boya yoğunluğuna göre derecelendirildi (-; yok, +; zayıf, ++; orta, +++; güçlü). Sonuçlarımız, sıçanların akciğer dokusunda güçlü NUCB2/nesfatin-1 immünoaktivitesini gösterdi. Dolayısıyla NUCB2/nesfatin-1'in akciğer fizyolojisinin potansiyel olarak önemli bir düzenleyicisi olabileceği kanısına varılmıştır.

Anahtar Kelimeler: NUCB2/nesfatin-1, Akciğer, İmmünohistokimya, Sıçan



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**IMMUNOHISTOCHEMICAL DISTRIBUTION OF NUCB2/NESFATIN-1 IN LUNG
TISSUE OF FEMALE RATS**

ABSTRACT

Nesfatin-1, a nucleobindin2 (NUCB2) derivative saturated neuropeptide, was first discovered in the rat hypothalamus in 2006. NUCB2/nesfatin-1, an 82 amino acid peptide, has been identified as a centrally acting anorexigenic peptide. Besides its central expression and actions, NUCB2/nesfatin-1 was then expressed predominantly in peripheral tissues and exerted various peripheral effects. It has been suggested that there is widespread distribution of peripheral NUCB2 mRNA expression in the lung tissue of mice. In the present study, it was aimed to examine the immunohistochemical distribution of NUCB2/nesfatin-1 in the lung tissue of female rats. For this purpose, 6 adult female Sprague-Dawley rats, 3-4 months old, were used in the study. Rats were housed in standard laboratory conditions (40-60% humidity, 24±3 °C temperature, 12 hours light: 12 hours dark cycle) throughout the study. The rats were given feed and water ad libitum. Procedures applied on rats were carried out with the approval of the Ethics Committee approved by the Local Ethics Committee. After the rats were decapitated, laparotomy was performed quickly and lung tissues were removed and fixed in 10% neutral buffered formalin solution. Immunohistochemistry (IHC) procedure was applied to tissue sections following routine histological steps. IHC staining procedure was applied according to the avidin-biotin-peroxidase complex method. Rabbit polyclonal Nesfatin-1 antibody was administered as the primary antibody. The IHC kit applied for the other steps was used according to the supplied company's instructions. Staining was completed using 3-amino-9-ethylcarbazole (AEC) chromogen. Sections were counterstained with Mayer's hematoxylin and covered with medium. Immunoreactivity in lung sections under the light microscope was evaluated semi-quantitatively and graded according to dye intensity (-; absent, +; weak, ++; moderate, +++; strong). Our results demonstrated potent NUCB2/nesfatin-1 immunoreactivity in lung tissue of rats. Therefore, it was concluded that NUCB2/nesfatin-1 could potentially be an important regulator of lung physiology.

Keywords: NUCB2/nesfatin-1, Lung, Immunohistochemistry, Rat



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1. INTRODUCTION

Nesfatin-1 is a recently discovered multi-functional protein (Leung et al., 2019). Nesfatin-1, an 82-amino-acid polypeptide, was firstly identified in 2006 by Oh and colleagues (Oh et al., 2006) as the amino-terminal fragment of nucleobindin2 (NUCB2), a protein that is highly conserved in humans, mice, and rats. NUCB2/nesfatin-1 is expressed in various hypothalamic nuclei for appetite control such as the arcuate nucleus (ARC), paraventricular nucleus (PVN), supraoptic nucleus (SO), lateral hypothalamic area (LHA), and zona incerta in rats (Brailoiu et al., 2007; Fort et al., 2008; Kohno et al., 2008; Goebel et al., 2009; García-Galiano et al., 2010). So, NUCB2/nesfatin-1, a centrally acting anorexigenic hypothalamic peptide, controls appetite and energy metabolism. It is suggested that NUCB2/nesfatin-1 is expressed not only in the brain but also in many other tissues (Kim ve ark., 2014). In particular, NUCB2/nesfatin-1 is thought to be a peripheral source of nesfatin-1, with its ability to pass through the blood-brain barrier bidirectionally (Pan et al., 2007). Therefore, in addition to its central expression and actions, NUCB2/nesfatin-1 is reported to be predominantly expressed in peripheral tissues and exert a variety of peripheral effects (Prinz and Stengel, 2016). It has been suggested that NUCB2 mRNA was highly expressed in the lung tissue of female mice (Kim ve ark., 2014). The aim of our study is to determine the distribution of NUCB2/nesfatin-1 neuropeptide in the lung tissues of adult female rats by immunohistochemical method.

2. MATERIALS AND METHODS

In this study, 6 adult female Sprague-Dawley rats, 3-4 months old, were used. Rats were obtained from Firat University Experimental Research Center (FUDAM) and were housed in standard laboratory conditions (40-60% humidity, 24±3 °C temperature, 12 hours light: 12 hours dark cycle) during the study. The rats were provided with feed and water ad libitum. The procedures applied on rats were carried out with the approval of the Ethics Committee (Protocol No: 2019/145) approved by the Firat University Animal Experiments Local Ethics Committee. After the rats were decapitated, laparotomy procedures were performed quickly and lung tissues were removed. Tissue samples were fixed in 10% buffered neutral formalin solution for 24-30 hours. After washing, the samples were passed through graded alcohol series. Then, the samples were passed through xylol series and were kept in a xylol-paraffin mixture in a 45°C oven for 1 night. Following this, paraffin blocks were prepared by keeping them in three different



paraffin series for one hour. Serial sections of 5 μ m thick were taken from the prepared paraffin blocks on a microtome. These sections were dried at room temperature for 24 hours or more.

2.1. IMMUNOHISTOCHEMISTRY PROCEDURE

Immunohistochemistry (IHC) staining procedure was applied according to the avidin-biotin-peroxidase complex method. Anti-rat nesfatin-1 (1-82) polyclonal antibody (1:300, H-003-22, Phoenix Pharmaceuticals, Inc., Burlingame, CA 94010, USA) was administered as the primary antibody. The IHC kit (Cat. No. TP-015-HA, UltraVision Detection System, Anti-polyvalent, HRP/AEC, Thermo Fisher Scientific Co., USA) applied for the other steps was used according to the instructions of the supplied company. Staining was completed using 3-amino-9-ethylcarbazole (AEC) chromogen. Sections were counterstained with Mayer's hematoxylin and covered with medium. It was evaluated semi-quantitatively under the light microscope and graded according to dye density (-; none, +; weak, ++; moderate, +++; strong).

3. RESULTS

According to our immunohistochemical staining results, it was determined that NUCB2/nesfatin-1 immunoreactivity was strong in lung sections of rats (Figure 1 and 2).

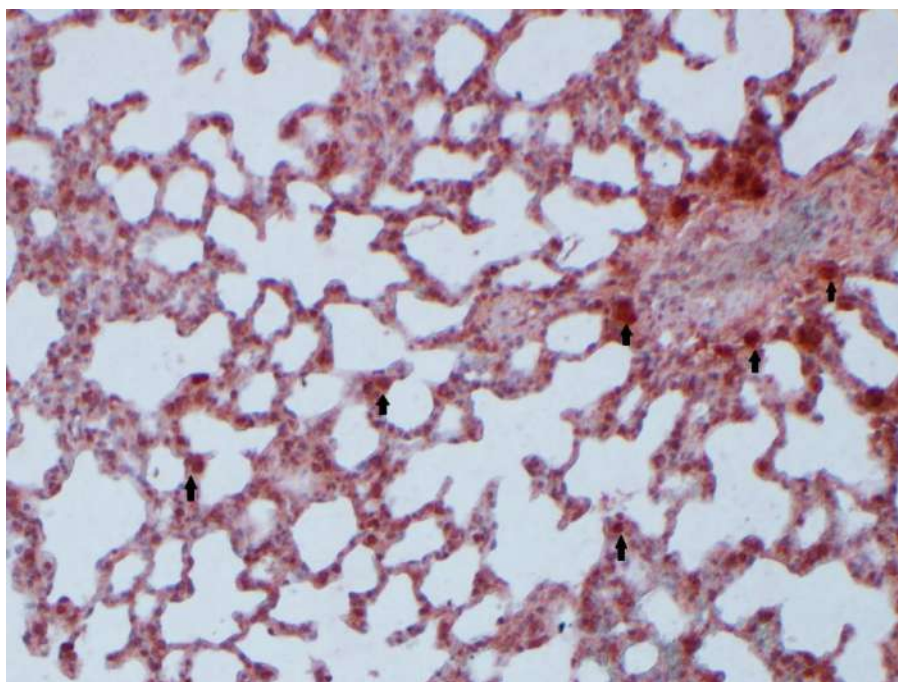


Figure 1. Strong NUCB2/nesfatin-1 immunoreactivity (arrows) in rat lung tissue (IHC, Mayer's haematoxylin counterstain, Magnification $\times 100$)

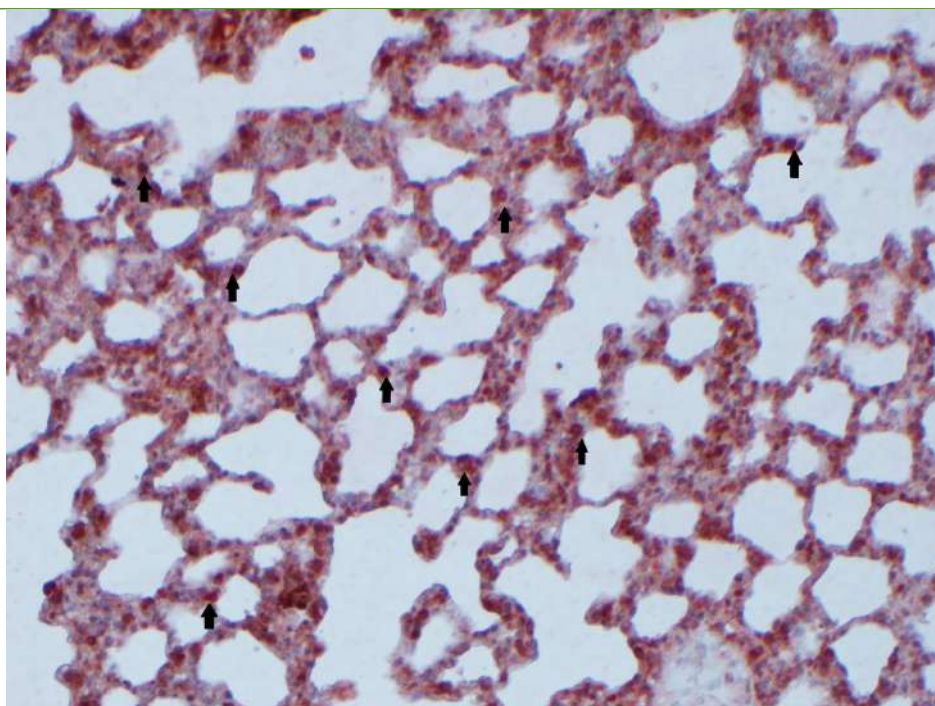


Figure 2. Strong NUCB2/nesfatin-1 immunoreactivity (arrows) in rat lung tissue (IHC, Mayer's haematoxylin counterstain, Magnification $\times 100$)

4. DISCUSSION

There have been a few reports of NUCB2/nesfatin-1 expression in various tissues, but the information on its localization in lungs is scarce. A previous study suggested a more diffuse distribution of peripheral NUCB2 mRNA expression with signals in the lungs of mice (Kim et al., 2014). However, in another study, it was stated that no immunoreactive signal of NUCB2/nesfatin-1 in rat lung (Stengel et al., 2009). Whether this is due to species differences or is related to the assessment method warrants further investigation. Data on the distribution of NUCB2/nesfatin-1-like immunoreactivity in the rat lung fill this gap (Hui et al., 2022). Also, it was stated that NUCB2/nesfatin-1 immunoreactivity was expressed in adult mouse lungs, although at lower levels compared to the fetal stage (Chung et al., 2013; Kim et al., 2019a; Hui et al., 2021). The NUCB2/nesfatin-1 mRNA expression in female mouse lungs has been shown to be significantly lower than in male mouse lungs and may also be influenced by the estrous cycle and pregnancy (Kim et al., 2019a,b). Based on these studies, our results also showed strong NUCB2/nesfatin-1 immunoreactivity in lung tissue of female rats. Current data on the peripheral distribution and regulation of peripheral NUCB2/nesfatin-1 suggest that they are a pleiotropic hormone not only involved in the central regulation of food intake but also several regulatory processes in peripheral organs and tissues.



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5. CONCLUSION

Our current study, in which the strong immunohistochemical distribution of Nesfatin-1 neuropeptide, was determined in the lung tissue, is of great importance in terms of studies indicating the presence or absence of this peptide at the molecular level. It is thought that this neuropeptide, which attract attention as a biomarker candidate, will lead to a better understanding of the pathophysiology of many diseases, including the lung, in future studies. We think that our study will contribute to the knowledge on the subject by eliminating the deficiency in the literature and will carry forward the researches to be done in the future.

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7. REFERENCES

- Brailoiu GC, Dun SL, Brailoiu E, Inan S, Yang J, Chang JK, Dun NJ 2007. Nesfatin-1: distribution and interaction with a G protein coupled receptor in the rat brain. *Endocrinology*, 148: 5088-5094.
- Chung Y, Jung E, Kim H, Kim J, Yang H 2013. Expression of nesfatin-1/NUCB2 in fetal, neonatal and adult mice. *Development & Reproduction*, 17: 461-467.
- Fort P, Salvert D, Hanriot L, Jego S, Shimizu H, Hashimoto K, Mori M, Luppi PH 2008. The satiety molecule nesfatin-1 is co-expressed with melanin concentrating hormone in tuberal hypothalamic neurons of the rat. *Neuroscience*, 155: 174-181.
- García-Galiano D, Navarro VM, Gaytan F, Tena-Sempere M, 2010. Expanding roles of NUCB2/nesfatin-1 in neuro-endocrine regulation. *Journal of Molecular Endocrinology*, 45: 281-290.
- Goebel M, Stengel A, Wang L, Lambrecht NW, Taché Y 2009. Nesfatin-1 immunoreactivity in rat brain and spinal cord autonomic nuclei. *Neuroscience Letters*, 452: 241- 246.
- Hui J, Aulakh GK, Unniappan S, Singh B 2021. Loss of nucleobindin-2/nesfatin-1 increases lipopolysaccharide-induced murine acute lung inflammation. *Cell and Tissue Research*, <http://dx.doi.org/10.1007/s00441-021-03435-6>, Online ahead of print.
- Hui J, Aulakh GK, Unniappan S, Singh B 2022. Localization of Nucleobindin2/Nesfatin-1-like immunoreactivity in human lungs and neutrophils. *Annals of Anatomy*, 239: 151774.
- Kim J, Chung Y, Kim H, Im E, Lee H, Yang H 2014. The tissue distribution of nesfatin-1/NUCB2 in mouse. *Development & Reproduction*, 18: 301-309.
- Kim J, Sun S, Lee D, Youk H, Yang H 2019a. Gonadotropin regulates NUCB2/nesfatin-1 expression in the mouse ovary and uterus. *Biochemical and Biophysical Research Communications*, 513: 602-607.
- Kim SH, Ahn MB, Cho WK, Cho KS, Jung MH, Suh BK 2019b. The relation of serum nesfatin-1 level with anthropometric and metabolic parameters in children and adolescents: a prospective observational study. *Medicine (Baltimore)*, 98: e15460.



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Kohno D, Nakata M, Maejima Y, Shimizu H, Sedbazar U, Yoshida N, Dezaki K, Onaka T, Mori M, Yada T 2008. Nesfatin-1 neurons in paraventricular and supraoptic nuclei of the rat hypothalamus coexpress oxytocin and vasopressin and are activated by refeeding. *Endocrinology*, 149: 1295-1301.

Leung AK, Ramesh N, Vogel C, Unniappan S 2019. Nucleobindins and encoded peptides: from cell signaling to physiology. *Advances in Protein Chemistry and Structural Biology*, 116: 91-133.

Oh IS, Shimizu H, Satoh T, Okada S, Adachi S, Inoue K, Eguchi H, Yamamoto M, Imaki T, Hashimoto K, Tsuchiya T, Monden T, Horiguchi K, Yamada M, Mori M 2006. Identification of nesfatin-1 as a satiety molecule in the hypothalamus. *Nature*, 443: 709-712.

Pan W, Hsueh H, Kastin AJ 2007. Nesfatin-1 crosses the blood-brain barrier without saturation. *Peptides*, 28: 2223-2228.

Prinz P, Stengel A 2016. Expression and regulation of peripheral NUCB2/nesfatin-1. *Current Opinion in Pharmacology*, 31: 25-30.

Stengel A, Goebel M, Yakubov I, Wang L, Witcher D, Coskun T, Tache' Y, Sachs G, Lambrecht NW 2009. Identification and characterization of nesfatin-1 immunoreactivity in endocrine cell types of the rat gastric oxyntic mucosa. *Endocrinology*, 150: 232-238.



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**MİKROBİYAL GÜBRE VE FARKLI İBA DOZ UYGULAMALARININ HÜNNAP
(*ZIZYPHUS JUJUBA* MİLL.) ODUN ÇELİKLERİNİN KÖKLENMESİ ÜZERİNE
ETKİLERİ**

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ÖZET

Bu çalışma farklı çelik çaplarına sahip hünnap odun çeliklerinde farklı İBA doz ve mikrobiyal gübrenin köklenmeye etkisini araştırmak için Bilecik Şeyh Edebali Üniversitesi Tarımsal Uygulama ve Araştırma Merkezinde bulunan köklendirme serasında yürütülmüştür. Araştırmada, Eskişehir ili Sarıcakaya ilçesinde bulunan üretici bahçesinden temin edilen hünnap genotiplerine ait odun çelikleri kullanılmıştır. Çelikler 2020 yılının Aralık ayında alınarak deneme alanına getirilerek kalınlıklarına göre ince (3-5 mm) ve kalın (6-9 mm) olarak iki gruba ayrılmış ve 15 cm uzunluğunda hazırlanmıştır. Dikim öncesinde çeliklere kontrol; 2500 ppm, 5000 ppm İBA; 5000 ppm, 10000 ppm Mikrobiyal gübre (Bm-Megaflu) ve bu iki uygulamanın kombinasyonu (2500 ppm İBA+5000 ppm gübre) uygulanmıştır. Çelikler alttan ısıtmalı (22±2 °C) perlit ortamına dikilmiş ve köklendirme ortamında 90 gün bekletilmiştir. Çeliklerin köklenme oranı, kallus oranı (%) ve kök sayısı tespit edilmiştir. Analiz sonuçlarına göre, uygulama doz ve çelik çaplarının köklenme oranına etkisi istatistiki olarak önemsiz bulunmuştur. En yüksek köklenme oranı, ince çelik çapına uygulanan 5000 ppm İBA uygulamasında; kalluslenme oranı ise 2500 ppm İBA+5000 ppm gübre kombinasyonundan elde edilmiştir.

Anahtar Kelimeler: Bm-Megaflu, çelik çapı, vejetatif çoğaltma



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**EFFECTS OF MICROBIAL FERTILIZER AND DIFFERENT IBA DOSES ON
ROOTING OF JUJUBE (*Zizyphus jujuba* Mill.) CUTTINGS**

ABSTRACT

This study was carried out in the rooting greenhouse of Bilecik Şeyh Edebali University Agricultural Application and Research Center, where different IBA doses and microbial fertilizers are tried to be rooted in jujube wood cuttings with different cutting diameters. In the research, wood cuttings belonging to jujube genotypes obtained from the producer's garden in Sarıcakaya district of Eskişehir province were used. The cuttings were taken in December 2020 and brought to the trial area, divided into two groups as thin (3-5 mm) and thick (6-9 mm) according to their thickness and prepared in 15 cm length. Before planting, two hormone doses (2500 ppm, 5000 ppm) including control, two Microbial fertilizer doses (5000 ppm, 10000 ppm Bm-Megaflu) and the combination of these two applications (2500 ppm IBA + 5000 ppm Bm-Megaflu) were applied to the cuttings. The cuttings were planted in perlite medium with bottom heating (22 ± 2 °C). The cuttings were removed after 90 days. Rooting rate, callus rate (%) and root number of cuttings were determined. According to the analysis results, the effect of application dose and cutting diameter on rooting rate was found to be statistically insignificant. The highest rooting rate is in 5000 ppm IBA application applied to thin cutting diameter; callus rate was obtained from the combination of 2500 ppm IBA + 5000 ppm fertilizer.

Keywords: Bm-Megaflu, cutting diameters, vegetative propagation



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1. GİRİŞ

Hünnap (*Ziziphus jujuba* Mill.) *Rosidea* alt sınıfından *Rhamnales* takımında olup *Rhamnaceae* familyasına aittir (Anşin ve Özkan, 1993). *Rhamnaceae* familyası 45 cins ve 550 tür içermektedir (Ecevit ve ark., 2008).

Hünnap Asya ve Kafkaslara özgü 6-8 m, bazen 12 m yüksekliğe ulaşabilen, su stresi, don, tuzluluk, yüksek sıcaklık, zararlı ve hastalıklar gibi çevresel stres koşullarına karşı dayanıklı ve kışın yaprak döken bir bitkidir. Geniş bir coğrafyada uyum sağlayabilme, kolay bakım, erken meyveye yatma, zengin besin kaynağı olması ve çok çeşitli değerlendirme imkânlarından dolayı gitgide artan oranda popüler olmaktadır (Ghazaeian, 2015).

Dünya’da üç milyon hektar hünnap üretim alanı ve dört milyon tonu geçen bir üretim olduğu bilinmektedir. Çin Hünnap’ın anavatanı olmasının yanında her yıl üretimin % 90’dan fazlasını gerçekleştirmektedir (Meng ve ark., 2021). Hünnap’ın 4000 yıl öncesinde Çin’de, 9000 yıl öncesinde Asya’da yetiştiriciliğinin yapıldığı bilinmektedir. Ülkemizde ise Marmara, Batı ve Güney Anadolu’da yabancılarına rastlanılmasına karşın üretimi yaklaşık on yıl önce başlamış ve son yıllarda artmıştır. Türkiye İstatistik Kurumu 2020 yılı verilerine göre yaklaşık 2500 dekarlık bir alanda 1 229 ton ve bu üretimin % 25’lik kısmı Amasya ilinde gerçekleşmiştir (TÜİK, 2021).

Hünnap meyvesi insan sağlığı açısından da oldukça önemlidir. Vücudun ihtiyacı olan çinko, fosfor, magnezyum, demir, riboflavin ve niasin gibi maddeleri bulundurmasının yanında A, C vitamini içermektedir. İnsan vücudunda, metabolizma ürünleri sonrası ortaya çıkan, kısa ömürlü fakat olumsuz etkisi fazla olan serbest radikaller diye adlandırılan molekülleri etkisiz hale getiren çok önemli antioksidanları da içerdiğinden son yıllarda hünnap tercih edilen bir meyve haline gelmiştir (Özgen ve ark., 2006; Gerçekcioğlu ve Aslan Uygun, 2021).

Hünnap tohumla çoğaltılabilir ancak meyve yetiştiriciliğinde tohumla çoğaltım tercih edilmediği için kök sürgünleri ve aşı ile çoğaltma yaygın şekilde kullanılmaktadır. Anaç olarak *Paliurus aculeatus*, karaçalı ya da kendi tohumları kullanılmaktadır (Guo ve Shan, 2010; Aslan, 2019).

Hünnap’ın çelikle çoğaltılması konusunda yapılan çalışmalar diğer türlere göre az sayıdadır. Çelikle çoğaltma ile yapılan çalışmalar çeliklerin alındığı dönem, çelik çapı, çelik boyu, farklı doz ve çeşitli bitki büyüme düzenleyicilere yönelik olduğu görülmektedir. Tezel ve ark. (2016) odun çeliklerinde farklı çelik çapı (2-4 mm, 5-7mm, 9-11 mm) ve farklı IBA (Kontrol, 2500 ppm, 5000 ppm) doz uygulamalarının köklenme üzerine etkilerini inceledikleri çalışmada çelik



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çapı ve hormon dozlarının köklenme üzerine etkilerini istatistiki olarak önemsiz bulduklarını belirtmişlerdir. Zenginbal ve ark. (2016) farklı uzunluktaki (15-20-25 cm) odun çeliklerinde IBA dozlarını (0-2500-5000 ppm) kullandıkları çalışmalarında en yüksek köklenme oranını 25 cm çelik boyu 2500-5000 ppm uygulamasından elde ettiklerini bildirmişlerdir. Polat ve Yıldırım (2017) Isparta koşullarında yarı-odun çeliklerde yaptığı çalışmasında çelik alma zamanının; kalluslenme oranı, köklenme oranı, kök sayısı, kök uzunluğu ve kök kalınlığı üzerine etkisini istatistiki olarak önemli olduğunu belirtmiştir. Gerçekcioğlu ve Aslan Uygun'un (2021) farklı dozlarda bitki büyüme düzenleyicilerin yeşil ve odun çeliklerinde köklenme başarısını araştırdıkları çalışmada, köklenmenin düşük olduğu ancak yeşil çelik tiplerinde, 250 ppm IBA uygulamasının daha başarılı olduğunu bildirmişlerdir.

Son zamanlarda bakteri uygulamalarının çeliklerin köklenmesi üzerine çalışmalar yapılmaktadır (Tütüncü ve ark., 2015; Gübbük ve Biner, 2016; Soydal ve ark., 2019). Toprağın rizosfer tabakasında bulunan PGPR yani bitki büyümesini teşvik eden rizobakteriler azot fiksasyonundan hormon üretimine kadar birçok görevleri bulunmaktadır. PGPR'nin birçok alt türü bulunmakla birlikte *Bacillus megaterium* *Bacillus spp*'nin alt türüne aittir ve bitki büyümesini teşvik eder. *Pseudomonas fluorescens* türü bitki büyümesini sağlayan oksin, giberellin, siderofot ve sitokinin gibi hormonları ürettiği bildirilmiştir (Mendes ve ark., 2013; Bolandnazar ve ark., 2018; Yayla ve Şenol, 2020).

Bu çalışmada daha önce yapılan çalışmalarda Hünnap'ın çelikle köklendirilmesinde mikrobiyal gübre kullanımına ilişkin bir literatüre rastlanmadığı için farklı çelik çaplarına sahip hünnap odun çeliklerinde farklı IBA doz ve mikrobiyal gübrenin köklenmeye etkisini araştırmak amaçlanmıştır.

2. MATERYAL VE YÖNTEM

Araştırma, Bilecik Şeyh Edebali Üniversitesi Tarımsal Uygulama ve Araştırma Merkezinde bulunan köklendirme serasında yürütülmüştür. Araştırmada, hünnap genotiplerine ait odun çelikleri kullanılmıştır. Çelikler Eskişehir ili Sarıcakaya ilçesinde bulunan bir üretici bahçesinden 22.12.2020 tarihinde alınarak deneme alanına getirilerek kalınlıklarına göre ince (3-5 mm) ve kalın (6-9 mm) olarak iki gruba ayrılmış ve 15-20 cm uzunluğunda hazırlanmıştır. Dikimden önce hazırlanan çelikler % 0,3'lük fungusite (Benlate) ile ilaçlandıktan sonra, yaklaşık on dakika kurumaya bırakılmıştır.



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BM-Megaflu; Mikrobiyal bir gübre olup *Pseudomonas fluorescens*, *Bacillus megaterium*, ve *Pantoea agglomerans* canlı mikroorganizmalarını içermektedir. Gübre hazırlanırken bakteri kolonisini arttırmak için prosedürde belirtildiği şekilde toz şeker ilavesi yapılmıştır.

Çeliklere kontrol dışında 2500 ppm, 5000 ppm IBA; 5000 ppm, 10000 ppm Mikrobiyal gübre (Bm-Megaflu) ve farklı bir uygulama olarak bu iki uygulamanın kombinasyonu (2500 ppm IBA+5000 ppm gübre) uygulanmıştır. IBA çözeltisine çeliklerin dip kısımları hızlı daldırma yöntemi (Zenginbal ve ark., 2015) ile gübre çözeltisine ise 60 sn (Soydal ve ark., 2019) daldırma yöntemi uygulanarak alttan ısıtmalı (22±2 °C) perlit ortamına dikilmiştir.

Odun çelikleri, köklendirme ortamında 90 gün bekletildikten sonra sökülerek; köklenme oranı (%), kallus oranı (%) ve kök sayısı tespit edilmiştir. Deneme, tesadüf parselleri deneme desenine göre 3 tekerrürlü olarak kurulmuş ve her tekerrürde 20 çelik kullanılmıştır.

İstatistiksel değerlendirmeler Minitab 19 paket programı kullanılarak varyans analiz testine tabi tutulmuş ve ortalamaların karşılaştırılmasında LSD çoklu karşılaştırma testi kullanılmıştır.

3. BULGULAR VE TARTIŞMA

Farklı çelik çapı, IBA dozları ve mikrobiyal gübre dozlarının hünnap odun çeliklerine ait köklenme bulguları Çizelge 1’de verilmiştir. Çizelge 1 incelendiğinde köklenme oranı üzerine çelik çapı ve uygulamaların istatistiksel olarak bir etkisinin olmadığı belirlenmiştir. Ortalamalar incelendiğinde köklenme oranı 5000 ppm IBA doz uygulamasının (%1,83) ve kalın çelik çapının ince çelik çapına göre daha iyi sonuç verdiği (%1,38) belirlenmiştir. Kalın çelik çapında 2500 ppm IBA dozu uygulamasının, ince çelik çapında ise kontrol uygulamasının en iyi köklenme oranının elde edildiği görülmüştür.

Çizelge 1. Hünnap çeliklerinin köklenme oranı üzerine çelik kalınlığı ve uygulamaların etkileri

Köklenme Oranı (%)							
	Kontrol	2500 ppm IBA	5000 ppm IBA	5000 ppm M.G.	10000 ppm M.G.	2500 ppm IBA+5000 ppm M.G.	Ort.
İNCE (3-5 MM)	1,66 A	0,33 A	3,00 A	0,33 A	0,33 A	0,33 A	1,00 A
KALIN (6-9 MM)	1,00 A	2,33 A	0,66 A	1,00 A	1,66 A	1,66 A	1,38 A
ORT.	1,33 A	1,33 A	1,83 A	0,66 A	1,00 A	1,00 A	

Tezel ve ark., (2016) farklı üç çelik çapının kullanıldığı hünnap çeliklerinde köklendirme çalışmalarında en iyi köklenme oranını 5000 ppm IBA dozunda ve 6-8 mm çelik çapında (%2,22) elde ettiklerini bildirmişlerdir. Zenginbal ve ark., (2016) farklı uzunluktaki hünnap



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eliklerine farklı IBA doz uyguladıkları alıřmalarında en yksek kklenme oranını 25 cm elik boyu ve 2500 ppm IBA dozundan elde ettiklerini bildirmişlerdir. Farklı zaman ve IBA uygulamalarının hnnap eliklerinde kklenme oranlarının belirlendięi alıřmada en iyi kklenme oranının řubat ayında alınan eliklerde 2000 ppm IBA uygulamasından elde edildięi belirtilmiştir (Polat ve Yıldırım, 2017).

izelge 2’de ortalamalar incelendięinde en iyi kalluslenme oranı (%), kalın elik apında (% 12,00) ve 2500 ppm IBA+500 ppm gre kombinasyonu (% 11,66) uygulamasından elde edildięi grlmektedir. Kalın elik apında en iyi kalluslenme oranı hormon ve mikrobiyal gbre konbinasyonunda en yksek (%14,33), ince elik apında da en iyi kallus oranı 2500 ppm IBA+500 ppm gre kombinasyonundan (% 9,00) elde edilmiştir. Genel olarak incelendięinde kalluslenme oranı zerine uygulamalarının istatistiksel bir etkisinin olmadığı belirlenmiştir.

izelge 2. Hnnap eliklerinin kalluslenme oranı zerine elik kalınlıęı ve uygulamaların etkileri

KALLUSLENME ORANI (%)							
	Kontrol	2500 ppm IBA	5000 ppm IBA	5000 ppm M.G.	10000 ppm M.G.	2500 ppm IBA+5000 ppm M.G.	Ort.
İNCE (3-5 MM)	6,00 AB	8,00 AB	5,00 AB	8,66 AB	4,00 B	9,00 AB	6,77 B
KALIN (6-9 MM)	9,00 AB	10,00 AB	12,33 AB	13,33 AB	13,00 AB	14,33 A	12,00 A
ORT.	7,50 A	9,00 A	8,66 A	11,00 A	8,50 A	11,66 A	

Polat ve Yıldırım (2017) tarafından yapılan alıřmada elik alma zamanının kalluslenme oranının istatistiki olarak nemli bulunduęunu ve bu oranın řubat ayında en yksek Kontrol uygulamasında olduęunu tespit etmişlerdir.

izelge 3 incelendięinde kk sayısı zerine de elik apı ve uygulamalarının istatistiki bir etkisinin olmadığı belirlenmiştir. Ortalamalar incelendięinde kalın elik apının (1,83) ince elik apına gre, uygulamalarda ise 2500 ppm ve 5000 ppm IBA dozunun daha iyi sonu verdięi belirlenmiştir. Genel olarak incelendięinde ince elik apında 5000 ppm IBA dozunda, kalın elik apında ise 2500 ppm IBA dozunda en iyi kk sayısının elde edildięi belirlenmiştir.



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Çizelge 3. Hünnap çeliklerinin kök sayısı üzerine çelik kalınlığı ve uygulamaların etkileri

	KÖK SAYISI (ADET)						Ort.
	Kontrol	2500 ppm IBA	5000 ppm IBA	5000 ppm M.G.	10000 ppm M.G.	2500 ppm IBA+5000 ppm M.G.	
İNCE (3-5 MM)	0,33 A	1,00 A	3,33 A	0,33 A	1,33 A	1,00 A	1,22 A
KALIN (6-9 MM)	0,66 A	4,66 A	2,33 A	0,33 A	3,00 A	0,33 A	1,83 A
ORT.	0,50 A	2,83 A	2,83 A	0,33 A	2,16 A	0,50 A	

Tezel ve ark. (2016)'ın yaptıkları çalışmada çelik çapı (5-7 mm, 6-8 mm) ve uygulanan hormon dozları arasındaki farkın istatistiki olarak önemsiz bulunduğunu 9-11 mm çelik çapında en yüksek kök sayısının 2500 ppm dozundan elde edildiğini bildirmişlerdir. Bizim çalışmamızda da benzer sonuçlar elde edilmiştir. Yapılan çalışmalarda NAA, IAA uygulamalarının kök sayısı ve kalluslenme oranını arttırdığı belirlenmiştir (Cui, 2009; Polat ve Yıldırım, 2017).

4.SONUÇ

Bu çalışmada farklı çelik çaplarına sahip hünnap odun çeliklerinde farklı IBA doz ve mikrobiyal gübrenin köklenmeye etkisi araştırılmıştır. Hünnap'ın çelikle çoğaltılması zor bir tür olduğu bilinmekle birlikte bu çalışmada dahil olmak üzere şimdiye kadar yapılan çalışmalarda da etkili bir köklenme elde edilememiştir. En iyi köklenme oranı 5000 ppm IBA dozu ve kalın çelik çapında, en iyi kalluslenme oranı da IBA ve Mikrobiyal gübre kombinasyonundan elde edildiği görülmüştür. Bundan sonra yapılacak çalışmalarda, hünnap'ın çelikle çoğaltılması konusunda başarılı bulunmuş kalın çelik çapı, uzun çelik ve yeşil çelik döneminde mikrobiyal gübre ve bitki büyüme düzenleyici kombinasyonlarının denenmesinde fayda olacağı düşünülmektedir.



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KAYNAKÇA

Ansin, R., Z. C. Ozkan, Z.C. 1997. Tohumlu Bitkiler (*Spermathophyta*): Odunsu Taksonlar, Karadeniz Teknik Üniversitesi, Orman Fakültesi Yayınları, Trabzon, Turkey, 306–311.

Aslan, Z. 2019. Hünnap (*Ziziphus jujuba*) 'ın yeşil ve odun çelikleri ile köklenmesi üzerine hormon uygulamalarının etkileri. Tokat Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü (Yüksek Lisans Tezi), 47s.

Bolandnazar, S., Sharghi, Naghdi Badhi, A., H., Mehrafarin, A., Sarikhani, M.R. 2018. The impact of *Sinorhizobium meliloti* and *Pseudomonas fluorescens* on growth, seed yield and biochemical product of fenugreek under water deficit stress. Adv. Hort. Sci., 32(1), 19-26.

Cui, X., 2009. Research on the Technique of Wild *Jujube Softwood* Cutting. Journal of Anhui Agricultural Sciences 28

Ecevit, M. F., B. Şan, T. Dilmaç Ünal, F. Hallaç Türk, A. N. Yıldırım, M. Polat ve F. Yıldırım, 2008. Selection of Superior Ber (*Ziziphus jujuba* L.) Genotypes in Çivril Region. Tarım Bilimleri Dergisi, 14(1):51–56.

Gerçekcioğlu, R., Aslan Uygun, Z. 2021. Hünnap'ın (*Ziziphus Jujuba*) Yeşil ve Odun Çelikleri ile Köklenmesi Üzerine Hormon Uygulamalarının Etkileri. Gaziosmanpaşa Bilimsel Araştırma Dergisi (GBAD). 10(2):165-175.

Ghazaeian, M. 2015. Genetic diversity of Jujube (*Ziziphus jujuba* Mill.) germplasm based on vegetative and fruits physicochemical characteristics from Golestan province of Iran/Diversidade genética de Jujuba (*Ziziphus jujuba* Mill.) baseada em germoplasma de frutos com características físico-químicas da província de Golestan do Irã. Comunicata Scientiae, 6(1): 10.

Guo, Y., Shan, G. 2010. The chinese jujube. Shanghai Scientific and Technical Publishers, Shanghai, China

Gübbük, H., Biner, B. 2016. Passifloranın (*Passiflora edulis* Sims.) çoğaltılması ve fidan yetiştiriciliği üzerinde araştırmalar. TÜBİTAK proje sonuç raporu, s. 52.

Mendes, R., Garbeva, P., Raaijmakers, J.M. 2013. The rhizosphere microbiome: significance of plant beneficial, plant pathogenic, and human pathogenic microorganisms. FEMS Microbiology Reviews, 37(5): 634–663.



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Meng, F. H., Xiao-Wen Ana Jie Yangb wang Zi-juana Li Jia-ming, Chang-Wei Ao. 2021. Study on the Effect of Jujube Powder on the Quality of Bread. Journal of Food Technology & Nutrition Sciences. SRC/JFTNS-136. DOI: doi.org/10.47363/JFTNS/2021(3)121.

Özgen M, Reese RN, Tulio AZ, Miller AR, Scheerens JC. 2006. Modified 2,2-azino-bis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS) method to measure antioxidant capacity of selected small fruits and comparison to ferric reducing antioxidant power (FRAP) and 2,2'-Diphenyl-1-picrylhydrazyl (DPPH) methods, Journal of Agricultural and Food Chemistry, 54, 1151-1157.

Polat, M., Yıldırım, A.N. 2017. Bazı Hünnap Genotiplerinin Çeliklerinin Köklenmesi Üzerine Çelik Alma Zamanı ve IBA Uygulamalarının Etkileri, Bahçe 46 (Özel Sayı 1):249-253.

Soydal, A., Gübbük, H., Balkıç R., 2019. Pitaya (*Hylocereus* spp.) çeliklerinin köklenmesi üzerine bakteri konsantrasyonlarının etkileri. Mediterranean Agricultural Sciences 32(3): 275-280

Tezel, E., Kantar, A., Aydın, E., Bostan, S.Z. 2016. Farklı IBA dozu ve çelik çapı uygulamalarının hünnap (*Ziziphus jujuba* Mill.) çeliklerinin köklenmesi üzerine etkisinin belirlenmesi. BAHÇE (Özel Sayı Cilt:1) Cilt: 45, Sayfa: 788-792.

TUİK, 2021. <https://biruni.tuik.gov.tr/medas/?locale=tr> (01.12.2021)

Tütüncü, M., Çömlekçioğlu, S., Şimşek, Ö., İzgü, T., Küden, A. 2016. Bazı Zeytin Çeşitlerinin Çeliklerinin Köklenme Olanaklarının Araştırılması. BAHÇE (Özel Sayı Cilt:1) Cilt: 45, Sayfa: 379-382.

Yayla, Ş.R., Şenol, N. 2020. Tarımda Kullanılan Bazı Mikrobiyal Gübrelerin Eisenia foetida Deri Dokusu Üzerinde Etkisinin Histolojik Açıdan Değerlendirilmesi. Süleyman Demirel Üniversitesi Fen Edebiyat Fakültesi Fen Dergisi, 15(2), 213-223.

Zenginbal, E., Kantar, A., Aydın, E., Bostan, S.Z. 2016. Hünnap'ta (*Ziziphus jujuba* Mill.) çelik boyu ve IBA dozlarının köklenmeye etkisi. BAHÇE (Özel Sayı Cilt:1) Cilt: 45, Sayfa: 798-801.



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KONTAMİNE OLMUŞ TOPRAKLARDA ENERJİ BİTKİLERİ TARIMI

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ÖZET

Dünya enerji tüketimi, nüfusun artması ve endüstriyel gelişmelerin eşliğinde hızla artmaktadır. Bununla birlikte kirliliğe maruz kalan topraklarda da bir artış yaşanmaktadır. Gerek yenilenemeyen enerji kaynaklarının hızla azalması gerekse zararlı emisyon salınımının yarattığı küresel sorunlar enerji arzı ve toprak kirliliği konusunda yeni arayışlara hız kazandırmıştır. Ülkemizde potansiyel tarım arazilerinin sınırlı olması da göz önünde bulundurulduğunda çevreyi daha az kirleten doğal temelli yaklaşımlar sürdürülebilir bir ekosistem açısından ön plana çıkmaya başlamıştır. Nitekim enerji bitkileri tarımının, enerji arzı ve ekolojik sorunlar çıkmazında büyük olanaklar sunacağı ve kirleticilerin topraktan uzaklaştırılması ile sorunlu bölgenin sağlıklı kullanılması açısından büyük önem taşıdığı öngörülmektedir. Atmosferik karbonu kullanma yeteneği yüksek olan C4 bitkileri (dallı darı, kral otu, miskantus) enerji bitkileri tarımında ve özellikle kontamine olmuş topraklarda kullanılan biyokütle bitkilerinin başında gelmektedir. Bu derlemede kontamine alanlarda tarımı yapılan enerji bitkileri hakkında bilgiler verilmiştir.

Anahtar Kelimeler: Enerji bitkileri, Biyokütle, Toprak kirliliği, Yenilenebilir enerji.



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CULTIVATION OF ENERGY CROPS ON CONTAMINATED SOILS

ABSTRACT

World energy consumption is increasing rapidly with the increase of population and industrial developments. However, there is an increase in the lands exposed to pollution. Both the rapid decrease in non-renewable energy resources and the global problems caused by harmful emissions have accelerated new searches for energy supply and soil pollution. Considering the limited potential agricultural lands in our country, natural-based approaches that pollute the environment less have come to the fore in terms of a sustainable ecosystem. As a matter of fact, it is of great importance that energy crops agriculture will offer great opportunities in the energy supply and ecological problems, and it is of great importance in terms of removing pollutants from the soil and using the problem area in a healthy way. C4 plants, which have a high ability to use atmospheric carbon, are the leading biomass plants used in energy crops agriculture and especially in contaminated soils. In this review, information about energy crops cultivated in contaminated areas is given.

Keywords: Energy crops, Biomass, Soil pollution, Renewable energy.



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1. GİRİŞ

Topraklar, tarımsal (gübreler, pestisitler, herbisitler vb.), endüstriyel (fosil yakıtlar, madenler vb.), kentsel (kâğıt, plastik vb.) ve nükleer kökenli kirleticilerle hızlı bir şekilde kontamine olmakta (Tan, 1994), toprak kirliliği dünya genelinde yaygınlaşan bir sorun haline gelmektedir. Nitekim topraktaki mevcut kirliliğin artışı gerek ekolojik döngüyü gerekse toprak verimliliğini olumsuz etkilemektedir. Küresel nüfus artışına da bağlı olarak sürekli artan enerji talebi, azalan fosil yakıt rezervleri ve çevresel kaygılar; gıda dışı ürünlerden yenilenebilir ve sürdürülebilir alternatif enerji kaynakları elde edilmesi zorunluluğunu ortaya çıkarmıştır (Bilgili ve ark., 2019). Türkiye’de mevcut tarım arazileri tükenme noktasına gelmiş, nüfustaki artışa bağlı olarak insan ihtiyaçlarının da artmasıyla yoğun tarımsal faaliyetler yapılmaya başlanmıştır. Tarımdaki yoğun faaliyetler sonucunda da tarım arazilerinde kirlilik sorunu başlamış ve toprak kalitesinin gün geçtikçe daha da kötüleştiği tespit edilmiştir (Özkan, 2017). Gerek yenilenemeyen enerji kaynaklarının hızla azalması gerekse zararlı emisyon salınımının yarattığı küresel sorunlar, enerji arzı ve toprak kirliliği konusunda yeni arayışlara hız kazandırmıştır. Bu bağlamda enerji bitkileri tarımının, enerji arzı ve ekolojik sorunlar çıkmazında büyük olanaklar sunacağı ve kirleticilerin topraktan uzaklaştırılması ile sorunlu bölgenin sağlıklı kullanılması açısından büyük önem taşıdığı öngörülmektedir.

Biyokütle enerjisi tarımsal, hayvansal vb. organik atıklardan veya ürünlerden temin edilen yenilenebilir bir enerji kaynağıdır. Biyokütle enerji gurubu içerisinde yer alan enerji bitkilerinin araştırılması ve bu bitkilerden biyodizel, biyoetanol gibi biyoyakıtların üretilmesi konusunda yapılan çalışmalar tüm dünyada araştırmacılar tarafından ilgi görmektedir. Ülkemizde ise 2010 yılından itibaren biyokütle enerjisine yönelik yatırımlar ve araştırmalar yapılmaya başlanmıştır. Enerji bitkileri yetiştiriciliğinde çoğunlukla sulama ve bakım gereksinimleri düşük olan bitkiler tercih edilmektedir. Enerji bitkilerinin marjinal alanlara uyum sağlayarak ekosisteme büyük ölçüde katlı sağlayabilmesi de ayrıca önem taşımaktadır. Dolayısıyla tarımsal faaliyetler açısından marjinal kabul edilen alanlarda enerji bitkilerinin üretilmesi ve bu bitkilerin işlenerek biyoenerji ham maddelerinin üretilmesi önem taşımaktadır (Kavlak ve Çabuk, 2021).

Biyoenerji bitkileri, enerji amaçlı yetiştirildiklerinde fosil yakıt tüketiminin azaltılması sonucu karbon emisyonunu azaltması ve önemli ekonomik girdi ile büyük avantajlar sunarken, ilaveten kontamine olmuş topraklarda yetiştirilerek bu alanlarında temizlenmelerine yardım etmeleri nedeni ile son derece önemlidirler. Biyokütle tarımının, kontamine olmuş marjinal alanlara kaydırılması ile boşalacak arazilerde farklı üretimlerin gerçekleştirilmesi de mümkün



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olabilecektir (Smith ve ark., 2013). Kötü çevresel koşullara toleranslı olan, marjinal topraklar dahil olmak üzere çeşitli topraklarda yetiştiriciliği yapılabilen çok yıllık buğdaygiller içerisinde enerji bitkisi olarak en çok tercih edilen türler miskantus (*Miscanthus x giganteus*), dallı darı (*Panicum virgatum* L.) ve kral otu (*Pennisetum hybridum*)'dur. Nitekim yapılan çalışmalar bu türlerin kirlilik, tuzluluk vb. tarımsal faaliyetleri sınırlandıran marjinal alanlarda yetiştiriciliğinin yapılmasıyla bölge topraklarında iyileşmelerin olduğunu ve benzer marjinal alanların tarıma kazandırılabilceğini ortaya koymuştur. Bu türler toprak yapısını iyileştirmenin yanında yüksek biyokütle içermelerinden dolayı enerji arzı noktasında büyük önem taşımaktadırlar.

2. ALTERNATİF ENERJİ BİTKİLERİ

2.1. Miskantus (*Miscanthus x giganteus*)

Buğdaygiller (Gramineae) familyasının bir üyesi olan *Miscanthus x giganteus*, yüksek verim potansiyeline sahip çok yıllık bir enerji bitkisidir. Orijini, Güneydoğu Asya'nın tropikal bölgeleridir. Doğal ortamında 6 metre yüksekliğe ulaşan bitkinin kardeşlenme yeteneği çok yüksek olup kardeş çapı 20 mm bulabilmektedir. Avrupa'da yaklaşık 50 yıldır bilinen miskantus, önceleri süs bitkisi olarak kullanılmış ve daha sonra enerji amaçlı kullanılmaya başlanmıştır. Bu bitki, *Miscanthus sinensis* ve *Miscanthus sacchariflorus*'un melezlenmesiyle oluşturulmuş doğal bir melezdir.

Yetiştiriciliğinin ilk yılında miskantus yaklaşık 2 metre yüksekliğe ulaşabilir ve verimi 2-5 t ha⁻¹ kuru madde düzeyindedir. Yetiştiriciliğin ikinci yılında bitkiler 3 metreden fazla yüksekliğe ulaşabilir ve elde edilen verim 8-10 t ha⁻¹ kuru madde düzeyinde olabilmektedir. Doğru bitki büyüme oranını sağlamak için, ilk büyüme döneminde uygun bir gübre dozu uygulamak önemlidir. Miskantusun maksimum potansiyel hasadı, ekiminin üçüncü yılından itibaren başlar. 20 ton ha⁻¹ kuru maddeye ulaşabilen yüksek biyokütle verimleri, hasat sonrasında 10 yıla kadar devam edebilir. Miskantustan elde edilen biyokütle, doğrudan yanmaya yönelik çok kaliteli bir yakıt şeklidir. Ayrıca biyoyağ üretimi, gazlaştırma ve kömürleştirme süreçlerinde substrat olarak yüksek potansiyele sahiptir (Saletnik ve ark., 2018).

2.2. Dalli Darı (*Panicum virgatum* L.)

Buğdaygiller (Gramineae) familyasının bir üyesi olan dallı darı, yüksek biyokütle verimi, geniş adaptasyon kabiliyeti ve marjinal alanları değerlendirebilme yeteneğinden dolayı selülozik



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etonol üretimi konusunda Amerikan Biyoenerji Programı tarafından 37 bitki arasında model tür olarak seçilmiştir (Wright ve Turhollow, 2010). Hem yem bitkisi kaynağı olarak kullanılması, hem de yüksek biyoenerji kapasitesine sahip olması gibi üstün tarımsal özellikleri, bu türü daha da ön plana çıkarmıştır. Biyoyakıt bitkisi olmasının yanı sıra dallı darı, yüksek enerji içeriği dolayısıyla farklı enerji kullanım alanları içinde önemli bir biyokütle bitkisi halini almıştır. Ayrıca dallı darı bitkisinin biyoyakıt ve yem bitkisi olarak kullanımının dışında çevreye olan yararları üzerinde de oldukça durulmuş ve diğer tek yıllık bitkiler ile karşılaştırıldığında dallı darının toprak erozyonunu %95 ve pestisit kullanımını ise %90 oranında azalttığı belirlenmiştir (Hohenstein ve Wright, 1994; Ma ark., 2000).

Dallı darı minimum kurutma ihtiyacıyla odun türlerine göre daha ekonomik bir hammadde dir. Nüfusun daha yoğun olduğu yerlere yakın bölgelerde de dallı darı yetiştirilebildiği için odun türlerine göre taşıma masrafları daha düşük; depolanması ve pazarlanması ise daha kolaydır. Genel olarak biyokütle kaynakları hacimli yapıda olup, kullanım güçlükleri varken, dallı darının pelet haline getirilmesi ve yakıt olarak kullanılması ticaretini kolaylaştırmaktadır (Başer ve ark., 2008). Bu kadar çok yönlü ve verimli kullanım alanı olan dallı darının Türkiye şartlarında da yetiştirilmeye uygun alanların ivedilikle belirlenmesi gerekmektedir. Böylece dallı darı üretimi yenilenebilir enerji kaynağı olarak biyokütle üretiminde alternatif olacağından, küresel ısınma sorunlarının çözümüne de katkıda bulunacaktır (Peşkircioğlu ve ark., 2019).

2.3. Kralotu (*Pennisetum hybridum*)

Tropik Afrika orijinli ve buğdaygiller (Gramineae) familyasının bir üyesi olan dev kralotunun genellikle 3-4 m kadar olan bitki boyu, tropik koşullarda 7 m'ye kadar çıkabilmektedir. Dev kralotunun hızlı gelişen bir C-4 buğdaygil bitkisi olduğunu, tropik ve bazı subtropik bölgelerde 4 kez biçilebildiğini ve dekara 35 ton yaş biyokütle verimi üretebildiğini, büyükbaş ve küçükbaş hayvanlar tarafından sevilerek tüketildiği gibi kümes hayvanı ve balık yemi yapımında da peletlenerek kullanılabildiği tespit edilmiştir (Kukkonen, 2009).

Dev kralotunun çok yıllık olması, bir başka ifadeyle üretim maliyetinin düşük olması ve yüksek biyokütle verimi oluşturabilmesi, onun iyi bir biyoyakıt hammadde si olduğunu ortaya çıkarmaktadır. Gübre ihtiyacının düşük olması, kolay yetişmesi ve yüksek kuru madde sağlaması nedeniyle birçok tropik buğdaygili geride bırakmıştır. Silolanabilir yaş biyokütle verimi bakımından mısırdan daha üstün olan dev kralotu, çok yıllık ve rizomlu bir bitki olması nedeniyle de mısır gibi, tohum ve ekim masrafları içermemekte, işletme ekonomisi yönünden



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daha fazla kâr sağlayabilmektedir. Bakım işlemleri (sulama, gübreleme, hasat, vb) açısından mısır bitkisinden hiçbir farkı olmayan ve Akdeniz iklim koşullarında bir kez dikilen dev kralotu bitkisinden, uygun bakım koşullarında uzun yıllar (10 yıl) ekonomik ürün alınabilmektedir (Geren, 2017).

3. SONUÇ

Sürdürülebilir bir tarım açısından mevcut tarım arazilerini verimli bir şekilde kullanmak büyük önem arz etmektedir. Küreselleşmenin etkisiyle doğaya salınan zararlı gaz emisyonları sera gazı etkisiyle iklim değişikliklerine yol açmakta, bu da mevcut tarım sistemlerini olumsuz etkilemektedir. Bunlara bir de insan kaynaklı yanlış uygulamalar da eklenince topraklarımızda kirlilik, tuzluluk vb. sorunlar ortaya çıkmaktadır. Ülke olarak enerji ihtiyacını karşılamada dışa bağımlı olmamızda göz önünde bulundurulduğunda, marjinal alanlarda enerji bitkileri tarımı son yıllarda daha da önem kazanan doğal temelli bir yaklaşım olarak dikkat çekmeye başlamıştır. Nitekim gün geçtikçe enerji bitkileri ve bu bitkilerin tarımı daha da önem kazanmaktadır. Gerek gelecek yıllardaki enerji ihtiyaçlarının karşılanması gerekse sanayileşmenin tarım toprakları üzerindeki olumsuz etkileri düşünüldüğünde, kötü çevresel koşullara toleranslı olduğu bilinen, marjinal ve kirlenmiş topraklarda yüksek biyokütle verimi elde edilen alternatif enerji bitkileri tarımı önemli bir role sahip olacaktır.



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KAYNAKLAR

- Başer, E., Acaroğlu, M. ve Kan, M. 2008. Peletlenmiş Dallı Darının (*Panicum virgatum*) Biyoyakıt Olarak Kullanım Ekonomisi. VII. Ulusal Temiz Enerji Sempozyumu, UTES'2008, 323-332.
- Bilgili, M. E., Sevilmiş, U., Seydoşoğlu, S., Kahraman, Ş. ve Sevilmiş, D. 2019. Ketencik Biyodizelinin Eldesi İle Özellikleri Ve Kullanım Alanları. Ziraat Mühendisliği, (367), 36-53.
- Geren, H. 2017. Farklı Oranlarda Baklagil Yembitkileri ile Silolanan Dev Kralotu (*Pennisetum hybridum*)'un Bazı Kalite Özellikleri Üzerine Bir Araştırma. Ege Üniversitesi Ziraat Fakültesi Dergisi, 51 (2): 209-217.
- Hohenstein, W. G., Wright, L. L. 1994. Biomass Energy Production in The United States: An Overview. Biomass and Bioenergy, 6 (3), 161-173.
- Kavlak, M. Ö. ve Çabuk, S. N. 2021. Enerji Bitkisi Yetiştiriciliğinde Coğrafi Bilgi Sistemlerinin Kullanımı: Fil Otu İçin Uygun Alanların Belirlenmesi. GSI Journals Serie C: Advancements in Information Sciences and Technologies (AIST), 4 (2): 1-27.
- Kukkonen, C. 2009. An Energy Crop for Cellulosic Biofuels and Electric Power Plants, VIASPACE Inc. Irvine, California USA.
- Özkan, A. 2017. Antakya-Cilvegözü Karayolu Etrafındaki Tarım Arazilerinde ve Bitkilerdeki Ağır Metal Kirliliği. Çukurova Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi, 32 (3); 9-18
- Peşkircioğlu, M., Özaydın, K. A., Kodaş, R., Özyazıcı, G., Aydoğmuş, O., Bağcı, M., Yıldız, H., Karaman, N. ve Akçelik, E. 2019. Biyoenerji Bitkisi Olarak Dallı Darının (*Panicum virgatum* L.) Türkiye'de Potansiyel Yetiştirme Alanlarının Belirlenmesinde Analitik Hiyerarşi Süreci ve Coğrafi Bilgi Sistemleri Yaklaşımı. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi, 28 (1): 39-52
- Saletnik, B., Zagula, G., Bajar, M., Czernicka, M. ve Puchalski, C. 2018. Biochar and Biomass Ash as a Soil Ameliorant: The Effect on Selected Soil Properties and Yield of Giant Miscanthus (*Miscanthus x giganteus*). Energies 11, 2535.



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Smith, L. S., Thelen, K. D. Ve MacDonald, S. J. 2013. Yield and Quality Analyss of Bionergy Crops Grown on a Regulatory Brownfield. Biomass and Bioenergy 49: 12-130

Tan, H.K. 1994. Environmental Soil Science, Marcel Dekker, New York.

Wright, L. ve Turhollow, A. 2010. Switchgrass Selection as a Model Bioenergy Crop. A History of The Process. Biomass and Bioenergy, 34,851-868.



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**TARIMSAL KIYMET TAKDİRİ VE BİLİRKİŞİLİKTE KULLANILAN YENİ
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ÖZET

Tarım işletmeleri ve işletme arazilerinin alım satımlarının belirgin bir piyasa oluşturacak ölçüde yaygın olmaması, özellikle bu taşınmazların homojen olmamaları, değerlerinin biçilmesine yönelik özel bir disiplin ve mesleğin gelişmesine yol açmıştır. Bunun yanında, tarım işletmesi ve arazilerin değer takdirini gerektiren, kamulaştırma, kredilendirme, vergilendirme vb. uygulamaların yaygınlık kazanması da bu disiplinin gelişmesinde önemli rol oynamış ve içeriğinin zenginleşmesine neden olmuştur. Gerçekte tarım arazileri, tarımsal mallar ve hakların tarım işletmeleriyle ilgisi düşünüldüğünde bu yaklaşımlarda temel bir farklılık bulunmamaktadır. Tarım işletmesi, tarım arazileri, bunlara bağlı haklar ve diğer tarımsal malların değerlemesi ile ilgili yöntem ve uygulamalar yeni yöntemlerle değerlendirilmektedir. Tarımsal kıymet takdiri konusu, tarımla ilgili teknik bilgilerin, konuyla ilgili yasal düzenlemelerin ve değerlendirme işlemlerinde kullanılacak yöntemlerin bilinmesini zorunlu kılmaktadır. Değerlemeye konu olabilecek bazı alanlarda yasal düzenlemeler bulunmaktadır ve Türkiye'de en yaygın kıymet takdiri konusu olan, kamulaştırma ile ilgili örnekler ek olarak sunulmuştur. Konular daha çok Türkiye'deki uygulamalar dikkate alınarak işlenmiştir.

Anahtar Kelimeler: Tarım ekonomisi, Tarım işletmeleri, Tarımsal kıymet takdiri, Bulanık mantık, Hedonik fiyatlandırma.



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NEW METHODS USED IN AGRICULTURAL APPRAISAL AND EXPERTISE

ABSTRACT

The fact that the purchase and sale of agricultural enterprises and farm lands is not widespread enough to create a clear market, especially the inhomogeneity of these immovables, has led to the development of a special discipline and profession for valuation. In addition to this, expropriation, crediting, taxation, etc., which require the valuation of agricultural enterprises and lands. The prevalence of these practices has also played an important role in the development of this discipline and has led to the enrichment of its content. In reality, there is no fundamental difference in these approaches when considering the relevance of agricultural lands, agricultural goods and rights to agricultural enterprises. Methods and practices related to the valuation of agricultural enterprises, agricultural lands, rights attached to them and other agricultural goods are evaluated with new methods. The subject of agricultural valuation necessitates knowing the technical information about agriculture, the relevant legal regulations and the methods to be used in valuation processes. There are legal regulations in some areas that may be subject to valuation, and examples of expropriation, which is the most common valuation subject in Turkey, are presented as an appendix. The subjects are mostly covered by considering the practices in Turkey.

Keywords: Agricultural economy, Farms, Farm appraisals, Fuzzy logic, Hedonic pricing.



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1. GİRİŞ

Tarımsal kıymet takdiri, dilimizde İngilizce “Farm Appraisal” veya “Rural Appraisal” kavramlarının karşılığı olarak; Türkçe’de “Tarım İşletmelerinin Değerinin Biçilmesi” veya “Kırsal Alanda Değer Biçme” ya da kısaca “Kırsal Değerleme” şeklinde çevirebiliriz. Tarım işletmeleri ve işletme arazilerinin alım satımlarının belirgin bir piyasa oluşturacak ölçüde yaygın olmaması, özellikle bu taşınmazların homojen olmamaları, değerlerinin biçilmesine yönelik özel bir disiplin ve mesleğin gelişmesine yol açmıştır. Bunun yanında, tarım işletmesi ve arazilerin değer takdirini gerektiren, kamulaştırma, kredilendirme, vergilendirme vb. uygulamaların yaygınlık kazanması da bu disiplinin gelişmesinde önemli rol oynamış ve içeriğinin zenginleşmesine neden olmuştur. Tarım işletmesi, tarım arazileri, bunlara bağlı haklar ve diğer tarımsal malların değerlemesi ile ilgili yeni yöntem ve uygulamalar bu kavramın esasını oluşturmaktadır.

2. KIYMET TAKDİRİ’NİN (DEĞERLEMENİN) ANLAM VE KAPSAMI

Değer biçme, değerleme veya kıymet takdiri, belirgin özelliklere sahip olan, kesin bir pazarı ve fiyatı olmayan malların parasal değerini ortaya koyma veya tahmin işlemi olarak tanımlanabilir. Tarımsal kıymet takdiri ise tarım işletmeleri, işletme parselleri ve diğer kırsal mal ve hakların değerlerinin tam ve doğru olarak ortaya konmasıdır. Tarımsal değerlemenin temel konusu tarım işletmesi, arazi ve arazi parçaları ve bunlara bağlı haklar olarak ortaya çıkarken, bu çerçevede veya bağımsız olarak diğer tarımsal malların değerlemesi de söz konusudur. Tarımsal kıymet takdiri, günümüz modern tarım ekonomisi bilim dalının önemli bir disiplini ve profesyonel bir uğraşı alanı haline gelmiştir. Tarımsal kıymet takdirinin ana konusunu oluşturan arazi ve diğer mallar faydalı olmaları yanında kıt olduklarından bir değere sahiptirler. Ekonomik anlamda kıymet (değer) deyince, bir malın ve hizmetin insan ihtiyaçlarını giderme (faydalı olma) açısından taşıdıkları görece önemi anlıyoruz. Dünya üzerinde bütün mallar insan gereksinmesi için önemli ve kıt olduğuna göre farklı düzeylerde değere sahiptirler. Ekonomide değer deyince karşımıza temel iki kavram çıkmaktadır.

- Kullanım kıymeti
- Mübadele (değişim) kıymeti

Kullanım kıymeti, kişiden kişiye değişen ve bir malın kullanım değerini ifade eden görece bir kavramdır. Bu nedenle kullanım kıymetine "subjektif kıymet" diyoruz.



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Mübadele (değişim) kıymeti ise malların birbirlerine göre değişim değerini ifade eden ve ekonomik anlamda herkes için aynı olan kıymettir. Mübadele ekonomisinin geçerli olduğu bir ekonomik sistem içinde mübadele değerinin ölçüsü "fiyat"tır. Değişim kıymeti herkes için aynı olduğuna göre, bu kıymet "objektif kıymet" olarak ifade edilebilir.

3. KIYMET TAKDİRİ'NİN (DEĞERLEMENİN) YÖNTEMLERİ

Kıymet takdiri günümüzde bağımsız bir disiplin olarak gelişmiştir. Sağlıklı ve güvenilir takdirler yapabilmek için kıymet takdiri ile ilgili yöntemlerin iyi bilinmesi gereklidir. Ancak, tarımın yapısını da dikkate alırsak, tarımsal kıymet takdiri, belirli bir bilgi birikimi ve deneyim gerektirmektedir. Bu nedenle, abartılı olmakla birlikte, kıymet takdiri işinin bilimsel bir işleminden çok bir sanat olduğu belirtilmektedir. Tarımı ve takdir yapılan bölgeyi tanımadan sağlıklı ve güvenilir tahminler yapmak oldukça zordur. Tarımsal kıymet takdiri, profesyonel bir uygulama olarak üç temel bilgi grubuna dayanmaktadır.

Mesleki bilgi ve deneyim; Tarımsal kıymet takdiri yapacak kişi tarımı tanıyan, tarım hakkında kapsamlı teknik bilgilere sahip bir kişi olmalıdır. Profesyonel olarak düşünürsek, tarımsal kıymet takdiri yapan kişinin pratikte de olduğu gibi tarım eğitimi almış bir kişi (ziraat mühendisi) olması gerekir.

Yasa bilgisi; Kıymet takdiri çoğu durumlarda yasal düzenlemelere konu olan veya mahkemelerde dava konusu olmuş olaylarla ilgilidir. Bu durumda değerlendirme yapacak bilirkişinin bu yasalarla ilgili bilgisinin de olması gerekir.

Kıymet takdiri yöntem bilgisi (Kuramsal bilgiler); Tarımsal kıymet takdiri yapabilmek için, değerlemede kullanılan yöntem ve yaklaşımların ve bunların uygulamalarının bilinmesi gerekir. Tarımsal kıymet takdirinde kullanılan yöntemleri, pazar yöntemi, maliyet yöntemi ve gelir yöntemi olarak üç grupta toplamak olasıdır. Bu üç yönteme dördüncü bir grup olarak ileri yöntemleri (matematik-istatistik yaklaşımlar) de ekleyebiliriz. Buna göre tarımsal kıymet takdiri yöntemleri aşağıdaki gibi sıralanabilir.

- Pazar Yöntemi
- Maliyet Yöntemi
- Gelir Yöntemi
- İleri Yöntemler



3.1. İleri Yöntemler

Günümüz bilgisayar teknolojilerinden yararlanılarak değer belirlemede yeni arayışlar devam etmektedir. Taşınmazı değerinin belirlenmesinde çok kriteri beraberinde analiz ederek taşınmazın değeri üzerindeki etkileri belirleyen ve buna göre en iyi kombinasyonları ortaya koyan yaklaşımlar geliştirilmiştir. Bu yaklaşımlar ile doğru sonuçlara daha çabuk ulaşılmaktadır.

Bilgi ve iletişim teknolojilerindeki gelişmeler, bina ve arsa gibi taşınmazlarda olduğu gibi, tarım arazileri başta olmak üzere tarımsal mal ve hakların değerlerinin biçilmesi amacıyla da gelişmiş matematiksel veya kantitatif yöntem ve modeller kullanılmasına katkı yapmıştır. Bu yöntemler teorik bilimsel araştırmalar yanında uygulamalarda ve özellikle de toplu değerlemelerde kullanılmaktadırlar. Bu alanda kullanılan yaklaşımları genel olarak ileri yöntemler olarak isimlendirebiliriz.

- Çoklu Regresyon Analizi (ÇRA) (Multiple regression)
- Konumsal (Coğrafi) Bilgi Analiz Yöntemleri
- Yapay Sinir Ağı Yaklaşımı (YSA) (Artificial neural network)
- Bulanık Mantık Yaklaşımı (BM) (Fuzzy logic)
- Hedonik Fiyatlandırma (HF) (Hedonic pricing)

3.1.1. Çoklu Regresyon Analizi (ÇRA) (Multiple Regression)

Taşınmazlar için regresyon yöntemi taşınmaz değerinin önemli belirleyicilerinin tanımlanması ve miktarının ölçülmesi için taşınmazın ilgili karakteristiklerle birlikte değerlendirilmesini sağlayan istatistiksel bir teknik olarak tanımlanabilir. Regresyon yöntemi iki şekilde uygulanır.

- Lineer regresyon yöntemi
- Lineer olmayan regresyon yöntemi

Bağımsız değişkenler ile bağımlı değişkenler arasında doğrusal ilişki varsa lineer regresyon, bağımsız değişkenlerden herhangi birinin bağımlı değişkenle arasında doğrusallık yoksa lineer olmayan regresyon kullanılabilir. Taşınmaz değerini etkileyen kriter sayısı birden fazla olduğu için çoklu regresyon yöntemi uygulanabilir. Regresyon yöntemi için taşınmaz piyasasından alım-satımı yapılan değerler ve değeri etkileyen kriterler toplanır.

Çoklu regresyonda bağımlı değişkeni etkileyen birden çok bağımsız değişken söz konusu olup bu tür çalışmaların iki genel amacı vardır.

- Bağımlı değişkeni etkilediği düşünülen bağımsız değişkenlerden hangisi ya da hangilerinin bağımlı değişkeni daha çok etkilediğini bulmak.



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- Bağımlı değişkeni etkilediği belirlenen değişkenler yardımıyla bağımlı değişken değerini kestirmek

Regresyon yönteminin matematiksel modeli ise aşağıdaki gibidir.

$$Y_i = X_{i1}Q_1 + \dots + X_{ip}Q_p + E_i$$

$i=1,2,\dots,n$, X_i = Faktör değeri, Q =Bilinmeyen parametreler.

Örnek: $f_i = -82 + 1.39\text{Mevki} - 0.127\text{Cpuan} + 0.919\text{Kpuan} + 3.29\text{Aksesuar} + 1.87\text{Yol}$

(Konya ilinde yapılan kıymet takdirlerinde piyasa fiyatlarına %89 yaklaşılmıştır.)

Alım-satım değerlerinden hareketle hesaplanmasından ve çok fazla taşınmaz değeri kullanıldığında yöntemin doğruluğu artmaktadır. Uygulamada zor olmasına karşılık, alım-satım değerine çok yaklaşması açısından tercih edilebilecek bir yöntemdir.

3.1.2. Konumsal (Coğrafi) Bilgi Analiz Yöntemleri

Hızlı artan kentli nüfusa karşılık taşınmaz mal arzını yükseltme imkânı sınırlı kaldığı için, kentsel toprak kıt bir kaynak haline gelmekte ve taşınmazlar sürekli değer kazanmaktadır. Bu nedenle tarım arazilerinden imar parselli arazilere dönüşüm kaçınılmaz olmaktadır. Araziden arsaya dönüşümde değer artışı hem toplumu hem de oluşan yeni kentsel arazi ile kamuyu memnun etmektedir. Ülkemizde ise taşınmaz değerlendirmesini gerektiren birçok uygulamada kentsel ve kırsal arazi değerleri bilimsel ve matematiksel yaklaşımlardan ziyade, günlük piyasa şartlarına göre belirlenmektedir. Buna bağlı olarak taşınmaz sahipleri arasında haksız rant artışları ortaya çıkmakta, uygulamalarda düzenli ve sağlıklı bir arsa arazi değerlendirmesi ihtiyacı doğmaktadır.

Bunun için planlama öncesi ve sonrası bütün parseller, belli değer kriterlerine göre ayrı ayrı analiz edilmelidir. Böyle bir yaklaşımda verilerin toplanması, işlenmesi ve analiz edilmesi için önemli bir karar destek organı olan Coğrafi Bilgi Sistemleri (CBS) maliyet, zaman ve doğrulukta bize yardımcı olacaktır.

Arazi ve bina değerleri geçmişte sadece mal sahiplerinin ya da onlar adına iş gören satış ve yönetim elemanlarının fikrini yansıtırdı. Günümüzdeki karmaşık ekonominin içinde, bu tür değerlemeler oldukça basit kalmakta, gerçek dışı ve yanlış kararların alınmasın neden olmaktadır. Çünkü profesyonel değerlendirme, gerekli verilerin toplanması, uygun analitik tekniklerin kullanılması, bilgi ve tecrübe yanında profesyonel hüküm vermeyi de gerektirir (Öztürk,1985).



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Bu bağlamda herhangi bir taşınmazın değerini kesin olarak belirlemek mümkün değildir, ancak değişik kriterlerin dikkate alınması ile parselle ait yaklaşık değer belirlenebilir. Bir parselin değeri, genelde konum itibarı ile o parselin sahip olduğu özellikler ile doğrudan ilişkilidir. Bu düşüncelerden hareketle uygulama bölgesine ait değerlendirme faktörleri Tablo.1’de verilmiştir.

Tablo.1. Faktörlere ait ağırlık oranları (Başer, 2002).

Değer Faktörü	Ağırlık
Kamu Hizmeti	83.50
Manzara	83.30
Zararlı Böl. Uzaklık	78.70
T.A.K.S.	78.20
K.A.K.S.	72.00
Topografya	68.60
Ana Yola Uzaklık	64.80

Taşınmaz değerine etki eden faktörlerin sayısını kesin olarak sınıflandırmak elbette mümkün değildir. Buna bağlı olarak, bir taşınmazın değerini kesin olarak belirlemekte güçtür. Bu nedenle bölge bazlı yapılan bir değerlendirme işleminde taşınmaz değerine etki eden faktörlerden hareketle her bir taşınmaz için “nominal” değer üretilebilir. Bu bağlamda her bir taşınmazın parametrik değeri eşitliği ile belirlenebilir (Yomralıoğlu, 1997).

$$V_i = S_i \cdot \sum_{j=1}^k (F_{ji} \cdot W_j)$$

V: Toplam nominal değer, **S:** Parsel ya da piksel alanı, **F:** Faktör değeri (Puan), **W:** Faktör ağırlığı, **K:** Toplam faktör sayısı

3.1.3. Yapay Sinir Ağı Yaklaşımı (YSA) (Artificial neural network)

Yapay sinir ağları ya da kısaca YSA; insan beyninin çalışma sisteminin yapay olarak benzetimi çabalarının bir sonucu olarak ortaya çıkmıştır. En genel anlamda bir YSA insan beynindeki birçok nöronun (sinir hücresinin), ya da yapay olarak basit işlemcilerin birbirlerine değişik etki seviyeleri ile bağlanması sonucu oluşan karmaşık bir sistem olarak düşünülebilir. Önceleri temel tıp birimlerinde insan beynindeki nöronların matematiksel modelleme çabaları ile bağlayan çalışmalar, geçtiğimiz on sene içerisinde, disipline bir şekil almıştır. YSA bugün fizik, matematik, elektrik ve bilgisayar mühendisliği gibi çok farklı bilim dallarında araştırma konusu haline gelmiştir. YSA'nın pratik kullanımı genelde, çok farklı yapıda ve formlarda bulunabilen



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informasyon verilerini hızlı bir şekilde tanımlama ve algılama üzerinedir. Aslında mühendislik uygulamalarında YSA'nın geniş çaplı kullanımının en önemli nedeni, klasik tekniklerle çözümü zor problemler için etkin bir alternatif oluşturmastır. Çünkü bilgisayarlar insanın beyinsel yeteneğinin en zayıf olduğu çarpma, bölme gibi matematiksel ve algoritmik hesaplama işlemlerinde hız ve doğruluk açısından yüzlerce kat başarılı olmalarına rağmen insan beyninin öğrenme ve tanıma gibi işlevlerini hala yeteri kadar gerçekleştirememektedir.

YSA paralel dağılmış bir bilgi işleme sistemidir. Yani, YSA'nın temelinde, zeka gerektiren işlemlerden oluşan bilgi işleme işlevi vardır. Bu sistem tek yönlü işaret kanalları (bağlantılar) ile birbirine bağlanan işlem elemanlarından olur. Çıkış işareti bir tane olup isteğe göre çoğaltılabilir. YSA yaklaşımının temel düşüncesiyle, insan beyninin fonksiyonları arasında benzerlik vardır. Bu yüzden YSA sistemine insan beyninin modeli denilebilir. YSA çevre şartlarına göre davranışlarını şekillendirebilir. Girişler ve istenen çıkışların sisteme verilmesi ile kendisini farklı cevaplar verebilecek şekilde ayarlayabilir. Ancak son derece karmaşık bir içyapısı vardır. Onun için bugüne kadar gerçekleştirilen YSA; biyolojik fonksiyonların temel nöronlarını örnek alarak yerine getiren kompozite elemanlar olmuştur.

YSA bir anlatımla girdi ve çıktılar arasında açık bir ilişkinin bulunmadığı bir "kara kutu" gibidir. Deneme yoluyla sonuca gider. Yapay sinir ağında temel elemanlar nöron veya temel noktalar. Bunlar arasındaki ilişkiler ağırlıklara dayalı olarak saptanır. Bir YSA modeli esas olarak 3 unsurdan oluşur:

- Girdiler
- Gizli bölüm (Kara kutu)
- Çıktılar (Tahmin edilen değer veya değerler)

Kara kutu, ağırlıklı toplamlar fonksiyonu ve dönüşüm fonksiyonu olmak üzere iki işlemden oluşur (Pagourtzi ve ark. 2003). Ağırlıklı toplamlar fonksiyonu YSA modelinin işleyişini (ileri/geri) besleyen aşağıdaki gibidir.

$$Y_j = \sum_i^n X_i W_{ij}$$

Burada her bir gizli **j** bölümü için, **X_i** girdileri, **W_{ij}** de girdilere verilen ağırlıkları temsil etmektedir. Dönüşüm fonksiyonu ise kara kutuda toplanan verileri çıktı değerleri veya **Y_j**'lerle ilişkilendirir. Bu dönüşüm fonksiyonu başta doğrusal olmak üzere çok farklı formlarda olabilir. Paket programların çoğu aşağıdaki gibi bir sigmoid fonksiyonu kullanmaktadır.



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YSA kullanarak tarım problemlerini başarılı bir şekilde çözebilmek için problemin çok iyi modellenmesi gerekmektedir. Bu modelleme, problemi çözebilmek için sadece söz konusu olay ile ilgili örneklerin belirlenip toparlanmasına yardımcı olacaktır. Örneklerin dışında herhangi bir ön bilgiye ihtiyaç yoktur. Örnek bulmak bilgi bulmaktan çok daha kolaydır. YSA uygulamaları hem pratik hem de maliyet bakımından daha ucuzdurlar. Sadece örneklerin belirlenmesi ve bir program, problemi çözmek için yeterli olabilmektedir. YSA'lar zaman bakımından da çok verimli çalışırlar. Örneklerin bulunması, sinir ağlarının oluşturulması, YSA'nın eğitilmesi, gerçek zamanda kullanıma alınması çok kısa bir zaman diliminde mümkün olabilmektedir. Aynı zamanda YSA'nın çalışması da geleneksel sistemlerden daha hızlıdır. YSA yeni bilgilerin ortaya çıkması ve ortamda bazı değişikliklerin olması durumunda yeniden eğitilebilirler. Bazı ağı eğitilmesine de gerek yoktur. Çünkü bu YSA'lar kendi kendilerine öğrenme yapısına sahiptirler. Şöyle ki; hiç karşılaşmadıkları yeni bir örneği kullanarak kendilerini tekrar eğitebilirler.

3.1.4. Bulanık Mantık Yaklaşımı (BM) (Fuzzy Logic)

Günümüz teknolojisi olan bilgisayar günlük yaşantımızın pek çok alanında kullanılmaktadır. İnsan düşüncesini taklit etmesi için çalışılan bilgisayarlarda, klasik mantığın yetmediği alanların ortaya çıkarılmasıyla bulanık mantık kavramı oluşmuştur. Mantık doğru öncüllerden doğru sonuçlar çıkartma biçimlerini inceleyen bir bilim dalıdır. Bulanık mantık ile günlük konuşma dilinde geçen sözel belirsizlikleri modelleme ve hesap yapılırken işin içine katma imkânı bulunabilir. İnsanlar sözel verilerle konuşarak anlaşır. Bulanık sistemlerin asıl değerlendireceği alan bu tür bilgilerin bulunması halinde çözümlemelere gitmek için nasıl düşünüleceğidir. Bulanık mantıkla herhangi bir problemin yaklaşık olarak modellenmesi ve matematiksel olarak karmaşık olmayacak çözümlerle denetim altına alınmasına çalışılmaktadır (Şen, 2004).

Bulanık küme teorisinin kullanımı verilerde kesin olmayan kaçınılmaz durumları içermek için kullanıcıya izin verir. Bulanık sonuç çıkarma, bir takım bulanık kurallara dayanan çıktının, değişken girdinin belirli kümesindeki haritasının gerçek işlemlerden geçirilmesidir. Genel bir bulanık sonuç çıkarma sistemi temel olarak 4 bileşene sahiptir: bunlar bulanıklaştırma, bulanık kural tabanı, bulanık çıkarım motoru ve durulaştırma (Şen, 1998). Ayrıca giriş verileri ve çıkış verileri de vardır. Bulanıklaştırma her parça girdi verisinin üyelik fonksiyonlarını bir veya daha fazla üyelik fonksiyonlarına dönüştürür. Bulanık kural tabanı girdiler ve çıktılar arasındaki bulanık ilişkilerin tüm olasılıklarını kapsayan kuralları içermektedir.



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Bu kurallar Eğer-İse formatında ifade edilmektedir. Bulanık çıkarım motoru transfer edilen kümedeki girdilerden doğru sonucu çıkarmak için bulanık kurak tabanı ve öğrenmelerdeki tüm bulanık kuralları hesaba katmaktadır. Temel olarak iki tür sonuç çıkarma operatörü vardır. Bunlar; azaltma ve sonuçtur.

Bulanık sonuç çıkarma sistemleri, bulanık mantık ve sözel bulanık kurallar yardımıyla doğrusal olmayan davranışları taklit etmek için kullanılan güçlü araçlardır. “Eğer-İse” kurallarını kullanan bulanık sonuç çıkarma sistemi, insana ait bilgi ve mantıklı düşünme işlemlerini tam nicel analiz kullanmadan nitel bakış açısı olarak modelleyebilir.

Model çözümler irdelendiğinde bazı modeller basit ve nitel özellikte iken toprakla ilişkili çalışmalarda kullanılan birçok matematiksel model kompleks yapılı ve disiplinler arası niteliktedir. Kompleks modellerin sonucunu açıklamak çoğunlukla zordur ve gerçek koşullardaki toprakla ilişkili işlemleri yansıtmayabilir. Örneğin arazi değerlendirmesine ilişkin bir uygulama çalışması, kimya ve fiziğe dayalı bir karar verme gerçekleştirme işlemidir, fakat hükümlerin sonuçlarını değerlendirebilmek için sosyal bilgiler ve kurumlara ait bilgiler de gerekmektedir. Bu nedenle toprak bilimindeki birçok model, modelleyicinin tercihler yapmasını zorlayıcı nitelikte çoklu, çoğunlukla çelişen ve çıktısı girdi verisini desteklemeyen özelliktedir.

Bulanık mantık yöntemlerini kullanmak, az sayıda değişkenle çalışılmak istenildiği durumlarda, büyük bir havzadaki toprakların fiyat potansiyelini belirlemek için nispeten kolay bir yoldur. Saha çalışmalarının maliyeti surveyin ölçeğine bağlıdır. Bölgesel bir ölçekteki çalışma için oransal olarak kaba veri kümeleriyle çalışılacak olan pilot bir proje, alansal toprak problemlerini belirlemeye yardımcı olabilir. Böylece problemlerli alanlar tanımlanıp dağılımları belirlenebilir.

Bulanık mantık modelleri ile farklı çözünürlükteki veri kümelerine ait serilerinin kullanımı devamlı olarak problemlerli alanların alansal uzunluğunun daraltılmasına yardım eder. Böylece daha iyi veri kümeleri bütün bölge için değil spesifik problemlerli alanlar için gerekecektir. Daha sonra en iyi veri kümeleri ile problemlerli alanlar belirlenecek ve bu şekilde bütün alan çalışılmış olacaktır. Bu yaklaşım bütün bölgedeki potansiyel problemlerli alanların tanımlanması ve yerinin belirlenmesinde etkin bir maliyet azalması sağlayacaktır.

Herhangi bir çözünürlükte bulanık mantık temelli model uygulaması dijital ortamda sadece ucuz CBS paketlerini gerektirmesi nedeniyle göreceli olarak pahalı değildir. Geleneksel grid yöntemleri kullanılarak elde edilebilen eğim ve arazi kullanım/arazi örtüsü veri kümeleri,



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bulanık mantık temelli modeller ile kullanılabilir. Makul bir veri kümesi için pahalı CBS kurulumlarını satın almaya gerek yoktur. Sade grafik paketler bulanık mantık temelli çıktıları gösterebilir. Gelişmekte olan ülkelerdeki toprak erozyonu çalışmalarında bulanık mantık temelli modellerin kullanılması, büyük ölçüde ekonomik kazanç sağlamaktadır. Bulanık mantık temelli modellerin temel avantajı, pahalı dijital verilerden tam anlamıyla yararlanılamayan ucuz ve basit tekniklerin kullanılma zorunluluğu bulunan gelişmekte olan ülkelerde, özellikle toprak ve fiyat potansiyelinin survey keşifleri ile yapılmak istendiği durumlarda başarıyla kullanılabilir olmasıdır.

3.1.5. Hedonik Fiyatlandırma (Hedonic Pricing)

Çevre kalitesinin taşınmaz değerleri üzerine etkisini ölçmekte kullanılan çeşitli yöntemler bulunmaktadır. Bu yöntemler tüketicilerin taşınmazlarda meydana gelebilecek gelişmeler için yapacakları gönüllü ödeme isteklerine dayanmaktadır. İçlerinde en yaygın kullanılan yöntem hedonik fiyatlandırma modelidir. Bu varsayım altında, hem modellerin fiyatlarını hem de modelleri oluşturan özelliklerin her birinin fiyat üzerindeki etkinliklerini belirlemek mümkündür.

Hedonik yöntem, teknolojiye ve tercihlere dayanan bilgiyi içermektedir. Tüketiciler zevk ve tercihlere dayanan özelliklere sahip ürünleri seçeceklerdir dolayısıyla tüketicinin tercihleri farklılık gösterecek ve bu seçim bireysel tüketici tercihinin dönüşecektir.

Bu yöntem tüketicilerin ödemeye razı olduğu marjinal değer ve fiyatı etkileyen her bir özelliğin ayrı ayrı belirlenmesine olanak sağlamaktadır. Farklılaşmış ürün piyasalarına uygulanmaktadır. Ürünün kalitesi, tüketici faydası kadar markalara ve üreticinin kim olduğuna bağlıdır. Ürünün kalitesi ile tüketicinin bu üründen sağlayacağı fayda arasında kuvvetli bir ilişki bulunmaktadır. Aslında ürünün kalitesinin temelini tüketici tercihleri oluşturmaktadır. Tüketiciler arasındaki farklılıklar farklı niteliklerin bileşimiyle oluşan ürünlerin çeşitliliğine yol açar. Ürünün sahip olduğu özellikler onun kalitesinin bir göstergesidir (Boyacıgil, 2003).

Hedonik yaklaşım, mal piyasasının bütününe açıklarken, geleneksel talep teorisinden farklı olarak, ele aldığı malın çeşitli özellikleri bakımından heterojen niteliğe sahip olduğunu kabul eder. Bu, piyasada bulunan malların standart özelliklerinin yanı sıra, birbirlerinden kalite olarak farklılaşan ek özelliklere de sahip olabilecekleri anlamına gelir. Günümüz rekabet koşullarında bu tür piyasalarla sıkça karşılaşılır (Levent, 1995).

Örneğin, gayrimenkul piyasasında, hava kalitesine bağlı olarak ev fiyatlarının değiştiği düşünülebilir. Bu durumda, evin fiyatı ile hava kalitesi ve evin diğer özellikleri arasındaki



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fonksiyonel ilişki tahmin edilerek hava kalitesinin fiyatı, evin diğer özelliklerinin fiyatlarından bağımsız olarak belirlenebilir.

Teorik çerçevesi verilen hedonik fiyatlandırma yöntemi iki aşamada yürütülmektedir. İlk aşama, taşınmaz ve onun karakteristiklerinin bir arada incelendiği hedonik fiyat fonksiyonunun tahmin aşamasıdır. Bu aşamada örtülü (dolaylı) fiyatlar çoklu regresyon analizi ile tahmin edilmekte ve örtülü fiyatların tahmini çevresel değerlerdeki marjinal değişikliğin parasal değerini takdir etmekte kullanılmaktadır.

İkinci aşama ise, ilk aşamada elde edilen marjinal verilere dayanarak çevre kalitesi için talep fonksiyonunun tahmin edilmesidir. Bu aşamada diğer tüm değişkenler aynı kaldığında, çevresel özelliklerdeki niteliksel/niceliksel değişimler doğrultusunda, bireyin fayda düzeyinde meydana gelecek değişimlere bağlı olarak, refah değişimi tahmin edilmektedir (Alkay, 2002).

İkinci aşama ile ilgili zorunlu veri gereksinimleri ve ekonometrik problemler nedeniyle ampirik çalışmaların bir çoğu fiyatı olmayan çevresel faydaların ekonomik değerini tahmin etmek için hedonik regresyon modelinin ilk aşamasını kullanmışlardır. İlk aşamadaki hedonik fiyat fonksiyonu karakteristik dahilinde doğrusal ise, ikinci aşamanın uygulanması (ters talep eğrisinin tahmini) olanaksızdır. İkinci adımı yerine getirirken metodoloji ve verinin uygulanabilirliği ile ilgili bir takım zorluklarla karşı karşıya gelinmektedir. Sonuç olarak birçok çalışma tüketiciler tarafından belirli bir değeri olan nitelikler için marjinal ödeme isteğinin parasal olarak takdir edildiği ilk adımı uygulamaktadır (Mollard vd. 2004). Bu çalışmada da araştırmanın temel amacının çevre kalitesindeki değişikliğin tarım arazileri üzerine etkisinin belirlenmesi olduğundan sadece ilk aşama uygulanmıştır.

Genel olarak hedonik fiyatlandırma modeli; $F = f(Y, K, C)$ ile açıklanmaktadır. Burada F; taşınmazın satış fiyatı; Y; taşınmaz ile ilgili yapısal karakteristikler (m², oda sayısı, vb.), K; taşınmazın bulunduğu yer ile ilgili karakteristikler (nüfus, erişilebilirlik, okul sayısı vb.), C; çevresel karakteristikler (endüstriyel kirlilik, çevre kalitesinin düzeyi, vb.) olarak 3 gruba ayrılabilir.

Hedonik fiyatlandırma yöntemi genel olarak korelasyon ve regresyon tekniklerini kullanmaktadır. Piyasada alınıp satılan unsurların farklı fiyata sahip oluşlarının nedenleri belirlidir. Kullanıcıya sağladığı konfor, iş merkezlerine ve sosyal alanlara yakınlık, yerel hizmetlerin kalitesi, altyapı olanakları, kirlilik, gürültü, vergi miktarı gibi özellikler değerdeki bu farklılığın belirleyicileridir. Bu özelliklerden her biri Hedonik fiyatlandırma yöntemi



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uygulanmasının değişkenlerini yani regresyon ve korelasyon analizinde kullanılacak unsurları oluşturmaktadır.

Değişkenlerden herhangi biri dışlandığında büyük olasılıkla incelenen unsurun değeri de değişecektir. Değerdeki bu değişmelerin biçim ve ölçüsünü, kullanılan değişkenlerin birbirleriyle ya da mülkün fiyatı ile olan ilişkileri belirlemektedir. Bu bakımdan yöntemin uygulanmasında değişken seçimine duyarlı davranmak gerekmektedir (Boyacıgil, 2003).

Hedonik fiyatlandırma yönteminde kullanılabilecek doğrusal model: $F = \alpha + Y\beta + K\gamma + \zeta\eta + \epsilon$ olarak yazılmaktadır. Doğrusal modeller parametrelerin yorumlanmasının kolay olması nedeniyle kullanılırlar.

3.1.5.1. Tarım Arazileri ve Hedonik Fiyatlandırma Yöntemi

Hedonik fiyat modelleri arazi değerleri üzerine, arazinin sahip olduğu niteliklerin etkisini açıklamakta da kullanılmaktadırlar. Değeri biçilen arazinin sahip olduğu niteliklerdeki değişikliğin faydaları, karakteristik veya karakteristikler için temel teşkil eden talep yoluyla ölçülebilmektedir. Tarımsal arazi pazarları, tarımsal ekonomik koşullar, nüfus artışı, arazinin fiziksel karakteristikleri, bölgesel faktörler, devlet politikaları ve diğer ekonomik aktiviteler gibi çeşitli faktörlerden etkilenebilmektedirler.

Günümüze kadar gelen hedonik çalışmalardan bir kısmı tarım alanlarının değerleri üzerine odaklanmış ve önemli arazi değişkenlerinin değerlerini tahmin etmeye çalışmışlardır ve birçok grup çalışmasında toprak derinliği, pH, erozyon ve drenaj gibi toprak karakteristiklerinin değerini tahmin etme üzerine yoğunlaşmıştır. Diğer çalışmalar da tarımsal arazi değerleri üzerine şehirleşmenin etkisine ölçmeye çalışmışlardır.

Hedonik yaklaşım başlangıçta fiyat yaklaşımı, $P(Z_i)$ fonksiyonu ile açıklanır. İlk aşama arazi özelliklerinin formülasyonudur.

$$P(Z_i) = P(Z_{Organik\ madde} Z_{Toprak\ bünyesi} Z_{Parsel\ şekli} Z_{Toprak\ yapısı} Z_{Verimlilik} Z_{Yola\ uzaklık} Z_{Çiftliğe\ uzaklık})$$

Arazi değeri araziden sağlanan faydalarla yakından ilişkilidir. Tarımsal çıktı bu gibi faydaların en çok bilinenidir. Fakat sanayi bölgesine yakınlık, ticari yönden olumlu özellikler, yeşil alanlar, semtin çevre kalitesi vb. arazinin özel bir parçasını kullanma hakkına sahip olan bireyler için önemli faydalar sağlamaktadır. Farklı bölgelerin farklı çevresel niteliklerinin olması taşınmaz değerlerinin de farklı olması ile sonuçlanmaktadır.

Tarımsal arazi pazarında her bir karakteristiğin örtülü fiyatı, belirtilen pazar içindeki tüm alım satımlardan ortaya çıkarılabilmektedir. Ayrıntılı olarak değinildiği gibi hedonik analizler,



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satılabilir bir varlık veya üründe bir araya getirilen çeşitli karakteristiklerin değerini belirlemek için geliştirilmiştir.

Sonuç itibarıyla hedonik fiyatlandırma yöntemi birbirini etkileyen çok sayıda farklılaşmış ürünlerin olduğu kompleks pazar yapılarının analizini az sayıda homojen niteliklerin basit analizine sadeleştirmesidir. Yöntemin güçlü yanı gerçek seçimlere dayanan değerleri tahmin etmek için kullanılabilmesidir. Yöntemin yoğun olarak kullanıldığı alan daha çok taşınmaz piyasaları göreceli olarak bilgiye karşılık vermede etkilidir. Taşınmaz satışları ve karakteristiklerine ait veriler birçok kaynakta hazır bulunmakta ve analiz için tanımlayıcı değişkenleri sağlamada ikincil veri kaynaklarıyla ilişkilendirilmektedir. Yöntem çok yönlüdür ve çeşitli olası pazar malları ve çevre kalitesi arasındaki ilişkiye uygulanabilmektedir. Yöntemin ana fikri tüketicilerin bir taşınmazı satın almak istediklerinde, çevresel ve konumsal karakteristiklerine dayanan kararlar vermesini sağlamaktır.

4. SONUÇ

Günümüzde kullanılmakta olan yöntemler ve özellikleri konusunda yapılan araştırmalarda değişik sonuçlarla karşılaşılmıştır. Örneğin; Nghiep (2001) çalışmasında multi regresyon ve yapay sinir ağları ile elde edilen sonuçlar karşılaştırılmıştır. Yapay sinir ağları ile yapılan uygulama multi regresyona göre daha iyi performans vermiştir. Bir başka çalışma da Lokshina (2014) tarafından yapılmış ve multi regresyon, yapay sinir ağları, bulanık sistemleri karşılaştırılmıştır. Taşınmaz değerlemesinde yapay sinir ağları bulanık mantığın ve uygulanabilirliğini ispat edilmiş ve yapay zeka metotları yardımı ile uygun sonuçların elde edildiğini gösterilmiştir. Ayrıca multi regresyon analizi ile yapılan uygulamanın ev değerleri için performansının iyi olduğu sonucuna varılmıştır. Yapay sinir ağları ve bulanık mantık yöntemlerinin nitekim pahalı bir yöntem olan Coğrafi Bilgi Sistemleriyle birleştirilmesiyle kıymet takdirlerinin hem doğruluk payı arttırılmış hem de daha az örnek kullanarak maliyette de önemli bir ucuzlama sağlanmıştır.

Tarımsal arazilerin kıymet takdiri konusunda gelir ve pazar değeri yönteminin yanı sıra hedonik fiyat yönteminden de yararlanılması elde edilen değer biçme sonuçlarına ilişkin detaylı bilgi elde edilmesine katkı sağlamaktadır. Bu bilgiler gelir yönteminin bazı eksikliklerini tamamlama ve sonuçlara katkı yapması açısından önemlidir. Çevre kalitesi kavramı toplumun herhangi bir doğal kaynaktan olan beklentilerinin karşılanma düzeyi olarak ifade edilebilir. Bu durum gayrimenkul ve tarımsal arazi değerini etkileyen faktörlerden birisidir. Çevre kalitesinin arazi



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değeri üzerine etki düzeyi hedonik fiyat yöntemi kullanılarak ölçülebilmektedir. Arazi değeri çevre kalitesinin yüksek olduğu bölgelerde artmakta, düşük olduğu bölgelerde ise azalmaktadır. Ülke ekonomisi için önem arz eden taşınmaz değerlendirmesinin bilimsel ve gerçekçi metotlara dayandırılması kaçınılmaz gerekliliktir. Çok hızlı gelişen bilgisayar teknolojilerinden yararlanarak daha çok veri hızlı ve daha doğru işlenebilir. Önemli olan değerlemede kullanılacak model seçimidir. Geliştirilen modelin, ülke ekonomisine katkı sağlamada, taşınmaz piyasa değerinin optimum değerde tespit edilmesinde gerçekçi bir yaklaşım sergilemesi gerekmektedir.

Ülkemizde de taşınmazların değerlerinin belirlenmesi amacı çalışmada sözü edilen yöntemlerin uygulanabilirliği araştırılmalı ve teknik alt yapı hizmetlerinin aktiflik kazanması sağlanmalıdır. Taşınmaz değerlendirmesinde yasal düzenlemeler öncelikli olarak ele alınmalı ayrıca ekspertizlik müessesesi oluşumunun hızlandırılması ve kıymet takdirinin kurumsallaştırılması gerekmektedir.



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KAYNAKLAR

- Alkay, E. 2002. Hedonik Fiyat Yöntemi ile Kentsel Yeşil Alanların Ekonomik Değerlerinin Ölçülmesi. Doktora Tezi. İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü, İstanbul.
- Boyacıgil, O. 2003. Hedonic Pricing Yönteminin İskenderun Kenti Örneğinde Uygulanması. Yayımlanmamış Yüksek Lisans Tezi. Çukurova Üniversitesi Peyzaj Mimarlığı Anabilim Dalı, Adana.
- Levent, H. 1995. Talep Teorisine Hedonik Yaklaşım ve Bir Uygulama: İstanbul'da Konut Fiyatlarının Oluşumu. İstanbul Üniversitesi Sosyal Bilimler Enstitüsü İktisat Anabilim Dalı, İstanbul.
- Lokshina, I. V. ve Bartolacci, M. R. 2014. Thinking eHealth: A Mathematical Background of an Individual Health Status Monitoring System to Empower Young People to Manage Their Health. International Journal of Interdisciplinary Telecommunications and Networking (IJITN), 6(3), 27-36.
- Mollard, A., Rambonilaza, M. ve Vollet, D. 2004. Market Structure and Environmental Amenities in Hedonic Pricing of Rural Cottages, No. 200427.
- Nghiep, N. ve Al, C. 2001. Predicting Housing Value: A Comparison of Multiple Regression Analysis and Artificial Neural Networks. Journal of Real Estate Research, 22(3), 313-336.
- Öztürk, M. 1985. Emlak Değerlemesi. Yüksek Lisans Tezi. Gazi Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.
- Pagourtzi, E., Assimakopoulos, V., Hatzichristos, T. ve French, N. 2003. Practice Briefing Real Estate Appraisal: A Review of Valuation Methods, Journal of Property Investment and Finance, Volume 21, No. 4.
- Şen, Z. 2004. Mühendislikte Bulanık (Fuzzy) Mantık ile Modelleme Prensipleri. Su Vakfı
- Şen, Z. 1998. Fuzzy Algorithm for Estimation of Solar Irradiation From Sunshine Duration. Solar Energy, 63(1), 39-49.
- Yomralıoğlu, T. 1997. Taşınmazların Değerlendirilmesi ve Kat Mülkiyeti Mevzuatı. JEFOD-Kentsel Alan Düzenlemelerinde İmar Planı Uygulama Teknikleri, 153-169.



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**BEEKEEPING POTENTIAL AND GENERAL EVALUATION STATUS OF AĞRI
PROVINCE**

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ABSTRACT

The province of Ağrı has an important potential in beekeeping with its rich flora in terms of vegetation, the blooming of plants at different times and the presence of local flowers. Due to the main problems such as the traditional methods of beekeeping in the province, the lack of knowledge of the producers, the inability to adequately fight bee diseases, the use of low-yielding bee colonies in the region, the individual marketing of the products by the producers, the inability to commercialize the products, the instability in the market of illegal products brought from border countries. beekeeping cannot turn into a commercial activity with high income. There is a need to carry out studies that will reveal the current situation, problems and solutions of beekeeping in the province, ensure the differentiation and originality of beekeeping production in the province, and turn it into a branded commercial product. With this review, it is aimed to reveal the current situation, production potential, problems and solution suggestions of beekeeping in Ağrı and to draw attention to scientific studies to be done on this subject.

Key words: Beekeeping, Ağrı Province



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INTRODUCTION

Beekeeping, as a tradition of Anatolian people, has been practiced in Türkiye since ancient times. Although it has a very old history, the development of beekeeping has been in the last centuries depending on the advances in science and technology. Although it has a very old history, the development of beekeeping has been in the last centuries depending on the advances in science and technology. In today's technical sense, beekeeping, which is an agricultural occupation and production branch on its own, can be defined as "the art of using and managing honey bees" for certain purposes. As in other production branches, the aim in beekeeping is to provide the highest income with the least expense (1-3).

Technical beekeeping and success are two basic interconnected elements. The level of these two basic elements determines the level of income to be obtained from beekeeping. It is impossible to talk about success and income in beekeeping that is not based on knowledge and experience and technical applications are not made. While an unprofessional, ordinary and old-fashioned beekeeping can be done by anyone, a technical and successful beekeeping can only be done by people who have knowledge and experience in this field (1,2).

Honey bees; In addition to producing and collecting products that are extremely valuable for human health and nutrition such as honey, beeswax, royal jelly, bee venom, pollen and propolis, they have a vital importance in natural balance and agricultural production with the pollination services they provide in natural and agricultural plants. For this reason, honey bees are used all over the world in order to increase both the above-mentioned valuable products and the amount and quality of products in plant production, and important benefits are obtained from honey bees (4).

Beekeeping is of particular importance for Türkiye, which is an agricultural country and nearly half of its population lives in villages. Beekeeping is the easiest way to create jobs and earning opportunities for citizens who do not have land or live in villages with little land, in and on the edge of the forest. Because beekeeping; It is not dependent on land, it can be done by every individual of the society such as men and women, young and old, educated or uneducated, without the need for much capital to begin with, and it starts to generate income in a short time like a year. Because of these features and the cheapest employment in agriculture, beekeeping is one of the most important agricultural activities of today (1-4).

On the other hand, the fact that Turkey has a very rich vegetation and different climatic zones contributes significantly to the development of our beekeeping. As a matter of fact, in the last



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10 years, our beehive presence and honey production have increased approximately twice, reaching 4 million and 63 thousand tons, respectively. In addition, Türkiye ranks 4th in the world in terms of both the number of beehives and honey production, which is a very positive development. Annual honey and beeswax production, with production values and prices in 2019, contributed around 140 quadrillion TL to our national economy. This contribution can be increased 2-3 times by increasing honey production per hive. Considering the contribution of beekeeping to plant production, it is estimated that the total contribution of this activity to the national economy is around 500 quadrillion (2).

BEEKEEPING IN AĞRI PROVINCE

In terms of beekeeping, Ağrı province has similar geographical features as seen in most of the highlands of the Eastern Anatolia Region. The terrain of Ağrı is rugged and the beekeeping season may last longer due to topographic differences in a narrow area. In addition to the height differences; Ağrı has a rich flora in terms of vegetation, blooming of plants at different times, and the abundance of local flowers. As it is known, the use of pesticides reduces the nectar resources that honey bees benefit from, and this causes both a decrease in colony yield and more intensive mobile beekeeping. In Ağrı, on the other hand, the fact that agricultural control activities are not very intense provides an important privilege in protecting both the honey quality and the bee population (5,6).

According to the data of Ağrı Provincial Directorate of Agriculture, beekeeping is carried out in all districts except Doğubayazıt district. In terms of the intensity of beekeeping activities, the province of Ağrı is divided into four sub-regions. The first region is the center of Ağrı, with the number of colonies reaching 16412, and the districts of Hamur and Eleşkirt. The number of hives per km² in this region is higher than the provincial average of 2.4 hives/km². There is an important beekeeping potential in the region where there are natural environmental conditions suitable for beekeeping. Although beekeeping is practiced in almost all parts of the center of Ağrı, Hamur and Eleşkirt districts, it is noteworthy that it is especially concentrated around the Murat River and its tributaries (Seryan and Cumaçay valleys) (5).

Patnos and Tutak counties form the second region with 6481 colonies, while the third region is made up of Taslıçay and Diyadin counties, where beekeeping is sparse and the number of colonies is up to 550. Patnos and Tutak counties form the second region with 6481 colonies, while the third region is made up of Taslıçay and Diyadin counties, where beekeeping is sparse



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and the number of colonies is up to 550. Mostly itinerant beekeepers come to these districts. Similarly, in the Diyadin and Taşlıçay districts, which form the third region, mobile beekeeping is generally practiced. In the district of Doğubayazıt, which constitutes the fourth region, there is no migratory beekeeping, and there is no data in the records of the Provincial Directorate of Agriculture and Forestry regarding the domestic beekeeping. In addition, the weak vegetation in the region, which has a barren land structure, adversely affects both domestic and wandering beekeeping (5,6).

PLANT FLORA OF AĞRI PROVINCE

The diversity in the flora of Ağrı province; The main natural steppe families in the study area and the main species belonging to these families are as follows: Gramineae (Buğdaygiller): *Alopecurus arundinaceus* (çayır tilki kuyruğu), *Elymus hispidus* (ayrık otu), *Bromus tomentellus* (delice), *Hordeum bulbosum* (yabani arpa), *stipa pantica* (kılıç otu), Leguminosae (Baklagiller): *Astragalus mikrocephalus* (geven), *Astragalus christianus* (geven), *Midecago sativa* (yonca), *Vicia crassa* (yabani fiğ), *Trifolium pratense* (çayır üçgülü), Compositae (Toplu çiçekgiller): *Artemisia absinthium* (gelin otu), *Artemisia austriaca* (küçük yavşan otu), *Artemisia spicigera* (yavşan otu), *Triple Urospermum trarscoucaci* (papatya), *Centaurea iberica* (kırmızı peygamber çiçeği), *Centaurea glastifolia* (sarı peygamber çiçeği) *Centaurea solstitialis* (çayır diken), *Cirsium arvense* (tarla diken), *Helichrysum plicatum* (yayla çiçeği) (5-7).

Labiatae (Baklagiller): *Teucrium orienal* (kirve otu), *Thymus Fallax* (kekik), *Mentha longitolia* (tüylü nane), *Teucrium chamaedrys* (yer meşesi), *Stachys lavandula folia* (mor çiçekli dağ çayı) (Gümüş,1990;33). Roseaceae (Gülgiller): *Sanguis-orba minor* (küçük çayır düğmesi), *Sarguisorba armena* (çayır düğmesi), Polygonaceae (çoban değeneğiller): *Polygonom bistorta* (çayır çoban deneği), *Rumex scutatus* (ekşi kulak), Papaveraceae (Haşhaşgiller): *Papau orientale* (yabani haşhaş), Boraginaceae (Hodangiller): *Anchusa leptophylla* (sığır dili), Euphorbiaceae (sütlegengiller): *Eupharbia virgata* (sütlegen), Solana ceace (patlıcangiller): *Hyoscyamus reticulatus* (mor çiçekli banotu), Convolvulaceae (sarmaşıkgiller): *Conculuulusarvensis* (tarla sarmaşığı), Umbelliferae (Maydanozgiller): *Eryngium billardieri* (boğa diken) (5-7).

This diversity in the flora seen throughout the field has created an important beekeeping potential in the region. This potential, which has not been adequately evaluated by local



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beekeepers, is partially utilized, especially by the many itinerant beekeepers who come to Ağrı every year (5-7).

PROPERTIES OF HONEY OF AĞRI PROVINCE

The beekeeping season, which lasts for approximately four months, is carried out in the mountains, plains and highlands throughout the province of Ağrı. Our city is located at an altitude of 1640 m above sea level. 46% of its land is mountainous areas, 29% is plains, 18% is plateaus and 7% is plateaus. Thanks to the natural and rich vegetation of many plains, plateaus and highlands, Ağrı becomes one of the production centers of natural honey (5).

HONEY PRODUCTION AMOUNTS IN AĞRI PROVINCE

In our province, the use of pesticides and/or chemical fertilizers is very small in our forests, meadows, pastures and non-agricultural areas (rocky swamp etc.) where environmental pollution is not experienced. In the last 5 years in our province, the number of hives has increased from 9,850 to 19,300 and the amount of honey produced has increased from 97 tons to around 200 tons. Our province, which has the largest certified organic agricultural areas in our country, is very suitable for the production of natural and high quality honey, primarily due to the presence of our nectar resources. There are 130-150 wandering beekeepers and 219 local beekeepers in our province. Despite the capacity of 20,000 beehives this year, our city has never faced a problem such as a lack of flora, with the presence of 50 thousand colonies together with the wandering beekeepers coming to our city (5,8).



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REFERENCES

TOB, Arı yetiştiriciliği. Tarım ve Orman Bakanlığı, [http://www.tarim.gov.tr/HAYGEM/Belgeler/Hayvancılık/KüçükEvcilYetiştiriciliği/Arıcılık/Arı Yetiştiriciliği.docx](http://www.tarim.gov.tr/HAYGEM/Belgeler/Hayvancılık/KucukEvcilYetistiriciligi/Aricilik/Arı Yetiştiriciliği.docx), 2016.

TKDK. Arıcılık Sektör Toplantısı Sonuç Raporu 2016. Tarım ve Kırsal Kalkınmayı Destekleme Kurumu, [https://www.tdk.gov.tr /Content/File/Yayin/Rapor/Aricilikv2.pdf](https://www.tdk.gov.tr/Content/File/Yayin/Rapor/Aricilikv2.pdf), 2016.

Yılmaz B. Türkiye’de arıcılık. Ormanlarımız ve Arıcılık Çalıştayı I (49-86), Bolu, 2015.

TEPGE. Arıcılık tarım ürünleri piyasaları raporu 2020-2. Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü Müdürlüğü, TEPGE <https://arastirma.tarimorman.gov.tr/tepge/>, 2020.

Kaya F. Ağrı ilinde arıcılık yapısı ve değerlendirme durumu. Atatürk Üniv Sosyal Bil Enst Derg. 2008; 12(2): 35-55.

Gümüş İ. Tahir dağları ve Güzeldere havzası (Ağrı) vejetasyonunun bitki sosyolojisi yönünden araştırılması. Atatürk Üniv Fen Bil Enst. Biyoloji Ana Bilim Dalı, Doktora Tezi, Erzurum, 1990.

Gümüş İ (1991). Tahir dağları ve güzeldere havzası (Ağrı) step vejetasyonunun bitki sosyolojisi yönünden araştırılması. Turk J Bot. 1991; 16: 153-175.

TÜİK, 2021. Türkiye İstatistik Kurumu, TÜİK <http://www.TÜİK.gov.tr>, Erişim tarihi: 11.10.2021.



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METHOD OF MEASURING INTRAOCULAR PRESSURE

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ABSTRACT

Intraocular pressure (IOP) measurement is a variable parameter; it is stated that it varies between 3-6 mmHg according to the technique used, the experience of the physician, the type of animal, different times of the day, stress, anesthesia application, choroidal blood flow, scleral stiffness, orbicularis oculi muscle tension, external pressure, heart rate and respiratory cycle. High IOP is the most important risk factor in glaucoma and is one of the most important parameters that guide the classification, diagnosis, treatment and follow-up of the disease. Therefore, it is extremely important to measure IOP accurately and reliably. The determination of the patient's true IOP is very important for reasons such as preventing unnecessary, excessive or inadequate treatments in glaucoma, a chronic disease, and keeping the progression under control. Instruments called tonometers are used to measure IOP. The common features of newly developed tonometries are that they are less affected by the corneal parameter.

Key words: Intraocular Pressure (IOP), Tonometer



INTRODUCTION

Intraocular pressure (IOP), defined as the pressure exerted by the aqueous humor on the cornea and sclera, is the single most important and modifiable risk factor for glaucoma. Therefore, accurate measurement of IOP is necessary in the diagnosis, treatment and follow-up of glaucoma (1). The most accurate method of measurement is undoubtedly manometric measurement, but it requires insertion of a cannula into the eye and obviously cannot be part of a routine examination (1,2). The technological journey of tonometric methods started with Sir William Bowman's emphasis on the importance of eye pressure. In 1826, Bowman reported that digitally assessing "ocular tension" was part of his routine examination. After this date, digital IOP measurement has been a method adopted by all ophthalmologists. At the end of the 1800s, mechanical tonometers began to be used. To date, many tonometers have been offered for use. The first tonometer designed by Donders was to measure by contacting the sclera. In the following years, the use of cocaine as a local anesthetic created an opportunity for tonometric methods to measure pressure from the corneal surface. In the early 1900s, H. Schiötz introduced the first mechanical tonometer, which is known by his name and is the most widely used (1-4).

TONOMETRY

Although monometer, which is based on the direct measurement of IOP with the cannulation of the anterior camera, is often preferred in experimental studies because it gives more precise results than non-invasive techniques, it has not been widely used in clinical practice because it requires an invasive procedure. As a result of technological advances in diagnostic ophthalmology, non-invasive tonometric techniques have been developed based on the principle of identification, applanation and rebound, which make very precise measurements (1, 3-5).

Indentation Type Tonometric Evaluation

Indentation type tonometric evaluation is performed using a Schiötz tonometer. This technique, which is easy to use, inexpensive and portable in humans, is not practical in practice because of potential measurement errors in cases where scleral hardness and corneal thickening are excessively increased or decreased, sudden changes in intraocular blood flow during buckling adversely affect the measurement results and the necessity of giving the patient an appropriate position during measurement. Its use has decreased considerably in recent years (3-6) .



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Tono-Pen (Tono-Pen AVIA®, Tono-Pen® XL Applanation Tonometer , Reichert, Inc.)

The first prototype of applanation tonometry is the Goldmann tonometer. Based on this, new generation portable tonometers named Perkins, Draeger, MacKay-Marg and Tono-Pen have been developed, which are less affected by parameters such as corneal thickness, corneal curvature and corneal structure and can be easily used in pediatric and bedridden patients. Halberg, Maklakoff and Pneumotonograph type fixed applanation tonometry are also available today. Applanation tonometers named Tonopen-XL, Tonopen Avia and Tonopen-Vet, which have been developed specifically for animals and have been widely used in veterinary medicine in recent years, are minimally affected by the lying position, posture and size of the animal, are easy to use, have practical and portable features (6-8).

Rebound Tonometre (iCARE, Tiolat, Oy, Helsinki, Finland)

Rebound tonometer (RT) is one of the most promising devices for IOP measurement. It is a portable tonometer that does not require topical anesthesia (9). It has a 50 mm long steel probe with a diameter of 1.4/1.0 mm. The risk of damaging the cornea is reduced, thanks to its round-tipped plastic-coated design. Since the tip (tip) is replaceable, there is no risk of corneal infection. Horizontal coaxial is sprayed from the cornea 4-8 mm by two magnets. The probe bouncing off the cornea induces a voltage in the solenoid (magnetic coil), which is converted into a digital signal. The obtained value is read on the LCD screen. An average of 6 measurements are made and the average of these values is taken (10). Its advantages are that it is small, light, portable, and provides comfortable measurement without the need for a slit lamp and local anesthetic. The new models can also be used in a lying position if desired. It can make rapid measurements in children, dementia and maladaptive patients. Since RT is a non-contact and anesthesia-free method, a model that can be used by patients at home has also been developed. Measurements with RT show a high correlation with Goldmann applanation tonometry (GAT). IOP measurements made with RT highly overlap with the GAT corrected values, but differently, the values measured with RT vary in accordance with the central corneal thickness values (11-15).



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REFERENCES

- Kulualp K, Kılıç S, Muzoğlu O. Glakomun veteriner cerrahi açısından değerlendirilmesi. F.Ü.Sağ.Bil.Vet.Derg. 2016; 30(1): 57-65.
- Gelatt KN, Gelatt JP. Small animal ophthalmic surgery. Practical techniques for the veterinarian. Oxford: Butterworth& Heinemann, 2001.
- Önol M, Aydın P, Akova YA. Temel göz hastalıkları. Ankara: Güneş Kitapevi, 2001.
- Rusanen E, Florin M, Hässig M, Spiess BM. Evaluation of a rebound tonometer (Tonovet) in clinically normal cat eyes. Veterinary Ophthalmology 2010; 13: 313-316.
- Gelatt KN. The canine glaucomas. In: Gelatt KN. (Editor). Veterinary Ophthalmology. 3rd Edition, Philadelphia: Lea & Febiger, 1999.
- Elbay A. Aplanasyon tonometreleri ile elde edilen göz içi basıncı değerlerinin güvenilirliğinin önemi. Uzmanlık Tezi, İstanbul: İstanbul Sağlık Müdürlüğü, 2008.
- Sarıcaoğlu MS. Yeni tonometreler ve göz içi basıncı ölçümünde yeni tartışma: Korneanın biyomekanik özellikleri. Glokom-Katarakt 2010; 5: 67-74.
- Andrade SF, Palozzi RJ, Giuffrida R, et al. Comparison of intraocular pressure measurements between the Tono-Pen XL® and Perkins® applanation tonometers in dogs and cats. Veterinary Ophthalmology 2012; 15 Suppl 1: 14-20.
- Sahin A, Basmak H, Niyaz L, Yildirim N. Reproducibility and tolerability of the ICare rebound tonometer in school children. J Glaucoma. 2007; 16: 185-188.
- Brusini P., Salvat M.L., Zeppieri M. Comparison of ICare tonometer with Goldmann applanation tonometer in glaucoma patients. J Glaucoma. 2006; 15: 213-217.
- Kageyama M., Hirooka K. Comparison of ICare rebound tonometer with noncontact tonometer in healthy children. J Glaucoma. 2011; 20(1): 63-66.
- Chui W, Lam A, Chen D. The influence of corneal properties on rebound tonometry. Ophthalmology. 2008; 115: 80-84.
- Yagci R, Eksioğlu U, Midillioglu I, Yalvac I, Altıparmak E, Duman S. Central corneal thickness in primary open angle glaucoma, pseudoexfoliative glaucoma, ocular hypertension, and normal population. Eur J Ophthalmol. 2005; 5(3): 324-328.
- Pakrou N., Gray T. Clinical comparison of the ICare tonometer and Goldmann applanation tonometry. J Glaucoma. 2008; 17: 43-47.
- Asrani S., Chatterjee A. Evaluation of the ICare rebound tonometer as a home intraocular pressure monitoring device. J Glaucoma. 2011; 20(2): 74-79.



**ŞİRAZ (*Vitis vinifera* L.) ÜZÜM ÇEŞİDİNDE FARKLI BUDAMA
UYGULAMALARININ YAŞ ÜZÜM VERİMİNE VE BAZI POMOLOJİK
ÖZELLİKLERE ETKİSİ**

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ÖZET

Bu çalışma, önemli şaraplık üzüm çeşitlerinden biri olan Şiraz üzüm çeşidinin, tek kollu kordon terbiye şeklinde farklı budama uygulamalarına karşı göstermiş olduğu tepkilerin belirlenmesi amacıyla yürütülmüştür. Kış budamasında omca üzerinde farklı çubuk sayısı ve göz düzeyi bırakılacak şekilde budamalar yapılmış ve hasadı takiben yaş üzüm verimi ile bazı pomolojik özelliklerin değişimi incelenmiştir. Elde edilen bulgular hem çubuk sayısı x göz düzeyi değişimine hem de budama şarjının değişimine göre değerlendirilerek, asmalarda budama şarjı araştırmalarının sınırlılıkları tartışılmıştır. Şiraz üzüm çeşidinde budama şarjının artışına bağlı olarak yaş üzüm verimi ve salkımların fiziksel özellikleri olumlu etkilenmiş buna karşın suda çözünebilir kuru madde ve titrasyon asitliği düşüş göstermiştir. Tanelerin fiziksel özellikleri üzerine ise budama şarjlarının etkisi sınırlı bulunmuştur. Buna karşın bulguların çubuk sayısı ve göz düzeyi değişimine göre değerlendirilmesinin, incelenen özelliklerin çoğunda detaylı ve anlamlı sonuçlara ulaşmada daha geçerli olduğu görülmüştür. Ayrıca budama şarjı uygulamaları arasında saptanan farklılıkların temelinde, omcalar üzerinde bırakılan çubuk sayısının etkisinin olduğu ortaya konmuştur. Tek kollu kordon terbiye şeklinde yetiştirilen Şiraz üzüm çeşidinde kış budaması yapılırken, omcalar üzerinde 4 çubuk bırakılması ve çubuklar üzerinde 4 veya 5 göz bırakılmasının, üzüm verimi ve kalitesini arttırmak için önerilebileceği belirlenmiştir. Bununla birlikte farklı budama uygulamalarına tabi tutulmuş Şiraz üzüm çeşidinde, salkım sayısı ($r=0.887$, $p\leq 0.01$), salkım eni ($r=0.376$, $p\leq 0.01$), salkım boyu ($r=0.463$, $p\leq 0.01$), tane eni ($r=0.304$, $p\leq 0.01$) ve tane boyunun ($r=0.310$, $p\leq 0.01$) artışına paralel olarak yaş üzüm veriminin arttığı saptanmıştır. Ancak suda çözünebilir kuru madde içeriği ($r=-0.560$, $p\leq 0.01$), şıranın asitliği ($r=-0.587$, $p\leq 0.01$) ve titrasyon asitliğinin ($r=-0.507$, $p\leq 0.01$), verimin artışına paralel olarak azaldığı belirlenmiştir.

Anahtar Kelimeler: Budama şarjı, çubuk sayısı, göz düzeyi, tek kollu kordon



**THE EFFECT OF DIFFERENT PRUNING APPLICATIONS ON GRAPE YIELD
AND SOME POMOLOGICAL CHARACTERISTICS IN SHIRAZ (*Vitis vinifera* L.)
GRAPE VARIETY**

ABSTRACT

This study was carried out to determine the reactions of the Shiraz grape variety, which is one of the important wine grape varieties, to different pruning applications in the single cordon training system. In winter pruning, pruning was done in such a way that the different numbers of offshoots and buds were left on the vine, and the change in fresh grape yield and some pomological characteristics after harvest was investigated. The findings were evaluated according to both the number of offshoots x buds change and the change of crop loading levels, and the limitations of crop loading studies in vines were discussed. Depending on the increase in the crop loading levels on the Shiraz grape variety, the fresh grape yield and the physical properties of the clusters were positively affected, whereas the soluble solids and titration acidity decreased. However, the effect of crop loading levels on the physical properties of the berries was found to be limited. On the other hand, it was seen that the evaluation of the findings according to the number of offshoots and buds change was more valid in reaching detailed and meaningful results in most of the examined features. In addition, findings revealed that the number of offshoots left on the vines was the main factor of the differences determined between crop loading applications. It has been determined that when winter pruning is done in Shiraz grape variety grown in a single cordon training system, leaving 4 offshoots on the vines and leaving 4 or 5 buds on the offshoots could be recommended to increase the grape yield and quality. Also, it was determined that the fresh grape yield increased in parallel with the increase in the number of clusters ($r=0.887$, $p\leq 0.01$), cluster width ($r=0.376$, $p\leq 0.01$), cluster length ($r=0.463$, $p\leq 0.01$), berry width ($r=0.304$, $p\leq 0.01$), and berry length ($r=0.310$, $p\leq 0.01$) in the Shiraz grape variety, which was applied to different prunings. On the other hand, findings revealed that the soluble solids ($r=-0.560$, $p\leq 0.01$), the acidity of the must ($r=-0.587$, $p\leq 0.01$), and titration acidity ($r=-0.507$, $p\leq 0.01$) decreased in parallel with the increase in yield.

Keywords: Crop loading, offshoot number, bud level, single cordon



1. GİRİŞ

Asmalara kış dönemlerinde uygulanan budamalar ve omcalara verilen terbiye şekilleri, üzüm verimi ve kalitesi üzerinde oldukça etkili unsurlardır (Ağaoğlu, 1969; Çelik ve ark., 1998; Çelik, 2017). Asmalara verilen terbiye şekilleri; bağın tesis edildiği yörenin ekolojik koşullarına, üreticinin bağ tesisi için sahip olduğu yatırım sermayesine, üreticinin bağcılık konusundaki bilgi düzeyine, üretim amacına vb. etkenlere bağlı olarak değişim gösterebilmektedir (Çelik ve ark., 1998; Doğan Yıldırım, 2011; Çakır ve ark., 2017; Gazioğlu Şensoy ve ark., 2020). Buna karşın asmalara uygulanan kış budaması öncelikle omcalara verilen terbiye şekillerine göre değişiklik göstermektedir. Terbiye şeklinin yanı sıra kış budamasının uygulanış şeklini etkileyen diğer faktörler; bağdan elde edilecek ürün veya ürünlerin değerlendirilme yöntemi, yörenin iklimsel özellikleri, omcaların gelişim düzeyi, bağın bakım düzeyi, üreticinin budama konusundaki bilgisi ve deneyimi ve son olarak yetiştiriciliği yapılan üzüm çeşididir (Çelik ve ark., 1998; Creasy ve Creasy, 2009).

Genel olarak çok şiddetli budamalar asmanın fizyolojik dengesini olumsuz yönde etkilemekte, verimliliği düşürmektedir (Çelik ve Tekintaş, 2004). Bunun aksine omcalar yeterli düzeyde budanmazlarsa, yeşil aksamın çoğalmasına, sürgünlerin zayıf kalmasına hatta çalılışmaya neden olmaktadır (Yılmaz, 1994). Bu nedenle bağcılık yapılan yörelerde, yetiştirilen farklı üzüm çeşitlerinin optimum budama düzeylerinin tespit edilmesi gerekmektedir.

Daha önce yapılan araştırmalarda her üzüm çeşidinin farklı budama isteğinin olduğuna dikkat çekilmiştir (Karataş ve Ağaoğlu, 2005). Burada ifade edilen budama isteği, çubuklara yani bir yaşlı dallara uygulanan kesim düzeyidir. Her ne kadar üzüm çeşitlerinin kısa ampelografilerinde budama istekleri daha basit ve kolay anlaşılabilmesi amacıyla “kısa”, “yarı uzun” veya “uzun” olarak ifade edilmekteyse de aslında bu ifadelerde de belirli göz düzeyleri yani göz sayıları belirtilmektedir (Çelik ve ark., 1998; Çelik, 2006; Çelik, 2011). Üzüm çeşidine göre kış budamasında çubuklarda yapılacak kesimlerin düzeyinin değişiklik gösterdiği değerlendirilmesinin temeli; verimli göz düzeylerinin çeşitlere göre farklılık göstermesine dayanmaktadır (Çelik, 1999; Dardeniz ve Kısmalı, 2005; Başaran, 2006). Nitekim farklı üzüm çeşitlerinde verimli göz düzeyinin belirlenmesi amacıyla yürütülen çalışmalarda en verimli gözler 2-9 arasında değişim göstermiştir (Çelik, 1999; Ferrer ve ark., 2004; Akın ve ark., 2011; Leão ve ark., 2017; Uyak ve Doğan, 2018; Şen ve Atak, 2020). Bununla birlikte omca üzerinde bırakılan göz sayısı veya belirli bir birim alana düşen göz sayısına göre de verimliliğin ve üzüm kalitesinin değiştiğini bildiren, “budama şarjı” veya “ürün yükü” çalışmalarına da literatürde



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rastlanmaktadır (Akın ve Kısmalı, 2004; Polat ve Uzun, 2007; Topuz, 2013; Dölek ve ark., 2020). Buna karşın Akın (2003), belirli bir çeşidin değişik ekolojilerde gereksinim duyduğu yükleme (şarj) seviyesinin değişiklik gösterebileceğini bildirmiştir.

Üzüm çeşitlerinin verimliliklerini ve üzümlerin kalitesini etkileyen kış budamalarında, yalnızca çubuklarda bırakılan göz sayısını veya omcada bırakılan toplam göz sayısını belirten budama şarjını dikkate almak doğru bir yöntem olmayabilir. Nitekim göz verimliliği dikkate alınarak çubuklarda belirli bir sayıda göz bırakılsa dahi omca üzerinde bırakılan çubuk sayısı da verimliliği etkileyebilir. Benzer bir şekilde omca üzerinde bırakılan toplam göz sayısı sabit tutulsa bile çubuklarda farklı sayıda göz bırakmak da verimliliği etkileyebilir. Nitekim Çelik (2017), telli terbiye sistemlerinde ürün yükünün önceden belirlenmesinde, sürgün sayısı üzerinden hareket edilmesinin yeni ve daha doğru bir yaklaşım olduğunu aktarmıştır. Delice ve Çelik (2005) ise sürgün pozisyonunun, hem vegetatif gelişme üzerinde etkili olduğunu hem de bu sürgünler üzerinde oluşturulan üzümlerin kalite parametrelerini etkilediğini bildirmiştir. Söz konusu etkenler dikkate alındığında; her çeşit için farklı terbiye şekillerinde en yüksek verimliliği ve üzüm kalitesini sağlayacak çubuk sayısı ve göz düzeyinin belirlenmesi gerekmektedir. Bu sayede hem çeşitlerin budamaya verdikleri tepkiler ortaya konulabilir hem de fizyolojik denge sağlanabilir (Oraman, 1965; Akın ve ark., 2011).

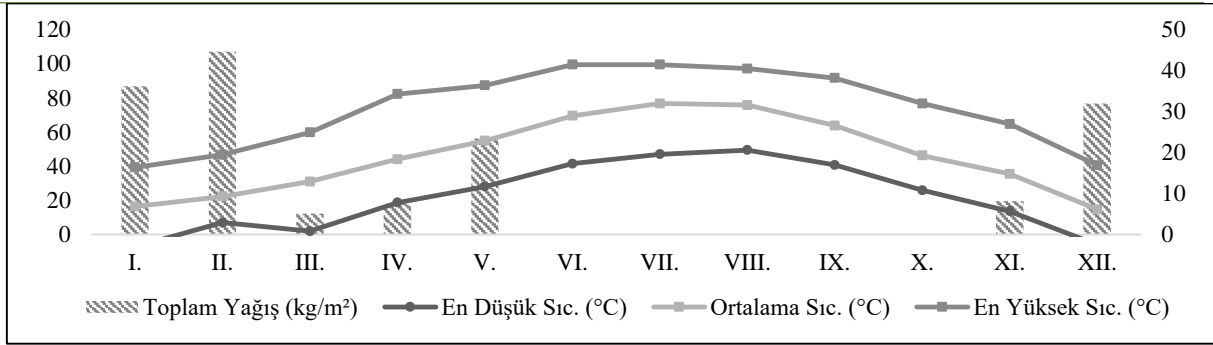
Bu çalışmada, hem şaraplık üzüm üretiminde dünyada önemli bir konuma sahip olan Şiraz üzüm çeşidine tek kollu kordon terbiye şeklinde en uygun budama şeklinin tespit edilmesi hem de budama şarjı ile çubuk-göz sayısı uygulamalarının karşılaştırılması amaçlanmıştır.

2. MATERYAL-YÖNTEM

Bu çalışma Şanlıurfa'da, 1103 P anacı üzerine aşılı Şiraz (*Vitis vinifera* L.) üzüm çeşidinde yürütülmüştür. Çalışmada bitkisel materyal olarak yer alan omcalar 9 yaşında olup, tek kollu kordon terbiye şeklinde ve 1.5 m x 3 m aralıklarda yetiştirilmiştir. Çalışmanın yürütüldüğü yöredeki üreticilerin bağlarında sürdürdükleri kültürel uygulama modelleri dikkate alınarak deneme sezonunda bağda sulama yapılmamış ancak tarımsal mücadele yöntemleri uygulanmıştır. Vegetatif gelişme kuvvetleri ve verimlilikleri benzer düzeyde olan omcalar bir yıl önceden tespit edilerek işaretlenmiş ve 2013 yılı Şubat ayında budama uygulamalarına tabi tutulmuştur. Bağın, çalışmanın yürütüldüğü yıla ait bazı iklimsel verileri Şekil 1'de sunulmuştur.



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Şekil 1. Çalışmanın yürütüldüğü bağın aylık yağış ve sıcaklık verileri (2013 yılı)

Çalışmanın konusunu oluşturan; farklı çubuk ve göz düzeyinden yapılan budama uygulamaları Çizelge 1 'de belirtilmiştir. Omca üzerinde bırakılan çubuklar benzer kalınlıkta olup, birden fazla çubuk bırakılan konularda çubuklar arası mesafe 20-25 cm olacak şekilde deneme tasarlanmıştır. Deneme bölünmüş parseller deneme desenine göre üç tekerrürlü olarak yürütülmüş ve her tekerrürde 9 omca yer almıştır.

Çizelge 1. Çalışmada Şiraz/1103P çeşidine etkileri incelenen farklı budama uygulamaları

Omcada Bırakılan Çubuk Sayısı		Çubukta Bırakılan Göz Sayısı			
1 Çubuk	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz
2 Çubuk	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz
3 Çubuk	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz
4 Çubuk	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz

Çalışmada, farklı budama uygulamalarına bağlı olarak değişimleri incelenen özellikler şunlardır; yaş üzüm verimi, salkım sayısı, salkım uzunluğu ve genişliği, tane eni ve boyu, tane ağırlığı, suda çözünebilir kuru madde kapsamı (SÇKM), şıranın asitliği (pH), titrasyon asitliği (TA) ve olgunluk indisi. Yaş üzüm verimi Cangi ve ark. (2011)'nin, salkım sayısı ise Noyaner (2004)'in bildirdiği yöntemle belirlenmiştir. Salkım boyutları Çelik (2003)'in yöntemine göre şerit metre kullanılarak ölçülmüştür. Tane boyutları Ağaoğlu (1999)'nun belirtmiş olduğu tane morfolojisi tanımı esas alınarak, Noyaner (2004)'ün yöntemiyle belirlenmiştir. SÇKM el refraktometresi ile belirlenmiştir (McCraw ve ark., 2005). Şıranın asitliğini belirlemek için salkımlardan rastgele seçilen 250 g tanenin şırası elle çıkarılmış ve dijital pH metre ile asitlik düzeyi belirlenmiştir (Foott ve ark., 1989; Harbertson ve Keller, 2012). Asitlik ölçümleri yapılan şıralarda daha sonra Cemeroğlu (1992)'nin bildirdiği metot kullanılarak tartarik asit cinsinden titrasyon asitliği belirlenmiştir. Olgunluk indisi, SÇKM'nin titrasyon asitliğine oranlanması ile belirlenmiştir (Ergenoğlu ve ark., 1999).

Elde edilen bulgular hem çubuk x göz sayısı gruplarına (20 grup) hem de budama şarjı gruplarına (13 grup) göre ayrı ayrı değerlendirilmiştir. Bu amaçla veriler, Minitab 18.0 istatistik



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programında varyans analizine tabi tutulmuş ve grupların ortalama değerleri arasındaki farklılıklar, Tukey çoklu karşılaştırma testinden yararlanılarak belirlenmiştir.

3. ARAŞTIRMA BULGULARI VE TARTIŞMA

Elde edilen bulgulara göre Şiraz üzüm çeşidinin yaş üzüm verimi, kış budamasında omca üzerinde bırakılan çubuk sayısı ve çubukların göz sayısı interaksyonunda yer alan gruplara göre farklılık ($p \leq 0.01$) göstermiştir (Çizelge 2). En yüksek yaş üzüm verimi ($1101.1 \text{ kg da}^{-1}$), 4 çubuk-5 göz budama uygulamasından elde edilmiştir. Omca üzerinde bırakılan çubuk sayısından bağımsız olarak göz sayıları incelendiğinde; çubuklar üzerinde 4 veya 5 göz bırakmanın diğerlerine göre üzüm verimini arttırdığı saptanmıştır.

Göz sayılarını dikkate almadan yalnızca çubuk sayıları bakımından bir karşılaştırılma yapıldığında ise; omca üzerinde 4 çubuk bırakmanın diğerlerine göre daha yüksek verim almayı sağladığı görülmüştür. Bununla birlikte genel olarak çubuk sayısı arttıkça üzüm verimi de artış göstermiştir. Ancak bu değişimin belirli bir çubuk sayısından sonra durağanlaşacağı ve sonrasında olumsuz etki yapacağı unutulmamalıdır. Her ne kadar bu çalışmada omca üzerinde bırakılan en fazla çubuk sayısı 4 ise de gelecek çalışmalarda daha fazla çubuk bırakmanın etkisi incelenmeli ve verimliliğin tepe noktası saptanmalıdır.

Çizelge 2. Farklı çubuk sayısı ve göz düzeyinde budamanın Şiraz üzüm çeşidinin yaş üzüm verimine etkisi (kg da^{-1})

	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz	Çubuk Ort.
1 Çubuk	175.4 e**	189.8 e	285.3 de	307.5 de	229.8 e	237.5 C**
2 Çubuk	148.7 e	179.3 e	301.9 de	251.4 de	283.1 de	232.9 C
3 Çubuk	306.4 de	412.9 cde	471.8 cde	504.5 b-e	619.4 bcd	463.0 B
4 Çubuk	341.9 de	470.6 cde	733.7 abc	870.2 ab	1101.1 a	703.5 A
Göz Ort.	243.1 C**	313.2 BC	448.2 AB	483.4 A	558.3 A	

*: $p \leq 0.05$, **: $p \leq 0.01$, öd: önemli değil

Farklı harflerle (a, b, c, A, B, C vb.) belirtilen gruplar arasında istatistiki olarak anlamlı farklılıklar vardır.

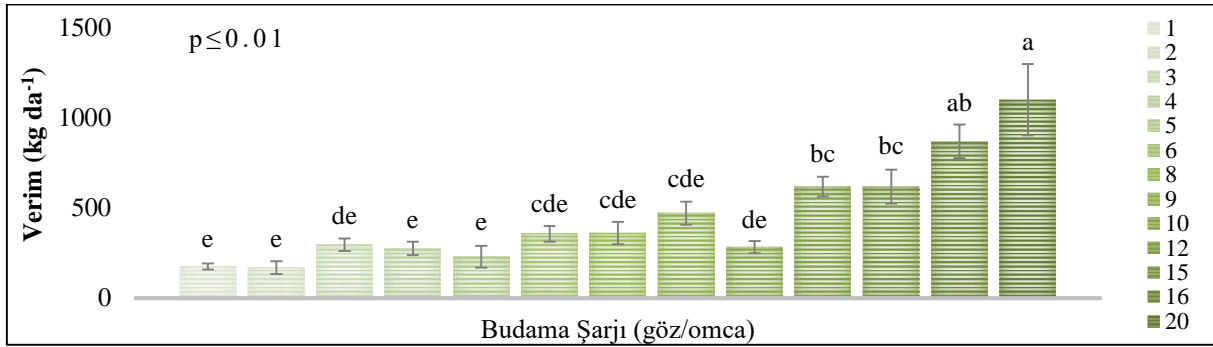
Omcaların gelişme kuvvetlerine göre taşıyabilecekleri ürün yükü değişmektedir (Karataş ve Ağaoğlu, 2005). Omcaların gelişme kuvveti ve verimliliği, pek çok faktörün etkisiyle değişim göstermektedir (Çelik, 1999). Ağaoğlu ve ark. (2010)'na göre omcalarda fizyolojik denge kurulamazsa hem meyvelerin kalitesi hem de bitkilerin verimliliği olumsuz etkilenmektedir. Bununla birlikte, bağcılıkta kış budamasına ilişkin budama şarjı çalışmalarıyla karşılaştırma yapabilmek için bu çalışmadan elde edilen veriler, budama şarjına göre incelendiğinde; her ne kadar genel olarak omca başına düşen göz sayısının artışına bağlı olarak üzüm verimi artış göstermişse de bazı çelişkili sonuçlar dikkat çekmiştir. 6, 8 ve 9 göz omca⁻¹ şarjlarına kıyasla



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10 göz omca⁻¹ şarjında daha düşük verim elde edilmesi, 15 ve 16 göz omca⁻¹ şarjları arasındaki farklılığın (yaklaşık %40 artış), 12 - 15 ve 6 - 8 - 9 şarjları arasında saptanmamış olması bunların bazılarıdır (Şekil 2). Bu bulgular ışığında iki farklı değerlendirme yapılabilir. Bunlardan ilki; düşük şarj uygulamaları arasında verimlilik bakımından büyük farklılıkların görülmemesi, omcaların sert budamaya benzer tepkileri vermesinden kaynaklanmış olabilir. İkinci ve daha muhtemel değerlendirmeye göre; verimliliği etkileyen ana unsur omca üzerinde bırakılan toplam göz sayısı değil, bu gözleri taşıyan çubukların sayısı ve dolayısıyla her çubukta yer alan gözlerin sayısıdır. Asmalarda göz verimliliği üzerine yapılan araştırmalar da ikinci değerlendirmeyi destekler bulguları ortaya koymakta ve çubuk üzerinde yer alan her gözün salkım oluşturma potansiyelinin farklı olduğuna işaret etmektedir (Akın ve ark., 2011; Uyak ve Doğan, 2018; Gutiérrez-Gamboa ve ark., 2018).



Şekil 2. Şiraz üzüm çeşidinin yaş üzüm verimine farklı budama şarjlarının etkisi

Şiraz üzüm çeşidinin omcalarında salkım oluşumu üzerine çubuk x göz interaksiyonunda yer alan grupların etkisi istatistiki olarak anlamlı bulunmamıştır. Buna karşın kış budamasında, hem omca üzerinde bırakılan çubuk sayısının hem de çubuklar üzerinde bırakılan göz sayısının birbirlerinden bağımsız olarak salkım sayısı üzerinde etkili oldukları saptanmıştır (Çizelge 3). Çubuklar üzerinde bırakılan göz sayısının artışına paralel olarak, omca üzerinde oluşan salkım sayısı artış göstermiştir. Benzer bir şekilde çubuk sayısının artışı da salkım oluşumunu etkilemiştir. Bununla birlikte bir omca üzerinde çok salkım oluşumu her zaman istenen bir durum değildir. Şiraz gibi şaraplık çeşitlerde birim alandan elde edilen şıra miktarı üreticiler açısından daha önemli iken sofralık çeşitlerde, salkım sayısının artışı çoğu kez tanelerin iriliğinin azalmasıyla sonuçlanmakta ve arzu edilmemektedir (Khadiji-Khub ve ark., 2014; Odabaşoğlu, 2020). Şaraplık çeşitlerde ise salkım sayısının artışı ile şıra randımanının olumsuz etkilendiği, Bekar ve Cangi (2018) tarafından bildirilmiştir.



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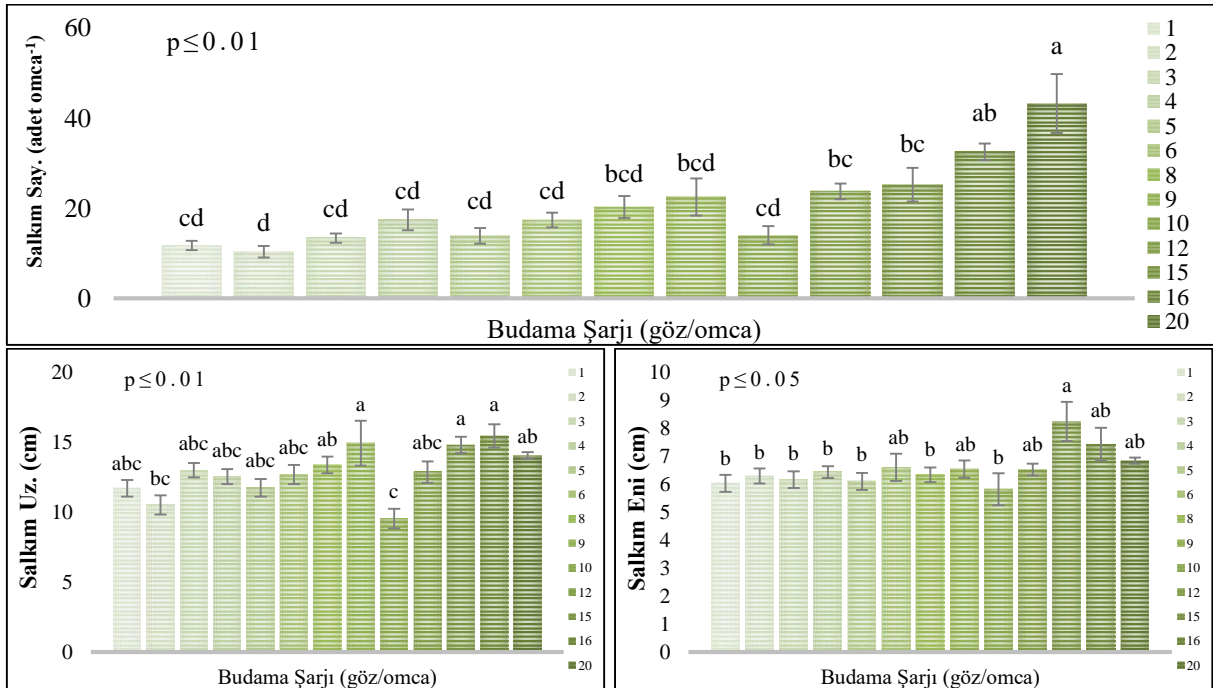
Çizelge 3. Farklı çubuk sayısı ve göz düzeyinde budamanın Şiraz üzüm çeşidinde salkım sayısına etkisi (adet omca⁻¹)

	1 Göz	2 Göz	3 Göz	4 Göz	5 Göz	Çubuk Ort.
1 Çubuk	11.8 ^{öd}	12.8	14.0	17.0	13.9	13.3 C**
2 Çubuk	11.0	9.8	17.3	16.0	14.0	14.2 C
3 Çubuk	12.8	17.5	22.5	21.3	25.3	19.9 B
4 Çubuk	22.5	24.5	26.3	32.5	43.3	29.8 A
Göz Ort.	14.5 C**	16.1 BC	20.0 ABC	21.7 AB	24.1 A	

*: p≤0.05, **: p≤0.01, öd: önemli değil

Farklı harflerle (a, b, c, A, B, C vb.) belirtilen gruplar arasında istatistiki olarak anlamlı farklılıklar vardır.

Salkım sayısının budama şarjına göre değişimi incelendiğinde ise 10 göz omca⁻¹ şarjından itibaren budama şarjının artışıyla paralel olarak artış gösterdiği saptanmıştır (Şekil 3). Buna karşın aynı değişim 1.'den 6. göz omca⁻¹ şarjına kadar görülmemiştir. Ayrıca 6.-9. göz omca⁻¹ şarjları arasında kısmi artış, 9.-10. göz omca⁻¹ şarjları arasında ise keskin düşüş yaşanmıştır. Genel olarak kış budaması sonrasında, bir omca üzerinde kalan göz sayısının artışına paralel olarak toplam salkım sayısının artışı beklenen bir durumdur (Babalık ve ark., 2013). Söz konusu değişim, çubuk sayısının artışıyla paralel olduğunda yani göz sayısını arttıran etken çubuk sayısı olduğunda ya da uç gözleri verimli çeşitler incelendiğinde daha net görülebilmektedir. Nitekim Sinciri, Trakya İlkeren ve Early Sweet gibi uç gözleri verimli çeşitler üzerinde yapılan araştırmalar, yukarıdaki değerlendirmeyi destekler niteliktedir (Değirmenci, 2019; Balbaba, 2020; Dölek ve ark., 2020).





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Salkım boyutlarına (uzunluk-en) budama şarjlarının etkisi istatistiki olarak anlamlı bulunmuş buna karşın çubuk x göz interaksionunda yer alan gruplar arasında her iki özellik bakımından da istatistiksel olarak anlamlı bir farklılık olmadığı belirlenmiştir (Şekil 3 ve Çizelge 4). Salkımların boyutlarına, çubuklar üzerinde yer alan göz sayısının tek başına etki etmediği görülmüştür. Buna karşın omca üzerinde bırakılan çubuk sayısı her iki özelliği de etkilemiştir. Nitekim budama şarjına ilişkin bulgular da bu değerlendirmeyi desteklemektedir. 10 göz omca⁻¹ şarjının diğer şarj uygulamalarına kıyasla daha küçük salkımlara sahip olması, 2 çubuk 5 göz budamasının bu şarjı oluşturmasından kaynaklanmaktadır. Oysaki 9, 15, 16 ve 20 göz omca⁻¹ şarjları daha fazla çubuğun bırakıldığı uygulamalar olup, bunların salkım boyutları diğerlerine nispetle daha büyüktür. Bulgulara dayanarak, kış budamasında tek kollu kordon terbiye şekli verilmiş Şiraz üzüm çeşidi omcalarında 3 veya 4 adet çubuk bırakılmasının, 1 veya 2 adet çubuk bırakılmasına kıyasla salkımların daha büyük olmasını sağlayacağı söylenebilir.

Tane boyutlarının çubuk x göz interaksionunda yer alan gruplara bağlı olarak değişim gösterdiği saptanmıştır. En büyük taneler (uzunluk-en), 4 çubuk-3 göz uygulamasından elde edilmiştir (Çizelge 4).



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Çizelge 4. Farklı çubuk sayısı ve göz düzeyinde budamanın Şiraz üzüm çeşidinin salkım boyutlarına ve tanelerin fiziksel özelliklerine etkisi

Çubuk	Göz	Salkım Uz. (cm)	Salkım Eni (cm)	Tane Uz. (mm)	Tane Eni (mm)	100 tane ağı. (g)
1	1	11.7 ^{öd}	6.0 ^{öd}	12.1 b ^{**}	11.2 b ^{**}	116.0 ^{öd}
	2	11.2	6.7	12.6 b	11.6 b	111.7
	3	12.2	6.1	12.5 b	11.5 b	110.5
	4	12.8	6.5	12.8 b	11.8 b	120.2
	5	11.7	6.1	13.0 b	11.7 b	124.5
2	1	9.8	5.9	12.9 b	11.9 b	105.7
	2	11.0	6.0	13.5 b	12.2 ab	115.7
	3	12.2	6.8	12.6 b	11.8 b	114.6
	4	13.4	6.2	11.8 b	11.2 b	103.6
	5	9.5	5.8	13.1 b	12.3 ab	114.4
3	1	13.8	6.3	13.2 b	12.2 b	134.8
	2	13.2	6.4	13.3 b	11.9 b	125.1
	3	14.9	6.5	12.9 b	12.1 b	135.9
	4	12.8	6.6	12.5 b	11.5 b	110.0
	5	14.8	8.2	13.3 b	12.6 ab	135.6
4	1	13.8	6.8	13.0 b	11.8 b	128.9
	2	13.4	6.5	12.5 b	11.4 b	114.9
	3	13.0	6.5	18.0 a	13.9 a	120.4
	4	15.4	7.4	12.4 b	11.3 b	108.6
	5	14.1	6.8	13.1 b	12.2 b	129.7
Çubuk Ort.	1	11.9 B ^{**}	6.3 B [*]	12.6 B ^{**}	11.6 B [*]	116.6 AB ^{**}
	2	11.2 B	6.1 B	12.8 B	11.9 AB	110.8 B
	3	13.9 A	6.8 A	13.0 AB	12.0 AB	128.3 A
	4	13.9 A	6.8 A	13.8 A	12.1 A	120.5 AB
Göz Ort.	1	12.3 ^{öd}	6.3 ^{öd}	12.8 B ^{**}	11.8 AB ^{**}	121.3 ^{öd}
	2	12.2	6.4	12.9 B	11.8 AB	116.9
	3	13.1	6.5	14.0 A	12.3 A	120.3
	4	13.6	6.7	12.4 B	11.4 B	110.6
	5	12.5	6.8	13.1 AB	12.2 A	126.0

*: p≤0.05, **: p≤0.01, öd: önemli değil

Farklı harflerle (a, b, c, A, B, C vb.) belirtilen gruplar arasında istatistiki olarak anlamlı farklılıklar vardır.

Tane boyutlarını, çubuk sayısının ve göz düzeyinin birbirlerinden bağımsız olarak da etkiledikleri saptanmıştır (Çizelge 4). Benzer bir şekilde budama şarjlarının da tane boyutları üzerindeki etkileri istatistiksel olarak anlamlı bulunmuştur (Şekil 4). 12 göz omca⁻¹ budama şarjının, tane iriliğini diğerlerine göre arttırdığı belirlenmiştir. Tanelerin fiziksel yapısında budama şarjına bağlı olarak gerçekleşen değişimin temel nedeni muhtemelen çubuk sayısından ileri gelmektedir. Nitekim çubuk sayısının artışına paralel olarak taneler büyümüştür. Buna karşın göz sayısı ile tane boyutları arasında aynı doğrusal ilişki görülmemiştir. 3 ve 5 göz bırakılan uygulamalar bu özellikler bakımından tepe değerlerini oluşturmuş ancak 1, 2 ve 4 göz bırakılanlar daha küçük tanelerin oluşumuna neden olmuşlardır.

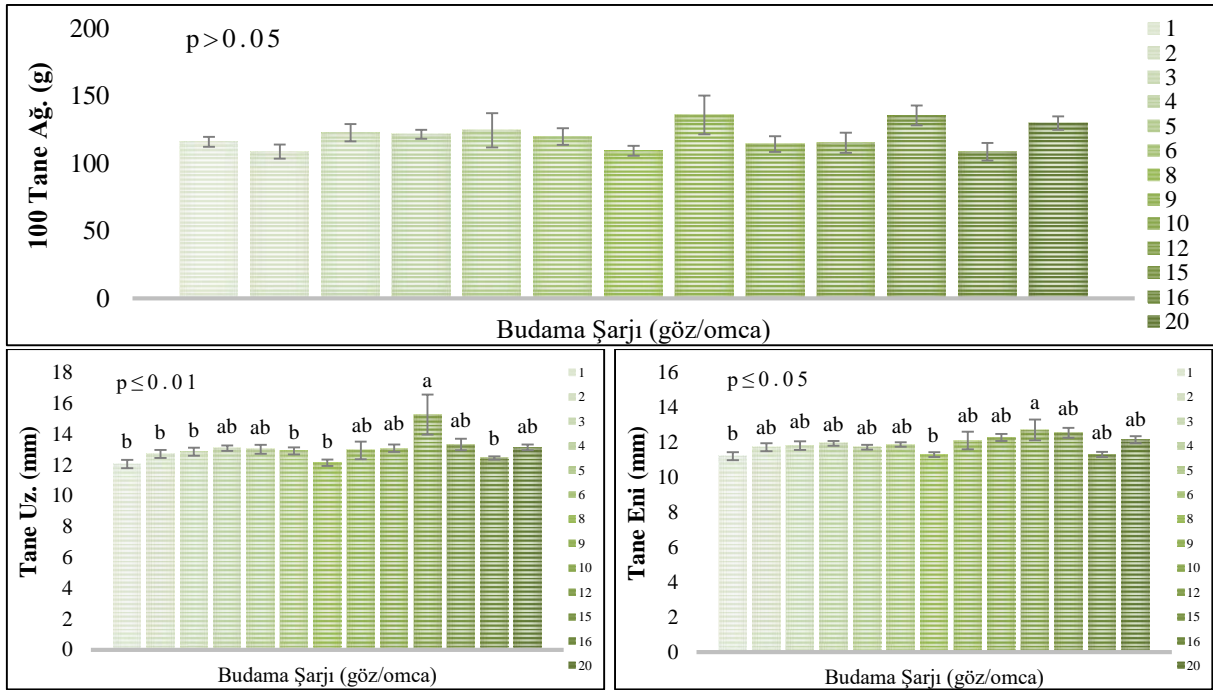
Göz sayılarının tane boyutları üzerindeki etkilerini, salkım rekabeti ya da tane rekabeti ile de açıklamak oldukça güçtür. Nitekim hem salkım sayısına ilişkin bulgular hem de salkım



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boyutlarına ilişkin bulgular, farklılığın rekabete dayalı gerçekleştiğine işaret etmemektedir. Daha fazla kış gözünün daha çok yazlık sürgün oluşturmaları sayesinde; toplam asimilasyon miktarının artışına paralel olarak böyle bir değişimin gerçekleştiğini söylemek de pek mümkün değildir. Zira böyle bir durumda göz sayısı arttıkça tane ağırlığının da artış göstermesi gerekir ki bu çalışmada tane ağırlıkları üzerinde göz sayılarının istatistiksel olarak anlamlı bir etkisinin olmadığı saptanmıştır. Ayrıca, çubuk x göz interaksyonunda yer alan grupların 100 tane ağırlığı 103.6-135.9 g arasında değişim göstermişse de gruplar arasında istatistiki olarak anlamlı farklılık saptanmamıştır (Çizelge 4).



Şekil 4. Şiraz üzüm çeşidinin tane özelliklerine budama şarjlarının etkisi

Budama uygulamalarına bağlı olarak, Şiraz üzüm çeşidinde şiranın asitliği (pH) 3.43-3.99 arasında değişim göstermiştir (Çizelge 5 ve Şekil 5). Hem çubuk x göz hem de budama şarjına göre uygulamalar gruplandırıldığında; incelenen gruplar arasında, şiranın asitliği (pH) bakımından istatistiksel olarak %1 önem düzeyinde farklılar olduğu saptanmıştır. Bununla birlikte çubuk x göz interaksyonunda yer alan gruplar arasında hem SÇKM hem titrasyon asitliği hem de olgunluk indisi bakımından istatistiksel olarak önemli ($p \leq 0.01$) farklılıklar olduğu saptanmıştır. Budama şarjlarına göre değerlendirme yapıldığında ise; pH, titrasyon asitliği ve SÇKM'nin değişim gösterdiği belirlenmiştir (Şekil 5).



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pH üzerinde göz düzeylerinin doğrusal azalan bir etkisinin olduğu, bir başka ifade ile çubuklar üzerinde bırakılan göz sayısı arttıkça asitliğin arttığı ($p \leq 0.05$) saptanmıştır. Budamada, omca üzerinde bırakılan çubuk sayısının artışı da şıranın pH sınırının azalmasına ($p \leq 0.01$) neden olmuştur. Bu çalışmada saptanmış olan şıra asitliği değerleri, daha önce Şiraz üzüm çeşidi üzerinde yapılan araştırmalarda belirtilmiş olan sınır değerlerinin (3.0-4.2) içerisinde ve literatürle uyumludur (Peña-Neira ve ark., 2007; Gil-Muñoz ve ark., 2009).

En yüksek SÇKM 2 çubuk 2 göz grubundan, en düşük SÇKM içeriği ise 4 çubuk 4 göz şeklinde budanan gruptan elde edilmiştir. Hem omca üzerinde bırakılan çubuk sayısının hem de çubuklar üzerinde bırakılan göz sayısının artışıyla tanelerde SÇKM düzeyi azalış göstermiştir. Buna karşın titrasyon asitliği, çubuk sayısının artışıyla azalmıştır (Çizelge 5).

Çubuk sayısının artışıyla birlikte hem SÇKM'nin hem titrasyon asitliğinin hem de pH 'nın azalış göstermesi oldukça dikkat çekicidir. Benzer bir şekilde, budama şarjının artışıyla bu üç özelliğin azalış göstermesi; budama şarjı uygulamalarında değişime neden olan ana etkenin çubuk sayısı olduğu değerlendirmesini desteklemektedir. Ancak olgunluk indisi ve şıranın asitliğine (pH) ilişkin bulgular, her iki değişkenin (çubuk sayısı ve göz sayısı) de benzer etkilerinin olabileceğine işaret etmektedir. Her ne kadar çubuk x göz sayısı interaksyonunda yer alan grupların verileri (Çizelge 5) incelendiğinde, olgunluk indisi hakkında yukarıdaki değerlendirmeyi yapmak mümkün olmuşsa da budama şarjı grupları arasında olgunluk indisi farklılıkları (Şekil 5) istatistiksel olarak anlamlı bulunmamıştır.



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Çizelge 5. Farklı çubuk sayısı ve göz düzeyinde budamanın Şiraz üzüm çeşidi tanelerinin bazı pomolojik özelliklerine etkisi

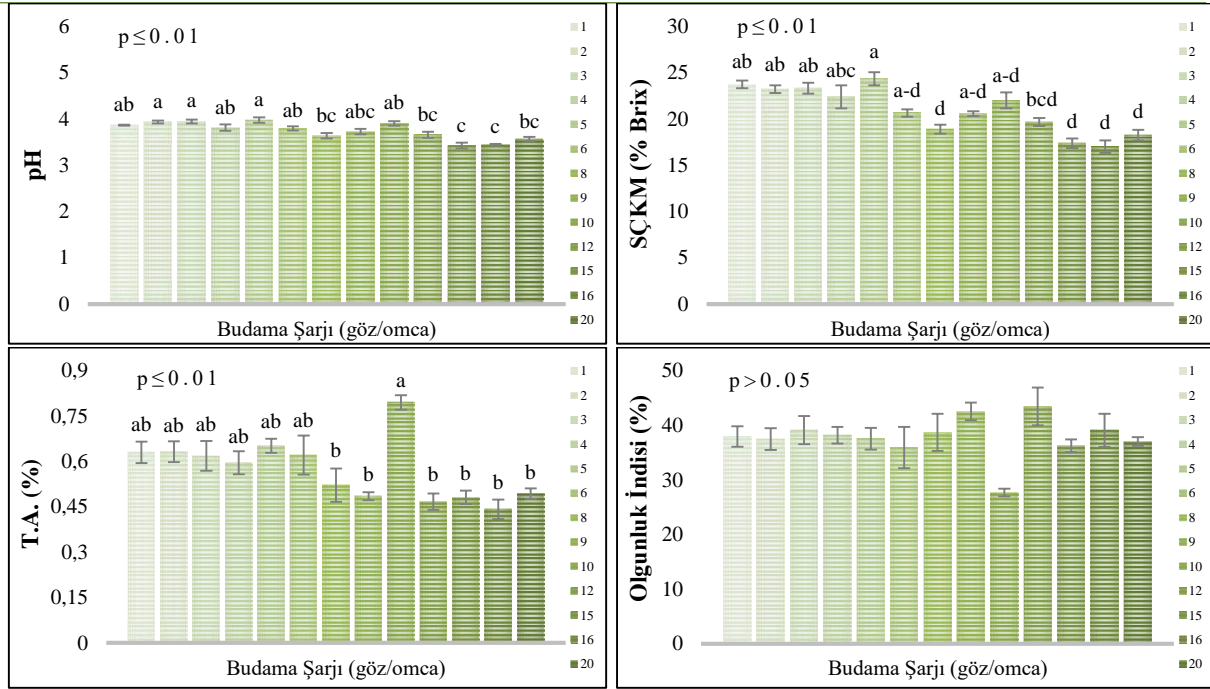
Çubuk	Göz	pH	SÇKM (%Brix)	T.A. (%)	Olgunluk İndisi (%)
1	1	3.87 a**	23.75 abc**	0.63 b-e**	37.98 b-f**
	2	3.92 a	24.18 abc	0.70 abc	34.37 d-g
	3	3.92 a	24.41 ab	0.75 ab	32.67 d-g
	4	3.98 a	23.29 abc	0.68 abc	34.55 d-g
	5	3.98 a	24.36 ab	0.65 a-d	37.57 b-f
2	1	3.96 a	22.32 a-d	0.56 c-f	40.57 a-e
	2	3.99 a	25.42 a	0.67 a-d	38.26 b-f
	3	3.84 a	20.02 b-e	0.77 ab	26.41 g
	4	3.77 abc	19.91 cde	0.66 a-d	30.05 efg
	5	3.91 a	22.04 a-d	0.80 a	27.70 fg
3	1	3.97 a	22.29 a-d	0.49 efg	45.60 abc
	2	3.77 abc	21.33 a-e	0.47 fg	45.49 abc
	3	3.73 abc	20.60 b-e	0.49 efg	42.56 a-d
	4	3.81 ab	18.86 de	0.52 d-g	36.33 c-g
	5	3.43 d	17.40 e	0.48 efg	36.28 c-g
4	1	3.50 cd	18.52 de	0.45 fg	41.80 a-d
	2	3.51 cd	17.94 de	0.38 g	47.38 ab
	3	3.52 cd	20.51 b-e	0.41 fg	50.66 a
	4	3.45 d	17.03 e	0.44 fg	39.11 b-e
	5	3.57 bcd	18.27 de	0.49 efg	37.05 b-g
Çubuk Ort.	1	3.93 A**	24.00 A**	0.68 A**	35.43 B**
	2	3.89 A	21.94 B	0.69 A	32.60 B
	3	3.74 B	20.10 C	0.49 B	41.25 A
	4	3.51 C	18.45 D	0.44 C	43.20 A
Göz Ort.	1	3.83 A*	21.72 AB**	0.53 B**	41.49 A**
	2	3.80 AB	22.22 A	0.56 AB	41.38 A
	3	3.75 AB	21.38 ABC	0.61 A	38.08 AB
	4	3.75 AB	19.77 C	0.58 AB	35.01 B
	5	3.72 B	20.51 BC	0.61 A	34.65 B

*: $p \leq 0.05$, **: $p \leq 0.01$, öd: önemli değil

Farklı harflerle (a, b, c, A, B, C vb.) belirtilen gruplar arasında istatistiki olarak anlamlı farklılıklar vardır.



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Şekil 5. Şiraz üzüm çeşidinin bazı kalite özelliklerine budama şarjlarının etkisi

Kış budamasında bir omca üzerinde bırakılan çubuk sayısının ve toplam göz sayısının artışına paralel olarak salkım sayısı artış göstermekte ve bu durum her ne kadar bitkide toplam asimilasyon oranını arttırsa da tanelerde biriktirilen fitokimyasalların azalmasıyla sonuçlanmaktadır. Nitekim bulgular, verim ile salkım sayısı arasında pozitif korelasyon ($r=0.887$, $p \leq 0.01$) olduğunu ancak verim ile SÇKM ($r=-0.560$, $p \leq 0.01$), verim ile titrasyon asitliği ($r=-0.507$, $p \leq 0.01$) ve verim ile pH ($r=-0.587$, $p \leq 0.01$) arasında negatif korelasyon olduğunu ortaya koymuştur (Çizelge 6). Ayrıca verimdeki değişimlere paralel olarak tane uzunluğu ($r=0.310$, $p \leq 0.01$) ve tane eninin ($r=0.304$, $p \leq 0.01$) de değişmesine karşılık 100 tane ağırlığının ($r=0.217$, $p > 0.05$) değişim göstermemiş olması, tane boyutlarında gerçekleşen farklılaşmanın kuru maddeden ziyade sıra birikimiyle ilişkili olduğunu düşündürmektedir.

Kamiloğlu ve Üstün (2014)'ün bildirdiği, salkım boyutları ile tane boyutları arasındaki ilişki, bu çalışmada saptanmamıştır. Buna karşın, salkım uzunluğu ile eni ($r=0.616$) arasında ve tane uzunluğu ile eni arasında ($r=0.905$) pozitif korelasyon olduğu belirlenmiştir (Çizelge 6). Farklı araştırmacıların bildirmiş olduğu SÇKM ile pH arasındaki pozitif ilişki, bu çalışmada da ($r=0.699$, $p \leq 0.01$) saptanmıştır (Karanis ve Çelik, 2002; Kamiloğlu, 2011). Elde edilen bulgular bu yönüyle literatürle paralellik göstermektedir.



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Çizelge 6. Budama uygulamalarına bağlı olarak değişimleri incelenen özelliklerin birbirleriyle korelasyonları

	2	3	4	5.	6	7	8	9	10	11
1	0.887**	0.463**	0.376**	0.310**	0.304**	0.217 ^{öd}	-0.587**	-0.560**	-0.507**	0.220*
2		0.477**	0.366**	0.140 ^{öd}	0.145 ^{öd}	0.172 ^{öd}	-0.609**	-0.607**	-0.472**	0.143 ^{öd}
3			0.616**	0.083 ^{öd}	0.093 ^{öd}	0.308**	-0.420**	-0.411**	-0.489**	0.299**
4				0.104 ^{öd}	0.148 ^{öd}	0.260*	-0.451**	-0.334**	-0.197 ^{öd}	0.024 ^{öd}
5					0.905**	0.407**	-0.191 ^{öd}	-0.028 ^{öd}	-0.279*	0.372**
6						0.530**	-0.141 ^{öd}	-0.037 ^{öd}	-0.210 ^{öd}	0.272*
7							-0.109 ^{öd}	-0.032 ^{öd}	-0.238*	0.237*
8								0.699**	0.537**	0.200 ^{öd}
9									0.571**	-0.023 ^{öd}
10										-0.806**

*: $p \leq 0.05$, **: $p \leq 0.01$, ^{öd}: önemli değil

1) Verim, 2) Salkım Sayısı, 3) Salkım uzunluğu, 4) Salkım eni, 5) Tane Uzunluğu, 6) Tane Eni, 7) 100 tane ağırlığı, 8)pH, 9)SÇKM, 10)TA, 11)Olgunluk indisi

4. SONUÇLAR

Bağıcılıkta, verim ve kalite parametrelerine doğrudan etkisi olan ve bunları büyük ölçüde etkileyen kültürel uygulamalardan birinin budama olduğuna ilişkin, literatürde yer alan çalışmalarla benzer sonuçlara ulaşılmıştır. Bununla birlikte telli terbiye sisteminde, tek kollu kordon terbiye şekli verilmiş Şiraz üzüm çeşidine kış budaması yapılırken omca üzerinde 4 çubuk ve çubuklar üzerinde en az 3 göz bırakılması, ideal bir üretim için ise 4 veya 5 göz bırakılması uygun bulunmuştur.

Bu çalışma kapsamında karşılaştırılan budama şarjı ve çubuk x göz sayısı metotlarından, çubuk x göz sayısı metodunun üzümlerin kalite özellikleri üzerine budamaların etkisinin belirlenmesinde daha geçerli olduğu kanaatine varılmıştır. Kış budamalarında, omca üzerinde bırakılan çubuk sayısının oldukça önemli bir unsur olduğu ve budama şarjı metoduna ilişkin bulgularda ana değişken olduğu sonucuna varılmıştır. Bu alanda yapılacak yeni araştırmalarda farklı üzüm çeşitleri ve terbiye sistemlerinin incelenmesi, çalışma kapsamında ulaştığımız sonuçların geçerliliğinin belirlenmesi açısından önemlidir.



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KAYNAKLAR

Ağaoğlu, Y.S., 1969. Sofralık Üzüm Çeşitlerinden Hasandede, Kalecik Karası, Papaz Karası, Öküzgözü ve Furmint'in Tomurcuk Yapıları, Floral Gelişme Devreleri ve Bu Çeşitlere Uygun Budama Metotlarının Tesbiti Üzerinde Mukayeseli Araştırmalar. Ankara Üniversitesi, Ziraat Fakültesi, Doktora Tezi, 297s., Ankara.

Ağaoğlu, Y.S., Çelik, H., Çelik, M., Fidan, Y., Gülşen, Y., Günay, A., Halloran, N., Köksal, A.İ. ve Yanmaz, R., 2010. Genel Bahçe Bitkileri (3.Baskı). Ankara Üniversitesi Ziraat Fakültesi, Yayın No:1579, Ders Kitabı No:531, 369s., Ankara.

Akın, A., 2003. Bazı Sofralık Üzüm Çeşitlerinde Farklı Şarj ve Yaprak Gübresi Uygulamalarının Gelişme, Üzüm Verimi ve Kalitesine Etkileri Üzerinde Araştırmalar. Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, 311s., Konya.

Akın, A., Çotur, E. ve Değirmenci, A., 2011. Konya ve Kayseri'de Yetiştirilen Bazı Üzüm Çeşitlerinin Göz Verimliliklerinin Belirlenmesi. Yüzüncüyıl Üniversitesi Tarım Bilimleri Dergisi, 21(3): 220-224.

Akın, A. ve Kısmalı, İ., 2004. Bazı sofralık üzüm çeşitlerinde farklı şarj ve yaprak gübresi uygulamalarının gelişme, üzüm verimi ve kalitesine etkileri üzerinde araştırmalar. Ege Üniv. Ziraat Fak. Derg., 41(3): 1-10.

Babalık, Z., Çetin, E.S., Türk, F.H. ve Baydar, N.G., 2013. Isparta Koşullarında Bazı Sofralık Üzüm Çeşitleri İçin En Uygun Terbiye Şekillerinin Belirlenmesi. International Journal of Agricultural and Natural Sciences, 6(1):101-106.

Balbaba, N., 2020. Organik yetiştirilen Trakya İlkeren üzüm çeşidinin verim ve kalite özelliklerinin incelenmesi. Mediterranean Agricultural Sciences, 33(3): 327-333.

Başaran, Ç., 2006. Kalecik Karası Klonlarında Asma Performansı ile Göz Verimi, Ürün Miktarı ve Kalitesi Arasındaki İlişkiler. Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 44s., Ankara.

Bekar, T. ve Cangi, R., 2018. Narince üzüm çeşidinde verim ve sıra kompozisyonu üzerine salkım seyreltmenin etkileri. Bahçe, 47(Özel Sayı 1): 605-612.

Cangi, R., Kesgin, M. ve Yağcı, A., 2011. Sofralık Amaçlı Sultani Çekirdeksiz Üzüm Yetiştiriciliğinde Gölgeleme ve Örtü Materyali Uygulamalarının Ekonomik Analizi. GOÜ, Ziraat Fakültesi Dergisi, 28(2): 9-19.

Cemeroğlu, B., 1992. Meyve ve Sebze Endüstrisinde Temel Analiz Metotları. Biltav Üniversite Kitapları Serisi, No:02-2, 381s., Ankara.



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Creasy, G.L. and Creasy, L.L., 2009. Grapes. Crop Production Science in Horticulture Series: 16. The Centre for Agriculture and Bioscience: Wallingford-England, 295p.

Çakır, A., İşlek, F., Odabaşıoğlu, M.İ. ve Alanko, M., 2017. Diyarbakır ili Dicle ilçesi bağcılığının mevcut durumu, başlıca sorunları ve çözüm önerileri. Alatarım, 16(2): 37-46.

Çelik, H., Ağaoğlu, Y.S., Fidan, Y., Marasalı, B. ve Söylemezoğlu, G., 1998. Genel Bağcılık. Sunfidan A.Ş. Mesleki Kitaplar Serisi. 1: 253s., Ankara.

Çelik, H., 1999. Amasya’da Yetiştirilen Bazı Üzüm Çeşitlerinin Göz Verimliliklerinin Belirlenmesi Üzerine Araştırmalar. Turkish J. of Agriculture and Forestry. 23 (Ek Sayı 3): 685-690.

Çelik, H., 2006. Üzüm Çeşit Kataloğu. Sun Fidan A.Ş. Mesleki Kitaplar Serisi. No:3 165s., Ankara.

Çelik, H., 2017. Bağlarda Taç Yönetimi-Kış Budamaları. TÜRKTOB Dergisi, 24: 32-42.

Çelik, M., 2003. Yuvarlak Çekirdeksiz Üzüm Çeşidinde Bazı Anaç ve Kültürel Uygulamaların Üzüm Verimi ve Kalitesi ile Vegetatif Gelişmeye Etkileri Üzerinde Araştırmalar. Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, 194s., Aydın.

Çelik, M. ve Tekintaş, F.E., 2004. Bazı Budama Uygulamalarının Sultani Çekirdeksiz Üzüm Çeşidinde Kuru Üzüm Kalitesine, Çelik Özelliklerine ve Mineral Madde Alımına Etkileri. ADÜ Ziraat Fakültesi Dergisi, 1(1): 35-39.

Çelik, S., 2011. Bağcılık (Ampeloloji) Cilt 1 (3.Baskı). Anadolu Matbaa San. ve Tic. Ltd. Şti., 428s., Tekirdağ.

Dardeniz, A. ve Kısımlı, İ., 2005. Bazı Sofralık Üzüm Çeşitlerinde Kış Gözü Verimliliğinin Saptanması İle Optimum Budama Seviyelerinin Tespiti Üzerine Araştırmalar. Ege Üniv. Ziraat Fak. Derg., 42(2): 1-10.

Değirmenci, A., 2019. Early sweet (Vitis vinifera L.) üzüm çeşidinde kış gözü verimliliğin saptanması ve budama seviyesinin belirlenmesi üzerine araştırmalar. Manisa Celal Bayar Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 36s., Manisa.

Delice, A. ve Çelik, S., 2005. Italia üzüm çeşidinde iki farklı terbiye şeklinde sürgün gelişimi ile üzüm kalitesi arasındaki ilişkiler. Harran Üniversitesi Ziraat Fakültesi Dergisi, 9(1): 43-52.



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Doğan Yıldırım, E.Ç., 2011. Kalecik karası (Vitis vinifera L. cv) üzüm çeşidinde bazı kanopi yönetimi tekniklerinin asma performansı, ürün verim ve kalitesi üzerine etkileri. Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, 147s., Ankara.

Dölek, T., Atlı, H.S. ve Keskin, N., 2020. Siirt Yöresinde Yetiştirilen Bazı Üzüm Çeşitlerinin Göz Verimliliklerinin Belirlenmesi ve Farklı Göz Şarjı Uygulamalarının Verim ve Kaliteye Etkisi. Munzur Zirvesi 2. Uluslararası Uygulamalı Bilimler Kongresi, 31 Mayıs, Tunceli, s.139-155.

Ergenoğlu, F., TangolaR, S., Gök, S., Büyüktaş, N. ve Orhan, E., 1999. Bazı Sofralık Üzüm Çeşitlerinin Farklı Zamanlarda Plastik Örtü Altına Alınmasının Verim ve Kalite Üzerine Etkileri. Tr. J. of Agriculture and Forestry, 23: 899-908.

Ferrer, M., Abella, J. M., Sibille, I., Camussi, G. and González-Neves, G. (2004). Determination of bud fertility as a simple method for the determination of harvesting volume in Vitis vinifera L. cv Tannat, using two pruning systems. Oeno One, 38(1): 49-53.

Foott, J.H., Ough, C.S. and Wolpert, J.A., 1989. Rootstock effects on wine grapes. California Agriculture, 43: 27-29.

Gazioğlu Şensoy, R.İ., Kısaca, G., Baş, E.Ö. ve Yılmaz, Y., 2020. Siirt İli ve Bazı İlçelerinde Mevcut Bağcılık İşletmelerinin Yapısal Özellikleri ve Tarımsal Uygulamalara Yaklaşımlarının Belirlenmesi. Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi, 30(2): 289-298.

Gil-Muñoz, R., Vila-López, R., Fernández-Fernández, J.I. and Martínez-Cutillas, A., 2009. Effects of cluster thinning on anthocyanin extractability and chromatic parameters of Syrah and Tempranillo grapes and wines. OENO One, 43(1): 45-53.

Gutiérrez-Gamboa, G., Díaz-Gálvez, I. and Moreno-Simunovic, Y., 2018. Effects of bud nodal position along the cane on bud fertility, yield component and bunch structure in ‘Carménère’ grapevines. Chilean Journal of Agricultural Research, 78(4): 580-586.

Harbertson, J.F. and Keller, M., 2012. Rootstock Effects on Deficit-Irrigated Winegrapes in a Dry Climate: Grape and Wine Composition. Am. J. Enol. Vitic., 63(1): 40-48.

Kamiloglu, O., 2011. Influence of some cultural practices on yield, fruit quality and individual anthocyanins of table grape cv.‘Horoz Karasi’. Journal of Animal and Plant Sciences, 21(2): 240-245.

Kamiloglu, Ö. ve Üstün, D., 2014. Bazı Şaraplık Üzüm Çeşitlerinin Hasat Sonrası Kalite Özellikleri. Türk Tarım ve Doğa Bilimleri Dergisi, 1(3): 361-368.



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Karanis, C. ve Çelik, H., 2002. Amasya’da Yetiştirilen Bazı Üzüm Çeşitlerinin Tane İçeriklerindeki Değişimin İncelenmesi ve Optimum Hasat Zamanlarının Tespiti Üzerine Araştırmalar. Türkiye V. Bağcılık ve Şarapçılık Sempozyumu, 5-9 Ekim, Cappadocia-Nevşehir, s.441-448.

Karataş, H. ve Ağaoğlu, Y.S., 2005. Asmalarda Göz Verimliliği. Alatarım, 4(1): 13-22.

Khadivi-Khub, A., Salimpour, A. and Rasouli, M., 2014. Analysis of grape germplasm from Iran based on fruit characteristics. Brazilian Journal of Botany, 37(2): 105-113.

Leão, P.C.D.S., Souza, E.M.D.C, Nascimento, J.H.B. and Rego, J.I.D.S., 2017. Bud fertility of new table grape cultivars and breeding selections in the São Francisco Valley. Revista Brasileira de Fruticultura, 39(5): e-042.

McCraw, B.D., McGlynn, W.G. and Keith Striegler, R., 2005. Effect of Rootstock on Growth, Yield and Juice Quality of Vinifera, American and Hybrid Wine Grapes in Oklahoma. Proc. 2005 Symposium on Grape Rootstocks: Current use, research, and application, 5 February, Missouri, s.61-65.

Noyaner, B., 2004. Sultani Üzüm Çeşidinin Sofralık Amaçlı Kullanımı İçin Bazı Kültürel Uygulamaların Etkileri Üzerine Araştırmalar. Ege Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, 170s., İzmir.

Odabaşoğlu, M.İ., 2020. Semi-Arid Koşullarda Farklı Anaçlar Üzerinde Yetiştirilen Sofralık Üzüm Çeşitlerinin Verim, Kalite ve Çekirdek Özellikleri ile Stoma Morfolojilerinin İncelenmesi. Harran Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi, 307s., Şanlıurfa.

Oraman, M.N., 1965. Yeni Bağcılık. Ankara Üniversitesi Ziraat Fakültesi Yayınları. Ders Kitabı No:89, 347s., Ankara.

Peña-Neira, A., Cáceres, A. and Pastenes, C., 2007. Low molecular weight phenolic and anthocyanin composition of grape skins from cv. Syrah (Vitis vinifera L.) in the Maipo Valley (Chile): Effect of clusters thinning and vineyard yield. Food Science and Technology International, 13(2): 153-158.

Polat, İ. ve Uzun, H.İ., 2007. Plastik Serada Yetiştirilen Trakya İlkeren Üzüm Çeşidinde Farklı Terbiye Sistemi ve Asma Şarjı Uygulamalarının Erkencilik, Verim ve Kalite Faktörleri Üzerine Etkileri. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 20(2): 289-300.



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Şen, A. ve Atak, A., 2020. Bud Fertility Determination of Some New Table Grape Cultivars (*Vitis vinifera*). Bahçe, 49(1): 43-49.

Topuz, E., 2013. Kara Dimrit Üzüm Çeşidinde Farklı Seviyede Şarj (Ürün Yüğü) ve Yaprak Gübresi Uygulamalarının Üzüm Verimi Ve Kalitesine Etkileri. Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 60s., Konya.

Yılmaz, M., 1994. Meyve Ağaçlarında Budama. 134s, Adana.



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**INVEST MODEL KULLANILARAK SEDİMENT İLETİM ALANLARININ
MODELLENMESİ VE HARİTALANMASI: TOKAT OVASI ÖRNEĞİ**

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ÖZET

Sedimentasyon Dünyada olduğu gibi Türkiye 'dede önde gelen çevresel ve sosyo-ekonomik sorunlardan birisidir ve bu problemin çözümünde etkili toprak ve su koruma önlemlerinin uygulanması için riskli bölgelerinin belirlenmesi çok önemlidir. Bu araştırma da Tokat ilinde ülkemizin önemli tarım ovalarından olan Tokat ovası havzasının erozyon ve sediman oluşturma ve toplama alanlarının belirlenmesinde InVEST modelinin kullanılabilirliğinin test edilmesi amaçlanmıştır. InVEST model toprak erozyonunu ve bununla birlikte taşınacak sediment miktarlarının hesaplanmasında USLE (küresel toprak kaybı Eşitliği) eşitliğini ve sediment iletim oranı indeksini kullanmaktadır. Model için gerekli olan faktör haritaları ArcGIS yazılımında gri olarak hazırlanmıştır. Model çalıştırıldıktan sonra elde edilen erozyon ve sediman iletim haritalarına göre havzada potansiyel toprak kaybı 0 ile 8722,54 ton ha⁻¹ yıl⁻¹ arasında ve ortalama 98.12 ton ha⁻¹ yıl⁻¹ hesaplanırken, USLE haritasına göre korumaya yönelik faktörler ile beraber 0-1510,2 ton ha⁻¹ yıl⁻¹ arasında ve ortalama 6,23 ton /ha yıl olarak hesaplanmıştır. Ayrıca havzada sediman verimi ise 0-431,13 ton ha⁻¹ yıl⁻¹ arasında değişirken ortalama 0,85 ton ha⁻¹ yıl⁻¹ olarak hesaplanmıştır. Havza içinde tortullanan sediman miktarı ise 0-4454 ton ha⁻¹ yıl⁻¹ arasında ve ortalama olarak da 82,88 ton ha⁻¹ yıl⁻¹ olarak belirlenmiştir. Bu değerler tokat ovası havzasında sediman veriminin tolerans değerlerini aşmadığını ve bitkisel ve topografik şartlardan dolayı sedimanların büyük bir kısmının akarsularla havzadan çıkamadan biriktiğini göstermektedir. Model sonuçları InVEST yazılımının sediman ve erozyon haritalamada kullanım pratikliği açısından ekosistem çalışmaların da kolaylıkla ve başarılı bir şekilde kullanılabileceği göstermiştir.

Anahtar Kelimeler: Erozyon, Sediment İletim Oranı, InVEST Model



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**MODELING AND MAPPING OF SEDIMENT DELIVERY AREAS USING INVEST
MODEL: CASE STUDY OF TOKAT PLAIN**

ABSTRACT

Sedimentation is one of the leading environmental and socio-economic problems in Turkey as well as in the world, and it is very important to determine the risky areas for the implementation of effective soil and water protection measures in solving this problem. In this research, it is aimed to test the usability of the InVEST model in determining the erosion and sediment formation and collection areas of the Tokat plain basin, which is one of the important agricultural plains of our country in the province of Tokat. The InVEST model uses the USLE (global soil loss Equation) equation and the sediment transmission rate index to calculate soil erosion and the amount of sediment to be transported with it. The factor maps required for the model are prepared in ArcGIS software in gray. According to the erosion and sediment transmission maps obtained after the model was run, the potential soil loss in the basin was calculated between 0 and 8722.54 tons ha⁻¹ year⁻¹ and an average of 98.12 tons ha⁻¹ year⁻¹, while 0-1510 with protection factors according to the USLE map. It is calculated between ,2 tons ha⁻¹ year⁻¹ and average 6,23 tons/ha year. In addition, while the sediment yield in the basin varied between 0-431.13 tons ha⁻¹ year⁻¹, it was calculated as 0.85 tons ha⁻¹ year⁻¹ on average. The amount of sediment deposited in the basin was determined as 0-4454 tons ha⁻¹ year⁻¹ and on average as 82.88 tons ha⁻¹ year⁻¹. These values show that the sediment yield in the Tokat plain basin does not exceed the tolerance values and due to vegetative and topographic conditions, most of the sediments accumulate before they can leave the basin by rivers. The model results showed that the InVEST software can be used easily and successfully in ecosystem studies in terms of its practicality in sediment and erosion mapping.

Keywords: Erosion, Sediment Delivery Ratio, InVEST Model



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1.GİRİŞ

Yağış erozyonu, toprak verimliliği ve sürdürülebilir tarım üzerinde uzun vadeli etkileri olduğu bilinen küresel bir tehlikedir (Shi ve ark. 2012). Ayrıca erozyon sonucu artan sediment verimi dünyanın birçok bölgesinde su kalitesini ve baraj rezervuarlarını olumsuz etkilemektedir (Park ve ark, 2015). Küresel bağlamda kabaca 1094 milyon ha alan hidrolojik süreçler nedeniyle toprak erozyonundan etkilenir ve arazilerin 224 milyon ha alanı geri dönüşümsüz olarak yok olmaktadır (Oldeman, 1994). Bu nedenle toprak erozyonu ve sediment verim miktarının alansal olarak belirlenmesi uygun koruma önlemlerinin tasarlanmasında önem arz etmektedir (Hamel ve ark. 2015).

Bugüne kadar büyük ölçekli alanlarda toprak erozyonunu ve sediment verimini modelleyen birçok araştırma yürütülmüştür ve bu araştırmaların çoğu farklı koşullar altında toprak erozyonunu ve sediment verimini kantitatif olarak ölçen tahmini veya saha çalışmaları ile karşılaştıran fiziksel bazlı modellerdir. Fizik bazlı modeller son yıllarda büyük ilerleme kaydetmiştir (Thomas ve ark, 2018). Ancak, bu modeller farklı uzaysal ve zamansal ölçeklerde karmaşık ve temini zor olan veri gereksinimi duymasından dolayı bazı zorluklara sahiptir (Avwunudiogba ve Hudson, 2014). Özellikle modelin kalibrasyonu ve testi için kapsamlı veriye ihtiyaç duyulmasının yanı sıra kullanım konusunda da uzmanlık gerektirir (McIntyre ve ark, 2014). Bundan dolayı kapsamlı verilerin temin edilemediği bölgelerde fiziksel tabanlı modellerin kullanılması kısıtlanmaktadır. Bu gibi durumlarda deneysel yaklaşımlardan evrensel Toprak Kaybı Eşitliği (USLE) (Wischmeier ve Smith, 1978) ve Revize Edilmiş Evrensel Toprak Kaybı eşitliği (RUSLE) (Renard ve ark, 1997) basit, şeffaf ve güçlü model yapısı, az sayıda veri gereksinimi, kolay veri girişi sağlaması ve Coğrafi bilgi sistemi yazılımları ile uyumluluğu gibi avantajlardan dolayı yaygın bir şekilde kullanılmaktadır (Haregeweyn ve ark., 2017; Panagos ve ark., 2015).

USLE ve RUSLE gibi modeller bir havzada toprak kaybını tahmin ederken havzadan ihraç edilen sediment miktarını tahmin edememektedir (De Vente ve ark., 2013). Son yıllarda geliştirilen ve kullanımı giderek artan InVEST model (Integrated Valuation of Environmental Services and Tradeoffs-Çevresel Hizmetlerin Entegre Değerlemesi ve Takaslar) bir dizi ekosistem hizmetini ölçmeyi ve haritalamayı amaçlayan bir yazılım paketidir (Sharp ve ark., 2021) ve içerisinde bulunan Sediment iletim oranı (SİO) aracı sayesinde bir havzadan ihraç edilen ve kara içinde tutulan sediment miktarları niceliksel olarak haritalanabilmektedir (Hamel ve ark., 2015). Bu model Rusle gibi modellerin sınırlılığını gidererek peyzaj boyunca



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havzanın hidrolojik bağlanabilirliğinin karakterizasyonunu mümkün kılarak sediment oluşumunu ve dereye taşınmasını ve ayrıca sediment depolanmasını haritalamaktadır (Aneseyee ve ark., 2020). Küresel iklim değişikliğinin ve arazi kullanımı değişimlerinin etkileri de bu model ile kolaylıkla belirlenebilmektedir (Hamel ve ark., 2015; Aneseyee ve ark., 2020). Bu sayede elde edilecek bilgiler ekonomik olarak değerlendirilebilecek olan rezervuarların yönetimi ve akarsuların su kalitesi için planlamalarda özellikle önemlidir.

Bu araştırmada daha önce ülkemizde literatürde kullanılmayan InVEST modelinin ülke şartlarında uygulanabilirliğinin test edilmesi ve tanıtılması amaçlanmaktadır. Bu amaçla Tokat ovası havzası sınırları içindeki toprak erozyon miktarı ve sediment veriminin haritalanması InVEST model kullanılarak belirlenmeye çalışılmıştır.

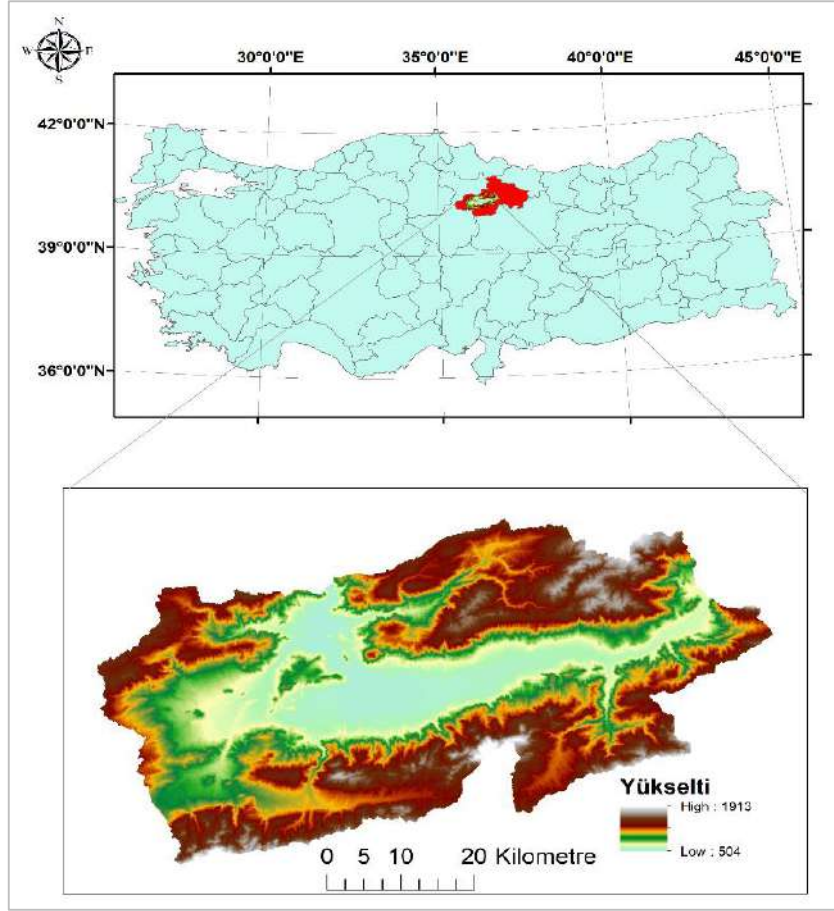
2. MATERYAL VE METOD

2.1. Çalışma Alanı

Araştırmanın yürütüldüğü saha Orta Karadeniz Bölümünün iç kesiminde Turhal ovası, Zile ovası ve Tokat ovasını içine alan bir havzadır. Havza 35°44'155"-36°49'653" D ile 40°31'066"-40°04'536" K koordinatları arasında bulunmaktadır. Bu havzanın genişliği yaklaşık 2861 km² dir. Sahanın yüksekliği 504-1913 m arasında değişmektedir. Tokat merkez meteoroloji istasyonunun uzun yıllar ortalamasına bakıldığında ortalama yağış miktarı 436,7 mm ve ortalama yağışlı gün sayısının 104 olduğu görülmektedir.



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Şekil 1. Çalışma alanı lokasyon haritası.

2.2. InVEST Sediment İletim Modeli

InVEST sediment iletim modelinin amacı, çoğunlukla kırsal sahalardaki sediment iletim ve tutma oranlarını ölçmek ve haritalamaktır. Bu amaç doğrultusunda model CBS tabanlı iklim, toprak, topografya ve arazi örtüsü grid verilerini kullanarak alt havza başına ortalama yıllık sediment verimini ve tutulmasını piksel bazlı hesaplayarak haritalamaktadır. Model öncelikle havzadaki toprak kaybını hesaplar ardından akıntıya ulaşan toprak kaybının oranına karşılık gelen sediment ilirim oranını hesaplamaktadır (Borselli ve ark., 2008). Model toprak kaybını USLE (Küresel Toprak Kaybı Eşitliği) modeli kullanarak hesaplamaktadır (Renard ve ark., 1997). (Eşitlik 1)

$$usle_i = (R \cdot K \cdot LS \cdot C \cdot P)_i \quad (1)$$

Eşitlik 1’de R; yağış erozivitesi ($\text{MJ} \cdot \text{mm} (\text{ha} \cdot \text{hr})^{-1}$), K: toprak erodibilitesi ($\text{ton} \cdot \text{ha} \cdot \text{hr} (\text{MJ} \cdot \text{ha} \cdot \text{mm})^{-1}$), LS: Eğim uzunluğu ve derecesi (birimsiz), C: arazi yönetim faktörü (birimsiz), P: koruma destek faktörü (birimsiz).



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Model de kullanılan girdiler raster harita formatında hazırlanmıştır. R faktör haritası için Panagos ve ark., (2017) tarafından hazırlanan 1km çözünürlüklü küresel R faktör haritasından faydalanılmıştır. Küresel ölçekli harita Türkiye için 160 adet meteoroloji istasyonunun 2005 - 2014 yılları arasındaki yağış verilerinden hesaplanan R faktör değerlerini içermektedir. K faktör haritası ise Türkiye toprak veri tabanı kullanılarak hesaplanmıştır. Havza sınırları içindeki büyük toprak gruplarına literatür taraması ile K faktör değerleri belirlenmiş ve ardından harita K faktör değerlerine göre grid haritaya dönüştürülmüştür. C faktör için 2018 yılına ait seviye 3 CORINE veri tabanı arazi örtüsü haritalarından faydalanılmıştır. Her arazi örtüsü ve arazi kullanımı tipine yine literatür taraması yardımıyla C faktör değerleri belirlenmiştir. P koruma faktörü ise çalışma sahasında gözlemlenen her hangi bir koruma faktörü olmadığından 1 olarak alınmıştır. Ayrıca model için biyofiziksel tablo oluşturulmuş ve tabloda her arazi kullanımının kodu ve bu kodların karşılığı ve P faktörü içeren bir metin dosyası hazırlanmıştır. USLE eşitliğindeki LS faktörü sisteme yüklenilen sayısal yükselti modelinden otomatik olarak hesaplamaktadır. Modelde üretilen haritaların çözünürlüğü sayısal yükselti modelinin çözünürlüğüne (30m) göre belirlenmekte ve diğer farklı olan faktör haritalarının ise çözünürlüğü yükselti modeline göre yeniden örneklenmektedir. Ayrıca model tarafından alt havza haritası vektör formatında istenmektedir. Model alt havza sınırlarını kullanarak sediment taşınım ve birikim olan bölgeler ayırt etmektedir. Alt havza sınır haritaları elde edilen sayısal yükselti modeli ve ArcGIS yazılımının hidrolojik analiz eklentisi ile oluşturulmuştur.

InVEST modelde USLE denklemine göre belirlenen toprak kaybının akarsulara ulaşma miktarını hesaplamak için sediment iletim oranı (SİO) kullanılmaktadır. Bu oran akıntıyla taşınacak ve havzadan çıkacak olan toprak tanelerinin oranını temsil etmektedir. SİO hesaplanmasına ise Borselli ve ark., (2008) tarafından geliştirilen bağlantı indeksi (IC-Connectivity İndeks) kullanılmaktadır. Bu indeks sediment kaynakları ile akarsular arasındaki hidrolojik bağlantıyı tanımlamaktadır (eşitlik 2).

$$IC = \log_{10} \left(\frac{D_{yukarı}}{D_{aşağı}} \right) \quad (2)$$

$$D_{yukarı} = \bar{C}_{th} \bar{S}_{th} \sqrt{A} \quad (3)$$

$$D_{aşağı} = \sum_i \frac{d_i}{C_{th,i} S_{th,i}} \quad (4)$$



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Eşitliklerde; IC: bağlantı indeksi; $D_{yukarı}$: yukarı eğim bileşeni; $D_{aşağı}$: aşağı eğim bileşeni; Cth: yokuş yukarı katkıda bulunan alanın ortalama eşik C faktörü; Sth: eğime katkıda bulunan alanın ortalama eşiklenmiş eğim derecesidir A: yukarı eğime katkıda bulunan alandır; d_i : en dik yokuş aşağı yönüne göre i hücre boyunca akış yolunun uzunluğu.

Hidrolojik bağlantıyı tanımlayan indeks hesaplandıktan sonra ki adım Vigyak ve ark., (2012) tarafından geliştirilen sediment iletim oranının hesaplanmasıdır. Hesaplanan IC indeks ile Eşitlik 5 kullanılmaktadır.

$$SIO = \frac{SIO_{max}}{1 + \exp\left(\frac{IC_0 - IC_i}{k}\right)} \quad (5)$$

Eşitlikte SIO_{max} maksimum teorik SIO ve Vigyak ve ark. (2012) tarafından ortalama 0.8 ayarlanmıştır, IC ve k, SIO-IC ilişkisinin şeklini tanımlayan kalibrasyon parametreleridir. ($IC_0 = 0.5$ ve $k=2$)

SIO belirlendikten sonra havzanın sediment verimi hesaplanmaktadır. Verim, belirli i pikselden nehre ulaşan ve o pikselden aşındırılan sediment miktarıdır. Eşitlik 6 kullanılarak havzanın sediment verimi hesaplanmaktadır.

$$E_i = usle_i \cdot SIO_i \quad (6)$$

Ardından toplam havza sediment verim miktarı eşitlik 7 kullanılarak hesaplanmıştır.

$$E \text{ (ton ha}^{-1} \text{ yıl}^{-1}) = \sum_i E_i \quad (7)$$

Havza ile ilgili oluşturulan potansiyel toprak kaybı, USLE toprak kaybı, sediment verimi ve sediment tutulma noktalarının grid haritaları oluşturulmakta ve oluşturulan haritaların dağılımlarının istatistiği alt havzalara göre yazılım tarafından vektör formatında çıktı olarak hazırlanmaktadır.

3. BULGULAR VE TARTIŞMA

Tokat ovası havzasında modelin uygulanabilirliğini test etmek amacıyla hazırlanan grid formatlı haritalar Şekil 2 de verilmiştir. Aster uydu görüntüsünden havza sınırları kullanılarak hazırlanan SYM 504 ile 1913 m arasında değişmekte olup ortalama 1011 m dir. Aynı SYM kullanılarak oluşturulan dokuz alt havzanın haritası şekil 2 de alt havzaların alansal dağılımı da tablo 1 de verilmiştir. Çalışma alanında en fazla yüz ölçüme sahip alt havza alanın en batısındaki 1 numaralı havzadır ve yaklaşık 652 km² alana sahiptir. En az alan kaplayan alt havza ise 4 numaralı alt havzadır ve bu havza tokat ovasının son çıkış hattını oluşturmaktadır.



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Tablo 1 . Çalışma alanında bulunan alt havzalar ve yüz ölçümleri

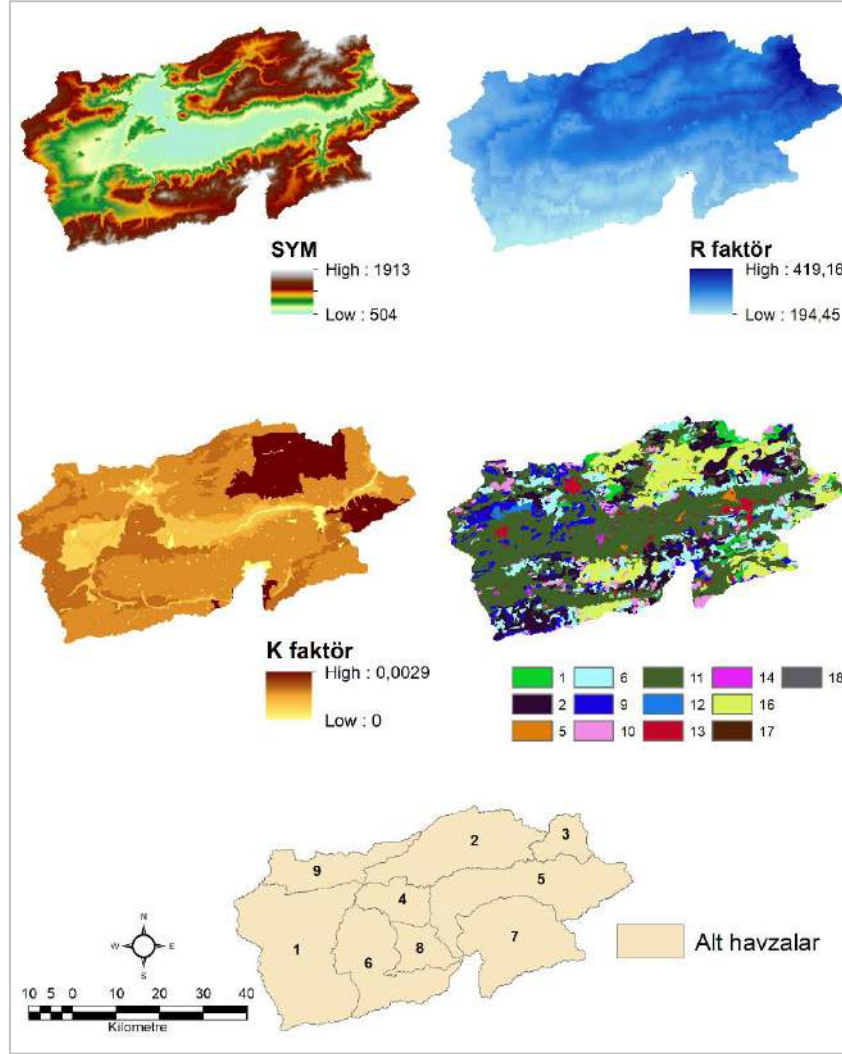
Alt havza no	Alan Km2
1	652
2	410
3	102
4	134
5	475
6	358
7	399
8	120
9	211
Toplam	2861

InVEST model sediment miktarını hesaplarırken önce havzadaki toplam toprak kaybını USLE model eşitliği hesaplamaktadır. USLE eşitliği için modele tanımlanan faktör haritaları şekil 2 de verilmiştir. Küresel R faktör haritasından hazırlanan yağış erozivitesi değerleri 194,45 ile 419,16 MJ·mm (ha·hr)⁻¹ arasında değişmektedir. R faktör değerleri havza geneline bakıldığında sahanın kuzey ve kuzey doğu kesimlerinde daha yüksek olduğu görülmektedir. Kale (2018)' Yeşilirmak havzasında Karadeniz bölgesine doğru yağış miktarlarının artarken havzanın iç kesimlerine doğru ise azaldığını bildirmektedir. Yağış miktarlarındaki bu değişimlerin R faktör üzerine olan etkisinden dolayı Karadeniz bölgesine daha yakın kesimlerde R faktör daha yüksek çıkmıştır.

Tablo 2'de havza da yayılım gösteren büyük toprak grupları ve guruplara belirlenen K faktör değerleri verilmiştir (Özden ve Özden, 1997). Araştırma sahasının %51.83 'ü kahverengi orman toprakları ile örtülü bulunmaktadır. Yağmur erozyonuna karşı en hassas topraklar havzada kireçsiz kahverengi orman toprakları olarak belirlenmiştir ki erodobilite değerleri en yüksek (K=0.29) olan grup bu topraklardır.



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Şekil 2. InVEST modelde kullanılan raster haritalar.

Yağmur erozyonuna karşı en hassas topraklar havzada kireçsiz kahverengi orman toprakları olarak belirlenmiştir ki erodobilite değerleri en yüksek ($K=0.29$) olan grup bu topraklardır. Bahtiyar (1979)' a göre topraklardaki kireç toprak tanelerinin flokülasyonuna neden olarak agregasyonu tetiklemektedir ve bu durumda toprak tanelerinin erozyona karşı direnç kazanmasına neden olur. Kireçsiz kahverengi orman topraklarda da en yüksek K faktör değeri alması bu şekilde açıklanabilir. 0.13 erodobilite değerini alan Kahverengi Topraklar ise havzada erozyona karşı en dayanıklı toprak grubu olarak belirlenmiştir.



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Tablo 2. Çalışma sahasında bulunan büyük toprak grupları ve K faktörleri.

BTG	Alan km ²	Yüzde %	K Faktör
Yapay Yüzey	72,06	2,52	0
Alüvyal T.	231,60	8,10	0.15
Kahverengi T.	91,92	3,22	0.13
Kestane rengi T.	248,17	8,68	0.22
Kırmızımsı Kestane Rengi T.	266,24	9,31	0.22
Kolivyal T.	112,22	3,93	0.18
Kahverengi Orman T.	1481,36	51,83	0.20
Kireçsiz Kahverengi Orman T.	354,62	12,41	0.29

Modelde arazi kullanım ve arazi örtüsü haritası olarak kullanılan 2018 yılına ait 3. Seviye CORINE arazi örtüsü tipleri ve bunlara ait C faktör değerleri Tablo 3 de verilmiştir. Çalışma sahasında yüz ölçüm olarak toplam sahanın %19,80 ini örten sulu tarım alanları en fazla alan örten kullanım türüdür. Tarım arazilerinin payı yaklaşık %39,54 iken ormanlık ve çalı tipindeki sahalar ise yaklaşık % 52 olarak sahayı kaplamaktadır. İnsan yapısı yapay yüzeyler ise toplam sahanın % 2,14 'ünü kaplamıştır. Ormanlık alanlar yağmur damlalarının kinetik enerjilerine karşı daha koruyucu olduğundan daha düşük C faktör değerleri alırken, yüzey kanopisi düşük olan sınıflar daha yüksek faktör almıştır (Kılıç, 2021). Yapay yüzeyler ile su yüzeyleri ise 0 değerini almıştır. Elde edilen corine veri tabanı arazi kullanım kodları atanarak raster haritaya çevrilmiş ve her kullanım tipinin C faktör değeri biyofiziksel tablo olarak InVEST yazılımına yüklenmiştir (Şekil 2).

Tablo 3. Çalışma alanına ait CORINE 3. Seviye arazi örtüleri ve C faktör değerleri.

Corine Kodu	Alan km ²	Alan %	C faktör	Corine Kodu	Alan km ²	Alan %	C faktör
Yapay Yüzeyler	61.21	2.14	0	İğne Yapraklı orman	82,04	2,87	0.003
Susuz Tarım	285,47	9,98	0.2	Karışık Orman	395,04	13,81	0.003
Sulu Tarım	566,54	19,80	0.2	Doğal Çayır	118,97	4,16	0.08
Bağ alanları	0,43	0,02	0.45	Kesintili Ormanlık-Çalılık	335,29	11,72	0.05
Meyve Bahçeleri	9,62	0,34	0.3	Kum düzlükleri	5,63	0,20	0
Mera	16,54	0,58	0.15	Çıplak Kayalık	14,95	0,52	0
Karışık Ekim	153,12	5,35	0.2	Zayıf Bitki Örtüsü	199,45	6,97	0.45
Temelde Tarım ve Üzeri Doğal Örtü	252,36	8,82	0.2	İç Bataklık	2,41	0,08	0
Geniş Yapraklı Orman	359,57	12,57	0.003	Su Topluluğu	2,88	0,10	0
				Toplam	2861,53	100	

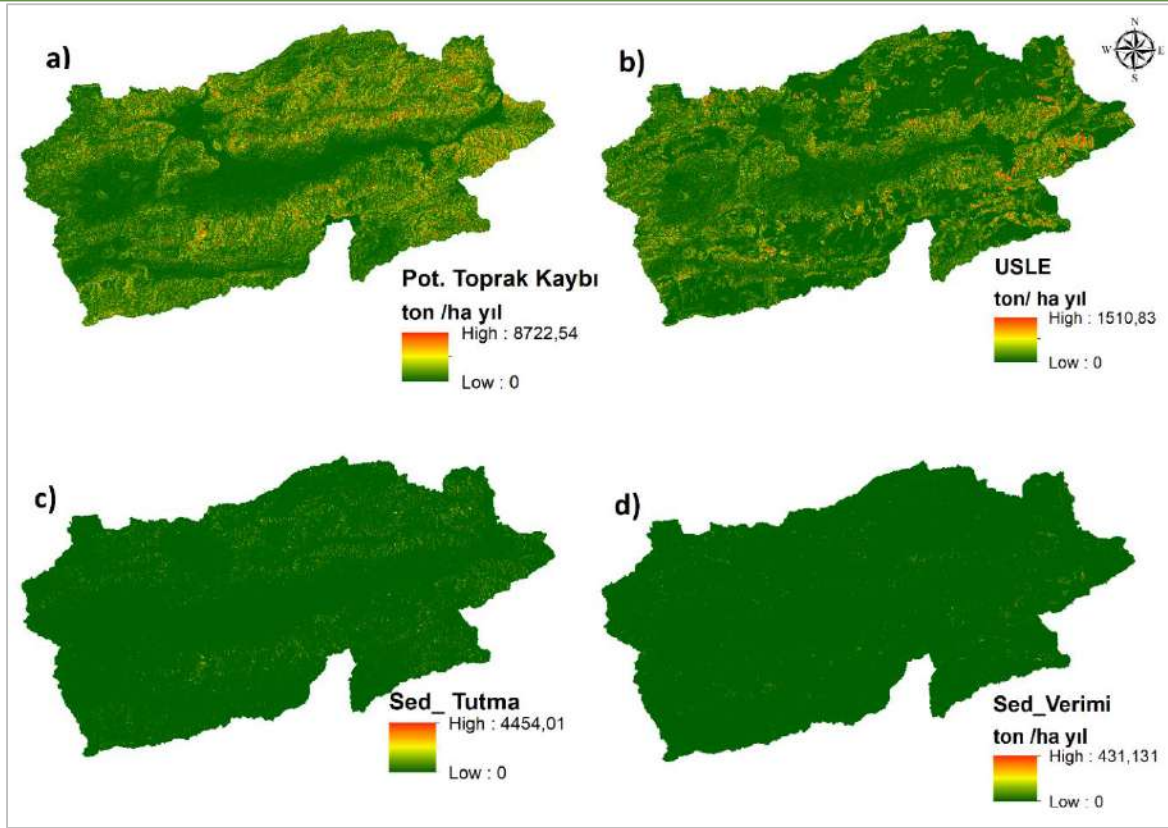


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Hazırlanan grid haritalar, biyofiziksel tablo ve kalibrasyon parametreleri InVEST modeline girildikten sonra yazılımın çalıştırılması ile elde edilen çıktılar Şekil 3’ de verilmiştir. Elde edilen model sonuçlarına göre havzada koruma faktörleri olmadan hesaplanan potansiyel toprak kaybı 0 ile 8722.54 arasında ve ortalama 98.12 ton ha⁻¹ yıl⁻¹ toprak kaybı tahmin edilmiştir. Koruma faktörleri olmadan en fazla toprak kaybı sahada havzanın kuzey kesimlerinde bulunan ormanlık arazilerin bulunduğu yüksek kesimlerde göze çarpmaktadır.

Koruma faktörleri ile birlikte hesaplanan USLE tahmin haritasına göre de havzada toplam toprak kaybı piksel başına 0 ile 1510,83 arasında ve ortalama olarak 6.23 ton ha⁻¹yıl⁻¹ tahmin edilmiştir. Bu değerler Hurni (1983) tarafından bildirilen 6-10 ton ha yıl tolerans değerleri arasında dır ve havzada çok ciddi boyutlarda toprak kaybının gerçekleşmediğini göstermektedir. Erozyonun yüksek tahmin edildiği alanlar Tokat kent merkezinin güney kesimlerindeki eğimi derecesi yüksek olan alanlar ile Deveci dağlarının en doğusundaki yüksek eğimli ve seyrek örtülü sahalarda görülmektedir. Sed_Tutma indeksi hidrolojik bağlantı dahilinde akışa geçerek taşınmaya başlayan fakat mevcut arazi örtüsü tarafından engellenerek akarsulara ulaşamayan piksel başına sediment miktarını veren haritadır. Bir bakıma arazi kullanımıyla engellenen toprak kaybını temsil etmektedir. Yalnız bu indeks havzanın üst kısımlarından akışa geçen ve yukarı kesimlerde tutulan miktarı hesaplamadığından sonucu düşük tahmin etmektedir (InVEST Documentation, 2021). Havzadaki toplam sediment verimini haritası ise 0 – 431,13 ton/piksel arasında değişirken 0,85 ton/piksel ortalama değerini almıştır.



Şekil 3. InVEST model ile üretilen toprak kaybı ve sediman verim haritaları. a: Potansiyel Toprak Kaybı (RKLS) haritası, b) USLE toprak kaybı haritası ; c) Sediment Tutunma Haritası; d) Sediment Verim haritası

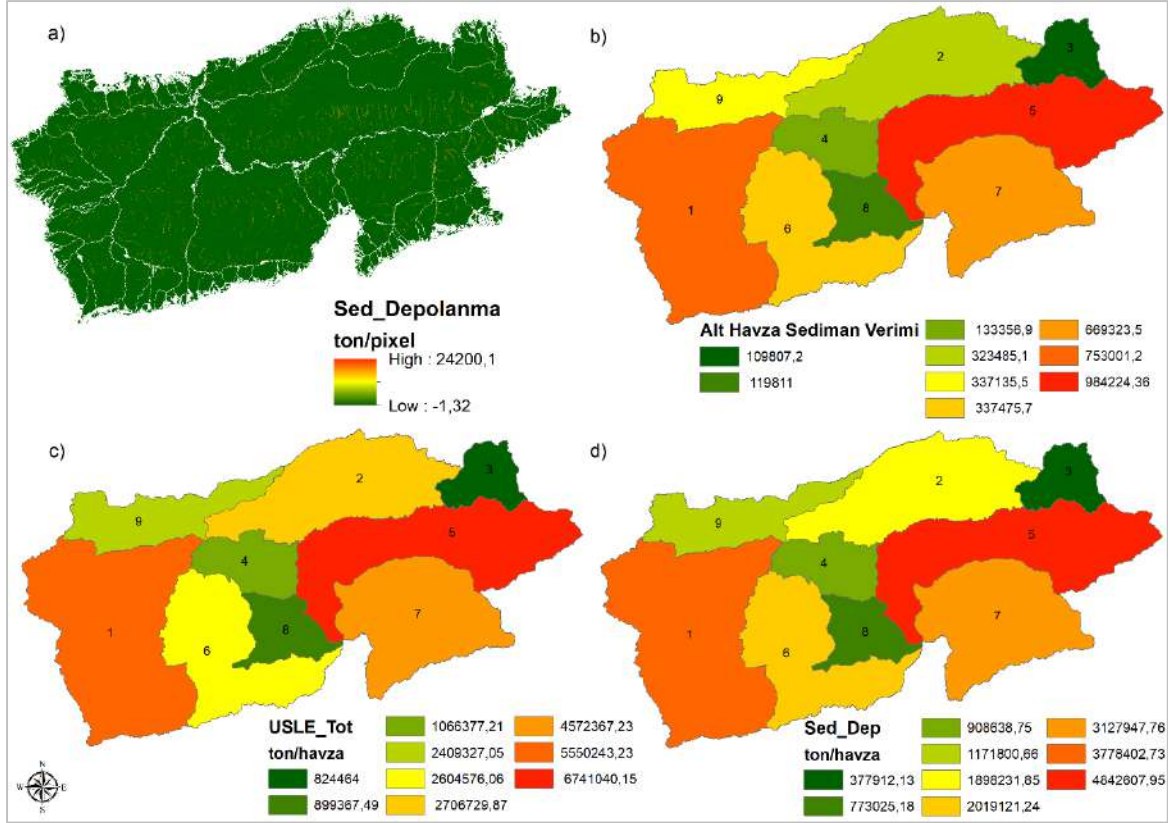
Havzadan akışa geçerek uzaklaşan toplam sediman miktarı ise 3767621,18 ton/havza olarak belirlenmiştir. Ayrıca sediment depolanma grid haritası da model tarafından üretilmiştir. Bu harita tutmanın bir sonucu olarak yukarı akış kaynaklarından piksel üzerinde biriken toplam sediman miktarını vermektedir (Şekil 4). Sediman depolanma miktarı ise piksel başına -1.32 ile 24200,1 arasında değişmekte olduğu görülmüştür. Alt havzaların toprak kaybı ve sediman verimi ile sediman depolanma miktarlarını gösteren harita şekil 4 de verilmiştir. Elde edilen haritalara göre 5 numaralı alt havza toprak kaybı ve sediman verimi ayrıca da sediman depolanma miktarı en fazla olan alt havza olarak belirlenmiştir. Bu havzada toplam sediman verimi 984224,36 ton/havza olarak belirlenmiştir. En az verime sahip alt havza ise 109807,2 ton/havza miktarı ile 3 numaralı havza olarak belirlenmiştir. Araştırma sahasında alt havzalarda belirlenen sediman depolanma miktarının verimin den daha yüksek çıkması taşınan sedimanların havzayı terk etmeyip saha içinde biriktiğini göstermektedir. Bu araştırma InVEST model ile kırsal alanlarda toprak kaybı ve sediman veriminin hızlı ve kolay bir şekilde belirlenebildiğini göstermiştir. Fakat bu gibi çalışmalarda modeller tarafından tahmin edilen



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verim değerleri mevcut gözlemler ile karşılaştırılarak modelin başarısı test edilmelidir. İlerleyen çalışmalarda küresel iklim değişikliği ve arazi örtüsü değişikliklerinin erozyona olan etkisi InVEST sediment iletim modeli ile başarıyla araştırılabilecektir.



Şekil 4. Sediman depolanma haritası ve alt havzaların toplam sediman verimi, sediman depolanma miktarı ve USLE toprak kaybı haritası.

4. SONUÇLAR

Bu çalışma Tokat ovalarını kapsayan havza içindeki toprak kaybının ve sediment veriminin niceliksel olarak hesaplanmasında InVEST sediment iletim modelinin kullanılabilirliğinin test edilmesini amaçlamıştır. Elde edilen sonuçlar havza genelinde toprak kaybının tolerans sınırlarını aşmadığını ve sediment veriminin $0.85 \text{ ton ha}^{-1}\text{yıl}^{-1}$ olarak hesaplanmıştır. Ayrıca sediman depolama haritaları da havzada sedimentlerin akarsulara ulaşmadan depolandığını göstermiştir. Kalibrasyon yapılmadan elde edilen InVEST model sonuçları sediman tepkilerini hesaba katarak saha koruma, geliştirme ve düzenleme faaliyetlerinin planlanması için önemli bilgiler sunduğu belirlenmiştir. Model gerektirdiği verilerin basitliği ve ulaşımı konusunda ki kolaylıkları nedeniyle Türkiye şartlarında etkili bir şekilde kullanılabileceğini göstermiştir.



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KAYNAKLAR

Aneseyee, A. B., Elias, E., Soromessa, T., & Feyisa, G. L. (2020). Land use/land cover change effect on soil erosion and sediment delivery in the Winike watershed, Omo Gibe Basin, Ethiopia. *Science of the Total Environment*, 728, 138776.

Borselli, L., Cassi, P., & Torri, D. (2008). Prolegomena To Sediment And Flow Connectivity in The Landscape: A GIS And Field Numerical Assessment. *Catena*, 75(3), 268-277.

H. Hurni (1983). Soil Formation Rates In Ethiopia. *Ethiopian High Lands Reclamation Study*.

Hamel, P., Chaplin-Kramer, R., Sim, S., & Mueller, C. (2015). A New Approach To Modeling The Sediment Retention Service (Invest 3.0): Case Study Of The Cape Fear Catchment, North Carolina, USA. *Science Of The Total Environment*, 524, 166-177.

Haregeweyn, N., Tsunekawa, A., Poesen, J., Tsubo, M., Meshesha, D. T., Fenta, A. A., ... & Adgo, E. (2017). Comprehensive assessment of soil erosion risk for better land use planning in river basins: Case study of the Upper Blue Nile River. *Science of the Total Environment*, 574, 95-108.

J.H. Pak, M. Fleming, W. Scharffenberg, S. Gibson, T. Brauer (2015). Modeling Surface Soil Erosion And Sediment Transport Processes In The Upper North Bosque River Watershed Texas. *J. Hydrol. Eng.*, 20, P. 04015034, 10.1061/(ASCE)He.1943-5584.0001205.

Kale, M. (2018). Yeşilirmak Havzası Mekânsal Yağış Dağılımına Ait Değişiminin Deterministik Ve Stokastik Yöntemlerle Belirlenmesi. *Yerbilimleri*, 39(3), 263-276.

Kilic, O. M. (2021). Effects Of Land Use And Land Cover Changes On Soil Erosion In Semi-Arid Regions Of Turkey; A Case Study In Almus Lake Watershed. *Carpathian Journal Of Earth And Environmental Sciences*, 16(1), 129-138.

McIntyre, N., Ballard, C., Bruen, M., Bulygina, N., Buytaert, W., Cluckie, I., ... & Wheeler, H. (2014). Modelling the hydrological impacts of rural land use change. *Hydrology Research*, 45(6), 737-754.

Oldeman, L. R. (1994). An International Methodology For An Assessment Of Soil Degradation, Land Georeferenced Soils And Terrain Database, In The Collection And Analysis Of Land Degradation Data. *FAO-RAPA Publication 1994/3*, Bangkok, Pp. 35–60.



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and RURAL DEVELOPMENT
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BINGOL, TURKEY**



Özden, Ş., & Özden, D. M. (1997). Türkiye Toprak Erozyon Tahmin Modeli TURTEM. Başbakanlık Köy Hizmetleri Genel Müdürlüğü Toprak Ve Gübre Araştırma Enstitüsü Müdürlüğü Yayınları, Ankara.

Panagos P., Borrelli P., Meusburger K., Yu B., Klik A., Lim K.J., Yang J.E, Ni J., Miao C., Chattopadhyay N., Sadeghi S.H., Hazbavi Z., Zabihi M., Larionov G.A., Krasnov S.F., Garobets A., Levi Y., Erpul G., Birkel C., Hoyos N., Naipal V., Oliveira P.T.S., Bonilla C.A., Meddi M., Nel W., Dashti H., Boni M., Diodato N., Van Oost K., Nearing M.A., Ballabio C., 2017. Global Rainfall Erosivity Assessment Based On High-Temporal Resolution Rainfall Records. Scientific Reports 7: 4175. DOI: 10.1038/S41598-017-04282-8.

Panagos, P., Borrelli, P., Poesen, J., Ballabio, C., Lugato, E., Meusburger, K., ... & Alewell, C. (2015). The new assessment of soil loss by water erosion in Europe. Environmental science & policy, 54, 438-447.

Sharp, R., Douglass, J., Wolny, S., Arkema, K., Bernhardt, J., Bierbower, W., Chaumont, N., Denu, D., Fisher, D., Glowinski, K., Griffin, R., Guannel, G., Guerry, A., Johnson, J., Hamel, P., Kennedy, C., Kim, C.K., Lacayo, M., Lonsdorf, E., Mandle, L., Rogers, L., Silver, J., Toft, J., Verutes, G., Vogl, A. L., Wood, S, and Wyatt, K. 2020, InVEST 3.9.2.post17+ug.gbe19f67 User's Guide. The Natural Capital Project, Stanford University, University of Minnesota, The Nature Conservancy, and World Wildlife Fund. İnternet Adresi: <https://storage.googleapis.com/releases.naturalcapitalproject.org/invest-userguide/latest/index.html>. Ulaşım Tarihi:10.12.2021

Shi, Z. H., Ai, L., Fang, N. F., & Zhu, H. D. (2012). Modeling The İmpacts Of İntegrated Small Watershed Management On Soil Erosion And Sediment Delivery: A Case Study İn The Three Gorges Area, China. Journal Of Hydrology, 438, 156-167.

Thomas, J., Joseph, S., & Thrivikramji, K. P. (2018). Estimation of soil erosion in a rain shadow river basin in the southern Western Ghats, India using RUSLE and transport limited sediment delivery function. International Soil and Water Conservation Research, 6(2), 111-122.

Vigiak, O., Borselli, L., Newham, L. T. H., McInnes, J., & Roberts, A. M. (2012). Comparison Of Conceptual Landscape Metrics To Define Hillslope-Scale Sediment Delivery Ratio. Geomorphology, 138(1), 74-88.



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**MUŞ İLİ ARAZİ KULLANIMI VE ARAZİ ÖRTÜSÜNÜN ZAMANSAL (1990-2018)-
MEKÂNSAL DEĞİŞİMİNİN İNCELENMESİ**

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ÖZET

Arazi kullanım planlaması ve sürdürülebilir doğal kaynak yönetimi için arazi örtüsü ve arazi kullanım dinamiklerinin şekillendirici gücünü ve etkinliğini anlamak önemli bir yere sahiptir. Bu bakımdan Muş ilinin doğal kaynak planlaması ve arazi kullanım planlarına yardımcı olması adına detaylı arazi örtüsü değişikliklerinin belirlenmesi bu çalışmanın ana amacını oluşturmaktadır. Bu amaçla ilin arazi örtüsünün dağılışı ve gelişimi coğrafi bilgi sistemleri (CBS) ve CORİNE seviye 3 sınıflandırma haritaları kullanılarak incelenmiştir. 1990 ve 2018 yıllarına ait arazi örtüsü haritaları CBS yazılımında uzaysal kesiştirme yöntemi ile analiz edilmiş ve 28 yıl arasındaki değişim matriksi elde edilmiştir. 1990 yılında en fazla alan kaplayan kullanım tipi sulanmayan ekilebilir arazi (194.266 ha) olduğu ve 28 yılın sonunda bu kullanım tipinin en fazla değişim gösteren sınıf olduğu belirlenmiştir. Bu sınıftaki toplam değişim 50.385,9 ha olarak belirlenmiş bu değişimin büyük çoğunluğunun sulanabilir arazilere olduğu anlaşılmıştır. Ayrıca yıllar arasındaki değişime bakıldığında en fazla alan kazanan kullanım tipinin kalıcı olarak sulanabilen araziler olduğu belirlenmiştir ve 54.436 ha artış göstermiştir. Önemli doğal kaynaklardan orman alanları ile doğal çayır ve mera sahalarında önemli artışlar belirlenmiştir. Çalışma sahasında antropojen kaynaklı yanlış arazi kullanım şekilleri de göze çarpmaktadır. Özellikle 175,59 ha doğal mera ve çayır arazisi maden sahasına, orman arazilerinin geçişindeki çalılık sahalardan 71,22 ha alan ise inşaat artıklarının boşaltım sahasına dönüşmüştür. Kesintili kentsel alanlar ise yanlış arazi kullanım örneklerinin görüldüğü en problemli kullanım tipidir ve yaklaşık 382 ha artış göstermiştir. Özellikle bu artışın büyük çoğunluğunun sulanmayan tarım arazileri ve doğal mera alanlarından olduğu anlaşılmıştır. Bu veriler il genelinde yanlış arazi kullanımının gelecekte önemli problemlere yol açabileceğini göstermektedir. Elde edilen sonuçların Muş ili için sürdürülebilir kalkınma planlarının oluşturulmasında katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Arazi Örtüsü/Arazi Kullanımı, CBS, Corine, Muş



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**SPATIAL AND TEMPORAL INVESTIGATION OF LAND USE AND LAND COVER
IN MUŞ PROVINCE**

ABSTRACT

Understanding the shaping power and effectiveness of land cover and land use dynamics has an important place for land use planning and sustainable natural resource management. In this respect, the main purpose of this study is to determine the detailed land cover changes in order to assist the natural resource planning and land use plans of Muş province. For this purpose, the distribution and development of the land cover of the province were examined using geographic information systems (GIS) and CORINE level 3 classification maps. The land cover maps of 1990 and 2018 were analyzed in GIS software by spatial intersection method and the change matrix between 28 years was obtained. It was determined that the use type that covered the most area in 1990 was the non-irrigated arable land (194.266 ha), and at the end of 28 years, this type of use was the class that showed the most change. The total change in this class was determined as 50,385.9 ha, and it was understood that the majority of this change was in irrigable lands. In addition, when the change between years is examined, it has been determined that the usage type that gains the most area is the lands that can be permanently irrigated, and it has increased by 54,436 ha. Significant increases were determined in forest areas and natural meadow and pasture areas from important natural resources. In the study area, anthropogen-induced incorrect land use patterns are also striking. In particular, 175.59 ha of natural pasture and meadow land has turned into a mine site, and 71.22 ha of the bush areas at the transition of forest lands has been turned into a construction waste dumping area. Intermittent urban areas, on the other hand, are the most problematic type of use where incorrect land use examples are seen and increased by about 382 ha. In particular, it has been understood that the majority of this increase is from non-irrigated agricultural lands and natural pasture areas. These data show that improper land use across the province may cause significant problems in the future. It is thought that the results obtained will contribute to the creation of sustainable development plans for the province of Muş.

Keywords: Land Cover/Land Use, GIS, Corine, Muş



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1.GİRİŞ

Ekosistemlerin işlevini ve sağlığını değerlendirmek için kullanılan önemli göstergelerden biri arazi kullanımı/arazi örtüsü (AKAÖ) değişikliğidir. Düzenli aralıklarla bu değişikliğın tespiti, ekolojistlere ve bilim adamlarına mevcut ve gelecekteki ekolojik sorunları etkin bir şekilde izleme ve değerlendirme konusunda yardımcı olur (Khwarahm, 2021). Bu değişimlerin itici güçleri, doğal ve antropojenik faktörler dahil olmak üzere dış faktörlere bağılı olarak mekana ve zamana göre değişim göstermektedir (Rimal ve diğ., 2018). Hızlı artan dünya nüfusuna bağılı olarak AKAÖ deki değişiklikler ekolojik hizmetleri, biyolojik çeşitliliğı ve peyzaj bütünlüğünü olumsuz etkilemektedir (Motlagh ve diğ., 2019). Antropojenik etmenlerin neden olduğı arazi dönüşümü ve tahribatı yıkıcı sonuçlar doğurmaktadır ki bunlar, ekim modellerinin değişmesi, orman alanlarının tahribatı, kentsel gelişim ve yerleşim alanlarının genişlemesi arazi dönüşümlerinin ortaya çıkardığı sonuçlardandır (Ren ve diğ. 2019). Bu sonuçlar aynı zamanda doğal arazilerin ve verimli tarım arazilerinin tahribatına neden olmasından dolayı AKAÖ değişikliğinin kontrolü ve yönetimi gelişmekte olan ülkelerde arazi kullanım planlama sistemlerinin en önemli problemlerinden birisi olarak görülmelidir (Hou ve diğ. 2019).

Peyzaj süreçleri ile ilgili bilgi kaynağı olan AKAÖ değişiklikleri hakkında zamanında tespit ve detaylı bilgiler insan ve doğa olayları arasındaki ilişkileri ve etkileşimleri anlamak için önemlidir (Weber, 2007). Bu amaçla CBS, bu değişiklikler ile ilgili coğrafi olayların mekânsal dağılımını ve gelişimini incelemek için en iyi yöntemlerden birisidir (Popovici ve diğ. 2013). CBS, değişiklik tespiti için gerekli sayısal verilerin hazırlanması, depolanması, görüntülenmesi ve analiz edilmesi için uygun ortamı sağlamaktadır (Liping ve diğ. 2018). CORINE (Coordination of Information on the Environment) arazi örtüsü veri tabanı, Avrupa Birliğine üye ülkelerin tamamında çevresel politikaların belirlenmesinde kullanılmak üzere arazi kullanım arazi örtüsü haritalarında bir standart getirilmesi amaçlanarak tasarlanan haritalardır (Başayığıt, 2004). Avrupa ülkelerinin 1990, 2000, 2006, 2012 ve 2018 yıllarına ait arazi örtüsü haritaları ve bu yıllar arasındaki değişimler Avrupa birliğı Çevre ajansı idaresinde üye ülkelere CBS ve uzaktan algılama yöntemleri kullandırılarak hazırlatılmıştır. CORINE veri tabanı AKAÖ değişikliklerinin tespit etmenin yanısıra arazi örtüsü dağılımı ve miktarını hesaplamak için önemli bilgiler içermektedir. Bu veri tabanları CBS ile analiz edilerek hem bölgesel hemde ulusal ölçekte AKAÖ çalışmaları gerçekleştirilmiştir (Ferenac ve diğ. 2010; Aydoğdu ve diğ. 2012; Ateşoğlu 2016). Türkiye’ de CORINE veri tabanlarının ilk hazırlanması TUIK tarafından 2001 yılında başlatılmış, Gıda ve Tarım bakanlığı tarafından 2005-2008 yıllarında yürütölmüş



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ardından ise Tarım ve Orman Bakanlığına devredilmiştir (Özür ve Ataol, 2018). Halihazırda mevcut veri tabanı Avrupa Birliği Çevre Ajansının ve Tarım ve Orman bakanlığının web sayfalarından temin edilmektedir. Veri tabanları sayesinde özellikle AKAÖ dağılımlarının ve değişimlerinin incelenmesinin yanı sıra sulak alanların yok olması, ormansızlaşmanın takip edilmesi, hassas alanlarda tarımsal faaliyetlerin artması, kıyı kesimi boyunca turizm gelişmesi, tarımsal alanlarda vejetasyonun zayıflaması gibi konularda tespit çalışmaları yapılmaktadır (Aydoğdu ve diğ. 2012; Yıldırım, 2015; Ateşoğlu 2016; Özdemir ve Demirel, 2016; Bayar ve Karabacak, 2017).

Ülkemizde son yıllarda nüfusun artmasına paralel olarak sosyal ve ekonomik ihtiyaçların artış göstermesi yıllar içinde arazi kullanımlarında önemli değişimlere sebep olmuştur (Aktürk ve Güney, 2021). Bu araştırmanın ana amacı ise antropojen kaynaklı AKAÖ değişimlerinin zengin doğal kaynakların ve verimli tarım arazilerinin bulunduğu Muş ilinde nasıl ve ne yönde şekillendiğini anlayabilmektir. Bu amaç doğrultusunda CORINE 1990 ve 2018 yıllarına ait AKAÖ veri tabanlarından faydalanılarak 28 yıl içerisinde ki değişimler CBS ile analiz edilerek araştırılmıştır. Elde edilen sonuçların il genelinde çevre planlarının tasarlanması konusunda yardımcı olacağı düşünülmektedir.

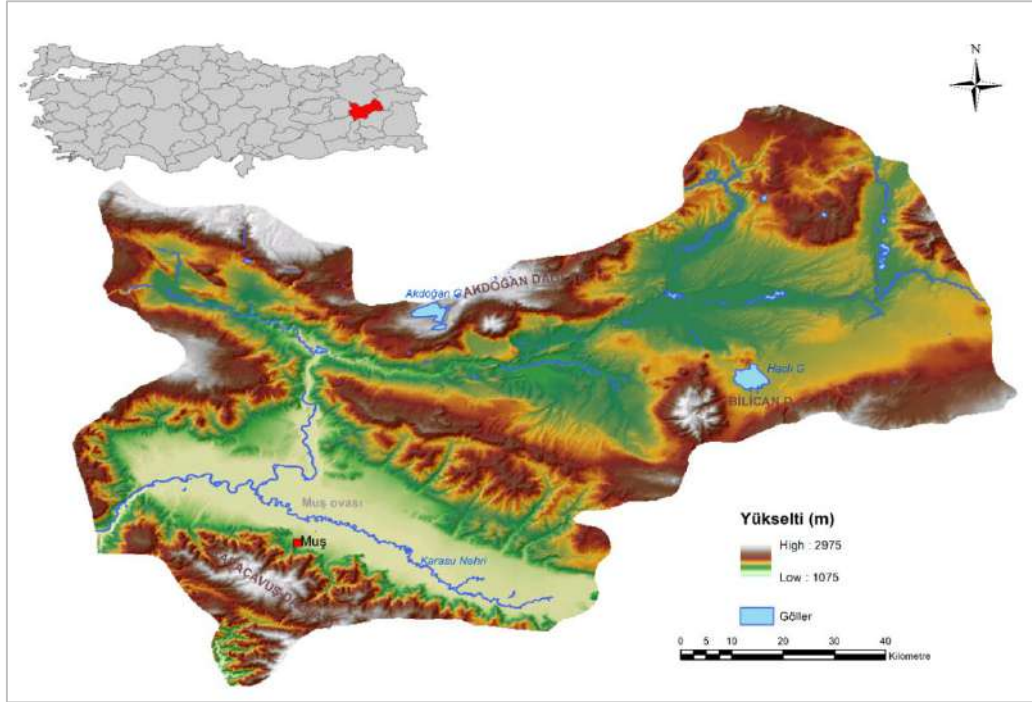
2. MATERYAL VE METOD

2.1. Çalışma Alanı

Çalışmanın yürütüldüğü Muş ili Doğu Anadolu bölgesinde Yukarı Murat havzasında yer almaktadır (Şekil 1). Çalışma sahasının büyüklüğü 865086,7 ha (8650km²) dır. Sahanın yükseltisi 1075-2975 m arasında iken ortalama yükseltisi 1692 m dir. Jeomorfolojik açıdan bakıldığında % 35'i dağlık, % 27'si ovalık ve % 38'i alçak ve yüksek plato alanlarından oluştuğu görülmektedir. Sahanın etrafı yüksek dağlık alanlarla çevrili iken taban düzlüklerinde Muş, Malazgirt ve Bulanık ovaları yer almaktadır. İl genelinde ortalama yıllık yağış 764.5 mm, ortalama sıcaklık ise 9.6 C° dir (Durmuş ve Dölek, 2019).



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Şekil 1. Çalışma alanı lokasyon haritası.

2.2. CORINE Veri Tabanı ve Araştırma Yöntemi

CORINE veri tabanının amacı, arazilerin tanımlanmasında tüm alanları kapsayan ortak bir sınıflandırma dili geliştirmektir. CORINE arazi örtüsü ve arazi kullanımı veri tabanı üç hiyerarşik seviyeden oluşan bir sınıflama sistemidir. Birinci düzeyde beş ana grup, ikinci seviyede onbeş ve üçüncü seviyede ise 44 alt sınıf bulunmaktadır (Tablo 1). CORINE veri tabanı Landsat, Spot, IRS ve Sentinel uydu görüntülerinin CBS ve uzaktan algılama teknikleri ile yardımcı topografik veriler kullanılarak oluşturulmaktadır. Oluşturulan arazi sınıfları minimum 25 ha 'lık haritalama birimlerinden oluşmaktadır ve haritaların çözünürlüğü 100 m dir. Araştırmada kullanılan CORINE veri tabanı 3.düzyer sınıf haritalarıdır ve bu haritaların genel doğruluğu geliştiriciler tarafından %85'in üzerinde hesaplanmıştır. 3. Düzey haritalar çalışma sahası genelinde ayrıntılı bir şekilde arazi kullanımlarını vermekte bu sayede arazi değişimleri daha detaylı bir şekilde belirlenebilmektedir.



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Tablo 1. CORINE arazi örtüsü ve kullanımı sınıflandırma sistemi

1. YAPAY BÖLGELER	3. ORMAN VE YARI DOĞAL ALANLAR
1.1. Şehir Yapısı	3.1. Ormanlar
1.1.1. Sürekli şehir yapısı	3.1.1. Geniş Yapraklı Ormanlar
1.1.2. Kesintili/Süreksiz Şehir Yapısı	3.1.2. İğne Yapraklı Ormanlar
1.2. Endüstri Ticaret ve Ulaşım Birimleri	3.1.3. Karışık ormanlar
1.2.1. Endüstriyel ve Ticari Birimler	3.2. Maki ve Otsu Bitkiler
1.2.2. Karayolları, Demiryolları ve ilgili alanlar	3.2.1. Doğal Çayırliklar
1.2.3. Limanlar	3.2.2. Fundaliklar
1.2.4. Havaalanları	3.2.3. Sklerofil Bitki Örtüsü
1.3. Maden Ocağı Boşaltım ve İnşaat Sahaları	3.2.4. Bitki değişim alanları
1.3.1. Maden Çıkarım Sahaları	3.3. Bitki örtüsü ile kaplı olmayan veya az miktarda bitki örtüsü ile kaplı açık alanlar
1.3.2. Boşaltım Sahaları	3.3.1. Sahiller kumsallar kumluklar
1.3.3. İnşaat Sahaları	3.3.2. Kayaliklar
1.4. Yapay Tarımsal Olmayan Yeşil Alanlar	3.3.3. Seyrek bitki alanları
1.4.1. Yeşil Şehir Alanları	3.3.4. Yanmış alanlar
1.4.2. Spor ve Eğlence Alanları	3.3.5. Buzul ve kalıcı kar
2. TARIMSAL ALAN	4. SULAK ALANLAR
2.1. Ekilebilir Alan	4.1. Karasal Bataklıklar
2.1.1. Sulanmayan Ekilebilir Alanlar	4.1.1. Karasal Bataklıklar
2.1.2. Sürekli Sulanan Alanlar	4.1.2. Turbalıklar
2.1.3. Pirinç Tarlaları	4.2. Denize yakın ıslak alanlar
2.2. Sürekli Ürünler	4.2.1. Tuz bataklığı
2.2.1. Üzüm Bağları	4.2.2. Tuzlalar
2.2.2. Meyve Bahçeleri	4.2.3. Gelgit olayı ile oluşan düzlükler
2.2.3. Zeytinlikler	5. SU YAPILARI
2.3. Meralar	5.1. Hareketli Sular
2.3.1. Mera Alanları	5.1.1. Su yolları
2.4. Karışık Tarımsal Alanlar	5.1.2. Su kütleleri
2.4.1. Sürekli ürünlerle birlikte bulunan senelik ürünler	5.2. Deniz suları
2.4.2. Karışık Tarım Alanları	5.2.1. Kıyı Lagünleri
2.4.3. Esas olarak doğal bitki örtüsü önemli alanlarla tarım tarafından işgal edilen arazi	5.2.2. Nehir ağızları deltalar
2.4.4. Ormanla karışık tarım alanları	5.2.3. Deniz- okyanus

Avrupa Birliği Çevre ajansının web sayfasından indirilen 1990 ve 2018 yıllarına ait sayısal vektör haritalar ArcGIS yazılımının overlay ve uzaysal analiz araçları kullanılarak alansal dağılımları analiz edilmiştir. Elde edilen veri tabanları öncelikle il sınır haritası yardımıyla kesilmiş ve zonal hesaplama araçları ile alansal dağılımları hesaplanmıştır. Ardından 1990 ve 2018 yıllarına ait iki harita kesiştirme yöntemi ile karşılaştırılmış ve yeni veri tabanı Excel programının pivot tablo sınıflandırma aracı kullanılarak değişim matrisi elde edilmiştir. Elde edilen matris ile yıllar arasındaki arazi kullanım değişiminin yönü ve miktarı alansal olarak belirlenmiştir.



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3. BULGULAR VE TARTIŞMA

Elde edilen 1990 ve 2018 yıllarına ait CORINE AKAÖ haritalarının alansal dağılımları ve bu sınıfların değişimleri Tablo 2 de verilmiştir. 1990 yılında çalışma sahasında 19 farklı kullanım tipi belirlenmiştir. Bu sınıflar içinde 1990 yılında en fazla yüzey kaplayan kullanım tipi sulanmayan ekilebilir arazi (194.266 ha) sınıfıdır. Sönmez (2014)' Muş ilinde 1989 ve 2011 yıllarına ait arazi kullanımlarını haritaladığı çalışmasında bulgularımıza paralel sonuçlar bulmuş ve 1989 yılında en fazla arazi kullanım tipinin kuru tarım alanları olduğunu belirtmiştir. 1990 yılında ikinci sıra en fazla kaplayan sınıf doğal meralar (154.476,83 ha), üçüncü sırada ise seyrek bitki örtüsü bulunan kesimlerdir (147.947,1 ha). 1990 yılında en az alan kaplayan sınıf ise Endüstriyel veya ticari alanlar sınıfı olarak belirlenmiştir ve yaklaşık 135,87 ha dır. Ardından iğne yapraklı ormanlar 364,90 ha alanla ikinci sırada, üçüncü sırada en az alan örten sınıf ise hava alanı olarak belirlenmiştir ki bu sınıfta 719,39 ha yer kaplamaktadır. Diğer sınıflar ve alansal ölçümleri tablo 2 verilmiştir.

1990 yılında toplam 19 olan AKAÖ sayısı 2018 yılında yirmi ikiye çıkmıştır. 28 yıl sonunda ortaya çıkan AKAÖ tipleri ise kesintisiz şehir yapısı, karayolu, demiryolu ve bunlara bağlı araziler, maden alanları ve inşaat artıkları boşaltım sahaları olarak karşımıza çıkmıştır. 2018 yılında sulanamayan ekilebilir arazilerde meydana gelen azalma ve mera alanlarında gözlemlenen artışlardan dolayı en fazla alan kullanımı 1990 'da ki duruma göre sıra değişikliğine uğramıştır. 1990 da en fazla alan kaplayan sınıf 2018 de ikinci sıraya gerilemiştir ve 2018 yılında meralardaki alansal artıştan dolayı bu yıl en fazla alan kaplayan sınıf konumuna girmiştir (166.125,3 ha). Kıranşah ve Şengün (2016) araştırmalarında, Bulanık ve Malazgirt ovalarında 2002 ve 2016 yılları arasındaki arazi kullanımında en önemli değişimin mera alanlarındaki azalış olarak vurgulamaktadır. Bizim çalışmamız da ise benzer bir duurm ortaya çıkmıştır fakat şekil 2 dikkatli incelendiğinde özellikle mera alanlarının muş ovasının kuzey ve güney kesimlerinde fazla miktarda artış görülürken, bulanık ve Malazgirt bölgesinde ki meralarda ise zaman içerisinde araştırmacıların bahsettiği gibi bir azalma görülmektedir.

2018 yılında ikinci sıra da ise sulanamayan araziler bulunmaktadır ve 143.880,4 ha alan kapladığı belirlenmiştir. Ardından üçüncü sırada ise tarım tarafından işgal edilen araziler (120.758,2 ha) gelmektedir. 2018 yılında sahanın geneline bakıldığında alanın yaklaşık %39 'unun çayır ve doğal mera alanları ile kaplı olduğu görülmektedir. Bu dağılışı ilin hayvancılık bakımından yüksek potansiyelini ortaya koymaktadır (Durmuş ve Çağlayan, 2019).



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Yıllar içindeki değişime dikkat edildiğinde ise kullanım tiplerinde negatif ve pozitif değişimler görülmektedir. 2010 yılında Murat Nehri üzerine kurulan Alparslan 1 barajının faaliyete geçmesi ve su tatmaya başlaması ve aynı zamanda Muş Ovasının kuzey batı kısımlarında da sulama imkânlarının artmasından dolayı il genelinde en fazla artış kalıcı olarak sulanabilir tarım arazilerinde belirlenmiştir. Toplam artış 54.436 ha olarak belirlenmiş ve artıştan yaklaşık 45.594 ha sulanamayan arazi sulama imkânına kavuşmuştur. Kıranşah ve Şengün (2016) da Bulanık ve Malazgirt ovalarında sulu tarım alanlarında %10.6'lık bir artışın olduğunu ve artışın nedeni olarak sulama projelerinde uygulanmasına bağlamaktadır.

Tablo 2. Muş İlinde 1990 ve 2018 yıllarına ait AKAÖ alansal dağılımı ve yıllar içindeki değişimi

AKAÖ Tipi	Corine Kodu	1990 (ha)	%1990	2018 (ha)	%2018	Değişim (ha)
Kesintisiz Şehir Yapısı	111	-	0,00	459,51	0,05	459,51
Kesintili Şehir Yapısı	112	9536,7	1,10	9919,6	1,15	382,91
Endüstriyel veya Ticari Alanlar	121	135,87	0,02	831,63	0,10	695,76
Karayolu, Demiryolu ve Buna Bağlı Araziler	122	-	0,00	28,61	0,00	28,61
Hava Alanları	124	719,39	0,08	791,95	0,09	72,56
Maden Alanları	131	-	0,00	197,71	0,02	197,71
İnşaat Artıkları Boşaltım Alanı	133	-	0,00	108,38	0,01	108,38
Sulanamayan Ekilebilir Arazi	211	194266,4	22,46	143880,4	16,63	-50385,9
Kalıcı Olarak Sulanan Arazi	212	49394,07	5,71	103830,1	12,00	54436,06
Çayır	231	31880,03	3,69	54543,89	6,31	22663,86
Karmaşık Ekim Modelleri	242	19396,03	2,24	25254,36	2,92	5858,33
Esas Olarak Doğal Bitki Örtüsü Önemli Alanlarla Tarım Tarafından İşgal Edilen Arazi	243	111784,1	12,92	120758,2	13,96	8974,06
Geniş Yapraklı Orman	311	19953,08	2,31	29862,67	3,45	9909,58
İğne Yapraklı Orman	312	364,90	0,04	-	0,00	-364,90
Karışık Orman	313	16825,9	1,94	1103,5	0,13	-15722,4
Doğal Meralar	321	154476,8	17,86	166125,3	19,20	11648,5
Geçiş Ormanlık Çalı	324	44125,66	5,10	36847,62	4,26	-7278,05
Sahil Kumu ve Kum Düzlikleri	331	3356,9	0,39	2659,7	0,31	-697,14
Çıplak Kayalar	332	44494,51	5,14	26360,68	3,05	-18133,8
Seyrek Bitki Örtüsü Alanları	333	147947,1	17,10	118538,8	13,70	-29408,2
İç Bataklıklar	411	2403,7	0,28	2909,7	0,34	506,024
Su Yolları	511	10288,17	1,19	7294,3	0,84	-2993,79
Su Yüzeyleri	512	3737,2	0,43	12779,65	1,48	9042,37
Toplam		865086,7	100	865086,7	100	



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Yıllar içinde Çayır ve Mera arazilerin dede önemli pozitif gelişmeler gözlemlenmiştir. Çayır alanları 22.663,86 ha' lık bir artış sergilerken, Mera alanları 11.648,50 ha 'lık bir artma görülmüştür. Tablo 3'deki pivot tablo incelenerek bu artışlara neden olan en temel faktörün özellikle seyrek bitki örtüsü ile kaplı alanlar olduğu anlaşılmıştır. Bu sınıftan yaklaşık 3980 ha arazi çayır alanları sınıfına dâhil olduğu belirlenmiştir ve ardından en büyük ikinci etkeninde tarım tarafından işgal edilen arazilerden olan kazanım olduğu anlaşılmaktadır. Bu sınıftan hem çayır arazilerine hem de doğal mera alanlarına önemli geçişlerin olduğu Tablo 3'den anlaşılmaktadır.



Corine

Kodu 111 112 121 122 124 131 133 211 212 231 243 311

112	438,34	5364,88	163,75	28,62			506,99	776,63	309,25	879,58	428,91	311
121			131,09				0,47		0,11	0,09		
124					715,87		0,03	2,13	1,37			
211	0,03	791,92	92,33		0,91	1,04	124165,66	45594,23	3382,55	3816,82	7395,55	
212	15,18	370,21	171,38		0,40	16,77	1309,79	44604,14	488,40	1129,16	445,43	311
231		192,80	72,29		73,53	114,97	1989,25	1878,89	23004,76	306,25	1800,77	
242	5,44	2127,91	1,63		4,33		2488,43	2037,90	683,74	7456,87	2656,73	
243	0,52	514,97			1,25		8043,33	3356,56	3903,14	6913,42	72857,38	
311						17,54	1,68		30,08	51,03	42,33	
312									0,09		0,06	
313		0,28						0,42	72,38	14,52	596,43	
321		216,69	102,05		60,62		2371,40	2899,75	17198,21	1384,22	10101,16	
324		3,86	0,35			71,22	29,87	10,09	272,56	935,89	5933,43	
331		24,32	29,35				34,57	440,40	671,17	62,18	316,77	
332		9,54					292,99	265,73	337,09	179,67	3228,66	
333		264,93	1,02				2370,28	1527,61	3980,97	1650,29	14699,73	
411		29,95					114,74	217,35	60,22	34,49	18,82	
511		7,37	66,40			5,71	157,12	197,49	147,76	439,88	236,04	
512							3,84	20,81	0,05			

Genel

Toplam 459,51 9919,62 831,63 28,62 791,96 197,71 108,38 143880,44 103830,13 54543,89 25254,36 120758,19 29862,67



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Tablo 3 'ün devamı.

		2018						Genel Toplam
Corine Kodu	324	331	332	333	411	511	512	
112	28,94	1,93	26,93	145,82	0,19	0,48	256,66	9536,71
121				2,17		1,93		135,87
124								719,39
211	51,32	57,59	244,17	1602,49	10,30	87,46	5419,03	194266,39
212	66,74	117,10		32,26	22,31	361,68	55,25	49394,07
231	14,94	82,09	74,31	115,57	722,90	35,58	135,58	31880,03
242	187,29	45,54	18,93	575,20	1,41	31,40	18,05	19396,03
243	1287,69	214,50	619,46	3048,65	56,82	31,87	692,35	111784,12
311	3906,98		4,39	89,77		3,11	0,70	19953,08
312	49,09			0,27				364,90
313	4130,11	1,28	94,39	146,03				16825,90
321	1116,21	73,67	2163,85	24396,20	37,82	16,69	444,47	154476,84
324	20106,70	2,05	766,11	2423,58	27,34	6,68	4,80	44125,66
331	15,69	1343,40	23,18	90,11		108,62		3356,91
332	2427,62	0,21	1223,07	16349,30				44494,51
333	3448,12	70,16	21100,96	69473,65	121,14	60,25	372,23	147947,07
411	1,30			0,00	1909,42			2403,77
511	7,86	650,24	0,94	47,77		6548,64	1687,03	10288,17
512	1,03				0,16		3693,50	3737,28
Genel Toplam	36847,62	2659,76	26360,68	118538,85	2909,79	7294,39	12779,65	865086,71

Önemli değişimlerin görüldüğü diğer bir arazi kullanımı türü ise Seyrek biti örtüsü ile kaplı alanlarda olduğu görülmektedir. Bu kullanım tipinde toplam 29.408,20 ha 'lık bir negatif değişim hesaplanmıştır. Tablo 3 incelenerek bu sınıfın uğradığı dönüşümdeki en payda tarımın olduğu görülmektedir. 11.651 ha ile tarım tarafından işgal edilen arazi (243) sınıfına dönüşüm bunu göstermektedir. Ayrıca bu sınıfın yanında sulu ve susuz tarımda görülen (211 ve 212 kod) yaklaşık 2263 ha 'lık artma da antropojen kaynaklı dönüşümlerin bölgede etkinliğini göstermektedir. Özellikle tarımsal üretim teşviklerinin son yıllarda artmasıyla insanların tarım alanı kazanma yönünde ki tutumları bu sınıftaki azalmayı açıklamaktadır (Kıranşah ve Şengün, 2016).

28 yıl içinde önemli değişim gösteren sınıflardan biriside 332 kodlu çıplak kayalık alanlarında görülmüştür ki bu değişim negatif yönde olup 18133,8 ha arazi azalma göstermiştir (Tablo 2). Bu azalma da büyük payın doğal meral alanları ve seyrek bitki örtüsü ile kaplı alanlara olan

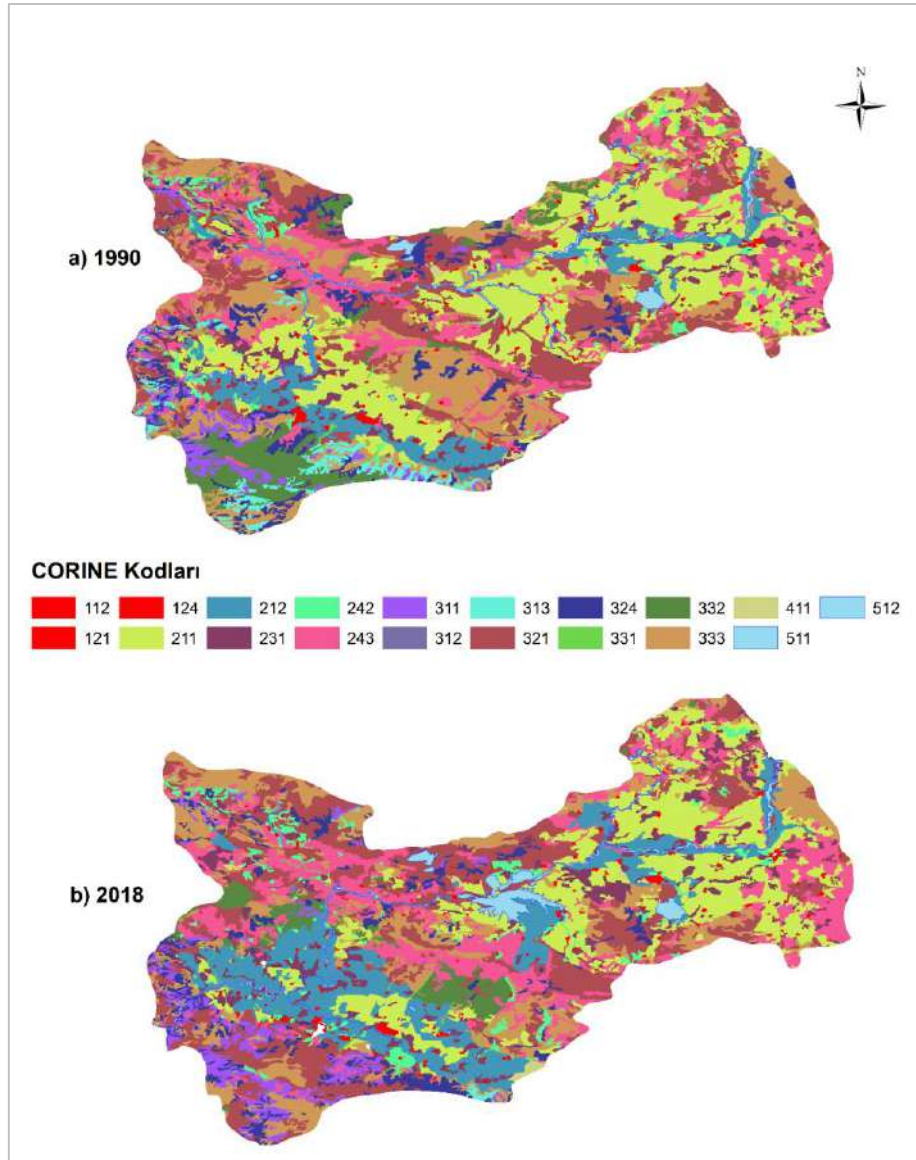


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dönüşümden olduğu Tablo 3 incelendiğinde anlaşılmaktadır. Karışık orman sınıfı ise (313) 15722,4 ha negatif değişim göstermiştir. Bu değişimin yönü pivot tablo da incelendiğinde büyük miktarda dönüşümün geniş yapraklı orman ve çalı sınıfına olduğu görülmektedir.

Araştırma sahasında önemli antropojenik değişimler görülmüştür. Özellikle kesintisiz kentsel alanlarda önemli bir büyüme görülmüştür. Bu büyüme yaklaşık olarak 459 ha olarak belirlenmiştir. Bu büyüme daha çok il ve ilçe merkezindeki yerleşim alanlarının birbirine yaklaşarak büyümesinden ileri gelmiştir.



Şekil 2. 1990 ve 2018 yıllarına ait CORINE AKAÖ haritaları.

112 kodlu kesintisiz kentsel alanlar da ise 382.9 ha 'lık bir artış belirlenmiştir. Bu artışın önemli bir kısmının karmaşık ekim modellerinden olduğu tablo 3 den anlaşılmıştır. 695 ha endüstriyel



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ve ticari alanlarda oluşan artışta önemli problemlerli dönüşümler olarak karşımıza çıkmaktadır. Sanayi alanları önemli ekonomik faaliyet alanlarıdır ancak bu dönüşümlerin tablo 3 den anlaşılacağı üzere yaklaşık 170 ha 'nın sulanabilir arazilerden, yaklaşık 100 ha 'nın da doğal mera alanlarından olması yanlış arazi kullanım problemlerini göstermektedir. Yine 133 kodlu inşaat atıkları boşaltım alanında görülen artışın yaklaşık 88 ha 'ı orman arazilerine doğru olmuştur. Ayrıca yaklaşık 114 ha çayır ve mera alanlarında 131 kodlu maden sahasının ortaya çıktığı belirlenmiştir.

4. SONUÇLAR

Bu çalışmada Muş ilindeki arazi kullanımları ve arazi örtüsü dağılımları 1990 ve 2018 yıllarına ait CORINE veri haritaları ve CBS analizleri yardımıyla incelenmiştir ve 28 yıl içindeki AKAÖ değişimleri araştırılmıştır. Elde edilen sonuçlar il genelinde önemli doğal kaynak zenginliği göze çarpmaktadır. Arazilerin büyük çoğunluğunu tarım arazileri ile doğal mera ve çayır arazileri oluşturmaktadır. Özellikle sulama projelerinde yıllar içindeki gelişmeler sulu tarım imkânlarını daha da artırdığı görülmüştür. Ayrıca il genelinde bulunan mera ve çayır arazilerinin genişlemesi hayvansal üretim konusunda ilin potansiyelini ortaya koymaktadır. Ayrıca il genelinde önemli olumlu değişimler görüldüğü gibi insan kaynaklı yanlış arazi kullanım değişimleri de görülmüştür. Özellikle yerleşim alanların kırsal alanlarda tarımsal araziler ve mera alanlarının üzerine yapılması ilerleyen yıllarda bu arazilerin kalitesini düşürecektir. Araştırma, Muş ilindeki doğal kaynakların verimli ve doğru bir şekilde kullanılması ve korunması adına alınması gereken planların tasarlanmasında önemli yardımcı fikirler verecektir.



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KAYNAKLAR

- Ateşoğlu, A. (2016). Havza Çalışmalarında Kullanılan CORINE 2006 Arazi Sınıflandırma Verilerinin Doğruluğunun Araştırılması. *İstanbul University Journal of the Faculty of Forestry*, 66(1), 173-183.
- Aydoğdu, M., Özdemir Ş., Dedeoğlu, F. ve Mermer, A. (2012). Coğrafi Bilgi Sistemleri ve Uzaktan Algılama Teknikleri Kullanılarak Ankara İli Yenimahalle İlçesindeki Tarım Alanlarının Amaç Dışı Kullanımı Bağlamında CORINE Sistemine Göre Belirlenmesi Üzerine Bir Çalışma. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 43 (3), 67-78.
- Başayığıt, L. (2004). CORINE Arazi Kullanımı Sınıflandırma Sistemine Göre Arazi Kullanım Haritasının Hazırlanması: Isparta Örneği. *Tarım Bilimleri Dergisi*, 10 (4): 366-374.
- Bayar R. ve Karabacak, K. (2017). Ankara İli Arazi Örtüsü Değişimi (2000-2012). *Coğrafi Bilimler Dergisi*, CBD 15 (1), 59- 76
- Durmuş, E., & Dölek, İ. (2019). Muş İl'inde Yerleşme Tiplerinin Coğrafi Dağılışı. *International Journal Of Geography And Geography Education*, (39), 256-278.
- Durmuş, E., Çağlıyan, A. (2019). Muş İli'nde Yaylaların Dağılışı. *Electronic Turkish Studies*, 14(2).
- Hou, H., Wang, R., & Murayama, Y. (2019). Scenario-based modelling for urban sustainability focusing on changes in cropland under rapid urbanization: a case study of Hangzhou from 1990 to 2035. *Science of the Total Environment*, 661, 422–431.
- Khwarahm, N.R. (2021). Spatial modeling of land use and land cover change in Sulaimani, Iraq, using multitemporal satellite data. *Environmental Monitoring and Assessment*, 193(3), 1-18.
- Kıranşah, K., & Şengün, M. T. (2016). Bulanık-Malazgirt (Muş) Havzası'nda Arazi Kullanımının Zamansal Değişimi. *Akademik Sosyal Araştırmalar Dergisi*, S, 4(35), 479-491.
- Liping, C., Yujun, S., & Saeed, S. (2018). Monitoring and predicting land use and land cover changes using remote sensing and GIS techniques—A case study of a hilly area, Jiangle, China. *PloS one*, 13(7), e0200493.
- Motlagh, Z. K., Lotfi, A., Pourmanafi, S., Ahmadizadeh, S., & Soffianian, A. (2020). Spatial modeling of land-use change in a rapidly urbanizing landscape in central Iran: integration of remote sensing, CA-Markov, and landscape metrics. *Environmental Monitoring and Assessment*, 192(11), 1-19.



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Özdemir-Işık, B., Demirel, Ö. (2016). Determination of Coastal Areas of Recreational Activities in The City of Trabzon. *Journal of the Faculty of Forestry Istanbul University*, 66 (2), 483- 496.

Özür N., Ataol, M. (2018). Türkiye’de CORINE verilerinin kullanılmasına dair değerlendirme. *Çankırı Karatekin Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 9(2), 110-130.

Popovici, E. A., Bălteanu, D., & Kucsicsa, G. (2013). Assessment of changes in land-use and land-cover pattern in Romania using Corine Land Cover Database. *Carpathian Journal of Earth and Environmental Sciences*, 8(4), 195-208.

Ren, Y., Lu, Y., Comber, A., Fu, B., Harris, P., & Wu, L. (2019). Spatially explicit simulation of land use/land cover changes: Current coverage and future prospects. *Earth-Science Reviews*, 190, 398–415.

Rimal, B., Zhang, L., Stork, N., Sloan, S., & Rijal, S. (2018b). Urban expansion occurred at the expense of agricultural lands in the Tarai Region of Nepal from 1989 to 2016. *Sustainability*, 10, 1341.

Sönmez, M. E. (2014). Muş Ovası’nın Tarımsal Potansiyeli Ve Arazi Kullanımı Arasındaki İlişkiler. *Makalelerle Muş Kitabı*, Muş Alparslan Üniversitesi.

Weber, J.L., 2007. Implementation of land and ecosystem accounts at the European environment agency. *Ecological Economics*, 61(4), 695–707.

Yıldırım, S. (2015). Büyük Baraj Projeleri ve Bağlantılı Yol İnşaatları Sonucunda Çoruh Nehri Havzasında Oluşan Arazi Kayıplarının ve Tahribatlarının Belirlenmesi. *Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi*, 16 (1), 1-17.



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**MATHEMATICAL MODELS TO INTERPRET RUMINAL DISAPPEARANCE
CURVES**

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ABSTRACT

Disappearance curves are usually showed feeds degradation profiles obtained using the polyester bag technique. Models to describe in situ disappearance curves were derived from first principles by considering simple compartmental schemes and assuming first-order kinetics but allowing the fractional rate of substrate degradation to vary with time. A number of applications such as MATLAB, PSO, and Sine Cosine can be used in data optimization.

Keywords: Mathematical models, Optimization, and Sine Cosine application



INTRODUCTION

Although recommendations for standardizing the conditions of the nylon bag method to reduce the scatter in the results have been proposed by Venzent et al. (1998), Michalt Dorothy (1991), and Nask (1988), among these factors, the mathematical model Used to estimate food degradability parameters and criteria for selecting an appropriate mathematical model, has been less studied.

The application of different models to estimate the parameters of nutrient degradability of feed material Formulation of hypotheses related to the biological principles governing ruminal digestion segregation has led to the development of various mathematical models describing the ratio of rumen disappearance. Using these models, ruminal digestion parameters of food can be estimated, and then food or different nutritional systems can be compared.

First-order kinetics

The model proposed by Orskov and McDonald (1979) is a simple negative exponential function with first-degree degradability kinetics that assumes a rate of nutrient decomposition. In this model, which was first used to determine the nitrogen degradability of food, three reservoirs for nitrogen are considered: a part that decomposes rapidly in the rumen and is determined by washing the bag containing food with water. A biodegradable part in the rumen decomposes at a constant rate per unit time and a non-biodegradable part. For some nutrients, there may be a delay phase before decomposition due to some factors such as substrate dewatering, microbial attachment to the substrate, and microbial colony formation. In this case, the general form of the equation used does not change. However, the interpretation of degradability parameters will be different. In this model, it is assumed that only the substrate limits the degradability of the nutrient and the decomposition of the nutrient is affected by the amount of substrate.

First-order kinetics model without lag phase: $Y = a + b(1 - e^{-ct})$

First-order kinetics model with lag phase: $Y = a + b(1 - e^{-c(t+l)})$

Gompertz model

It is a linear model bounded by two breakpoints and follows the zero-degradability kinetics. In this model, the degradability kinetics is changed from the first degree to zero, and the inhibitory effect of the non-degradable part and the restriction on microbial activity and growth on the degradability of the nutrient are considered. These researchers believe that the assumption that degradability follows first-order kinetics is incorrect. And in the case of the kinetic part, the final stages of decomposition are slower due to the presence of the digestible part. In the case



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of these feedstocks, with the passage of incubation time, the share of the non-degradable part in the material remaining in the bag increases and causes a rate of degradation of the first-order kinetics. This inhibitory effect of the non-biodegradable part on biodegradability is mathematically defined and considered in the model. Nutrient plasticity is also included in this model.

Gompertz model:

$$Y = a + b(k - k^{e(ct)})/(k - 1)$$

Mitchell's generalized model

It is an inverse or polynomial function that describes a rectangular joke and considers the rate of degradability of the decomposable part unstable. So that over time, its value decreases. This model shows sigmoid behavior. It is suitable for estimating the degradability parameters of structural carbohydrates, which are more diverse and complex than nitrogen. Although sigmoidal behavior can be simulated to reduce the latency in models with a downward slope (such as the Arskov and McDonald models), it does not appear that any decomposition occurred during the delay phase period. Moreover, the onset of nutrient degradability from the endpoint of the delay phase occurs instantaneously, in which case it will be biologically difficult to interpret the results, so the use of this model in such paradigms of harmful material is generally Their degradability curve in the form of sigmoid is recommended.

generalised Mitscherlich model:

$$Y = a + b(1 - e^{-c(t-l)-d(\sqrt{t}-\sqrt{l})})$$

Competency assessment on the value of different models

Model evaluation involves using all available methods to critique the model and is a relative process, and is involved in it from the evaluator's point of view. None of the proposed models are complete and are usually comprehensive in some respects and incomplete in others. At the same time, the initial evaluation of a model should always begin with the objectives of the model design and include questions in this regard. It seems logical that evaluation can also be done at a broader level (including model simplification, hypothesis accuracy, generality, applicability, and qualitative and quantitative accuracy of estimates). Another term associated with model fit is model validity. This means the model's ability to predict test results accurately. A model may be valid in some situations but invalid in others. Therefore, the model's validity is not limited to the characteristics of the model and is not subject to the law of all or none - but



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is in the range of one to zero. According to the above explanations, it is possible to get a review of a model alone to answer whether this model should be accepted or rejected. It is misleading, and it is always better to compare models and any model with the least error in advance. The nose of the observed values should be tested and selected as a more worthy and superior model. Comparisons between models are usually based on three indicators: model behavior, statistical evaluation of the model, and evaluation of the parameters estimated by the model (significance and justifiability of the parameters biologically).

Investigating model behavior:

Model behavior means a series of consequences observed when solving relevant equations by statistical software. In the case of the linear model, the model's behavior is simple and is investigated using the linear citizenship method. So that the values of the independent change are placed in the horizontal axis, and the values of the dependent variable are placed in the vertical axis of the curve, and the line containing the minimum sum of squares of the error represents the best value for the data. In order to investigate the behavior of nonlinear models, the capability on the value of food degradability data is investigated using the nonlinear citizenship method in statistical software. Unlike linear citizenship equations that are solved in one step, it is impossible to solve nonlinear citizenship equations in one step, but after successive iterations. These consecutive iterations result from assuming different initial values for the parameters by the software and then fitting the data with a curve based on these values. For this purpose, before solving the citizenship, an initial value should be considered for each parameter (usually, the selection of these values is based on the experiences and results of previous tests). These iterations continue until the new values selected for the parameters do not result in a better fit (the remaining value with less error) than the previously selected values.

- 1- There are very large or very small numbers in the data.
- 2- The selected equation is not suitable for fitting the data.
- 3- The initial selected values for the parameters are far from reality.
- 4- The scatter of data points is very high.
- 5- The data were not collected in the appropriate range of x values (independent variable).
- 6- Due to not considering the appropriate number of decimals for the data, computer calculations have not been done accurately.



- 7- The equation used to fit the data has a large number of parameters that, in such a case, either the standard error calculated by the program for each parameter is too large, or the program is unable to reach the answer.

In examining the model's behavior and reaching the solution, the number of ways necessary to reach the solution is also considered so that the more the number of these iterations indicates, the less competence of the model to fit the data. Nonlinear citizenship analysis is usually performed after 5 to 10 consecutive replications, even if the initial values selected for the parameters are very different from the values obtained after solving the model.

Moreover, a lower speed of solving the model (more consecutive repetitions) indicates that the program has trouble finding a solution. This problem can occur for several reasons:

- 1- Experimental data are insufficient to define the parameters, and more data points or more scattered points are needed.
- 2- The equation (equations) of the model contains many parameters, in which case one or more parameters should be defined as constant values.
- 3- The model equation also has a paradigm shift.

The model's sensitivity to the initial values selected for the parameters is another way to study the model's behavior. This means that if by changing the parameter's initial value (usually from half to two times), the repetitions required to reach the solution increase, and the value of the estimated parameters changes, and their standard error increases. Indicates the low fit of the model (Lopez et al., 1999).

The sine cosine algorithm method

In addition to the models discussed, artificial intelligence methods such as collective intelligence algorithms can also be used. One of these algorithms is the sine-cosine algorithm. The cosine sine algorithm (SCA) is one of the techniques used to solve joint optimization problems. In this algorithm, initial random answers are generated as problem-solving candidates. Random candidates based on a mathematical model on the sine and cosine oscillate toward the best solution. Other random and adaptive variables are also integrated with the mentioned algorithm to produce the best possible answer in the problem search space.

In finding the best values for the coefficients of the estimation curve, the coefficients can be considered the variables of the optimization problem, and the best values for the coefficients can be obtained using the method presented in the optimization algorithm. In determining the



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best coefficient values, the fitting function can be considered based on the errors obtained from each candidate to solve the problem. The purpose of optimization is to reduce the number of errors.



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REFERENCES

Dhanoa, M.S., France, J., Crompton, L.A., Mauricio, R.M., Kebreab, E., Mills, J.A.N., Sanderson, R., Dijkstra, J. & Lopez, S. 2004. A proposed method to determine the extent of degradation of a feed in the rumen from the degradation profile obtained with the in vitro gas production technique using feces as the inoculum. *J. Anim. Sci.* 82, 733–746. <https://doi.org/10.2527/2004.823733x>

Dhanoa, M.S., France, J., Siddons, R.C., Lopez, S. & Buchanan, S.J.G. 1995. A non-linear compartmental model to describe forage degradation kinetics during incubation in polyester bags in the rumen. *British J. Nut.* 73, 3-15. <https://doi.org/10.1079/BJN19950004>

France, J., Thornley, J.H.M., Lopez, S., Siddons, R.C., Dhanoa, M.S., Van Soest, P.J. & Gill, M. 1990. On the two-compartment model for estimating extent of feed degradation in the rumen. *J. Theor. Biol.* 146, 269– 287. [https://doi.org/10.1016/S0022-5193\(05\)80139-0](https://doi.org/10.1016/S0022-5193(05)80139-0)

Lopez, S., France, J., Dhanoa, M.S., Mould, F. & Dijkstra, J. 1999. Comparison of mathematical models to describe disappearance curves obtained using the polyester bag technique for incubating feeds in the rumen. *J. Anim. Sci.* 77, 1875-1888. <https://doi.org/10.2527/1999.7771875x>

Ørskov, E.R., Hovel, F.D.B. & Mould, F.L. 1980. The use of the nylon bag technique for evaluation of feedstuffs. *Trop. Anim. Prod.* 5, 195-213.

Ørskov, E.R.I. & McDonald, I.M. 1979. The estimation of protein degradability in the rumen from incubation measurements weighted according to rate of passage. *J. Agric. Sci.* 92, 499-503. <https://doi.org/10.1017/S0021859600063048>

Palangi, V. & Macit, M. 2019. In situ crude protein and dry matter ruminal degradability of heat-treated barley. *Revue Méd. Vét.* 170, 123-128.



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**PREDICTING MILK PRODUCTION USING FIRST LACTATION DATA AND
ARTIFICIAL NEURAL NETWORK**

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ABSTRACT:

Accurate estimation of milk production is one of the important requirements in livestock units. The use of accurate milk production data can lead to better modeling in the cost-benefit analysis of livestock units. Linear modeling is one of the methods that can be used in estimation. The artificial neural network method can be much more efficient as an intelligent method in this field. Easy to use the neural network can be one of the reasons for its increasing use. In this study, the neural network method is used to estimate and predict milk production of lactating cows. Milk production records in the early years have been used as training data in the neural network.

Keywords: Prediction, artificial neural network, milk production.



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INTRODUCTION

The development of artificial neural networks has led to their use in various fields. Easy use of neural networks and their proper efficiency is its increasing use (Ashton 2013). Using neural networks, very complex rules can be deduced structured (Khazaei et al., 2008). The structure of neural networks is nonlinear and has good resistance to different and complex states (Widrow et al., 1994). Much research has been done on applying neural networks in various sciences. Moreover, many researchers have expressed the effectiveness of this method (abbasi et al., 2016; Bahreini, 2015; Khazaei et al., 2008; Njubi et al., 2010; Park et al., 2005). The amount of milk production in livestock units is one of the very important issues. Accurate estimation of milk production can be helpful in livestock estimates and modeling (Fernández et al., 2007). In this article, we have examined how to use and model neural networks to estimate milk in lactating cows. Proper modeling and the use of appropriate training data can lead to the production of a simulated neural network model. The created model can easily obtain suitable estimates in the expected terrains.

Artificial Neural Networks

An artificial neural network inspired by a biological neural system is an information processing idea that processes information like the brain. The key element of this idea is the new structure of the information processing system. This system contains many highly interconnected processing elements called neurons that work together to solve a problem (Abiodun et al., 2018; Dike et al., 2018).

Artificial neural network models can train the relationships between independent and dependent variables (Mittal et al., 2000). Many authors have shown that the performance of artificial neural networks is better than other models (Park et al., 2005; Lek et al., 1996). Hosseinnia et al. (Hosseinnia et al., 2008) used artificial neural networks compared to regression models to predict milk and bee production performance, and colleagues (Roush et al., 1996) to predict the incidence of ascites in broiler chickens.

An artificial neural network consists of a set of interconnected neurons, and each is called a single layer. The role of neurons in neural networks is information processing. This is done in artificial neural networks by a mathematical processor similar to the activation function. The designer selects an activation function based on the specific need of the problem to be solved by the neural network. The simplest form of the network has only two layers (input and output layer). The network acts as an input and output system and uses the value of the input neurons



to calculate the value of the output neurons. Neural networks with hidden layers have more capabilities than two-layer neural networks (Menhaj, 1998). Comparing the actual output with the desired output causes the weight coefficient of the network to change so that a more accurate output is obtained in subsequent times (Izy and Zarghi, 2015).

Use of Artificial Neural Networks to Predicting

Neural network training with training data is required to estimate values of milk production. Therefore, we must use the data of two consecutive lactation periods of several lactating cows. Using the single-trait model analysis, we obtain the average corrective value of the first recorded lactation period records.

Also, the average lactation days and the cow's age in that calving can be considered an auxiliary variable, and the calving abdomen and paternal genetic group can be considered constant effects. Due to the lack of complete monthly records for some data, the average recorded records in each lactation period were used to correct the effects by using the average lactation days.

Therefore, to predict the average milk production in different periods, we can use the corrective value of the average milk production of the first period, calving turn, paternal genetic group, age of the first recorded calving, record number for each lactation period, and average, minimum and maximum lactation days as Used artificial neural network input.

The most common neural network for this problem seems to be the multilayer perceptron neural network with feedback network structures. Feedback training with hyperbolic tangent transfer function and delta law can be used for modeling [24].

The following formulas can be used to evaluate the model's fit from RMSE and the coefficient of explanation of milk production.

$$R^2 = \frac{\sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2}{\sum_{i=1}^n (Y_i - \bar{Y})^2}$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2}{n}}$$

In the above equations, n , Y_i and \hat{Y}_i are number of records, observed values and predicted values, respectively.



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CONCLUSIONS

Modeling using neural networks can be able to predict milk production in future periods. This forecast based on the data of the first lactation period can be very useful for analyzing livestock management. This study showed that the recording period of lactating cows could be easily shortened. Incomplete data can also be used in the genetic evaluation of livestock using systems based on artificial neural networks.



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REFERENCES:

Abbasi, A.R., Bahreini Behzadi, M.R. and Talebi, M.A. 2016. Prediction of some carcass characteristics from body measurements using linear regression and artificial neural network methods in Lori-Bakhtiari sheep. J. Ruminant. Res. 3: 1-20. (In Persian).

Abiodun, O. I., Jantan, A., Omolara, A. E., Dada, K. V., Mohamed, N. A., & Arshad, H. (2018). State-of-the-art in artificial neural network applications: A survey. Heliyon, 4(11), e00938.

Ashton Acton, Q. (2013). Advances in machine learning research and application. Scholarly Edition. Atlanta, Georgia, 455-475.

BAHREINI, BEHZADI MR. "Comparison of different growth models and artificial neural network to fit the growth curve of Lori-Bakhtiari sheep." (2015): 123-146.

Dike, H. U., Zhou, Y., Deveerasetty, K. K., & Wu, Q. (2018, October). Unsupervised learning based on artificial neural network: A review. In 2018 IEEE International Conference on Cyborg and Bionic Systems (CBS) (pp. 322-327). IEEE.

Fernández, C., Soria, E., Sanchez-Seiquer, P., Gómez-Chova, L., Magdalena, R., Martín-Guerrero, J. D., ... & Serrano, A. J. (2007). Weekly milk prediction on dairy goats using neural networks. Neural Computing and Applications, 16(4), 373-381.

Hosseinnia, P., Edriss, M. A., Edrisi, M., & Rahmani, H. R. (2008). Comparison of linear and non-linear methods in prediction of second parity milk yield in dairy cattle based on first parity production data. In Proceedings of the British Society of Animal Science (Vol. 2008, pp. 202-202). Cambridge University Press.

Izy, J., & Zarghi, H. (2015). Comparison of regression and artificial neural network models in predicting the production performance of laying hens. Iranian Journal of Animal Science Research, 7(1), 58-65.

Khazaei, J., & Nikosiar, M. (2008). Approximating milk yield and milk fat and protein concentration of cows through the use of mathematical and artificial neural networks models. In World Conference on Agricultural Information and IT, Tokyo, Japan (pp. 91-105).

Lek, S., Delacoste, M., Baran, P., Dimopoulos, I., Lauga, J., & Aulagnier, S. (1996). Application of neural networks to modelling nonlinear relationships in ecology. Ecological modelling, 90(1), 39-52.

Menhaj, M. B. (1998). Computational Intelligence, principles of neural networks. Tehran. Professor Hesabi Publication Center (in Persian).



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Mittal, G. S., & Zhang, J. (2000). Prediction of temperature and moisture content of frankfurters during thermal processing using neural network. *Meat Science*, 55(1), 13-24.

Njubi, D. M., Wakhungu, J. W., & Badamana, M. S. (2010). Use of test-day records to predict first lactation 305-day milk yield using artificial neural network in Kenyan Holstein–Friesian dairy cows. *Tropical animal health and production*, 42(4), 639-644.

Park, S. J., Hwang, C. S., & Vlek, P. L. G. (2005). Comparison of adaptive techniques to predict crop yield response under varying soil and land management conditions. *Agricultural Systems*, 85(1), 59-81.

Roush, W. B., Kirby, Y. K., Cravener, T. L., & Wideman Jr, R. F. (1996). Artificial neural network prediction of ascites in broilers. *Poultry Science*, 75(12), 1479-1487.

Widrow, B., Rumelhart, D. E., & Lehr, M. A. (1994). Neural networks: applications in industry, business and science. *Communications of the ACM*, 37(3), 93-106.



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**PREDICTION AND OPTIMIZATION OF BIOGAS YIELD USING ARTIFICIAL
NEURAL NETWORK**

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ABSTRACT:

The set of gases produced by digestion and excretion of wastes, including human, plant, and animal, produced as a result of lack of oxygen and activity of anaerobic bacteria, especially methanogens, is called biogas. An artificial neural network is a data processing system that takes ideas from the human brain and leaves data processing to many small and many processors that act as interconnected and parallel networks to solve a problem. Artificial neural networks can optimize biogas data and help estimate the amount of gas produced by biological systems. To conclude, this system is recommended to optimize biogas yield data.

Keywords: Biogas yield, Optimization, and Artificial intelligence



BIO NERVOUS SYSTEM

According to many scientists, the human brain is the most complex system ever observed and studied throughout the universe (Osmanlioğlu et al., 2019). However, this complex system has no galaxy-sized dimensions and more components than today's supercomputer processors. The mysterious complexity of this unique system goes back to the many connections between its components. This sets the human brain apart from all other systems. After all, the excellent performance of the brain in solving all kinds of problems and its high efficiency has made the simulation of the brain and its capabilities become the most important goal of hardware and software architects (Yamakawa, 2021; Yang et al., 2021). If the day comes (which, of course, apparently is not too far away) when we can build a computer the size of the human brain, there will certainly be a great revolution in science, industry, and of course, human life.

ARTIFICIAL NEURAL NETWORKS

An artificial neural network is an information processing idea inspired by the biological nervous system and processes information like the brain. The key element of this idea is the new structure of the information processing system. This system comprises a large number of highly interconnected processing elements called neurons that work together to solve a problem (Abiodun et al., 2018; Dike et al., 2018).

A data structure can be designed using computer programming knowledge that acts as a neuron. That creates a network of these interconnected artificial neurons, creates a training algorithm for the network, and applies that algorithm to the network. These networks have shown very high efficiency for estimation and approximation. The scope of application of these mathematical models, based on the function of the human brain, is very wide. As a few small examples, we can mention the use of this mathematical tool in processing biological, telecommunication, and electronic signals to help in astronomy and astronautics. If we equate a network with a graph, the network training process will determine the initial weight of each edge and base. Today, intelligent systems, especially artificial neural networks, have become so widespread that these tools can be classified as basic and common tools in basic mathematical operations because few academic disciplines do not need analysis, decision making, estimation, forecasting, design, and construction and do not use the subject of neural networks (Parisi et al., 2017; Singh and Dwivedi, 2018; Gaier and Ha, 2019).



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TYPES OF ARTIFICIAL NEURAL NETWORKS

Various types of computational models have been introduced under the general heading of artificial neural networks, each of which can be used for a range of applications, each inspired in a specific way by the capabilities and characteristics of the human brain. In all these models, a mathematical structure is considered, which can be displayed graphically and has a series of parameters and adjusting screws. This general structure is adjusted and optimized by a Training Algorithm to behave appropriately (Van Gerven and Bohte, 2017; Siregar and Wanto, 2017; Srinidhi et al., 2021). Some of the most important of which are listed below:

- Multilayer perceptron or MLP
- Radial neural networks or RBF
- Support vector machines or SVM
- Self-organized maps or SOM
- Vector Digitizer or LVQ
- Hopfield neural network

BIOGAS YIELD

Biogas, owing to the flexibility of its technology, can be manufactured practically based on any form of digestible organic or biomass substrate (Sakiewicz et al., 2020). Methane gas from livestock production activities is a significant source of greenhouse gas (GHG) emissions which have been shown to influence climate change (Min et al., 2020). Methane (CH₄), together with nitrous oxide and carbon dioxide, are the major greenhouse gases (GHG) produced by ruminants with growing concerns over their considerable impacts on climate change. In addition to the global warming effect, methane emission from ruminants is related to energy waste (Palangi and Macit 2021). Therefore, efforts to reduce enteric CH₄ production from ruminants not only limit the emission of GHG, but also can enhance the production performance of the animal.

USE OF ARTIFICIAL NEURAL NETWORKS TO OPTIMIZE BIOGAS YIELD

Biogas is a significant renewable fuel derived by sources of biological origin. One of today's research issues is the effect of biofuels on engine efficiency (Arora et al., 2021). Artificial neural networks have gained increasing popularity, due to their ability to model several types of complex phenomena which defy handling by analytical methods. This is made possible by the



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ability of artificial neural networks to sense patterns in data sets even under conditions of high imprecision and noise. In situations where the cause-effect relationships may not be overt or their mechanism is not established, artificial neural networks can still model a phenomenon (Abbasi et al., 2020).

CONCLUSIONS

An artificial network is an efficient tool for controlling and simulating an anaerobic digestion method. More developed models can predict the amount of biogas production and its fractional composition. Therefore, analysis of neural networks is recommended to confirm the validity of statistical experiments and better understand biogas with different choices.



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REFERENCES:

- Abbasi, T., Luithui, C., & Abbasi, S. A. (2020). A Model to Forecast Methane Emissions from Topical and Subtropical Reservoirs on the Basis of Artificial Neural Networks. *Water*, 12(1), 145.
- Abiodun, O. I., Jantan, A., Omolara, A. E., Dada, K. V., Mohamed, N. A., & Arshad, H. (2018). State-of-the-art in artificial neural network applications: A survey. *Heliyon*, 4(11), e00938.
- Arora, V., Mahla, S. K., Leekha, R. S., Dhir, A., Lee, K., & Ko, H. (2021). Intervention of Artificial Neural Network with an Improved Activation Function to Predict the Performance and Emission Characteristics of a Biogas Powered Dual Fuel Engine. *Electronics*, 10(5), 584.
- Dike, H. U., Zhou, Y., Deveerasetty, K. K., & Wu, Q. (2018, October). Unsupervised learning based on artificial neural network: A review. In 2018 IEEE International Conference on Cyborg and Bionic Systems (CBS) (pp. 322-327). IEEE.
- Gaier, A., & Ha, D. (2019). Weight agnostic neural networks. *arXiv preprint arXiv:1906.04358*.
- Min, B. R., Solaiman, S., Waldrip, H. M., Parker, D., Todd, R. W., & Brauer, D. (2020). Dietary mitigation of enteric methane emissions from ruminants: A review of plant tannins mitigation options☆. *Animal Nutrition*.
- Osmanlıoğlu, Y., Tunç, B., Parker, D., Elliott, M. A., Baum, G. L., Ciric, R., ... & Verma, R. (2019). System-level matching of structural and functional connectomes in the human brain. *NeuroImage*, 199, 93-104.
- Palangi, V., & Macit, M. (2021). Indictable mitigation of methane emission using some organic acids as additives towards a cleaner ecosystem. *Waste and Biomass Valorization*, 1-10.
- Parisi, G. I., Tani, J., Weber, C., & Wermter, S. (2017). Lifelong learning of human actions with deep neural network self-organization. *Neural Networks*, 96, 137-149.
- Sakiewicz, P., Piotrowski, K., Ober, J., & Karwot, J. (2020). Innovative artificial neural network approach for integrated biogas–wastewater treatment system modelling: Effect of plant operating parameters on process intensification. *Renewable and Sustainable Energy Reviews*, 124, 109784.
- Singh, P., & Dwivedi, P. (2018). Integration of new evolutionary approach with artificial neural network for solving short term load forecast problem. *Applied energy*, 217, 537-549.



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Siregar, S. P., & Wanto, A. (2017). Analysis of artificial neural network accuracy using backpropagation algorithm in predicting process (forecasting). *IJISTECH (International Journal of Information System & Technology)*, 1(1), 34-42.

Srinidhi, C. L., Ciga, O., & Martel, A. L. (2021). Deep neural network models for computational histopathology: A survey. *Medical Image Analysis*, 67, 101813.

Van Gerven, M., & Bohte, S. (2017). Artificial neural networks as models of neural information processing. *Frontiers in Computational Neuroscience*, 11, 114.

Yamakawa, H. (2021). The whole brain architecture approach: Accelerating the development of artificial general intelligence by referring to the brain. *Neural Networks*, 144, 478-495.

Yang, S., Wang, J., Hao, X., Li, H., Wei, X., Deng, B., & Loparo, K. A. (2021). BiCoSS: toward large-scale cognition brain with multigranular neuromorphic architecture. *IEEE Transactions on Neural Networks and Learning Systems*.



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BORİK ASİT PRİMING UYGULAMASININ YEM BEZELYESİ [*Pisum sativum* ssp. *arvense* L. (Poir.)]'NİN ÇİMLENME VE FİDE GELİŞİMİNE ETKİLERİ

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ÖZET

Tohum ön uygulamaları (priming); tohum çimlenmesini uyaran, çimlenme ve fide gelişim devresinde birtakım morfolojik parametreleri ve abiyotik stres altında bitki büyümesini ve gelişimini iyileştiren, düşük maliyetli ve etkili bir biyokimyasal süreçtir. Priming için kullanılabilen maddelerden biri de borik asit (BA)'tir. Bu çalışmada, BA ile tohum ön uygulamasının yem bezelyesi [*Pisum sativum* ssp. *arvense* L. (Poir.)]'nde çimlenme ve fide gelişim parametrelerine etkilerinin belirlenmesi amaçlanmıştır. Araştırma; Siirt Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Laboratuvarı'nda, 25±1 °C kontrollü şartlar altında yürütülmüştür. Çalışmanın bitkisel materyalini Kurtbey yem bezelyesi çeşidi oluşturmıştır. Laboratuvar çalışması, tesadüf parselleri deneme desenine göre 4 tekrarlamalı olarak petri kaplarında kurulmuştur. Araştırmanın konusunu; borik asitin 1, 2, 3, 4, 5 ve 6 mM konsantrasyonu ile hidro-priming ve priming yapılmayan kontrol grupları teşkil etmiştir. Çalışmada; çimlenme oranı, ortalama çimlenme süresi, çimlenme üniformite katsayısı, çimlenme enerjisi, çimlenme indeksi, fide yaş ve kuru ağırlığı ve fide güç indeksi parametreleri incelenmiştir. Araştırma sonuçlarına göre, BA priming uygulamasının çimlenme ve bazı fide gelişim parametrelerini anlamlı derecede etkilediği saptanmıştır. Çalışmada; çimlenme oranı % 80.0-97.3, ortalama çimlenme süresi 1.87-2.73 gün, çimlenme üniformite katsayısı 29.2-49.3, çimlenme enerjisi 0.0-29.3, çimlenme indeksi 7.6-14.7, fide yaş ağırlığı 0.5745-0.6153 g, fide kuru ağırlığı 0.1803-0.1984 g ve fide güç indeksi 46.0-59.9 arasında değişim göstermiştir. Çalışma sonucunda; yem bezelyesi tohumlarında ortalama çimlenme süresinin artan BA dozlarına bağlı olarak kısaldığı ve 4 mM BA konsantrasyonunun çimlenme ve bazı fide gelişim parametreleri açısından en iyi sonucu verdiği tespit edilmiştir.

Anahtar Kelimeler: Borik Asit, Priming, Yem Bezelyesi, Ortalama Çimlenme Süresi



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**THE EFFECTS OF BORIC ACID PRIMING ON GERMINATION AND
SEEDLING DEVELOPMENT IN FOAGE PEA [*Pisum sativum* ssp. *arvense* L. (Poir.)]**

ABSTRACT

Seed pre-applications (Priming); It is a low-cost and effective biochemical process that stimulates seed germination, improves some morphological parameters in the germination and seedling development cycle, and plant growth and development under abiotic stress. One of the materials that can be used for priming is boric acid (BA). In this study, it was aimed to determine the effects of seed pre-treatment with BA on germination and seedling growth parameters in forage pea [*Pisum sativum* ssp. *arvense* L. (Poir.)]. Research; it was carried out in Siirt University, Faculty of Agriculture, Field Crops Laboratory, under controlled conditions of 25 ± 1 °C. The plant material of the study consisted of Kurtbey forage pea variety. The laboratory study was set up in petri dishes according to the randomized plot design with 4 replications. In the research, the hydro-priming application with the 1, 2, 3, 4, 5 and 6 mM concentration of boric acid and the group that was not primed as a control constituted the subject of the research. In the study; germination rate, average germination time, germination uniformity coefficient, germination energy, germination index, seedling fresh weight, seedling dry weight and seedling power index parameters were investigated. According to the results of the research, it was determined that BA priming application significantly affected germination and some seedling growth parameters. In the study; germination rate 80.0-97.3%, average germination time 1.87-2.73 days, germination uniformity coefficient 29.2-49.3, germination energy 0.0-29.3, germination index 7.6-14.7, seedling fresh weight 0.5745-0.6153 g, seedling dry weight 0.1803-0.1984 g and seedling vigor index 46.0-59.9 varied in ranges. As a result of the study, it was observed that the average germination time was shortened due to increasing BA doses, while in terms of other investigated parameters, 4 mM BA concentration gave the best results in terms of germination and seedling development of forage pea.

Keywords: Boric Acid, Priming, Forage Pea, Mean Germination Time



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1. GİRİŞ

Baklagiller, 650'den fazla cins ve 18.000 tür ile çiçekli bitkilerin üçüncü büyük ailesi (Lewis ve ark., 2005) olup; içerdikleri protein, karbonhidratlar, suda çözünen çeşitli vitaminler ve mineraller ile insanlar ve hayvanlar için gıda olarak büyük katkı sağlar (Rodriguezve ark., 2008). Baklagil bitkilerinden biri olan yem bezelyesi [*Pisum sativum* ssp. *arvense* L. (Poir.)], yeşil ve kuru ot üretimi olarak değerlendirilen, yalın ve karışım halinde ikinci ürün olarak da ekilebilen önemli bir yem bitkisidir. Yüksek protein oranı, vitamin ve mineral içeriğine sahip olan yem bezelyesi; yeşil gübre, silaj ve otlatma amaçlı olarak ruminant hayvanlar tarafından tüketilmektedir (Elzebroek, 2008; Acikbas ve ark., 2022). Geniş adaptasyon potansiyeline sahip olan yem bezelyesi, toprağa azot bağlama özelliği ile de bir sonraki ürün için önemli avantaj sağlamaktadır (Kadioğlu ve Tan, 2018).

Bitkiler için en önemli mikro besin elementlerinden biri de bor (B)'dur. Borun; bitkilerde şekerlerin taşınımı, hücre duvarının yapısında yer alması, membran bütünlüğü, fotosentez ürünleri ile iyonların, metabolitlerin ve hormonların taşınmasında, karbonhidrat ve fenol metabolizması gibi fizyolojik ve biyokimyasal olaylarda önemli işlevleri bulunmaktadır (Goldbach ve Wimmer, 2007; Cervilla ve ark., 2009; Barut ve ark., 2018). Mikro besin maddeleri; topraktan, yapraktan ve tohum ön uygulama olmak üzere temel olarak üç farklı şekilde bitkilere uygulanabilmektedir. Mikro besinler ile zenginleştirilmiş tohumların (tohum ön hazırlama) kullanımının, besin maddelerinin bitkiye verilmesinde daha iyi bir strateji olduğu bildirilmiştir (Ambika ve ark., 2014).

Başarılı bir tarımsal üretimde, sağlıklı bitkilerin geliştirilmesinin yanı sıra, yüksek verim ve kalitede ürün elde edilmesi için o çeşide ait tohumun yüksek çimlenme oranına ve çıkış hızına sahip olması gerekmektedir. Çimlenme ve fide çıkış aşamasında başarılı olmak ve istenen sayıda fideyi homojen olarak elde edebilmek amacıyla tohumlar ekim öncesi, genel olarak priming adı da verilen çeşitli ön uygulamalara tabi tutulmaktadırlar (Heydecker ve Gibbins, 1978). Priming uygulamalarının birçok bitkinin tohumlarında çimlenmeyi ve çıkışı iyileştirdiği başarılı bir şekilde görülürken (Donaldson ve ark., 2001; Cokkızgın, 2013; Açıkbaş ve Özyazıcı, 2021), kullanılan priming maddesinin konsantrasyonuna bağlı olarak çimlenmeyi yavaşlatarak toksik etki yaptığı (Bonilla ve ark., 2004; Ölçer ve Kocaçalışkan, 2007) da rapor edilmiştir.



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Bu çalışmada, borik asit (BA) ile tohum ön uygulamasının yem bezelyesi [*P. sativum* ssp. *arvense* L. (Poir.)]'nde çimlenme ve fide gelişim parametrelerine etkilerinin belirlenmesi amaçlanmıştır.

2. MATERYAL VE METOT

Araştırma, Siirt Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Laboratuvarı'nda yürütülmüştür. Bitkisel materyal olarak, Kurtbey yem bezelyesi [*P. sativum* ssp. *arvense* L. (Poir.)] çeşidi kullanılmıştır.

Araştırmanın konusu; 6 farklı borik asit (H_3BO_3) dozları ($BA_1= 1$ mM, $BA_2= 2$ mM, $BA_3= 3$ mM, $BA_4= 4$ mM, $BA_5= 5$ mM ve $BA_6= 6$ mM) ve kontrol uygulaması [saf su ile ön uygulama (hidro-priming, HP) ve ön uygulama yapılmayan (K)] şeklinde planlanmıştır.

Laboratuvar denemesi, tesadüf parselleri deneme desenine göre 4 tekerrürlü olarak kurulmuş olup, her bir tekerrür için 25 adet tohum kullanılmıştır. Tüm uygulamalarda tohumlar 1 dakika % 70 etil alkolde steril edildikten sonra 3 defa steril su ile durulanmıştır. Daha sonra tohum yüzeyindeki mikroorganizmaların deforme olması için 10 dakika % 10'luk sodyum hipoklorit (NaOCl) + % 0.01 tween20 solüsyonu ile tohumları kaplayacak şekilde yüzey sterilizasyonu gerçekleştirilmiştir. Steril hale gelen tohumlar petri (90 mm x 15 mm) kaplarında bulunan iki katlı Whatman filtre kâğıdının arasına yerleştirilmiştir.

Borik asit ve hidro-priming uygulamalarında, her bir petri kabına tohum/solüsyon oranı 2:1 g/ml olacak şekilde ayarlanmış (Johnson ve ark., 2005); her bir petri kabına 5 ml olacak şekilde solüsyon uygulanarak, 8 saat süreyle tohumlar priming için bekletilmiştir. Bekletme süreleri tamamlanan tohumlar kuru filtre kağıdı arasına alınarak önce başlangıç nemine kadar (% $3\pm$) (Jatana ve ark., 2020) kurutulmuş ve daha sonra 24 saat kurumaya bırakılmıştır.

Priming uygulanan tohumlar ile ön uygulama yapılmayan tohumlar yeni petrilere yerleştirilmiş ve her petri kabına 5 ml saf su eklenmiştir. Petri kapları 25 ± 1 °C sıcaklığa ayarlı etüv (BINDER, GmbH, Almanya)'de çimlenmeye bırakılmıştır. Çalışmada, 24 saate 1 kez olacak şekilde her gün aynı saatte çimlenen tohumlar sayılmıştır. Çalışmanın bittiği güne kadar 48 saatte bir (nemlilik durumuna göre) 5 ml saf su tüm petri kaplarına ilave edilmiştir.

Deneme 7. günün sonunda her bir petri kabındaki bitkilerden rastgele seçilen 10 bitki üzerinden fide yaş ve kuru ağırlıkları ölçümleri yapılmıştır. Çalışmada; çimlenme oranı (ÇO), ortalama çimlenme süresi (OÇS), çimlenme üniformite katsayısı (ÇÜ), çimlenme indeksi (Çİ), çimlenme enerjisi (ÇE) ve fide güç indeksi (FGİ) özellikleri incelenmiştir.



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Çimlenme oranı parametresi her 12 saatte bir çimlenen tohumlar sayılarak Scott ve ark. (1984)'nın kullandığı Eşitlik 1'e göre belirlenmiştir.

$$\text{ÇO} = (N_{\text{ÇTS}}/TS) \times 100 \quad (1)$$

Eşitlikte $N_{\text{ÇTS}}$, normal çimlenen tohum sayısını; TS , kullanılan toplam tohum sayısını ifade etmektedir.

Ortalama çimlenme süresi genel olarak tohumların çimlendiği günü belirlemede kullanılmakta olup, Eşitlik 2'ye göre hesaplanmıştır (Ellis ve Roberts, 1981).

$$\text{OÇS} = \sum (N_i T_i / N_i) \quad (2)$$

Burada N_i , T_i gününde çimlenen tohum sayısını; T_i , çimlenmenin başlangıcından itibaren geçen günlerin sayısını ifade etmektedir.

Çimlenme indeksi Eşitlik 3 (Wang ve ark., 2004), ÇÜ Eşitlik 4 (Bewely ve Black, 1994), ÇE Eşitlik 5 (Li ve ark., 2020) ve FGİ Eşitlik 6 (Kalsa ve Abebie, 2012) yardımıyla hesaplanmıştır.

$$\text{Çİ} = \sum (G_i / T_i) \quad (3)$$

G_i , i. günde çimlenme oranı ve T_i , çimlenme süresinin günleridir.

$$\text{ÇÜ} = \sum n / \sum [(O\text{ÇS} - t)^2 n] \quad (4)$$

t , ekim günü olan 0. günden başlayarak gün cinsinden süreyi; n , t gününde çimlenmeyi tamamlayan tohum sayısını ifade etmektedir.

$$\text{ÇE} = (T_1/N) \times 100 \quad (5)$$

T_1 , birinci günde çimlenen tohum sayısını; N , toplam tohum sayısını ifade etmektedir.

$$\text{FGİ} = \text{ÇO} \times \text{fide yaş ağırlık (g)} \quad (6)$$

Varyans analizinden önce çimlenme oranı değerlerine ArcSin transformasyonu uygulanmıştır (Zar, 1996). Elde edilen veriler, tesadüf parselleri deneme desenine göre varyans analizine tabi tutulmuş ve ortalamalar arasındaki farklılıklar LSD testi ile kontrol edilmiştir (Yurtsever, 1984).

3. BULGULAR

Yem bezelyesi tohumlarına farklı konsantrasyonlarda BA priming uygulamaları sonucunda elde edilen, bazı çimlenme ve fide gelişim parametrelerine ait veriler Tablo 1 ve 2'de sunulmuştur. Araştırmada incelenen çimlenme ÇÜ ($p < 0.05$) ile ÇO, OÇS ve ÇE ($p < 0.01$) yönünden uygulamalar arasında anlamlı farklılıklar bulunmuştur (Tablo 1).



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Tablo 1. Yem bezelyesi tohumlarının bazı çimlenme özelliklerine BA priming dozlarının etkisi¹

Uygulamalar	Çimlenme oranı (%)	Ortalama çimlenme süresi (gün)	Çimlenme üniformite katsayısı	Çimlenme enerjisi
K	80.0 (63.5) d	2.73 a	29.2 c	0.0 d
HP	81.3 (64.4) cd	2.20 bcd	38.2 abc	18.7 cd
BA ₁	82.7 (65.5) cd	2.37 ab	35.4 bc	20.0 c
BA ₂	84.0 (66.5) c	2.37 ab	35.5 bc	20.0 c
BA ₃	90.7 (72.3) b	2.33 abc	40.0 abc	20.0 c
BA ₄	97.3 (80.6) a	1.97 bcd	49.3 a	29.3 a
BA ₅	90.7 (72.3) b	1.93 cd	47.8 ab	24.0 b
BA ₆	88.0 (69.8) b	1.87 d	47.7 ab	24.0 b
LSD değeri	3.33	0.78	12.43	3.88
	**	**	*	**

¹: Aynı sütunda aynı harfle gösterilen ortalamalar arasındaki farklılık istatistiki açıdan önemli değildir, (): Açık transformasyonu değerleri, *: p<0.05, **: p<0.01 düzeyinde önemli farklılık, K: Priming uygulaması yapılmamış, HP: Hidro-priming, BA₁= 1 mM borik asit dozu, BA₂= 2 mM borik asit dozu, BA₃= 3 mM borik asit dozu, BA₄= 4 mM borik asit dozu, BA₅= 5 mM borik asit dozu, BA₆= 6 mM borik asit dozu

Çimlenme oranı incelendiğinde, en yüksek değer 4 mM BA uygulamasında (% 97.3) tespit edilmiştir. En düşük ÇO priming uygulaması yapılmayan kontrol grubunda (% 80.0) belirlenmiştir. Borik asit dozlarının artışına bağlı olarak OÇS değerleri azalmış olup, en kısa OÇS borik asitin 6 mM konsantrasyonunda (1.87 gün) belirlenmiştir. Çalışmada, en geç çimlenmeler ise hiçbir uygulama yapılmayan kontrol grubunda 2.73 gün olarak tespit edilmiştir. Çimlenme üniformite katsayısı bakımından en yüksek değer 49.3 ile 4 mM BA dozunda tespit edilirken; bu doz ile HP, BA₃, BA₅ ve BA₆ dozları istatistiksel olarak farksız bulunmuştur. En düşük ÇÜ değeri 29.2 ile kontrol grubunda tespit edilmiştir. İncelenen parametrelerden çimlenme enerjisinde en yüksek değer BA₄ uygulamasında 29.3 olarak bulunmuştur. En düşük ise kontrol grubunda belirlenmiş olup, bu sonuç çimlenme denemesinin başladığı ilk gün herhangi bir tohumun çimlenmediğini göstermektedir (Tablo 1).

Çimlenme indeksi ve FGİ parametreleri incelendiğinde, en yüksek değerlerin BA₄ uygulamasında belirlendiği görülürken; bu doz ile BA₃, BA₅ ve BA₆ uygulamalarının istatistiksel olarak farksız olduğu görülmüştür. Her iki parametrede de en düşük değerler kontrol grubunda belirlenmiştir. Çalışmada, Çİ (p<0.01) ve FGİ (p<0.05) yönünden uygulamalar arasındaki bu farklılık istatistiki açıdan anlamlı bulunmuştur. Fide yaş ve kuru ağırlığı bakımından ise uygulamalar arasındaki farklılıklar istatistiki açıdan önemsiz çıkmıştır. (Tablo 2).



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Tablo 2. Yem bezelyesi tohumlarının bazı çimlenme ve fide gelişim özelliklerine BA priming dozlarının etkisi¹

Uygulamalar	Çimlenme indeksi	Fide yaş ağırlığı (g)	Fide kuru ağırlığı (g)	Fide güç indeksi
K	7.6 c	0.5745	0.1803	46.0 c
HP	11.4 b	0.5778	0.1826	47.0 bc
BA ₁	11.1 b	0.5802	0.1857	47.9 bc
BA ₂	11.0 b	0.5945	0.1884	50.1 bc
BA ₃	12.2 ab	0.6021	0.1915	54.9 ab
BA ₄	14.7 a	0.6153	0.1984	59.9 a
BA ₅	13.7 ab	0.6000	0.1846	54.4 abc
BA ₆	13.9 ab	0.5987	0.1828	52.7 abc
LSD değeri	2.92	0.06	0.02	8.36
	**	öd	öd	*

¹: Aynı sütunda aynı harfle gösterilen ortalamalar arasındaki farklılık istatistiki açıdan önemli değildir, *: p<0.05, **: p<0.01 düzeyinde önemli farklılık, öd: istatistiki açıdan fark önemsizdir, K: Priming uygulaması yapılmamış, HP: Hidro-priming, BA₁= 1 mM borik asit dozu, BA₂= 2 mM borik asit dozu, BA₃= 3 mM borik asit dozu, BA₄= 4 mM borik asit dozu, BA₅= 5 mM borik asit dozu, BA₆= 6 mM borik asit dozu

4. TARTIŞMA VE SONUÇ

Bitkilerin normal büyüme ve gelişmesi için besin maddelerinin yeterli miktarda alınması gerekmektedir. Eksiklik veya toksisiteye neden olan bir besin elementinin yetersiz alınımı, bitki büyümesini etkilemekte ve bitkilerde verim ve ürün kalitesi kayıplarına sebep olmaktadır. Bitkiler için en önemli mikro besin elementlerinden biri olan bor, priming tekniği için de kullanılabilen maddelerden biridir. Borik asit ile ilgili birçok bitki türünde priming çalışmaları (Ambika ve ark., 2014; Iqbal ve ark., 2017; Shahverdi ve ark., 2017; Asghar ve ark., 2019; Rasool ve ark., 2019) yapılmış ve olumlu sonuçlar alınmıştır.

İncelenen çimlenme ve fide gelişim parametrelerinden çimlenme oranı bakımından BA uygulamaları, kontrol ve hidro-priming uygulamalarına göre anlamlı olarak farklılıklar göstermiş ve borik asitte en iyi sonuçlara 4 mM uygulamasında ulaşılmış, bu dozdan sonraki uygulamalarda (5 ve 6 mM) ise anlamlı azalmalar meydana gelmiştir. BA dozlarının artışına bağlı olarak çimlenme süresinin kısaldığı ve BA₆ uygulamasında en hızlı çimlenmelerin gerçekleştiği görülmüştür. Çimlenme üniformite katsayısı bakımından 3, 4, 5 ve 6 mM BA priming dozları ile HP uygulamasından anlamlı olarak en iyi sonuçlar elde edilmiştir. Çimlenme enerjisi ilk gün çimlenen tohum sayısına bağlı olduğundan kontrol grubunda çimlenme gerçekleşmezken, BA₄ uygulamasında en iyi sonuçlar elde edilmiştir. Çimlenme indeksi ve FGİ bakımından kontrole göre, HP ve BA uygulamalarının olumlu sonuçlar verdiği ve en iyi sonuçların ise BA₄ uygulamasında gerçekleştiği görülmüştür (Tablo 1 ve 2). Farklı



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bitki türleri ile yapılan priming uygulamalarında, örneğin; buğday (Iqbal ve ark., 2012), çeltik (Farooq ve ark., 2011), soya (Imran ve ark., 2008), stevia (Shahverdi ve ark., 2017), arpa (Ajouri ve ark., 2004), papaya (Deb ve ark., 2010) ve brokoli (Memon ve ark., 2013) gibi bitkilerde de BA priming uygulamalarının çimlenme ve fide gelişim parametrelerine anlamlı etkilerinin olduğu bildirilmiştir.

Borik asit priming uygulaması ile yapılan çalışmalarda; Mirshekari (2012) *Anethum graveolens* L. bitkisinde çimlenme oranı yönünden % 1.5 borik asitte, Shahverdi ve ark. (2017) *Stevia rebaudiana* Bertoni bitkisinde çimlenme üniformite katsayısı yönünden % 1, ortalama çimlenme süresi açısından ise % 2 borik asitte en yüksek değerlere ulaştıklarını rapor etmişlerdir. Ayrıca, Farooq ve ark. (2011) çeltik bitkisinde ortalama çimlenme süresi, çimlenme yüzdesi, çimlenme enerjisi ve çimlenme süresini ve Iqbal ve ark. (2017) buğdayda fide büyüme hızını ve gelişimini bor ile priming uygulamalarının olumlu etkilediğini bildirmişlerdir. Borik asitin priming olarak kullanıldığı çalışmalardan da görüldüğü üzere; çimlenme ve fide gelişim parametreleri, kullanılan bitki türüne, uygulanan dozların miktarlarına ve priming süresine göre değişkenlik göstermektedir.

Araştırmacılar, nişasta metabolizmasında görev alan fosfataz, amilaz vb. enzimlerin aktivasyonunda görev alan borik asitin, düşük konsantrasyonlarının bile tohumlarda çimlenme metabolizmanın başlamasını sağladığını ve bunun sonucunda da çimlenmenin hızlandığını rapor etmişlerdir (Cresswell ve Nelson, 1973; Chatterjee ve ark., 1990; Bam ve ark., 2006; Memon ve ark., 2013). Borik asit ile priming uygulamasında kullanılan konsantrasyonun miktarına bağlı olarak, Wongmo ve ark. (2004) buğday ve arpa tohumlarının düşük konsantrasyonlarda yaprak sayıları ve kardeşlenme de önemli gelişme gözlemlerken, Bonilla ve ark. (2004) ise yüksek konsantrasyonun bitkilerin büyümesini engellediğini ve toksik etki yaptığını rapor etmişlerdir. Ölçer ve Kocaçalışkan (2007) borik asitin bu toksik etkisinin, çimlenme işlemi sırasında embriyolarda ve endospermde polifenol oksidaz aktivitesinin inhibisyonundan kaynaklandığını ve bu durumun çimlenen tohum yüzdesini azalttığını ifade etmiştir.

Tabrizian ve Osareh (2007), bir bitkinin su, ışık ve mineraller yönünden rekabet edebilmesi için hızlı bir gelişim yapmasının ve birincil büyümesi için fide gücünün önemli olduğunu vurgulamıştır. Elde ettiğimiz sonuçlarda da BA priming uygulaması, tohumların çimlenme ve fide gücü indeksinin artmasında etkili olmuştur (Tablo 2). Mirshekari (2012)'nin de *Anethum*



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graveolens L. bitkisinde borik asit (H_3BO_3) ile yaptığı priming çalışmasında elde ettiği tohum canlılık indeksi sonuçları çalışmamızı destekler niteliktedir.

Sonuç olarak, borik asit ile priming uygulamalarının yem bezelyesi bitkisinde olumlu tepkiler verdiği, çimlenme ve bazı fide gelişim özelliklerini iyileştirdiği görülmüştür. Bununla birlikte artan borik asit konsantrasyonları bazı parametrelerde olumsuz etkiler de göstermiştir. Yem bezelyesinde çimlenme ve fide gelişimi için tohumların 4 mM borik asit konsantrasyonu ile ön işleme tabi tutulması önerilmektedir.



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KAYNAKÇA

Acikbas, S., Ozyazici, M.A., Bektas, H., 2022. Root system architecture and seed weight relations in forage pea (*Pisum sativum* ssp. *arvense* L. Poir.). *Ciência Rural*, 52(6).

Açıkbaş, S., Özyazıcı, M.A., 2021. Yaygın mürdümük (*Lathyrus sativus* L.) tohumlarına silisyum ön uygulamasının çimlenme üzerine etkileri. *3rd International African Conference on Current Studies*, 27-28 Şubat, Abomey-Calavi, Benin, s. 404-412.

Ajourri, A., Asgedom, H., Becker, M., 2004. Seed priming enhances germination and seedling growth of barley under conditions of P and Zn deficiency. *J. Plant Nutr. Soil Sci.* 167: 630-636.

Ambika, S., Manonmani, V., Deepika, S., 2014. Seed priming with micronutrients for quality and yield. *Popular Kheti*, 2(4): 35-37.

Asghar, M.K., Sarwar, M.A., Malik, S.R., Ahmad, W., Zareen, S., Ali, S., Ali, A., 2019. Seed priming with boron improves achene yield and oil contents of sunflower. *Pakistan Journal of Agricultural Research*, 32(1): 73-77.

Bam, R., Kumaga, F.K., Ofori, K., Aisedu, E., 2006. Germination, vigor and dehydrogenase activity of naturally aged rice (*Oryza sativa* L.) seeds soaked in potassium and phosphorus salts. *Asian J. Plant Sci.*, 5: 948-955.

Barut, H., Aykanat, S., Aşikli, S., Eker, S., 2018. Bitkisel Üretimde Bor, *Uluslararası Doğu Akdeniz Tarımsal Araştırma Enstitüsü Dergisi*, 1(1): 33-46.

Bewely, J., Black, M., 1994. Seeds: Physiology of Development and Germination. New York.

Bonilla, I., El-Hamdaoui, A., Bolanos, L., 2004. Boron and calcium increase *Pisum sativum* seed germination and seedling development under salt stress. *Plant and Soil*, 267 (1-2): 97-107.

Cervilla, L.M., Blasco, B., Ríos, J.J., Rosales, M.A., Rubio-Wilhelmi, M.M., Sánchez-Rodríguez, E., Ruiz, J.M., 2009. Response of nitrogen metabolism to boron toxicity in tomato plants. *Plant Biology*, 11(5): 671-677.

Chatterjee, C., Sinha, P., Agarwala, S.C., 1990. Boron nutrition of cowpea. *Proceedings of the Indian Academy of Sciences Plant Science*, 100:311-318.

Cokkızgın, A., 2013. Effects of hydro and osmo-priming on seed vigor of pea (*Pisum sativum* L.). *Agriculture, Forestry and Fisheries*, 2(6): 225-228.



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Cresswell, C.F., Nelson, H., 1973. The influence of boron on the RNA level, a-amylase activity and level of sugars in germinating *Themeda rriandra* Forsk. seed. *Annals of Botany*, 37 (3):427-438.

Deb, P., Das, A., Ghosh, S.K., Suresh, C.P., 2010. Improvement of seed germination and seedling growth of papaya (*Carica papaya* L.) through different pre-sowing seed treatments. *Acta Horticulturae*, 851:313-316.

Donaldson, E., Schillinger, W.F., Stephen, M.D., 2001. Straw production and grain yield relationships in winter wheat. *Crop Sci.* 41: 100-106.

Ellis, R.A., Roberts, E.H., 1981. The quantification of ageing and survival in orthodox seeds. *Seed Science and Technology*, 9(2): 373-409.

Elzebroek, A.T.G., 2008. Guide to Cultivated Plants. CAB International, p. 540.

Farooq, M., Rehman, A., Aziz T., Habib, M., 2011. Boron nutrimpriming improves the germination and early seedling growth of rice (*Oryza sativa* L.). *Journal of Plant Nutrition*, 34:1507-1515.

Goldbach, H.E., Wimmer, M.A., 2007. Boron in plants and animals: Is there a role beyond cell-wall structure? *Journal of Plant Nutrition and Soil Science*, 170(1): 39-48.

Heydecker, W., Gibbins, B., 1978. The priming of seeds. *Acta Hort.*, 83: 213-215.

Jatana, B.S., Ram, H., Gupta, N., 2020. Application of seed and foliar priming strategies to improve the growth and productivity of late sown wheat (*Triticum aestivum* L.). *Cereal Research Communications*, 48: 383-390.

Johnson, S.E., Lauren, J.G., Welch, R.M., Duxbury, J.M., 2005. A comparison of the effects of micronutrient seed priming and soil fertilization on the mineral nutrition of chickpea (*Cicer arietinum*), lentil (*Lens culinaris*), rice (*Oryza sativa*) and wheat (*Triticum aestivum*) in Nepal. *Experimental Agriculture*, 41: 427-448.

Iqbal, S., Farooq, M., Nawaz, A., Rehman, A.U., Rehman, A., 2012. Optimizing boron seed priming treatment for improving the germination and early seedling growth of wheat. *Journal of Agriculture and Social Science*, 8: 57-61.

Iqbal, S., Farooq, M., Cheema, S.A., Afzal, I., 2017. Boron seed priming improves the seedling emergence, growth, grain yield and grain biofortification of bread wheat. *International Journal of Agriculture & Biology*, 19(1).



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Imran, M., Neumann, G., Romheld, V., 2008. Nutrient seed priming improves germination rate and seedling growth under submergence stress at low temperature. Competition for Resources in a Changing World: New Drive for Rural Development, Tropentag, October 7-9, Hohenheim.

Kadıoğlu, S., Tan, M., 2018. Determination of Seed Yield and some characteristics of some forage pea lines and varieties in Erzurum conditions. *Atatürk University Journal of the Agricultural Faculty*, 49:143-149.

Kalsa, K.K., Abebie, B., 2012. Influence of seed priming on seed germination and vigor traits of *Vicia villosa* ssp. *dasycarpa* (Ten.). *African Journal of Agricultural Research*, 7(21): 3202-3208.

Lewis, G., Schirer, B., Mackinder, B., Lock, M., 2005. "Legumes of the World"; Royal Botanical Gardens: Kew, United Kingdom.

Li, Q., Ma, C., Li, H., Xiao, Y., Liu, X., 2004. Effects of soil available silicon on growth, development and physiological function of soybean. *J. Appl. Ecol.*, 15:73-76.

Memon, N.U.N., Gandahi, M., Pahoja, V., Sharif, N., 2013. Response of seed priming with boron on germination and seedling sprouts of broccoli. *International Journal of Agricultural Science and Research*, 3(2):183-94.

Mirshekari, B., 2012. Seed priming with iron and boron enhances germination and yield of dill (*Anethum graveolens*). *Turkish Journal of Agriculture and Forestry*, 36(1): 27-33.

Ölçer, H., Kocaçalışkan, İ., 2007. Excess boron reduces polyphenol oxidase activities in embryo and endosperm of maize seed during germination. *Zeitschrift für Naturforschung*, 62(1-2): 111-115.

Rasool, T., Ahmad, R., Farooq, M., 2019. Seed priming with micronutrients for improving the quality and yield of hybrid maize. *Gesunde Pflanzen*, 71(1): 37-44.

Rodriguez, C., Frias, J., Vidal-Valverde, C., Hernandez, A., 2008. Correlations between some nitrogen fractions, lysine, histidine, tyrosine and ornithine contents during the germination of peas, beans, and lentils. *Food Chemistry*, 108: 245-252.

Scott, S.J., Jones, R.A., Williams, W.A., 1984. Review of Data Analysis Methods for Seed Germination. *Crop Science*, 24: 1192-1199

Shahverdi, M.A., Omid, H., Tabatabaei, S.J., 2017. Determination of optimum duration and concentration of Stevia (*Stevia rebaudiana* Bert.) seed priming with boric acid (H_3BO_3). *Türkiye Tarımsal Araştırmalar Dergisi*, 4(1), 24-30.



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Tabrizian, F., Osareh, A.M., 2007. Improved seed emergence and yield related traits of marigold (*Calendula officinalis* L.) by on-farm seed micronutrient treatment trials. *Iranian J. Crop Sci.* 9: 124-141.

Wang, F., Chen, X., Chen, Q., Chin, X., Li, Z., 2000. Determination of neurotoxin 3-N-oxalyl-2, 3- diaminopropionic acid and non-protein amino acids in *Lathyrus sativus* by precolumn derivatization with 1- fluoro-2, 4-dinitrobenzene. *Journal of Chromatography*, 883(1-2): 113-118.

Wongmo, J., Jamjod, S., Rerkasem B., 2004. Contrasting responses to boron deficiency in barley and wheat. *Plant and Soil*, 259 (1-2):103-110.

Yurtsever, N., 1984. Deneysel İstatistik Metotları. Köy Hizmetleri Genel Müdürlüğü Yayınları, Genel Yayın No: 121, Ankara.

Zar, J.H., 1996. Biostatistical Analysis. 3rd ed. Prentice Hall, p. 662, New Jersey, USA.



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**KOCA FİĞ (*Vicia narbonensis* L.) ÇEŞİTLERİNE ÇİNKO PRIMİNG
UYGULAMASININ ÇİMLENME VE FİDE GELİŞİMİNE ETKİLERİ**

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ÖZET

Bu çalışmada, çinko (Zn) ile tohum ön uygulamasının koca fiğ (*Vicia narbonensis* L.) çeşitlerinde çimlenme ve fide gelişim parametrelerine etkilerinin belirlenmesi amaçlanmıştır. Araştırma; Siirt Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Laboratuvarı'nda, 25±1 °C kontrollü şartlar altında yürütülmüştür. Çalışmanın bitkisel materyalini Karakaya ve Halilbey koca fiğ çeşitleri oluşturmuştur. Laboratuvar çalışması, tesadüf parselleri deneme desenine göre 4 tekrarlamalı olarak petri kaplarında kurulmuştur. Araştırmada çinko sülfatın 0.5, 1.0, 1.5, 2.0 ve 2.5 mM konsantrasyonu ile hidro-priming uygulaması ve kontrol olarak priming yapılmayan grup araştırmanın konusunu teşkil etmiştir. Çalışmada; çimlenme oranı, ortalama çimlenme süresi, çimlenme üniformite katsayısı, çimlenme enerjisi, çimlenme indeksi, fide yaş ve kuru ağırlığı ve fide güç indeksi parametreleri incelenmiştir. Araştırma sonuçlarına göre, Zn priming uygulamasının çimlenme ve fide gelişim parametrelerini anlamlı derecede etkilediği saptanmıştır. Çalışmada Zn priming uygulamalarına göre; çimlenme oranı % 74.7-90.7, ortalama çimlenme süresi 2.00-2.65 gün, çimlenme üniformite katsayısı 28.56-46.15, çimlenme enerjisi 0.0-22.2, çimlenme indeksi 7.4-13.1, fide yaş ağırlığı 0.349-0.449 g, fide kuru ağırlığı 0.105-0.121 g ve fide güç indeksi 25.5-40.3 arasında değişim göstermiştir. Bu çalışmada, çinko sülfat priming uygulamasının, koca fiğ çeşitlerinin çimlenme ve fide gelişimleri üzerine etkili olabileceğini göstermiştir. Çalışmada ayrıca, priming uygulamalarının etkilerinin çeşide göre de farklılık gösterdiği görülmüştür. Araştırma sonucunda, koca fiğ tohumlarında çinko ile tohuma ön uygulamanın genel olarak çinkonun 2 mM dozunda en olumlu sonuçlar verdiği söylenebilir. Koca fiğ bitkisinde çimlenme ve fide gelişimi açısından; daha homojen bir gelişimin sağlanması, tohumların çimlenmesinin kolaylaşması ve hızlanması için tohumlara çinko sülfat uygulamasının kullanılması önerilmektedir.

Anahtar Kelimeler: Çinko, Priming, Koca Fiğ, Çimlenme Oranı, Çimlenme İndeksi



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**THE EFFECTS OF ZINC PRIMING ON THE GROWTH AND SEEDLING
DEVELOPMENT OF NARBON VETCH (*Vicia narbonensis* L.) VARIETIES**

ABSTRACT

In this study, it was aimed to determine the effects of seed pretreatment with Zn on germination and seedling growth parameters of narbon vetch (*Vicia narbonensis* L.). Research; It was carried out in Siirt University, Faculty of Agriculture, Field Crops Laboratory, under controlled conditions of 25 ± 1 °C. The plant materials of the study consisted of Karakaya and Halilbey narbon vetch variety. The laboratory study was set up in petri dishes according to the randomized plot design with 4 replications. In the research, the hydropriming application with the 0.5, 1.0, 1.5, 2.0 and 2.5 concentration of zinc and the group that was not primed as a control constituted the subject of the research. In the study; germination rate, average germination time, germination uniformity coefficient, germination energy, germination index, seedling fresh weight, seedling dry weight and seedling vigor index parameters were investigated. According to the results of the research, it was determined that Zn priming application significantly affected germination and seedling growth parameters. In the study; germination rate 74.7-90.7%, average germination time 2.00-2.65 days, germination uniformity coefficient 28.56-46.15, germination energy 0.0-22.2, germination index 7.4-13.1, seedling fresh weight 0.349-0.449 g, seedling dry weight 0.105-0.121 g and seedling vigor index 25.5-40.3 varied in ranges. In this study, it has been shown that zinc sulfate priming can be effective on germination and seedling growth of narbon vetch cultivars. In the research, it was seen that the effects of priming applications differ according to the type. As a result of the research, it can be said that the pre-application to the seed with zinc in narbon vetch seeds gives the most positive results at a dose of 2 mM of zinc in general. In terms of germination and seedling development in narbon vetch; it is recommended to use zinc sulfate application on seeds to ensure a more homogeneous development, to facilitate and accelerate the germination of seeds.

Keywords: Zinc, Priming, Narbon Vetch, Germination Rate, Germination Index



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1. GİRİŞ

Koca fiğ (*Vicia narbonensis* L.); kuraklığa ve soğuğa dayanıklı, az bakım işlemi gerektiren (Fırıncıoğlu ve ark., 2012; Muhammed ve Karim, 2021), kurak ve/veya yarı kurak bölgelerde yetişebilen (Berger ve ark., 2003; Badrzadeh ve ark., 2008; Özyazıcı ve Açıkbaş, 2019) önemli bir baklagil yem bitkisidir. Tohumlarında yaklaşık olarak % 28 oranında protein içeren ve oldukça dengeli bir aminoasit içeriğine sahip olan (Aletor ve ark., 1994) koca fiğ; yem verimliliğini ve hayvan performansını etkileyebilen bazı sekonder metabolitleri (tanenler, tripsin inhibitörleri ve γ -glutamin-S-etenilsistin) de içermektedir (Enneking, 1995; Berger ve ark., 2003). Özellikle et ve süt besiciliğinde düşük maliyetli bir protein kaynağı olarak düşünülen koca fiğ (Yu ve ark., 2001; Hadjipanayiotou, 2003; Lahuta ve ark., 2017; Del Pino-García ve ark., 2018); erken ilkbaharda otlatılabilmekte, silaj, tane, kuru ve yeşil yem olarak değerlendirilebilmekte (Allden ve Geytenbeek, 1980; Turk ve ark., 2003) ve yeşil gübre ve örtü bitkisi olarak da kullanılmaktadır (Jones ve Singh, 2000).

Bitkilerin çimlenme ve fide oluşum devresi, biyotik ve abiyotik birçok faktörün etkilediği en hassas dönemdir (Vishal ve Kumar, 2018; Yadav ve ark., 2020). Bu dönemde bitkilerin ihtiyacı olan, bitki büyümesini ve gelişmesinde rol oynayan bitki besin elementlerinin, alımı ve etkisi çok önemlidir. Bu anlamda, özellikle bitkilerde ve insanlarda yaygın görülen çinko (Zn) noksaklığı önemli problemlerden biridir (Johnson ve ark., 2005). Tohumların içerdiği Zn oranı, tohumların çimlenmesini ve fide canlılığını üzerinde önemli etkilere sahiptir (Cakmak, 2008). Tohumların çimlenip fide oluşumu aşamasında Zn, ya tohum rezervlerinden ya da topraktan temin edilmekte; bu nedenle, özellikle Zn eksikliği olan topraklarda tohumların çimlenmesi için danede yeterli miktarda Zn bulunması önem taşımaktadır (Rengel ve Graham, 1995). Bu durum dikkate alındığında, Zn ile tohum ön hazırlama (priming) uygulaması, ekonomik ve etkili bir yol olarak öne çıkmaktadır (Farooq ve ark., 2012).

Bu çalışmada; bazı koca fiğ (*V. narbonensis* L.) çeşitlerine ait tohumlara Zn priming uygulamalarının, çimlenme ve fide gelişimi üzerine etkilerinin belirlenmesi amaçlanmıştır.

2. MATERYAL VE METOT

Araştırma, Siirt Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Laboratuvarı'nda yürütülmüştür. Çalışmada, Karakaya ve Halilbey koca fiğ (*V. narbonensis* L.) çeşitleri bitkisel materyal olarak kullanılmıştır.



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Araştırmada denemenin konusunu, 5 farklı Zn dozları ($Zn_1= 0.5$ mM, $Zn_2= 1.0$ mM, $Zn_3= 1.5$ mM, $Zn_4= 2.0$ mM ve $Zn_5= 2.5$ mM) ve kontrol uygulamaları [saf su ile ön uygulama (hidro-priming, HP) ve ön uygulama yapılmayan (K)] oluşturmuştur. Çalışmada Zn kaynağı olarak çinko sülfat ($ZnSO_4$) kullanılmıştır.

Laboratuvar denemesi, tesadüf parselleri deneme desenine göre 4 tekerrürlü olarak kurulmuş ve her bir tekerrür için 25 adet tohum kullanılmıştır. Tüm uygulamalarda tohumlar 1 dakika % 70 etil alkolde steril edildikten sonra 3 defa steril su ile durulanmıştır. Daha sonra tohum yüzeyindeki mikroorganizmaların deforme olması için 10 dakika % 10'luk sodyum hipoklorit ($NaOCl$) + % 0.01 tween20 solüsyonu ile tohumları kaplayacak şekilde yüzey sterilizasyonu gerçekleştirilmiştir. Steril hale gelen tohumlar petri (90 mm x 15 mm) kaplarında bulunan iki katlı Whatman filtre kâğıdının arasına yerleştirilmiştir.

Çinko ve hidro-priming uygulamalarında, her bir petri kabına tohum/solüsyon oranı 2:1 g/ml olacak şekilde ayarlanmış (Johnson ve ark., 2005); her bir petri kabına 5 ml olacak şekilde solüsyon uygulanarak, 12 saat süreyle tohumlar priming için bekletilmiştir. Bekletme süreleri tamamlanan tohumlar kuru filtre kağıdı arasına alınarak önce başlangıç nemine kadar (% $3\pm$) (Jatana ve ark., 2020) kurutulmuş ve sonra da 24 saat kurumaya bırakılmıştır.

Priming uygulanan tohumlar ile ön uygulama yapılmayan tohumlar yeni petrilere yerleştirilmiş ve her petri kabına 5 ml saf su eklenmiştir. Petri kapları 25 ± 1 °C sıcaklığa ayarlı etüv (BINDER, GmbH, Almanya)'de çimlenmeye bırakılmıştır. Çalışmada, 24 saate 1 kez olacak şekilde her gün aynı saatte çimlenen tohumlar sayılmıştır. Çalışmanın bittiği güne kadar 48 saatte bir (nemlilik durumuna göre) 5 ml saf su tüm petri kaplarına ilave edilmiştir.

Deneme 7. günün sonunda her bir petri kabındaki bitkilerden rastgele seçilen 10 bitki üzerinden fide yaş ve kuru ağırlıkları ölçümleri yapılmıştır. Çalışmada; çimlenme oranı (ÇO), ortalama çimlenme süresi (OÇS), çimlenme üniformite katsayısı (ÇÜ), çimlenme indeksi (Çİ), çimlenme enerjisi (ÇE) ve fide güç indeksi (FGİ) özellikleri incelenmiştir.

Çimlenme oranı parametresi her 12 saatte bir çimlenen tohumlar sayılarak Scott ve ark. (1984)'nın kullandığı Eşitlik 1'e göre belirlenmiştir.

$$CO = (NCTS/TS) \times 100 \quad (1)$$

Eşitlikte $NCTS$, normal çimlenen tohum sayısını; TS , kullanılan toplam tohum sayısını ifade etmektedir.



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Ortalama çimlenme süresi genel olarak tohumların çimlendiği günü belirlemede kullanılmakta olup, Eşitlik 2'ye göre hesaplanmıştır (Ellis ve Roberts, 1981).

$$O\check{S} = \sum (N_i T_i / N_i) \quad (2)$$

Burada N_i , T_i gününde çimlenen tohum sayısını; T_i , çimlenmenin başlangıcından itibaren geçen günlerin sayısını ifade etmektedir.

Çimlenme indeksi Eşitlik 3 (Wang ve ark., 2004), ÇÜ Eşitlik 4 (Bewely ve Black, 1994), ÇE Eşitlik 5 (Li ve ark., 2020) ve FGİ Eşitlik 6 (Kalsa ve Abebie, 2012) yardımıyla hesaplanmıştır.

$$\check{C}\check{I} = \sum (G_i / T_i) \quad (3)$$

G_i , i. gündeki çimlenme oranı ve T_i , çimlenme süresinin günleridir.

$$\check{C}\check{U} = \sum n / \sum [(O\check{S} - t)^2 n] \quad (4)$$

t , ekim günü olan 0. günden başlayarak gün cinsinden süreyi; n , t gününde çimlenmeyi tamamlayan tohum sayısını ifade etmektedir.

$$\check{C}E = (T_1 / N) \times 100 \quad (5)$$

T_1 , birinci günde çimlenen tohum sayısını; N , toplam tohum sayısını ifade etmektedir.

$$FG\check{I} = \check{C}O \times \text{fide yaş ağırlık (g)} \quad (6)$$

Elde edilen veriler, tesadüf parselleri deneme desenine göre varyans analizine tabi tutulmuş ve ortalamalar arasındaki farklılıklar TUKEY çoklu karşılaştırma testi ile kontrol edilmiştir (Açıkgöz ve Açıkgöz, 2001).

3. BULGULAR

Koca fiğ çeşitlerine farklı konsantrasyonlarda Zn priming uygulamalarından elde edilen bazı çimlenme ve fide gelişim verileri Tablo 1 ve 2'de sunulmuştur.

Çimlenme oranı bakımından, Zn dozları ve çeşitler arasındaki farklılık istatistiksel açıdan çok önemli ($p < 0.01$) bulunmuştur. Çalışmada, Zn konsantrasyonlarının artışına bağlı olarak ortalama çimlenme oranının arttığı, en yüksek Zn dozunda ise bir miktar anlamlı düşüşün gerçekleştiği görülmüştür. En yüksek çimlenme oranı değeri çeşitlerin ortalaması olarak % 90.7 ile Zn₄ uygulamasında belirlenirken, en düşük değer priming uygulaması yapılmayan kontrol grubunda % 74.7 olarak tespit edilmiştir. Koca fiğ çeşitlerinin ortalama sonuçları incelendiğinde; çimlenme oranı Karakaya çeşidinde % 90.8 olarak tespit edilirken, Halilbey çeşidinde çimlenme oranı % 73.7 olarak belirlenmiştir (Tablo 1).



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Tablo 1. Koca fiğ tohumlarının bazı çimlenme özelliklerine Zn priming dozlarının etkisi¹

Özellikler	Çeşit (Ç)	Uygulamalar (U)							Ortalama
		K	HP	Zn ₁	Zn ₂	Zn ₃	Zn ₄	Zn ₅	
Çimlenme oranı (%)	Karakaya	82.7	86.7	92.0	93.3	93.3	97.3	90.7	90.8 A
	Halilbey	66.7	69.3	72.0	73.3	74.7	84.0	76.0	73.7 B
	Ortalama	74.7 D	78.0 CD	82.0 BC	83.3 B	84.0 B	90.7 A	83.3 B	
Ortalama çimlenme süresi (gün)	Karakaya	2.43 abc	1.77 ef	1.70 f	1.60 f	1.93 def	1.80 def	1.87 def	1.87 B
	Halilbey	2.87 a	2.43 abc	2.67 ab	2.47 abc	2.23 bcd	2.20 cde	2.47 abc	2.48 A
	Ortalama	2.65 A	2.10 B	2.18 B	2.03 B	2.08 B	2.00 B	2.17 B	
Çimlenme üniformite katsayısı	Karakaya	33.97 cd	51.47 ab	54.84 ab	58.98 a	48.54 b	53.88 ab	48.57 b	50.04 A
	Halilbey	23.15 e	29.15 cde	27.04 de	29.90 cde	33.46 cd	38.42 c	31.01 cde	30.30 B
	Ortalama	28.56 C	40.31 AB	40.94 AB	44.44 AB	41.00 AB	46.15 A	39.79 B	
Çimlenme enerjisi	Karakaya	0.0 g	30.7 b	30.7 b	41.3 a	24.0 c	28.0 bc	13.3 d	24.01 A
	Halilbey	0.0 g	1.3 fg	1.3 fg	3.0 efg	6.7 ef	13.3 d	9.3 de	5.01 B
	Ortalama	0.0 D	16.0 B	16.0 B	22.2 A	15.3 B	20.7 A	11.3 C	
Önemlilik düzeyi									
Çimlenme oranı		Ç: 0.0001**			U: 0.0001**		Ç x U: 0.0875 ^{öd}		
Ortalama çimlenme süresi		Ç: 0.0001**			U: 0.0001**		Ç x U: 0.0050**		
Çimlenme üniformite katsayısı		Ç: 0.0001**			U: 0.0001**		Ç x U: 0.0002**		
Çimlenme enerjisi		Ç: 0.0001**			U: 0.0001**		Ç x U: 0.0001**		

¹: Aynı sütunda, aynı satırda ve aynı grupta aynı harfle gösterilen ortalamalar arasındaki farklılık istatistiki açıdan önemli değildir, **: p<0.01 düzeyinde önemli farklılık, öd: istatistiki açıdan fark önemsizdir, K: Priming uygulaması yapılmamış, HP: Hidro-priming, Zn₁= 0.5 mM, Zn₂= 1.0 mM, Zn₃= 1.5 mM, Zn₄= 2.0 mM ve Zn₅= 2.5 mM

Koca fiğ tohumlarının ortalama çimlenme süresi, çimlenme üniformite katsayısı ve çimlenme enerjisi üzerine Zn priming uygulamalarının ve çeşitlerin etkisi istatistiksel açıdan çok önemli (p<0.01) olmuştur. Çalışmada aynı zamanda, her üç parametrede de çeşit x çinko uygulamaları interaksyonu da istatistiksel açıdan çok önemli (p<0.01) olduğu görülmüştür (Tablo 1).

Çalışmada, hidro-priming ve Zn priming uygulamaları kontrole göre, ortalama çimlenme süresini kısalttığı belirlenmiştir. Priming uygulamaları arasında ortalama çimlenme süresi yönünden anlamlı farklılık olmamasına rağmen, en kısa sürede çimlenme Zn₄ uygulamasında 2.00 gün olarak tespit edilmiştir. Çeşitlerin sonuçları incelendiğinde; Karakaya çeşidinde ortalama çimlenme süresi 1.87 gün iken, Halilbey çeşidinde bu değer 2.48 gün olarak saptanmıştır (Tablo 1).

Araştırmada, Zn priming uygulamalarında en yüksek çimlenme üniformite katsayısı 46.15 ile Zn₄ uygulamasında tespit edilirken, en düşük değer kontrol grubunda (28.56) saptanmıştır. Ancak, çimlenme üniformite katsayısı yönünden çinkonun en yüksek dozu hariç diğer priming uygulamaları arasındaki farklılık istatistiksel açıdan önemsiz bulunmuştur. Çimlenme üniformite katsayısı bakımından çeşit ortalamaları, Karakaya çeşidinde 50.04 ve Halilbey çeşidinde 30.30 olarak tespit edilmiştir (Tablo 1).



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Çimlenme enerjisi incelendiğinde; Zn uygulamaları arasında en iyi değerler Zn₂ (22.2) ve Zn₄ (20.7) uygulamalarından elde edilirken, en düşük değer ise kontrol grubunda tespit edilmiştir. Çeşitlerin çimlenme enerjisi açısından tepkileri ise Karakaya çeşidi 24.01 değerine ulaşırken, Halilbey çeşidinin ortalaması 5.01 değerinde kalmıştır (Tablo 1).

Çimlenme parametrelerinden ortalama çimlenme süresi, çimlenme üniformite katsayısı ve çimlenme enerjisinde, çeşit x çinko priming interaksyonunun anlamlı çıkmasının nedeni olarak; kullanılan çeşitlerin Zn priming uygulamalarına farklı tepkiler vermesi ve özellikle Halilbey çeşidinin Karakaya çeşidine göre daha geç çimlenmesinden kaynaklandığı düşünülmektedir.

Çimlenme indeksi, fide güç indeksi ve fide yaş ağırlığı parametreleri açısından Zn uygulamaları ve çeşitler arasındaki farklılık istatistiksel açıdan çok önemli ($p < 0.01$) bulunmuştur. Fide kuru ağırlığı bakımından ise; Zn uygulamaları arasındaki farklılık istatistiki açıdan önemsiz olurken, çeşitler arasındaki farklılık $p < 0.01$ düzeyinde anlamlı bulunmuştur (Tablo 2).

Tablo 2. Koca fiğ tohumlarının bazı çimlenme ve fide gelişim parametrelerine ait veriler¹

Özellikler	Çeşit (Ç)	Uygulamalar (U)							Ortalama
		K	HP	Zn ₁	Zn ₂	Zn ₃	Zn ₄	Zn ₅	
Çimlenme indeksi	Karakaya	8.8	14.3	15.3	16.7	14.0	15.3	12.9	13.9 A
	Halilbey	5.9	7.9	7.5	8.0	9.2	10.9	8.9	8.3 B
	Ortalama	7.4 B	11.1 A	11.4 A	12.4 A	11.6 A	13.1 A	10.9 A	
Fide yaş ağırlığı	Karakaya	0.273	0.317	0.321	0.329	0.350	0.379	0.380	0.336 B
	Halilbey	0.424	0.447	0.451	0.460	0.468	0.519	0.499	0.467 A
	Ortalama	0.349 C	0.382 BC	0.386 ABC	0.395 ABC	0.409 ABC	0.449 A	0.440 AB	
Fide kuru ağırlığı	Karakaya	0.071	0.078	0.081	0.083	0.087	0.088	0.090	0.083 B
	Halilbey	0.139	0.140	0.141	0.144	0.147	0.153	0.145	0.144 A
	Ortalama	0.105	0.109	0.111	0.114	0.117	0.121	0.118	
Fide güç indeksi	Karakaya	22.6	27.7	29.6	30.7	32.6	37.0	34.4	30.7 B
	Halilbey	28.3	30.9	32.4	33.9	34.7	43.6	38.1	34.5 A
	Ortalama	25.5 C	29.3 BC	31.0 BC	32.3 BC	33.7 AB	40.3 A	36.3 AB	
Önemlilik düzeyi									
Çimlenme indeksi		Ç: 0.0001**			U: 0.0001**		Ç x U: 0.0586 ^{öd}		
Fide güç indeksi		Ç: 0.0047**			U: 0.0001**		Ç x U: 0.9565 ^{öd}		
Fide yaş ağırlık		Ç: 0.0001**			U: 0.0008**		Ç x U: 0.9880 ^{öd}		
Fide kuru ağırlık		Ç: 0.0001**			U: 0.1365 ^{öd}		Ç x U: 0.9518 ^{öd}		

¹: Aynı sütunda, aynı satırda ve aynı grupta aynı harfle gösterilen ortalamalar arasındaki farklılık istatistiki açıdan önemli değildir, **: $p < 0.01$ düzeyinde önemli farklılık, öd: istatistiki açıdan fark önemsizdir, K: Priming uygulaması yapılmamış, HP: Hidro-priming, Zn₁= 0.5 mM, Zn₂= 1.0 mM, Zn₃= 1.5 mM, Zn₄= 2.0 mM ve Zn₅= 2.5 mM

Çimlenme indeksi, Zn priming uygulamalarının ortalaması olarak Karakaya çeşidinde 13.9, Halilbey çeşidinde ise 8.3 olarak tespit edilmiştir. Çinko priming uygulamaları incelendiğinde, kontrol grubuna göre diğer uygulamaların daha iyi sonuçlar verdiği ve hidropriming ile Zn priming dozlarının istatistiki açıdan önemsiz olduğu tespit edilmiştir. Kontrol konusunun



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çimlenme indeksi ortalama 7.4 iken, priming uygulamalarının değeri 10.9-13.1 arasında değişkenlik göstermiştir (Tablo 2).

Fide güç indeksi ve fide yaş ağırlığı özellikleri incelendiğinde, Zn priming uygulamaları bakımından en yüksek değerler Zn₄ uygulamasında (sırasıyla, 40.3 ve 0.449 g) tespit edilirken, en düşük değerler kontrol grubunda belirlenmiştir. Fide kuru ağırlığı değerleri ise priming uygulamalarına göre 0.109-0.121 arasında değişim göstermiştir (Tablo 2).

Çeşitler arasındaki değişim incelendiğinde; fide güç indeksi ile fide yaş ve kuru ağırlığı değerleri Halilbey çeşidinde en yüksek iken, Karakaya çeşidinde daha düşük olmuştur (Tablo 2).

4. TARTIŞMA VE SONUÇ

Bitkilerin en kritik dönemlerinden olan çimlenme ve fide gelişim devresinde, farklı kimyasal priming uygulamaları ile birçok bitki türünde çimlenmenin teşvik edildiği yapılan çalışmalarda rapor edilmiştir (Roohizadeh ve ark., 2015; Ivani ve ark., 2018; Rasool ve ark., 2019; Ceritoğlu ve Erman, 2020; Açıkbaş ve Özyazıcı, 2021; El-Serafy ve ark., 2021; Sagervanshi ve ark., 2021).

Çimlenme oranı bakımından Zn konsantrasyonlarına bağlı olarak kontrole göre düşük dozlarda bile anlamlı farklılıklar belirlenmiş olup, artan dozlara bağlı olarak çimlenmenin arttığı, fakat en yüksek dozda Zn₄ uygulamasına göre anlamlı olarak azaldığı görülmüştür. Araştırmada, priming uygulamalarının kontrole göre ortalama çimlenme süresini kısalttığı saptanmıştır. Çimlenme üniformite katsayısı ve çimlenme enerjisi incelendiğinde, priming yapılmayan gruba göre çinko priming uygulanan konular açısından olumlu sonuçlar elde edildiği ve Zn priming uygulamalarının da dozlara bağlı olarak farklılıklar gösterdiği belirlenmiştir. Çimlenme indeksi özelliğinde, Zn priming uygulamaları eşit oranda etkili olurken, kontrol grubuna göre anlamlı farklılıkların oluşmasını sağlamıştır. Fide gelişimi parametrelerinden fide güç indeksi ve fide yaş ağırlığı özelliklerinde çinko priming uygulamaları fide gelişiminde pozitif etki ettiği ve Zn uygulamalarının fide gelişimine farklı oranlarda etkilediği de görülmüştür. İncelenen tüm çimlenme ve fide parametreleri yönünden Zn priming uygulamalarında çeşitlerin farklı reaksiyon verdiği tespit edilmiştir (Tablo 1 ve 2).

Farklı bitki türleri ile yapılan birçok çalışmada, örneğin; buğday (Rehman ve ark., 2015; Reis ve ark., 2018; Mohammed ve Pekşen, 2020), çeltik (Prom-u-thai ve ark., 2012), soya (Goiba ve ark., 2018) mısır (Ajouri ve ark., 2004; Muhammad ve ark., 2015), nohut (Johnson ve ark.,



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2005; Hidoto ve ark., 2017) ve fasulye (Kaya ve ark., 2007) gibi bitkilerde de Zn priming uygulamalarının çimlenme ve fide gelişimini olumlu yönde etkilediği kanıtlanmıştır.

Yapılan bazı çalışmalar detaylı olarak gözden geçirildiğinde, Zn priming uygulamalarının; çimlenme oranını (Harris ve ark., 2007; Todeschini ve ark., 2011; Prom-u-thai ve ark., 2012; Reis ve ark., 2018), fide kuru ve yaş ağırlığını (Cambrollé ve ark., 2012; Rehman ve Farooq, 2016; Mohammed ve Pekşen, 2020) arttırdığı ve ortalama çimlenme süresini (Mohammed ve Pekşen, 2020) kısalttığı rapor edilmiştir. Öte yandan yüksek konsantrasyonda Zn uygulamasının çimlenme ve fide gelişimi üzerine zararlı etki yaptığı ve bu olumsuz etkinin toksisiteye neden olduğu yapılan birçok çalışmada (Dirginčiutė-Volodkienė ve Pečiulytė, 2011; Rehman ve Farooq, 2016; Mohammed ve Pekşen, 2020) da vurgulanmıştır.

Bu çalışmada, çinko sülfat priming uygulamasının, koca fiğ çeşitlerinin çimlenme ve fide gelişimleri üzerine etkili olabileceğini göstermiştir. Çalışmada ayrıca, priming uygulamalarının etkilerinin çeşide göre de farklılık gösterdiği görülmüştür. Araştırma sonucunda, koca fiğ tohumlarında çinko ile tohuma ön uygulamanın genel olarak çinkonun 2 mM dozunda en olumlu sonuçlar verdiği söylenebilir. Koca fiğ bitkisinde çimlenme ve fide gelişimi açısından; daha homojen bir gelişimin sağlanması, tohumların çimlenmesinin kolaylaşması ve hızlanması için tohumlara çinko sülfat uygulamasının kullanılması önerilmektedir.



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KAYNAKÇA

Açıkbaş, S., Özyazıcı, M.A., 2021. Yaygın mürdümük (*Lathyrus sativus* L.) tohumlarına silisyum ön uygulamasının çimlenme üzerine etkileri. *3rd International African Conference on Current Studies*, 27-28 Şubat, Abomey-Calavi, Benin, s. 404-412.

Açıkgöz, N., Açıkgöz, N., 2001. Tarımsal araştırmaların istatistiki değerlendirilmesinde yapılan bazı hatalar: I. Tek faktörlü denemeler. *Anadolu*, 11(1): 135-147.

Ajourri, A., Asgedom, H., Becker, M., 2004. Seed priming enhances germination and seedling growth of barley under conditions of P and Zn deficiency. *Journal of Plant Nutrition and Soil Science*, 167(5): 630-636.

Aletor, V., Goodchild, A., El Moneim, A., 1994. Nutritional and antinutritional characteristics of selected Vicia genotypes. *Anim. Feed Sci. Technol.*, 47: 125-139.

Allden, W.G., Geytenbeek, P.E., 1980. Evaluation of nine species of grain legumes for grazing sheep. *Proc. Aust. Soc. Anim. Prod.*, 13: 249-252.

Badrzadeh, M., Zaragarzadeh, F., Esmailpour, B., 2008. Chemical composition of some forage Vicia spp. *J. Food, Agric. Environ.*, 6:178-180.

Berger, J.; Robertson, L.; Cocks, P., 2003. Agricultural potential of Mediterranean grain and forage legumes: Anti-nutritional factor concentrations in the genus Vicia. *Genet. Resour. Crop. Evol.*, 50, 201-212.

Bewely, J., Black, M., 1994. Seeds: Physiology of Development and Germination. New York.

Cakmak, I., 2008. Enrichment of cereal grains with zinc: agronomic or genetic biofortification? *Plant and Soil*, 302(1-2): 1-17.

Cambrollé, J., Mancilla-Leytón, J., Muñoz-Vallés, S., Luque, T., Figueroa, M., 2012. Zinc tolerance and accumulation in the salt-marsh shrub *Halimione portulacoides*. *Chemosphere*, 86(9): 867-874.

Ceritoğlu, M., Erman, M. (2020). Mitigation of salinity stress on chickpea germination by salicylic acid priming. *Uluslararası Tarım ve Yaban Hayatı Bilimleri Dergisi*, 6(3): 582-591.

Del Pino-García, R.; Rico, D.; Martín-Diana, A.B. 2018. Evaluation of bioactive properties of *Vicia narbonensis* L. as potential flour ingredient for gluten-free food industry. *J. Funct. Foods*, 47: 172-183.



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Dirginčiūtė-Volodkienė, V., Pečiulytė, D., 2011. Increased soil heavy metal concentrations affect the structure of soil fungus community. *Agriculturae Conspectus Scientificus*, 76(1): 27-33.

Ellis, R.A., Roberts, E.H., 1981. The quantification of ageing and survival in orthodox seeds. *Seed Science and Technology*, 9(2): 373-409.

El-Serafy, R. S., El-Sheshtawy, A. N. A., Atteya, A. K., Al-Hashimi, A., Abbasi, A. M., Al-Ashkar, I., 2021. Seed priming with silicon as a potential to increase salt stress tolerance in lathyrus odoratus. *Plants*, 10(10): 2140.

Enneking, D., 1995. The Toxicity of Vicia Species and their Utilization as Grain Legumes, second ed. Centre for Legumes in Mediterranean Agriculture, Occasional Publication No. 6. University of Western Australia, Crawley, Western Australia, Australia.

Farooq, M., Wahid, A., Siddique, K.H., 2012. Micronutrient application through seed treatments: A review. *Journal of Soil Science and Plant Nutrition*, 12(1): 125-142.

Fırıncioğlu, H.K.; Unal, S.; Pank, Z.; Beniwal, S.P.S., 2012. Growth and development of Narbon vetch (*Vicia narbonensis* L.) genotypes in the semi-arid central Turkey. *Span. J. Agric. Res.*, 10: 430.

Goiba, P.K., Durgude, A., Pharande, A., Kadlag, A., Chauhan, M., Nimbalkar, C., 2018. Effect of seed priming with iron and zinc on yield contributing parameters as well as the nutrient uptake of the soybean (*Glycine max*) in calcareous soil. *IJCS*, 6(2): 758-760.

Hadjipanayiotou, M., 2003. Replacement of soybean meal by narbon beans (*Vicia narbonensis*) in concentrate diets fed to growing and lactating ruminant height. *Focus on Forage*, 1(1): 1-4.

Harris, D., Rashid, A., Miraj, G., Arif, M. Shah, H., 2007. 'On-farm' seed priming with zinc sulphate solution-A cost-effective way to increase the maize yields of resource-poor farmers. *Field Crops Research*, 102(2): 119-127.

Hidoto, L., Worku, W., Mohammed, H., Bunyamin, T., 2017. Effects of zinc application strategy on zinc content and productivity of chickpea grown under zinc deficient soils. *Journal of Soil Science and Plant Nutrition*, 17(1): 112-126.

Jatana, B.S., Ram, H., Gupta, N., 2020. Application of seed and foliar priming strategies to improve the growth and productivity of late sown wheat (*Triticum aestivum* L.). *Cereal Research Communications*, 48: 383-390.



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Johnson, S.E., Lauren, J.G., Welch, R.M., Duxbury, J.M., 2005. A comparison of the effects of micronutrient seed priming and soil fertilization on the mineral nutrition of chickpea (*Cicer arietinum*), lentil (*Lens culinaris*), rice (*Oryza sativa*) and wheat (*Triticum aestivum*) in Nepal. *Experimental Agriculture*, 41: 427-448.

Jones, M.J., Singh, M., 2000. Long-term yield patterns in barley-based cropping systems in northern Syria. 2. The role of feed legumes. *J. Agric. Sci.* 135: 237-249.

Ivani, R., Sanaei Nejad, S.H., Ghahraman, B., Astarai, A.R., Feizi, H., 2018. Role of bulk and nanosized SiO₂ to overcome salt stress during fenugreek germination (*Trigonella foenum-graceum* L.). *Plant Signaling & Behavior*, 13(7): e1044190.

Kalsa, K.K., Abebie, B., 2012. Influence of seed priming on seed germination and vigor traits of *Vicia villosa* ssp. *dasycarpa* (Ten.). *African Journal of Agricultural Research*, 7(21): 3202-3208.

Kaya, M., Atak, M., Khawar, K.M., Çiftçi, C.Y., Özcan, S., 2007. Effect of pre-sowing seed treatment with zinc and foliar spray of humic acids on yield of common bean (*Phaseolus vulgaris* L.). *International Journal of Agriculture and Biology*, 7:875-878.

Lahuta, L.B., Ciak, M., Rybiński, W., Bocianowski, J., Börner, A., 2017. Diversity of the composition and content of soluble carbohydrates in seeds of the genus *Vicia* (Leguminosae). *Genet. Resour. Crop. Evol.*, 65: 541-554.

Li, W., Zhang, H., Zeng, Y., Xiang, L., Lei, Z., Huang, Q., Li, T., Shen, F., Cheng, Q., 2020. A salt tolerance evaluation method for sunflower (*Helianthus annuus* L.) at the seed germination stage. *Scientific Reports*, 10(1): 1-9.

Mohammed, M.M.A., Pekşen, E., 2020. Influence of Zn seed priming and coating on germination and seedling growth in wheat. *Anadolu Tarım Bilimleri Dergisi*, 35(2): 259-267.

Muhammad, I., Kolla, M., Volker, R., Günter, N., 2015. Impact of nutrient seed priming on germination, seedling development, nutritional status and grain yield of maize. *Journal of Plant Nutrition*, 38(12): 1803-1821.

Muhammed, S.R., Karim, S.F., 2021. The Effect of harvesting stages and locations on seed yield and its components of some narbon vetch (*Vicia narbonensis*) lines under rainfed condition of Sulaimani Governorate-Iraq. *Zanco Journal of Pure and Applied Sciences*, 33(s1): 143-159.



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Özyazıcı, M.A., Açıkbaş, S., 2019. Koca Fiğ (*Vicia narbonensis* L.) bitkisinde fosforlu gübre dozlarının ot ve tohum verimine etkisi. *Avrupa Bilim ve Teknoloji Dergisi*, (17): 1031-1036.

Prom-u-thai, C., Rerkasem, B., Yazici, A., Cakmak, I., 2012. Zinc priming promotes seed germination and seedling vigor of rice. *Journal of Plant Nutrition and Soil Science*, 175(3): 482-488.

Rasool, T., Ahmad, R., Farooq, M., 2019. Seed priming with micronutrients for improving the quality and yield of hybrid maize. *Gesunde Pflanzen*, 71(1): 37-44.

Rehman, A., Farooq, M., Ahmad, R., Basra, S., 2015. Seed priming with zinc improves the germination and early seedling growth of wheat. *Seed Science and Technology*, 43(2): 262-268.

Rehman, A., Farooq, M., 2016. Zinc seed coating improves the growth, grain yield and grain biofortification of bread wheat. *Acta Physiologiae Plantarum*, 38(10): 238.

Rengel, Z., Graham, R.D., 1995. Importance of seed Zn content for wheat growth on Zn-deficient soil. *Plant and Soil*, 173(2): 259-266.

Reis, S., Pavia, I., Carvalho, A., Moutinho-Pereira, J., Correia, C., Lima-Brito, J., 2018. Seed priming with iron and zinc in bread wheat: effects in germination, mitosis and grain yield. *Protoplasma*, 255(4): 1179-1194.

Roohizadeh, G., Majd, A., Arbabian, S., 2015. The effect of sodium silicate and silica nanoparticles on seed germination and some of growth indices in the *Vicia faba* L. *Trop Plant Res.*, 2(2):85-89.

Sagervanshi, A., Naeem, A., Geilfus, C.M., Kaiser, H., Mühling, K.H., 2021. One-time abscisic acid priming induces long-term salinity resistance in *Vicia faba*: Changes in key transcripts, metabolites, and ionic relations. *Physiologia Plantarum*, 172(1): 146-161.

Scott, S.J., Jones, R.A., Williams, W.A., 1984. Review of data analysis methods for seed germination. *Crop Science*, 24: 1192-1199.

Todeschini, V., Lingua, G., D'agostino, G., Carniato, F., Roccotiello, E., Berta, G., 2011. Effects of high zinc concentration on poplar leaves: a morphological and biochemical study. *Environmental and Experimental Botany*, 71(1): 50-56.

Turk M.A., Abd El Tawaha, R.M., Samara, N., 2003. Effects of seeding rate and date and phosphorus application on growth and yield of narbon vetch (*Vicia narbonensis* L). *Agronomie*, 23:1-4.



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Wang, Y.R., Yu, L., Nan, Z.B., Liu, Y.L., 2004. Vigor tests used to rank seed lot quality and predict field emergence in four forage species. *Crop Sciences*, 44(2): 535-541.

Vishal, B., Kumar, P.P., 2018. Regulation of seed germination and abiotic stresses by gibberellins and abscisic acid. *Front. Plant Sci.*, 9: 838.

Yadav, S., Modi, P., Dave, A., Vijapura, A., Patel, D., Patel, M., 2020. Effect of Abiotic Stress on Crops. In *Sustainable Crop Production*; IntechOpen: London, UK.

Yu, P., Sprague, M., Egan, A.R., Castleman, G.H., Leury, B.J., 2001. Comparison of raw and roasted narbon vetch beans (*Vicia narbonensis*) on performance and meat sensory attributes of lambs fed a roughage-base diet. *Anim. Feed Sci. Technol.*, 92: 1-16.



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ÖZET

Enerji, insanlığın başlangıcı ile birlikte var olan bir kavramdır. İnsanoğlu ilk başlarda kendi gücünden, daha sonra hayvanların gücünden yararlanmaya başlamıştır. Ateşin bulunmasıyla önceleri odun, daha sonra kömür enerji kaynağı olarak kullanılmış, bunu buhar gücünden yararlanma izlemiştir. En basit tanımı ile enerji, 'iş yapabilme gücü'ür. Ancak enerji sadece iş şeklinde değil; ısı, elektrik, kimyasal ve nükleer enerji gibi değişik şekillerde de mevcuttur. Enerji; kinetik, potansiyel, ısı, nükleer enerji, güneş enerjisi vb. türlerde olabilir ve bu türlerin birinden diğerine dönüşebilmektedir. İlerleyen teknoloji ve modern hayat tarzı enerjiyi olmazsa olmaz noktasına getirmiştir. Ulaşım, haberleşme, üretim, nakliye, aydınlanma ilk akla gelecek gereksinimlerin başında gelmektedir. Enerji olmadan modern toplumların ayakta kalamayacağı çok açık bir şekilde gözükmemektedir. Tarımsal ürünlerin üretimi, taşınması/dağıtılması, muhafazası, işlenmesi vb. gibi tüm faaliyetler enerjiye ihtiyacı kaçınılmaz hale getirmektedir. Bununla birlikte, modern tarımsal üretim sistemlerinde verim ve kaliteyi artırıcı yapay yöntemler de uygulanmaktadır ve bu yöntemler de enerjiye büyük oranda ihtiyaç duymaktadır. Son 100 yıldır hemen her alanda enerji kaynağı olarak fosil (konvansiyonel) yakıtlar kullanılmaktadır. Bu çerçevede dahilinde konvansiyonel yakıtlara dayalı yüksek oranda tarımsal faaliyetlerin kullanılmasıyla birlikte sera gazı emisyonları ve bunların global bazda iklim değişikliğine olan potansiyel etkilerinin yanında, söz konusu bu yakıtların sınırlı olması nedeniyle yeni enerji kaynaklarına yönelimi ile ilgili tartışmalar günümüzde en çok konuşulan konuların başında yer almaktadır. Tarımsal üretimde büyük bir potansiyele sahip olan yenilenebilir enerji kaynaklarının önemi bu anlamda ön plana çıkmaktadır. Çalışma kapsamında; tarımsal üretim işletmelerinde yararlanılabilecek yenilenebilir enerji kaynaklarının avantaj ve dezavantajları tartışılmış olup, tarım sektöründe enerji kullanımının etkinliği ve enerji korunumu önlemleri ile ilgili öneriler sunulmuştur.

Anahtar Kelimeler: Tarım, enerji, yenilenebilir enerji, enerji kaynakları



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**OPPORTUNITIES OF USING RENEWABLE ENERGY IN AGRICULTURAL
PRODUCTION**

ABSTRACT

Energy is a concept that existed with the beginning of humanity. At first, human beings started to benefit from their own power, then the power of animals. With the discovery of fire, wood was first used as an energy source, then coal, followed by the use of steam power. In its simplest definition, energy is “the power to do work”. But energy is not just in the form of work; It is also available in various forms such as heat, electricity, chemical and nuclear energy. Energy; kinetic, potential, heat, nuclear energy, solar energy etc. It can be in different species and can transform from one of these species to another. Advancing technology and modern lifestyle have made energy indispensable. Transportation, communication, production, transportation and enlightenment are among the first requirements that come to mind. It seems very clear that modern societies cannot survive without energy. All activities such as the production, transportation/distribution, storage, processing of agricultural products make the need for energy inevitable. However, artificial methods that increase efficiency and quality are also applied in modern agricultural production systems, and these methods also require a large amount of energy. For the last 100 years, fossil (conventional) fuels have been used as an energy source in almost every field. Within this framework, the use of conventional fuel-based agricultural activities at a high rate, greenhouse gas emissions and their potential effects on climate change on a global basis, as well as discussions about the orientation to new energy sources due to the limitedness of these fuels are among the most talked about topics today. The importance of renewable energy sources, which have a great potential in agricultural production, comes to the fore in this sense. Scope of work; The advantages and disadvantages of renewable energy sources that can be used in agricultural production enterprises are discussed, and suggestions about the efficiency of energy use in the agricultural sector and energy conservation measures are presented.

Keywords: Agriculture, energy, renewable energy, energy resources



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1. GİRİŞ

Dünya üzerindeki bütün ülkelerin ekonomik ve sosyal gelişmelerinin en temel öğelerinden birisi de enerjidir (Pamir 2003, Taşkın ve Vardar 2016). Modern yaşamın en temel gereksinimlerinden biri olan enerji kullanımına talep gelecekte de artarak devam edecektir. Günümüze oranla 2030 yılında enerji tüketiminin dünyada %60 ve ülkemizde ise %100'den daha yüksek oranda artması öngörülmektedir (Satman 2007, Taşkın ve Vardar 2016). Söz konusu bu öneminden dolayı, enerji kullanımı özellikle 1970'li yıllardan bu yana en çok önem verilen konulardan biri olmuştur. Dünya genelindeki ülkeler 1973 ve 1979 yıllarında fosil yakıtlarından özellikle petrol krizlerinde sonra, enerji korunumuna ilişkin önlemlere yoğun olarak ilgi göstermeye başlamışlardır. Daha sonraları 1980'li yıllarda, esas olarak fosil yakıtların kullanılması sonucunda oluşan çevre kirliliğine önem verilmeye başlanmıştır. Yakın gelecekte mevcut enerji ihtiyacının büyük bir bölümünü karşılayan ve sınırlı bir rezerve sahip olan fosil yakıtların tükeneceği bilinen bir gerçektir (Kambur ve ark. 2005). Son yıllarda; enerji kullanımı, sera gazı emisyonları ve bunların küresel iklim değişikliklerine olan potansiyel etkileri en çok tartışılan konulardan birisidir (Öztürk ve ark. 2009). Endüstri, ulaştırma, ticaret, konut ve tarım sektörlerinde enerji kullanımını azaltmanın en etkin yöntemlerinden birisi de, enerji kullanma etkinliğini artırmaktır. Günümüz endüstri dünyasında, enerji ve diğer kaynaklarının kullanımı önemli düzeye ulaşmıştır. Bu nedenle, bir taraftan doğal kaynakların temini azalmaya başlamış, diğer taraftan da çevre kirliliği gibi doğal ortama verilen zararlar artarak devam etmiştir. Bununla birlikte, enerji dönüşümüne ilişkin teknik iyileştirmeler yeterince etkin bir şekilde gerçekleştirilememektedir (Öztürk 2008).

Gelişmiş ve gelişmekte olan ülkelerde, gelecekteki enerji üretim ve tüketim düzeylerinin belirlenebilmesi için; nüfus artışı, ekonomik üretkenlik, tüketici alışkanlıkları ve teknolojik gelişmeler gibi dikkate alınması gereken birçok etmen vardır (Öztürk 2006).

Enerji temininin büyük bir kısmını oluşturan fosil yakıtların kullanımı ile ilgili sorunlar sadece küresel ısınma ile sınırlı olmayıp; ozon azalımı, asit yağmurları, hava kirliliği ile devam etmektedir. Söz konusu yakıtların tükenecek olması da yeni enerji kaynağı/kaynaklarının arayışına ek olarak enerji kullanım politikalarını da belirleme zorunluluğunu getirmiştir. Bunun için enerji kullanımının yarattığı çevresel etkilerin düşük düzeyde tutulabilmesi ve enerji temininin sürekliliği de ele alınması gereken konular ile yakından ilişkilidir.

Enerji kaynaklarının çevreye dost ve özellikle sürdürülebilir olması özelliğini barındıran yenilenebilir enerji kaynaklarının kullanımı ön plana çıkmıştır. Yenilenebilir enerji kaynakları



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hem tükenmez olup hem de fosil yakıtların aksine çevre ve insan sağlığı içinde önemli bir tehdit oluşturmamaktadır. Yenilenebilir enerji hem geleneksel biyokütle (odun, hayvan atıkları ve bitki artıkları) hem de modern teknolojilere dayalı güneş, rüzgar, biyokütle ve jeotermal kaynakları olarak ifade edilir. Küresel olarak bu enerji kaynaklarının katkıları hala düşük olup, ancak son yıllarda %10 ile %30 arasındaki artış hızı oranında yükselmektedir (Martinot et al. 2002, Taşkın ve Vardar 2016).

Bütün modern tarımsal üretim tekniklerinde doğrudan enerji kullanılmaktadır. Ancak mevcut olan fosil yakıtların kullanılmasıyla ortaya çıkan çevresel sorunların etkin bir şekilde önlenmesi ve enerji üretiminin sürdürülebilir olması açısından yenilenebilir enerji kaynaklarından yararlanılması kaçınılmaz bir hale gelmiştir (Öztürk 2010, Taşkın ve Vardar 2016).

Ülkemiz tarım sektöründe bölgesel ve ülke genelinde, üretim sistemleri ile ürün bazında ve toplam enerji kullanımına ilişkin ayrıntılı çalışmalar yapılmıştır (Barut ve Öztürk 2004, Yılmaz ve ark. 2004, Öztürk 2010, Taşkın ve Vardar 2016). Bu çalışmada, yenilenebilir enerji kaynaklarının tarımda kullanımı incelenmiştir. Tarımsal üretim işlemlerinde yararlanılabilecek yenilenebilir enerji teknolojilerinin üstünlük ve olumsuzlukları tartışılmıştır. Tarım sektöründe enerji kullanım etkinliği ve enerji korunumu önlemlerine ilişkin öneriler verilmiştir.

2. TARIMSAL ÜRETİMDE ENERJİ KULLANIMI

İnsanlık tarihinde, yerleşik hayata geçmeye başlanmasıyla birlikte tarımsal üretimde ekonomik bir pazar oluşmaya başlamıştır. Tarımsal üretime dayalı pazar ekonomisinin sürdürülebilirliği ve gelişebilmesi için yoğun bir tarımsal faaliyet başlamıştır. Söz konusu bu üretimde en önemli güç kaynağı insanların kendi kas güçleri olmuştur. Daha sonra hayvanların evcilleştirilmeye başlanmasıyla birlikte tarımsal üretimde hayvan gücü kullanılmaya başlanmıştır. Avrupa ülkelerindeki sanayi devriminden sonra tarımsal faaliyetler büyük ölçüde mekanik olmuş ve kültürel uygulamaların büyük bir çoğunluğu mekanik olarak yapılmaya başlanmıştır.

Mekanik uygulamalarının çoğu fosil yakıtların kullanıldığı mekanizasyon araçları hem tarımsal üretimi arttırmış hem de insan ve hayvan işgücünün tarımda kullanılmasını sınırlandırmıştır. Tarımda doğrudan veya dolaylı olarak fosil yakıt enerjilerinin kullanılması, üreticiler açısından ekonomik olarak kazançlı duruma gelmiştir. Bunun sonucunda modern tarımsal üretim işlemlerinin fosil yakıt kullanılmadan gerçekleştirilmesi mümkün değildir. Fakat fosil yakıt enerjisi, besin üretim hızını etkilemekle birlikte, genellikle besin enerjisine



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dönüştürülememektedir. Örneğin, tarımsal üretimde bitki çeşidine göre toprak işleme ve gübreleme, ürün gelişimini hızlandırmakta ve üretimi arttırmaktadır. Fakat toprak işleme ve gübre üretiminde kullanılan enerji ürün içinde görünmemektedir. Üretimi desteklemesine ve arttırmasına rağmen, enerji üretimi, dönüşüm işleminin bir bölümü değildir. Giren enerji miktarı ürüne bağlı olarak değişmekle birlikte, ürün ile kazanılan enerji miktarı kullanılan enerjiden türetilmemektedir. Enerji kaynaklarının kıtlığı ve dikkatsiz kullanılması sonucunda oluşan istenilmeyen yan etkiler, enerji tüketimini doğru bir şekilde planlanma ve dikkatli bir şekilde değerlendirmeyi gerektirmektedir (Öztürk ve ark. 2009).

Tarımsal üretimde enerji kullanımı iki grupta incelenebilmektedir.

2.1. Tarımsal Üretimde Dolaylı Enerji Kullanımı

Tarımsal savaş için kullanılan tarımsal ilaçların üretilmesi ve uygulanması; gübre, sulama, tohumluk üretimi için kullanılan tüketilen enerji ile insan-hayvan iş gücü ve tarım alet/makinaları için tüketilen enerji miktarlarıdır. Tarımsal üretimde dolaylı olarak kullanılan enerjinin analiz edilmesi kısmen daha zordur. Yine de bazı dolaylı enerji girdileri, toplam enerji tüketiminin belirli bir oranı olarak dikkate alınabilir. Örneğin, tarımsal üretim işlemlerinde kullanılan alet ve makinaların tamir ve bakım giderleri satın alma maliyetinin belirli bir oranı olarak dikkate alınmaktadır. Benzer yaklaşım, tamir/bakım işlemleri için enerji girdisinin belirlenmesi amacıyla uygulanırsa, tasarım enerjisinin belirli bir oranı tamir/bakım enerjisi olarak dikkate alınabilir (Öztürk ve ark. 2009, Taşkın ve Vardar 2016).

2.2. Tarımsal Üretimde Doğrudan Enerji Kullanımı

Büyük ve küçükbaş hayvan yetiştirme ve ürünlerinin elde edilmesinin yanında bitkisel üretimde, tarımsal ürünlerinin işlenmesi, muhafazası, nakliyesi vb. uygulamalarda elektrik, yakıt, yağ, kömür, petrol ürünleri, doğal gaz, biyokütle vb. enerjilerinin kullanılmasını kapsamaktadır.

2.2.1. Yakıt enerjisi

Fiziksel ve kimyasal yapısında bir değişim meydana geldiğinde enerji (ısı) açığa çıkaran her türlü malzemeye genel olarak yakıt denir (Öztürk ve ark. 2009). Yakıtlar; katı, sıvı ve gaz yakıtlar olmak üzere genel olarak üç gruba ayrılırlar.

Kömür, petrol ve doğal gaz gibi yakıtlar, fosil kökenli yakıtlardır. Fosil yakıtlar, milyonlarca yıl boyunca, bitkilerin ve hayvanların çürümesi ile oluşmuştur. Kısa sürede yenilenemeyen fosil yakıtlar kullandığımızdan daha az bir bölümü yeniden oluşabilmektedir. Bundan dolayı fosil yakıtlar kısa sürede yenilenemeyen enerji kaynakları olarak değerlendirilmektedir. Ayrıca bu



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yakıtların tükenmesi ve belirli bir fiyat istikrarının olmamasının yanı sıra tüketilmeleri sırasında çevreye verdikleri zararların insan sağlığına da olumsuz etkileri söz konusudur.

Bu sebeple fosil yakıtlar kısa süreçte yenilenemeyen enerji kaynakları olarak değerlendirilebilir. Diğer bir deyişle, kullandığımızdan daha az bir bölümü yeniden oluşmaktadır. Özellikle de artan nüfus, şehirleşme ve endüstrileşme pek çok yıldır bu yakıtlarla karşılanan enerji gereksiniminin daha da fazlalaşmasına neden olmaktadır. Bu yakıtların tükenmesi ve fiyatlarının devamlı artmasının yanı sıra, yanmaları sonucu çevreye verdikleri zararlar ve insan sağlığı üzerindeki etkileri de önemlidir.

Sıvı yakıtlar genel olarak; petrol esaslı yakıtlar, alkol ve yağlar olmak üzere üçe ayrılmaktadırlar. İçten yanmalı motorlarda günümüzde petrolden elde edilen sıvı yakıtlar kullanılmaktadır (Öztürk ve ark. 2009).

3. TARIMSAL ÜRETİMDE YENİLENEBİLİR ENERJİ KAYNAKLARININ KULLANIMI

Hayvansal ve bitkisel üretim işlemleri arasında çok fazla miktarda enerji tüketimi; hayvan barınaklarının ısıtma ve soğutulması, örtü altı yetiştiricilikte ısıtma ve soğutma işlemleri, sulama, gübreleme, ürün kurutma ve ürünlerin işlenmesi örnek verilebilir. Bu işlemler sırasında yaygın olarak; elektrik, motorin, doğal gaz, sıvılaştırılmış petrol gazı veya propan gibi yakıtlar kullanılmaktadır. Fosil yakıtların yoğun bir şekilde kullanılmasıyla ortaya çıkan çevresel sorunların etkin bir şekilde önlenmesi ve ileride ortaya çıkabilecek enerji krizinin önlenmesi için, yenilenebilir enerji kaynaklarından yararlanılması gerekmektedir. Burada dikkat edilmesi gereken en önemli noktalardan biri de tarımsal üretimde yenilenebilir enerji kaynaklarının kullanılmasının yanında tarımsal üretim işletmelerinde yenilenebilir enerji kaynaklarının ekonomik uygulanabilirliği ve uygulama yöntemidir. Çünkü yenilenebilir enerjinin ekonomik ve uygulanabilirliği yöntemi bölgesel ve yöresel koşullara göre değişebilmektedir. Tarımsal üretimde genel anlamda etkin olarak yararlanılabilecek başlıca yenilenebilir enerji kaynakları; güneş, jeotermal, rüzgar ve biyokütle enerjisidir (Öztürk ve ark. 2009).

3.1. Tarımsal Üretimde Güneş Enerjisinin Kullanımı

Güneş enerjisi sistemleri yöntem, malzeme ve teknolojik düzey açısından çok çeşitlilik göstermekle birlikte, ısı sistemleri ve elektrik sistemleri olmak üzere iki grup altında incelenebilir (Öztürk ve ark. 2009).



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Güneş ısı sistemlerinin düşük ve yüksek sıcaklıktaki uygulamaları vardır. Düşük sıcaklıktaki uygulamalar; yapıların ısıtılmasını, konut, sanayi ve tarımda çeşitli ısı gereksinimlerinin karşılanmasını kapsarken, yüksek sıcaklıktaki uygulamalar buhar üretiminden maden ergitmeye kadar uzanmaktadır. Isıl uygulamalar içinde su ısıtıcılar, yapıların ısıtılması ve soğutucular önemlidir. Güneş enerjisinin diğer ısı uygulamaları kurutma, acı ve tuzlu suların arıtılması, sıcak hava motorları ile diğer termodinamik ısı çevrimler olup, tarımda ve çeşitli sanayi kesimlerinde bu uygulamalardan yararlanılabilir (Ültanır 1998, Pamir 2003, Öztürk ve ark. Öztürk 2006, Taşkın ve Vardar 2016).

3.1.1 Tarımsal üretimde güneş enerjisinin kullanımı ile ilgili bazı uygulamalar

3.1.1.1 güneş enerjisi ile seraların ısıtılması ve havalandırması

Örtü altı tarımsal üretimde en büyük enerji harcamalarından biri de seraların ısıtılması veya soğutulmasıdır. Özellikle seraların ısıtılması için fosil yakıtların kullanılıyor olması, bu yakıtların kaynaklarının sınırlı olması, çevre kirliliği ve dolayısı ile insan sağlığına olumsuz etkilerine ek olarak büyük ekonomik kayıplara da sebep olmaktadır. Son yıllarda, örtü altı yetiştiriciliğinde enerji tüketiminin azaltılmasına yönelik olarak yapılan araştırmalar; ısıtma amacıyla yeni ve yenilenebilir doğal enerji kaynaklarının kullanılmasına ve fosil yakıtların tüketildiği geleneksel ısıtma sistemlerine alternatif olarak, düşük maliyetli ve etkinliği yüksek ısıtma sistemlerinin geliştirilmesine yönlendirilmiştir. En önemli yenilenebilir enerji kaynağı olan, güneş enerjisinden sera ısıtma amacıyla yararlanılması durumunda, sera tarımının toplam üretim giderleri içerisinde büyük yer tutan ısıtma giderleri azalacak ve buna bağlı olarak üretim maliyeti azalacaktır (Öztürk ve Başçetinçelik 2003, Öztürk 2006).

Örtü altı tarımsal üretimde en önemli uygulamalardan biri de söz konusu ortamın sürekli temiz hava gereksinimi olarak karşımıza çıkmaktadır (Öztürk 2006). Yaz aylarında yüksek sıcaklıkları, kış aylarında ise bağıl nem ve karbondioksit konsantrasyonun optimum düzeyde muhafaza etmek için sera içindeki havanın dış hava ile değiştirilmesi ile gerçekleştirilmektedir. Sera içindeki hava hareketi bitkinin fizyolojik dengesinin sağlanmasına yardımcı olmaktadır. Tayland'ta kurulan bir seraya 3 adet doğru akım ile çalışan fan monte edilmiştir. Düşük gerilim eşliğine sahip fanlar, 50W kurulu güce sahip güneş paneli ile etkin olarak kullanılabilmektedir (Janjai ve ark. 2009).

3.1.1.2. güneş enerjisiyle kurutma

Kurutulmuş gıdalar, diğer muhafaza yöntemlerinden farklı olarak, besin ögeleri açısından yoğunlaştırılmış nitelik kazanır (Yağcıoğlu 1996). Doğal kurutmada hijyenik ve ekonomik



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sorunlarla karşılaşıldığından, araştırmacılar, kurutmayla ilgili çalışmalarda, alışlagelmiş kurutma yerine daha çağdaş uygulamaları koyma çabasıdadır. Kurutma yöntemleri arasında doğal kurutmadan sonra en ekonomik olanı, güneş enerjisiyle ısıtılan havayla yapılan kurutmadır (Kısakürek 1980, Öztürk 2006).

Güneş enerjili kurutucular, işletme maliyetleri çok düşük olduğundan, birçok gıdanın kurutulmasında kullanılabilir. Bu tip kurutucular, meyve ve sebzelerin yanı sıra; hububat, baharat, çay ve kahvenin kurutulmasında kullanılabilir.

3.1.1.3. güneş enerjisiyle su pompalama

Tarımsal üretimde sürdürülebilirliğin sağlanması, yüksek ve kaliteli ürün elde etmek için sulu tarımın yapılması gerekmektedir. Tarımsal arazilerin sulanmasında özellikle su pompalamak için günümüzde halen insan enerjisi, hayvan gücü ve fosil yakıtlar gibi değişik güç kaynaklarından yararlanılmaktadır (Öztürk 2008). Güneş pili (PV) sistemleri ve güneş enerjili sulama, özellikle elektriğin ulaştırılamadığı yerlerde su temini ve tarımsal sulama amacıyla tasarlanmaktadır. Örnek olarak DC solar pompa kurulumu yapıp, ihtiyaç olan suyun depo ya da havuzdan karşılanması daha verimli ve etkin olan çözümdür. Bu sistemler 1- 240 mt derinlikten farklı debilerde su çekme kapasitesine sahip olabilmektedir (Taşkın ve Vardar 2016).

3.1.1.4. güneş enerjisi ile solarizasyon

Toprak dezenfeksiyonu, toprağın çeşitli yöntemlerle mikroorganizmalardan arındırılması işlemidir. Bu işlem toprağa çeşitli fiziksel ve kimyasal maddelerin uygulanması ile gerçekleştirilir. Toprağın ısıtılması, seralarda bitki yetiştiriciliğinde toprak kökenli zararlıların kontrolünde kullanılmaktadır. Toprak dezenfeksiyonu için üç yaklaşım vardır (Öztürk, 2008a):

- a) Biyofumigasyon
- b) Buhar uygulaması
- c) Toprak solarizasyonu

Buharla dezenfektasyon ve biyofumigasyon uygulamaları, 130 yıl önce geliştirilmiş uygulamalardır. Ancak, uygulamada her iki yöntem de ekonomik değildir. Üçüncü uygulama olan solarizasyon; maliyeti düşük, uygulaması kolay, çevre dostu ve kısmen yeni bir yaklaşımdır. Toprak kaynaklı zararlıların yok edilmesi için, yaygın olarak kimyasal dezenfektan kullanımına ilişkin artan kaygı, yeni ve çevre ile dost stratejilerin geliştirilmesi gereksinimini doğurmuştur. Toprak fumigasyonunda yüksek toksisiteli temel maddelerin kullanılması, sadece toprak kaynaklı zararlıları yok etmekle kalmamakta, aynı zamanda saprofit



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bakterilerin ve yararlı mikro floranın da ölmesine neden olmaktadır (Gamliel ve ark. 2000, Öztürk 2006).

3.1.1.5. güneş enerjili ilaçlama makinası

Tarımsal savaş ile bitkisel ürünler hastalık, zararlı ve yabancı otların etkilerinden ekonomik ölçüler içinde korunmakta, ürün kayıplarını en aza indirilmekte ve kalite yükseltilmektedir. Hastalık ve zararlılara karşı en etkili ve hızlı çözüm olarak çeşitli tarımsal savaş yöntemleri uygulanmaktadır. Bu kimyasal mücadelede ilaçların (herbisitler, fungusitler ve insektisitler) uygulanmasının yanı sıra uygun alet ve ekipmanın seçimi ve kullanılmasının büyük payı vardır (Demir, 2005). Güneş enerjili sırt pompaları ile sıvı formda ilaçlamalar yapılabilmüş ve akaryakıtı dayalı sistem yerine ücretsiz enerji sistemine dönüşüm gerçekleştirilebilmiştir (Joshua ve ark. 2010, Taşkın ve Vardar 2016).

3.1.1.6. güneş enerjili zararlı öldürücü

Tarımsal savaş yöntemleri kültürel, fiziksel, biyolojik, karantina ve kimyasal yöntemler olarak sıralanabilir. Ülkemizde tarımsal savaşın karşılığı kimyasal yöntemler olarak kabul edilse de modern bitki korumada entegre olarak tüm yöntemlerin dengeli ve bilinçli bir biçimde uygulanmaktadır (Demir 2005). Bu yönetime alternatif olan güneş enerjili zararlı öldürücü ile çevreye zarar vermeden yıl boyunca haşere kontrolü sağlanabilir. Pestisit içermeyen güneş enerjili zararlı öldürücüleri çiftliklerde, meyve bahçelerinde ve bağlarda kullanımı uygundur. Yararlı böcekleri etkilemeyip, sadece gece aktif olan zararlı böcekler öldürülmektedir. Gün boyunca bataryada depolanan güç ile geceleri ışık tuzakları çalıştırılmış ve bu yöntem ile hedefte olmayan böceklerinde öldürülmesi engellenebilmiştir (Tianhua ve ark. 2014, Taşkın ve Vardar 2016).

3.1.1.7. güneş enerjili çit sistemi

Güneş enerjili çit sistemleri değerli tarım arazilerinin ve bunun yanı sıra özellikle vahşi ve yırtıcı hayvanların meralara, ağıllara ve arılıklara girmesini önleyen en iyi yöntemlerden biri olarak ortaya çıkmaktadır. Bu yöntem ile hem büyük miktarlarda hayvan bir arada tutulabilmekte, hem de üretime zarar verebilecek yırtıcı hayvanlar engellenebilmektedir. Özellikle arılıklarda kullanımı ile kovanlarda oluşabilecek olası yaban hayatı zararları ortadan kaldırılmaktadır. Sistemler yabani hayvanlara ve insan sağlığına zararlı olmayacak ölçüde 3 miliamper akımla çalıştırılmaktadır (Ambarlı 2014, Taşkın ve Vardar 2016).



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3.1.2. Tarımsal üretimde rüzgar enerjisi kullanımı

Bir hava akışı şeklinde ilerleyen rüzgarın, önüne bir engel konulması veya sabit bir engelle karşılaşması halinde, rüzgar bu engel üzerine basınç yapmaktadır. Rüzgara karşı konan engelin hareket yeteneği, rüzgar enerjisini mekanik enerjiye çevirebilmektedir. Rüzgar enerjisinde kanat sayısı fazla olan türbinlerin shaft gücünden verimli ve ekonomik olarak su pompasında kullanılabilmektedir. Yeraltındaki suların içerisine yerleştirilen pompayla vasıtasıyla ve rüzgarın da gücünden yararlanılarak su çıkarılabilmektedir. Rüzgar enerjisi kesintili bir kaynak olması sebebiyle su ihtiyacının sürekli karşılanabilmesi adına depolama sistemleri ile beraber kullanılabilir (Yerebakan 2001, Öztürk 2006, Taşkın ve Vardar 2016).

3.1.3. Tarımsal üretimde jeotermal enerji kullanımı

Tarım ve tarımsal ürün işleme endüstrisi jeotermal enerjinin doğrudan kullanılabileceği başlıca alanlardır. Dünya genelinde tarımsal uygulamalar içerisinde jeotermal enerjiden en yüksek oranda (%14) sera ısıtma amacıyla yararlanılmaktadır. Balıkçılık ve diğer hayvancılık işletmelerinde jeotermal enerjiden yararlanma oranı %12'dir. Tarımsal uygulamalar içerisinde jeotermal enerjiden en düşük oranda (%1) ürün kurutma işlemlerinde yararlanılmaktadır. Gıda endüstrisinde günümüze kadar ticari kullanım alanı bulamayan jeotermal enerjinin, tarımdaki en başarılı ve yaygın uygulama alanı sera ısıtmadır. Sera ısıtmasının yanı sıra jeotermal enerjinin açık alanda toprak ısıtma, hayvan barınaklarında uygun hava koşullarının oluşturulması, tarımsal ürünlerin kurutulması, toprak ıslahı ve mantar üretiminde de kullanılabilmektedir (Kara ve Çiftçi 1994, Tüzel ve ark. 1994, Öztürk 2004, Öztürk ve ark. 2009).

3.1.4. Tarımsal üretimde biyokütle enerjisi kullanımı

Biyokütle terimi, tarım veya ormancılık ürünü olan ve tamamı veya bir kısmı içindeki enerjiyi geri kazanmak amacı ile yakıt olarak kullanılabilen bitkisel maddelerin tamamı veya bir kısmından oluşan ürünleri ve yakıt olarak kullanılan atıkları kapsamaktadır (Öztürk 2008, Öztürk ve ark. 2009).

Biyogaz olarak karşımıza çıkan yenilenebilir enerji, organik maddelerin oksijensiz koşullarda biyolojik parçalanması (anaerobik fermentasyon) sonucunda açığa çıkan ağırlıklı olarak metan (CH₄) ve karbondioksit (CO₂) gazlarından oluşmaktadır. (Öztürk ve ark. 2009). Enerji üretimi için tarımsal ürün yetiştirmek ile ilgili araştırmalar devam etmekle birlikte metan verimi en yüksek bitki mısır çeşitlerinden elde edilmektedir ve bunu buğday izlemektedir (Murphy ve Power 2008). Üretilen biyogazın enerji değeri yüksek olup, içerdiği metan değeri ile



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değişkenlik gösterebilmektedir (Murpy ve ark. 2004). Üretilen biyogaz, bir birleşik ısı ve güç tesisi (kojenerasyon sistemi) aracılığıyla ısı ve/veya elektrik üretmek için kullanılabilir. Bu durumda, uygun bir ısı değiştirici kullanılarak yanma süresince açığa çıkan ısı geri kazanılabilir.

4. SONUÇ VE ÖNERİLER

Tarımsal üretimde enerji tüketimi yönetiminin dünya çapında tartışılan bir konu olmasının sebebi fosil yakıtların neden olduğu olumsuz yan etkilerdir. Fosil yakıtların doğrudan veya dolaylı kullanılması ile ortaya çıkan sorunların etkin bir şekilde önlenmesi için yenilenebilir enerji kaynaklarından yararlanılması gerekmektedir. Çünkü fosil yakıtların kullanılması ile açığa çıkan karbondioksit ve diğer sera gazlarının sonucu olarak dünya yüzeyinin ortalama sıcaklığı yükselmekte olup küresel bazda iklim değişikliğine sebep olmaktadır. Bu olumsuzluğa ek olarak fosil yakıtlarının rezervlerinin sınırlı olması ve yaratmış olduğu çevre kirliliği de yeryüzünde yaşayan tüm canlıların sağlığını tehdit etmektedir. Modern yaşam tarzının temel ihtiyacı olan enerji temini ve kullanımı da her geçen gün artmaktadır. Tarımsal üretimde de enerji kullanımı ile çevre kirliliğini azaltmak hatta sıfıra indirmek ve enerji teminin sürdürülebilir kılmak için yeni ve sürdürülebilir enerji kaynağı olan yenilenebilir enerjinin kullanılması etkinliğine önem verilmesi gerekmektedir. Küresel ısınma ile dünyanın iklimsel özellikleri üzerinde değişiklikler görülecektir. Bu nedenle, tarım sektöründe günümüz enerji varlığını korumak ve çevreye olumsuz etkilerini önlemek amacıyla yeşil enerji kullanımına planlı biçimde teşvikler getirilmesi öncelikli bir gereksinimdir.

Tarımsal üretimde yenilenebilir enerjinin etkinliğini arttırmak için;

Tarımsal işletmelerin mekanizasyon altyapısında enerji verimliliğinin artırılması gerekmektedir.

Tarımsal işletmeler için gerekli yenilenebilir enerji güç kaynaklarının optimizasyonu gereklidir. İklimlendirme uygulamalarında ısı transferi için etkinlik artırılmalıdır.

Isı yalıtımı standartları geliştirilmelidir.

Atık ısı geri kazanımı uygulamaları yaygınlaştırılmalıdır.

Yenilenebilir enerji kaynaklarının teşviki için destek projeleri verilmelidir.

Tarımsal üretimde yenilenebilir enerji kullanımı ile birlikte; işletme giderleri azalır, dış alımı yapılan fosil enerjiye olan talep azalır bununla birlikte çevre kirliliği de önlenmiş olur. Son olarak tarımsal üretimde ekonomik gelişme sağlanarak hem sosyo-ekonomik gelişmelere hem de sürdürülebilir tarım anlayışına fayda sağlayacaktır.



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5. KAYNAKLAR

Ambarlı H. 2014. Arıcılık, Çiftlik, Hayvancılık ve Meyvecilik İçin Uygun Elektrikli Çit Sistemi Uygulaması. Url adres: <http://www.bozayi.blogspot.com.tr/p/elektro-soklu-cit-sistemi-bilgilendirme.html>

Barut Z.B. ve Öztürk H.H. 2004. Evaluation of Energy Inputs in Maize Production in Çukurova Region of Turkey. International Conference Science and Research Tools of Global Development Strategy, Czech University of Agriculture Prague, Technical Faculty, Prague, Czech Republic, 24 September.

Demir C. 2005. Tekirdağ İli Tarım İşletmelerinde Kimyasal Savaşmada Kullanılan Bitki Koruma Alet ve Makinelerinin Teknik Özellikleri ve Uygulama Sorunlarının Saptanması Üzerine Bir Araştırma. Yüksek Lisans Tezi. Trakya Üniversitesi Fen Bilimleri Enstitüsü. Tekirdağ.

Gamlıel A. Austerweil M. Kritzman G. 2000. Non-chemical Approach to Soilborne Pest Management Organic Amendments. Crop Protection, 19: 847-853.

Janjai S. Lamlert N. Intawee P. Mahayothee B. Bala B.K. Nagle M. and Müller J. 2009. Experimental and Simulated Performance of a PV-Ventilated Solar Greenhouse Dryer for Drying of Peeled Longan and Banana. Solar Energy, 83(9): 1550-1565.

Joshua R. Vasu V. and Vincent P. 2010. Solar Sprayer An Agriculture Implement. International Journal of Sustainable Agriculture, 2 (1): 16-19.

Kara M. Çiftçi N. 1994. Termal Suların Toprak Islahında Kullanılması. Jeotermal Uygulamalar Simpozyumu Bildiri Kitabı: 471-483, Denizli.

Kısakürek B. 1980. Kurutma Modelleri² Türkiye. Isı Bilimi ve Tekniği. Cilt 2, 37-40.

Kumbur H. Özer Z. Özsoy H.D. and Avcı E.D. 2005. Türkiye’de Geleneksel ve Yenilenebilir Enerji Kaynaklarının Potansiyeli ve Çevresel Etkilerinin Karşılaştırılması. III. Ulusal Yenilenebilir Enerji Kaynakları Sempozyumu, Mersin.

Martinot E. Chaurey A. Lew D. Moreira J.R. and Wamukonya N. 2002. Renewable Energy Markets in Developing Countries. Annual Review of Energy and the Environment, 27(1): 309-348.

Murphy J.D. Power N., 2008. Technical and Economic Analysis of Biogas Production in Ireland Utilising Three Different Crop Rotations. Applied Energy.



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Öztürk H.H. Kaya D. Ekinci, K. Ertekin, C. Yıldız O. Başçetinçelik A. 2009. Biyogazdan Birleşik Isı ve Güç Üretimi İçin Enerji ve Çevresel Etki Değerlendirmesi. V. Yeni ve Yenilenebilir Enerji Kaynakları Sempozyumu, 16-17 Ekim 2009, Kayseri, Bildiriler Kitabı: 154-161, MMO Yayın No: E/2009/512, ISBN: 978-9944-89-798-3.

Öztürk H.H. 2010. Antalya İklimi Koşullarında Sera Isıtma Amacıyla Güneş Enerjisinin Duyulur Isı Olarak Depolanması İçin Tasarım Değişkenlerinin Belirlenmesi. Url adres: http://www.mmo.org.tr/resimler/dosya_ekler/a1dfc4176d3ee05_ek.pdf?tip

Öztürk H.H. 2006. Seracılıkta Jeotermal Enerji Kullanımı. Türkiye Ziraat Odaları Birliği Yayın No: 259, S (394), ISBN: 975-8629-46-8.

Öztürk H.H. 2008. Yenilenebilir Enerji Kaynakları ve Kullanımı. Teknik Yayınevi, Ankara, ISBN 978-975-523-042-9.

Öztürk H.H., Başçetinçelik, A. 2003. Güneş Enerjisiyle Sera Isıtma. Türkiye Ziraat Odaları Birliği Yayın No: 240, S (39), ISBN: 975-8629-28-X.

Pamir A.N. 2003. Dünyada ve Türkiye’de Enerji. Türkiye’nin Enerji Kaynakları ve Enerji Politikalar. Url adres: http://www.metalurji.org.tr/dergi/dergi134/d134_73100.p

Satman A. 2007. Türkiye’nin Enerji Vizyonu, Jeotermal Enerjiden Elektrik Üretimi Semineri, 3-18.

Taşkın O. ve Vardar A. 2016. Tarımsal Üretimde Bazı Yenilenebilir Enerji Kaynakları Kullanımı. Uludağ Üniversitesi Ziraat Fakültesi Dergisi, 30 (1). 179-184 s.

Tianhua L. Zhengkun P. Sha Y. 2014. Research on the Design and Installation Techniques of Solar LED Pest Control Light. Journal of Chemical and Pharmaceutical Research, 6(7): 1366-1369.

Tüzel Y. Gül A. Dura S. 1994. Jeotermal Enerjinin Tarımda Kullanım Olanakları. Jeotermal Uygulamalar Sempozyumu Bildiri Kitabı: 485-490, Denizli.

Ültanır M.Ö. 1998. 21. Yüzyıla Girerken Türkiye’nin Enerji Stratejisinin Değerlendirilmesi. Yayın No: TÜSİAD-T/98-12/239, ISBN: 975-7249-59-9, Lebib Yalkın Yayınları ve Basım İşleri A.S., İstanbul.

Yağcıoğlu A. 1996. Ürün İşleme Tekniği. Ege Üniversitesi Ziraat Fakültesi Yayınları No: 517, Bornova-İzmir, ISBN 975-483-303-6.



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Yerebakan M. 2001. Rüzgar Enerjisi. İstanbul Ticaret Odası Yayın No: 2001-33, İstanbul, ISBN-975-512-582-5.

Yılmaz İ. Akçaöz H. ve Özkan B. 2004. An Analysis of Energy use and Input Costs for Cotton Production in Turkey. *Renewable Energy*. 30(2): 145-155.



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RENEWABLE ENERGY AND TECHNOLOGY IN SUSTAINABLE AGRICULTURE

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ABSTRACT

Current modern agriculture is threatened by climate change, loss of biodiversity, environmental saturation with excess nitrogen and other pollutants and depletion of resources. An agricultural revolution is needed to increase the crop production and improve the safety and quality of foods in a sustainable way. Sustainable agriculture is a type of agriculture which uses special farming techniques without significant environmental harm. This article includes selected some trend concepts related to sustainable agriculture to help agricultural students, researchers, and practitioners for a better understanding of the ecology of agricultural systems that will open the doors to new management options.

Keywords: Sustainable Agriculture, technology, biotechnology, nanotechnology, ICT, renewable energy



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INTRODUCTION

Agriculture is an important section of the economies globally and has major priorities for ending hunger, poverty, uncontrolled industrialization, economic activity diversification, sustainable resource management, investments and environmental management (Umesha et al., 2018). With rising incomes and urbanization the consumption of dairy and meat products are increasing, especially in a fast manner in developing countries. However, increasing livestock production leads to challenges which are needed to be addressed (Nam et al., 2020). Approximately 60% of the global ecosystems is not used in sustainable ways (Benckiser, 2010). Sustainability is in centre of governmental policies and research projects worldwide. But results of many decades of attempts to reach to sustainable agriculture targets are not satisfactory. There was some improvements but conventional agriculture is still the dominant paradigm (Karami & Keshavarz, 2010).

Sustainable agriculture is a type of agriculture including special farming techniques utilising environmental resources without harming environment. Environment friendly techniques are required for safe and healthy agricultural products (Singh et al., 2011). Sustainable agriculture is farming with principles of ecology, studying relationships between organisms and surrounding environment (Henkel, 2015). Current agriculture is threatened by climate change and loss of biodiversity and depletion of resources. An agricultural revolution is needed to increase the crop production and improve the safety and quality of foods in a sustainable way (do Espirito Santo Pereira et al., 2021). In many agricultural zones, environment is saturated with excess nitrogen and other pollutants. We require new approaches and tools to design and deployment of fine solutions (Robertson, 2015).

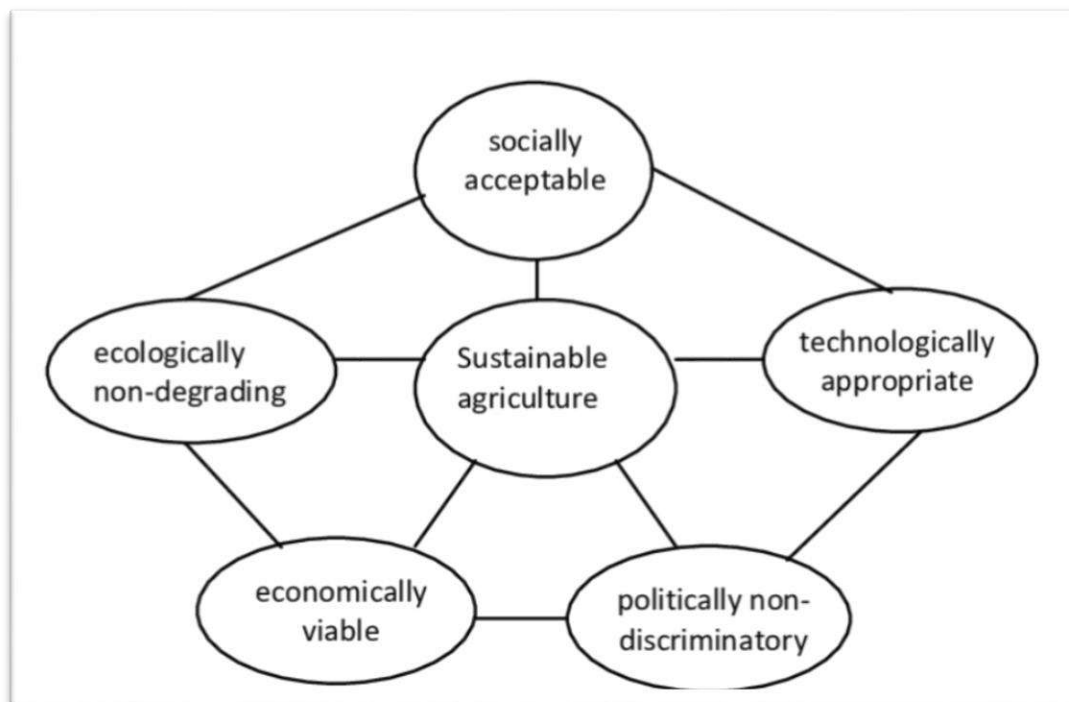


Fig.1. Dimensions of sustainable agriculture (Rajbhandari, 2015).

Sustainable agricultural and food systems cannot be developed by a simple improvement in current systems, but requires a transition (Elzen et al., 2012). Progress on sustainability is hindered by differing perceptions on advancing goals in systems with huge interdependency. Systems thinking is a model to improve understanding and management of this type of complex systems, but both the theory and the methods used to analyse systems thinking are not well developed (Levy et al., 2018).

THE PROBLEM

The present agricultural sector depends mainly on the usage of chemical fertilizers and pesticides which effect nutritional quality, health and productivity of the crops. Also, continuous release of these synthetic inputs causes accumulation of toxic chemicals and metals in the soil and plants which ultimately effect human health (Vishwakarma et al., 2020). Pesticides also results with development of resistance in pests due to accumulation of toxic materials in air, soil and water. Pesticides affect enzymes in soils, which are essential catalysts of soil quality (Campos et al., 2019). Big-scaled field crop monocultures accelerate the proliferation and prevalence of pest insects and diseases. Many studies mention the effects of



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crop species diversification upon pathogens, and the population dynamics of insects and beneficial organism in agri-ecosystems (He et al., 2019).

Sustainable agriculture targets to reduce pests and diseases incidence to a degree of unserious damaging level without damaging natural balance. An aim of sustainable agriculture is to discover and/or develop strategies with minimal cost and ecological side-effects. Synthetic pesticides resulted in with green revolution through increased yields. However, there is considerable pressure on consumers and farmers to reduce or eliminate synthetic pesticides in agriculture currently. This encouraged researchers to search for better alternatives (Dubey et al., 2010).

Development in genetics provides new technologies and knowledge needed to overcome some of these challenges. Plant genetics is a key for global food security in the future. Still much is needed be learned related to the crop–environment interaction biology and technologies for genetic improvements of plants (Ronald, 2011).

Conventional agriculture depends on high doses of fertilizers and pesticides which adversely affect ecosystems and living beings. For a basic sustainable agriculture achievement, minimum agrochemicals should be used to protect environment and conserve various species. Sustainable agriculture should be a low input system, which will reduce production costs are and increase net returns (Singh et al., 2021).

Some agro-ecological practices are not well integrated to agriculture. Natural pesticides, biofertilisers, intercropping, allelopathic plants, relay intercropping, crop choice, rotations, timber agroforestry, nut trees, fruit trees, direct seeding into living cover crops or mulch are among them. These practices have moderate potential to be implemented broadly in the following decade. Instead, some practices are well integrated already such as split fertilisation, organic fertilisation, reduced tillage, biological pest control, drip irrigation and cultivar choice (Wezel et al., 2014).

TECHNOLOGY

Compost is an organic matter which is an appropriate material for the recovery of degraded soils, carbon sequestration, fertility restoring and chemical input (fertilizers and pesticides) usage reduction. Composting is a critical technology for sustainable disposal of crop residues and livestock wastes. Well adopted composting technology depends on farm evaluations



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(compost material volumes, material types, existing machinery and facilities in the farms) (Pergola et al., 2018).

Technological developments to increase food productivity without significant negative effects on ecosystem is a need. Controlled delivery and slow release systems for agrochemicals (or genetic materials) are crucial. Chitosan is a good carrier for this aim due to non-toxicity, biocompatibility, biodegradability and adsorption capacity. Main advantages of encapsulating agrochemicals and genetic material in chitosan matrix is its function as a protective reservoir for the ingredients. While, chitosan is controlling their release. Despite progress in chitosan usage in pharmaceutical applications, there is a knowledge gap for the potential applications of chitosan assisted encapsulation of active ingredients to use in agriculture (Kashyap et al., 2015). Seed treatment is the application of chemical, physical or biological agents to the agricultural seed before sowing to kill, suppress, control or repel insects, pathogens and other seed or seedlings pests. Applications include dressing, coating or pelleting. Technologies like fluid drilling to sow germinated seeds in a gel delivery system or technology of solid matrix priming serve as a carrier for useful material. Physical, biological or chemical treatment are being used worldwide sole or in combination due to their environmental safety. Biological seed treatments may be the fastest growing treatment sector in future due to easier to register in EPA (Environment Protection Agency). Lack of farmer awareness on seed treatments is a limiting factor in disease management (Sharma et al., 2015).

IS BIOTECHNOLOGY COMPATIBLE WITH SUSTAINABLE AGRICULTURE?

Insect-resistant and herbicide-resistant genetically engineered crop varieties are major visible forms of biotechnology in agriculture. These early products' technology capacity is falling short to promote sustainable agriculture more due to the failure of fully engagement of all stakeholders. To use sustainability potential of biotechnology more, fundamental changes are required for private and public research, technology development and commercialization activities (Ervin et al., 2010).

Biotechnology is growing rapidly and has different applications in sustainable agriculture. Microbial biotechnology is an emerging field in human nutrition, food security and plant protection (Yadav et al., 2020).

Excess usage of conventional phosphorus fertilizers causes soil fertility depletion, water pollution and eutrophication, and toxic element accumulation. Some soil microorganisms



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solubilize and mineralize insoluble phosphate of soil and make it plant available. These microorganisms improve growth and yield of crops. Phosphate solubilizing microorganism inoculation of seeds, crops or soils is a good strategy to increase food production without environmental hazards (Alori et al., 2017).

Potassium (K) is an essential macronutrient required for the growth and development of plants. Its deficiency results with poor developed roots, slowed growth, disease susceptibility, delayed maturity, smaller seeds and reduced yields. Soluble K concentration of soil is very small as main part of K is in insoluble form. Main deposits of potassium are feldspar and mica. Available levels of K in soil has dropped during last decade due to developments in agriculture and imbalanced fertilizer applications. Potassium can be released when these minerals are slowly weathered or solubilized by beneficial microorganisms. Several fungal and bacterial strains are currently identified for efficient potassium solubilization. Diversified species of *Pisolithus*, *Cenococcum*, *Piloderma*, *Bacillus*, *Paenibacillus*, *Acidithiobacillus*, *Pseudomonas*, *Burkholderia*, *Aspergillus* and *Clostridium* release big amounts of potassium from different minerals. Co-inoculation of phosphate solubilising microorganisms and potassium solubilising microorganisms together with application of rock P and K minerals into soils were reported to increase N, P and K uptake, photosynthesis and yields of different plants in P- limited and K- limited soils. Identification of microbial strains capable of solubilizing potassium minerals have potential to rapidly conserve our resources and reduce environmental pollution hazards sourced from heavy application of chemical fertilizers (Rawat et al., 2016).

Interest is increasing in the alternative substances to synthetic chemicals in agriculture to increase environment and food safety and human health. Promising results were obtained from compounds obtained from aromatic plants to control pests. Some botanical originated compounds are highly effective with multiple action mechanisms with low toxicity to nontarget organisms. But, large scale application of these substances for pest control is limited by their poor stability and other technological issues (Campos et al., 2019).

Stress resistant crops provide yield stability under stressful environments and minimize environmental impacts during crop production. Naturally stress resistant plants from thousands of species have subjected to domestication by human and considered as minor crops. Wide scale cultivation of minor crops may help to diversify agriculture and human diet, improve food security and human health. Technologies are available for researchers to improve genetics of naturally stress resistant plants (Zhang et al., 2018).



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NANOTECHNOLOGY

Agricultural nanotechnology can transform agricultural practices. Nanoparticles can be produced by many chemical and physical methods. The biogenetic production procedures of nanoparticles are simple and versatile. Many plants and bacteria are able to synthesize nanoparticles or support production process. Nanoparticle-based smart delivery system and nanosensors do controlled agrochemical release and site specific delivery of many macromolecules to improve disease resistance, nutrient utilization and plant defence environment-friendly (Panpatte et al., 2016).

Combinations of nanotechnology and biotechnology may revolutionize agricultural systems and present solutions for problems. Development of controlled nutrient release smart fertilizer bioformulations based on bacteria or enzymes are possible solutions (Calabi-Floody et al., 2018).

Fertilization has a critical role to maintain soil fertility and improve crop yields and quality. Sensitive nutrient management of horticultural crops is an important challenge globally. Traditional fertilizers are costly and harmful to environment and humans. Nanotechnology is an alternative which may increase nutrient use efficiency via slowly nutrient release compared to conventional fertilizers. This approach also reduce nutrient leaching. Nanofertilizers may be used in combination with microorganisms for enhancing abiotic stress tolerance. However, their limitations should also be carefully considered before marketing. Nanomaterial release into environment and food chain may present risks to human health (Zulfiqar et al., 2019).

SMART AND PRECISION FARMING AND ICT (INFORMATION AND COMMUNICATION TECHNOLOGY)

Agriculture experienced revolutions of domestication of animals and plants, systematic crop rotations and “green revolution” including systematic breeding and widescale usage of synthetic fertilizers and pesticides. Agriculture seems to undergo into a 4th revolution by exponentially increasing information and communication technology (ICT) usage in agriculture (Walter et al., 2017).

Precision agriculture uses information technology based tools which are allowing farmers monitor soil and cropping conditions and analyzing treatment options electronically.



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Compatibility of the technology components effects precision agriculture technology adoption. Adoption is also influenced by farmer's expertise and financial resources (Aubert et al., 2012). The use of drones in agriculture is becoming more and more popular (Tripicchio et al., 2015). Unmanned aerial vehicles are attractive opportunity to monitor fields with the help of high spatial remote sensing tools (Gago et al., 2015).

Increasing complex problems, advancements of smart farming and precision agriculture in agricultural production systems offers suitable tools to improve agricultural sustainability. Data analytics is a key for future food safety, food security, and sustainability. Big data analytics, machine learning and cloud computing can help to solve several problems (Sharma et al., 2020).

RENEWABLE ENERGY

Energy efficiency of agriculture needs improvement to reduce the dependency on non-renewable energy sources (Alluvione et al., 2011).

About 40% of our food would not exist without synthetic ammonia (NH_3) for fertilization. Yet, NH_3 production is energy intensive. About 2% of the world's commercial energy is consumed as fossil fuels for NH_3 synthesis based on the century-old Haber-Bosch process (Pfromm, 2017).

Farm machines are mainly driven by fossil fuels. It contributes to greenhouse gas emissions which accelerate climate change. Renewable energy resources (wind, solar, biomass, geothermal, tidal, biofuels, small-scale hydro and wave-generated powers have a big potential for the agriculture industry. The concept of sustainable agriculture lies on a delicate balance of maximizing crop productivity and maintaining economic stability, while minimizing the utilization of finite natural resources and detrimental environmental impacts. Sustainable agriculture depends on minimized usage of non-renewable resources (natural gas used to convert atmospheric nitrogen into synthetic fertilizer, phosphate ores and fossil fuel for diesel generators). Promoting of solar photovoltaic water pumps and electricity, greenhouse technologies, solar dryers for post-harvest processing, and solar hot water heaters in remote lands, are environmentally-friendly options compared to diesel generators (Chel & Kaushik, 2011).



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CONCLUSIONS

Soil loss, soil fertility loss, increasing water demand for agricultural practices, environmental pollution due to intensive use of agrochemicals, biodiversity loss due to land use change and greenhouse gasses emission from agricultural activities are problems to be solved.

Some agroecological practices are poorly integrated in actual agriculture such as biofertilisers, natural pesticides, intercropping, relay intercropping, crop choice, rotations, timber agroforestry, nut trees, fruit trees, allelopathic plants, direct seeding into living cover crops or mulch. Technological developments to improve food productivity without significant adverse effects on ecosystem is a need.

Meeting the goals of sustainable growth of food production and reducing rural poverty requires assisting family farmers to develop more productive, profitable, resource efficient and environmentally friendly farms.



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LITERATURES

Alluvione, F., Moretti, B., Sacco, D., & Grignani, C. (2011). EUE (energy use efficiency) of cropping systems for a sustainable agriculture. *Energy*, 36(7), 4468-4481.

Alori, E. T., Glick, B. R., & Babalola, O. O. (2017). Microbial phosphorus solubilization and its potential for use in sustainable agriculture. *Frontiers in microbiology*, 8, 971.

Aubert, B. A., Schroeder, A., & Grimaudo, J. (2012). IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology. *Decision support systems*, 54(1), 510-520.

Benckiser, G. (2010). Ants and sustainable agriculture. A review. *Agronomy for Sustainable Development*, 30(2), 191-199.

Calabi-Floody, M., Medina, J., Rumpel, C., Condrón, L. M., Hernandez, M., Dumont, M., & de la Luz Mora, M. (2018). Smart fertilizers as a strategy for sustainable agriculture. *Advances in agronomy*, 147, 119-157.

Campos, E. V., Proença, P. L., Oliveira, J. L., Bakshi, M., Abhilash, P. C., & Fraceto, L. F. (2019). Use of botanical insecticides for sustainable agriculture: Future perspectives. *Ecological Indicators*, 105, 483-495.

Chel, A., & Kaushik, G. (2011). Renewable energy for sustainable agriculture. *Agronomy for sustainable development*, 31(1), 91-118.

do Espírito Santo Pereira, A., Caixeta Oliveira, H., Fernandes Fraceto, L., & Santaella, C. (2021). Nanotechnology potential in seed priming for sustainable agriculture. *Nanomaterials*, 11(2), 267.

Dubey, N. K., Shukla, R., Kumar, A., Singh, P., & Prakash, B. (2010). Prospects of botanical pesticides in sustainable agriculture. *Current Science*, 98(4), 479-480.

Elzen, B., Barbier, M., Cerf, M., & Grin, J. (2012). Stimulating transitions towards sustainable farming systems. In *Farming Systems Research into the 21st century: The new dynamic* (pp. 431-455). Springer, Dordrecht.

Ervin, D. E., Glenna, L. L., & Jussaume, R. A. (2010). Are biotechnology and sustainable agriculture compatible?. *Renewable Agriculture and Food Systems*, 25(2), 143-157.

Gago, J., Douthe, C., Coopman, R. E., Gallego, P. P., Ribas-Carbo, M., Flexas, J., ... & Medrano, H. (2015). UAVs challenge to assess water stress for sustainable agriculture. *Agricultural water management*, 153, 9-19.



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He, H. M., Liu, L. N., Munir, S., Bashir, N. H., Yi, W., Jing, Y., & Li, C. Y. (2019). Crop diversity and pest management in sustainable agriculture. *Journal of Integrative Agriculture*, 18(9), 1945-1952.

Henkel, M. (2015). 21st Century Homestead: Sustainable Agriculture II: Farming and Natural Resources. Lulu. com.

Karami, E., & Keshavarz, M. (2010). Sociology of sustainable agriculture. In *Sociology, organic farming, climate change and soil science* (pp. 19-40). Springer, Dordrecht.

Kashyap, P. L., Xiang, X., & Heiden, P. (2015). Chitosan nanoparticle based delivery systems for sustainable agriculture. *International journal of biological macromolecules*, 77, 36-51.

Levy, M. A., Lubell, M. N., & McRoberts, N. (2018). The structure of mental models of sustainable agriculture. *Nature Sustainability*, 1(8), 413-420.

Nam, K., Lim, H., & Ahn, B. I. (2020). Analysis of consumer preference for milk produced through sustainable farming: The case of mountainous dairy farming. *Sustainability*, 12(7), 3039.

Panpatte, D. G., Jhala, Y. K., Shelat, H. N., & Vyas, R. V. (2016). Nanoparticles: the next generation technology for sustainable agriculture. In *Microbial inoculants in sustainable agricultural productivity* (pp. 289-300). Springer, New Delhi.

Pergola, M., Persiani, A., Palese, A. M., Di Meo, V., Pastore, V., D'Adamo, C., & Celano, G. (2018). Composting: The way for a sustainable agriculture. *Applied Soil Ecology*, 123, 744-750.

Pfromm, P. H. (2017). Towards sustainable agriculture: Fossil-free ammonia. *Journal of Renewable and Sustainable Energy*, 9(3), 034702.

Rajbhandari, B.P. (2015). *Fundamentals of sustainable agriculture and rural development*. Kathmandu, HICAST Publ.

Rawat, J., Sanwal, P., & Saxena, J. (2016). Potassium and its role in sustainable agriculture. In *Potassium solubilizing microorganisms for sustainable agriculture* (pp. 235-253). Springer, New Delhi.

Robertson, G. P. (2015). A sustainable agriculture?. *Daedalus*, 144(4), 76-89.

Ronald, P. (2011). Plant genetics, sustainable agriculture and global food security. *Genetics*, 188(1), 11-20.



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Sharma, K. K., Singh, U. S., Sharma, P., Kumar, A., & Sharma, L. (2015). Seed treatments for sustainable agriculture-A review. *Journal of Applied and Natural Science*, 7(1), 521-539.

Sharma, R., Kamble, S. S., Gunasekaran, A., Kumar, V., & Kumar, A. (2020). A systematic literature review on machine learning applications for sustainable agriculture supply chain performance. *Computers & Operations Research*, 119, 104926.

Singh, J. S., Pandey, V. C., & Singh, D. P. (2011). Efficient soil microorganisms: a new dimension for sustainable agriculture and environmental development. *Agriculture, ecosystems & environment*, 140(3-4), 339-353.

Singh, R. P., Handa, R., & Manchanda, G. (2021). Nanoparticles in sustainable agriculture: An emerging opportunity. *Journal of Controlled Release*, 329, 1234-1248.

Tropicchio, P., Satler, M., Dabisias, G., Ruffaldi, E., & Avizzano, C. A. (2015). Towards smart farming and sustainable agriculture with drones. In *2015 International Conference on Intelligent Environments* (pp. 140-143). IEEE.

Vishwakarma, K., Kumar, N., Shandilya, C., Mohapatra, S., Bhayana, S., & Varma, A. (2020). Revisiting plant-microbe interactions and microbial consortia application for enhancing sustainable agriculture: A review. *Frontiers in Microbiology*, 11, 3195.

Walter, A., Finger, R., Huber, R., & Buchmann, N. (2017). Opinion: Smart farming is key to developing sustainable agriculture. *Proceedings of the National Academy of Sciences*, 114(24), 6148-6150.

Wezel, A., Casagrande, M., Celette, F., Vian, J. F., Ferrer, A., & Peigné, J. (2014). Agroecological practices for sustainable agriculture. A review. *Agronomy for sustainable development*, 34(1), 1-20.

Yadav, A. N., Singh, J., Singh, C., & Yadav, N. (2020). Current trends in microbial biotechnology for sustainable agriculture. Springer Singapore Pte. Limited.

Zhang, H., Li, Y., & Zhu, J. K. (2018). Developing naturally stress-resistant crops for a sustainable agriculture. *Nature plants*, 4(12), 989-996.

Zulfiqar, F., Navarro, M., Ashraf, M., Akram, N. A., & Munné-Bosch, S. (2019). Nanofertilizer use for sustainable agriculture: Advantages and limitations. *Plant Science*, 289, 110270.



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**ÇUKUROVA KOŞULLARINDA FARKLI EKİM SIKLIKLARININ CİN MISIRINDA
(*Zea mays everta*) DANE VERİMİ VE BAZI AGROMORFOLOJİK ÖZELLİKLERE
ETKİSİNİN SAPTANMASI**

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ÖZET

Bu araştırma, Çukurova Bölgesi ana ürün koşullarında cin mısırında farklı sıra üzeri mesafelerin (6 cm, 10 cm, 14 cm, 18 cm ve 22 cm) dane verimi ve diğer bazı agromorfolojik özelliklere etkisini belirlemek amacıyla, Çukurova Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Araştırma ve Uygulama Alanında 2019 yılında, bölünmüş parseller deneme desenine göre üç tekerrürlü olarak yürütülmüştür. Araştırmadan elde edilen sonuçlara göre, farklı ekim sıklıklarının birim alandaki bitki sayısı, sap kalınlığı, koçan boyu, koçanda dane sayısı, koçanda dane ağırlığı ve bin dane ağırlığı üzerine etkisinin önemli olduğu; cin mısırı çeşitlerinin ise dane verimi yönünden önemli farklılıklar gösterdiği saptanmıştır. Koçan dane verimi ve bitki yoğunluğuna bağlı olarak, dane verimi yönünden cin mısırında en uygun sıra üzeri ekim sıklığının 10-14 cm olduğu belirlenmiştir.

Anahtar Kelimeler: Cin mısırı, ekim sıklığı, dane verimi, patlama özellikleri



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**DETERMINATION OF THE EFFECT OF DIFFERENT SOWING RATES ON
GRAIN YIELD AND SOME AGROMORPHOLOGICAL CHARACTERISTICS OF
POPCORN (*Zea mays everta*) IN THE ÇUKUROVA REGION CONDITIONS**

ABSTRACT

This investigation was conducted to determine the effect of different seeding rates (6 cm, 10 cm, 14 cm, 18 cm and 22 cm) on the grain yield and several agromorphological characters of popcorn, with a split plot arrangement with three replications in the main crop conditions of Çukurova University, Agricultural Faculty, Field Crops Department Research Fields. The results showed that, different seeding rates affected significantly plant density per area, stem diameter, ear length, number of seeds per ear, grain weight per ear, and 1000 grain weight. Significant differences were observed for grain yield between the popcorn varieties. It can be concluded that, In the Çukurova Region conditions the optimum seedin rate was 10-14 cm for maksimum grain yield.

Keywords: Popcorn, seeding rate, grain yield, popping properties



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1. GİRİŞ

Başta hayvan yemi ve insan gıdası olmak üzere çok fazla kullanım alanı olan mısır üretimi ülkemizde son yıllarda önemli artış göstermiş ve 638 bin hektar alandan 6 milyon ton üretim gerçekleşmiştir (FAO, 2019). Ülkemizin yıllık ortalama talebi yaklaşık 9 milyon ton dolayında olup, üretimin eksik kısmı ithalat yoluyla karşılanmaktadır. Dünya genelindeki mısır üretiminin yaklaşık olarak % 37'si gıda, tohum ve endüstriyel amaçlı, % 63'ü hayvan yemi olarak kullanılmaktadır. Halk arasında patlamış mısır olarak bilinen cin mısırı aperlif bir atıştırılmalık olarak kullanılmakta, diğer aperlif yiyeceklerden farkı düşük kalori ve yağ oranı, yüksek karbonhidrat oranı içermesidir (Hansen, 2012). Mide asidini emici özelliği sayesinde tok tutucu iyi bir diyet ürünüdür (Ülger, 1998). Ayrıca zengin içerikli ve besleyici olduğu için iyi bir hayvan yemi olduğu, özellikle hindi yemi olarak kullanıldığı Lilburn (1994) tarafından bildirilmektedir.

Mısırdan dane verimi bakımından uygun ekim sıklıkları bölgelere göre farklılık göstermektedir (Yıldırım ve Baytekin, 2003). Yüksek verim alabilmek için uygun çeşidin kullanılması ve sıra üzeri mesafenin de uygun olması gerekmektedir. Farnworth ve Said. (1984), mısırdan bitki sıklığının tane verimiyle ilişkili olduğunu ve bitki sıklığının artmasıyla beraber tane veriminde de artış gözlemlendiğini bildirmişlerdir. Lucas ve Remison (1984), mısır bitkisinde, tane veriminin belirli bir ekim sıklığına kadar artış gösterdiğini, bir noktadan sonra düştüğünü; Özgürel (1980), 55cm x 15cm ekim sıklığında saptanan tane veriminin, 100 cm x 60 cm ekim sıklığından daha düşük bulunduğunu, Ülger (1998b), sıra üzeri ekim sıklığı arttıkça tane veriminde önemli artışlar olduğunu, sıra arası ekim sıklığı artınca tane veriminde bir azalma olduğunu bildirmişlerdir. Mısır bitkisinde sık ekimin, bitki boyu ve tane verimini arttırdığı, sap kalınlığını ise azalttığı pek çok araştırmacı tarafından kabul edilmektedir (Merlo ve ark. 1988; Wang ve ark. 1987).

Son yıllarda mısır ıslahında genellikle dik yapraklı çeşitlerin ıslahı üzerinde yoğunlaşmış olup, bu durum bitkilerin sıra üzeri mesafesinin daha azalması ve birim alanda daha yüksek bitki yoğunluğu elde edilmesine olanak sağlamaktadır. Bu araştırmanın amacı; Çukurova Bölgesi ana ürün koşullarında farklı sıra üzeri ekim sıklıklarının cin mısırında dane verimi, bazı bitkisel özellikler ve patlama kalitesi üzerine etkisinin belirlenmesi olarak özetlenebilir.



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2. MATERYAL VE METOD

Araştırmaya ilişkin tarla denemeleri, 2019 yılı mısır yetiştirme sezonunda Çukurova Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü Araştırma ve Uygulama Alanında kurulmuş olup, araştırmada farklı tohumculuk firmalarından temin edilen ve Çukurova Koşullarında mısır yetiştiriciliğinde tarımı yapılan Elacin, Baharcin ve R997 cin mısır çeşitleri materyal olarak kullanılmıştır.

Deneme Yerinin Toprak Özellikleri

Araştırma alanı topraklarının 0-30 cm toprak derinliğinden alınan toprak örneklerinin Çukurova Üniversitesi Ziraat Fakültesi, Bitki Besleme ve Toprak Bilimi laboratuvarında yapılan toprak analiz sonuçları aşağıda Çizelge 1’de verilmiştir.

Denemenin yürütüldüğü alan, Seyhan nehri yann kollarının getirdiği genç alüvyal topraklardan oluşmaktadır.

Çizelge 1. Araştırmanın yürütüldüğü Çukurova Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü araştırma alanı toprak analiz sonucu

pH	EC (mmhos cm ⁻¹)		Organik Madde (%)	CaCO ₃ (%)	Tekstür Sınıfı
7,125±0,21	0,36±0,00	Tuzsuz	1,32	27,2±0,5	C

Kaynak: Ç.Ü. Ziraat Fakültesi, Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarı Analiz Sonuçları, 2019

Deneme alanı toprakları C horizonuna sahip olup, orta derin ve derin profillidir. Organik madde oranı orta düzeyde (%1.32) ve tuzsuzdur. Hafif alkali yapılı olup, orta düzeyde kireçlidir.

Deneme Yerinin İklim Özellikleri

Denemenin yürütüldüğü Adana ilinde Akdeniz iklimi etkili olmaktadır. Bu nedenle kışları ılık ve yağışlı, yazları sıcak ve kurak geçmektedir. Uzun yıllara ve denemenin yürütüldüğü 2019 yılına ait iklim değerleri Çizelge 2’ de verilmiştir



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Çizelge 2. Denemenin kurulduğu yere ilişkin 2019 yetiştirme yılında saptanan bazı meteorolojik değerler ile uzun yıllar ortalaması

Aylar	Minimum Sıcaklık (°C)		Maksimum Sıcaklık (°C)		Ortalama Sıcaklık (°C)		Toplam Yağış (mm)		Nisbi Nem (%)	
	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar
Mart	2.3	8.2	26.4	19.4	13.8	13.4	96.5	65.1	69.0	68.2
Nisan	7.0	11.8	32.0	23.7	17.0	17.5	71.1	51.1	67.0	64.2
Mayıs	11.8	15.7	39.4	28.2	24.1	21.7	2.6	47.1	57.6	58.3
Haziran	18.7	19.7	37.5	31.7	27.1	25.6	21.3	20.5	68.7	64.2
Temmuz	21.6	22.9	36.3	33.9	28.4	28.2	30.9	6.2	68.8	68.2
Ağustos	22.9	23.3	39.6	34.7	29.6	28.7	0.0	5.5	68.0	68.3
Eylül	20.1	24.9	35.9	33.1	29.3	26.1	0.0	17.6	69.6	68.3

Kaynak: Adana Meteoroloji İşleri Bölge Müdürlüğü, Adana, 2019.

Çizelge 2'nin incelenmesinden de görüleceği gibi, deneme süresince ölçülen Mart ayı minimum sıcaklığı uzun yıllar ortalamasından daha düşük, maksimum sıcaklığı ise uzun yıllar ortalamasından daha yüksek olmuştur. Denemenin yürütüldüğü 2019 yılı yetiştirme mevsimini kapsayan aylarda ortalama sıcaklık değerinin genel olarak uzun yıllar ortalamasından daha yüksek olduğu görülmektedir.

Deneme Deseni, Ekim ve Bakım İşlemleri

Araştırmaya ilişkin deneme, çeşitler ana parsellere, farklı ekim sıklıkları alt parsellere gelecek şekilde bölünmüş parseller deneme desenine göre 3 tekrarlamalı olarak düzenlenmiştir. Her bir alt parselde, sıra arası sabit 70 cm ve sıra üzeri mesafeler sırasıyla 6, 10, 14, 18 ve 22 cm olarak düzenlenmiştir. Ekim, her bir sıra üzeri mesafe için özel hazırlanmış ve işaretlenmiş ekim çıtaları kullanılarak, markörle açılan sıralara elle yapılmıştır.

Tarlaya ekimle aynı tarihte viyollere de üç çeşidin tohumlarından ekilmiş ve çıkışlarda saptanan eksiklikler, viyollere ekilen bitkilerden şaşırtma yapılarak giderilmiştir.

Her parsel 5 m uzunluğunda 4 sıradan oluşmuştur. Ekim, 2019 yılı birinci ürün mısır ekimine uygun olarak 15 Mart 2019 tarihinde yapılmıştır. Yabancı otlarla mücadele, traktör çapalaması elle çapalama ve uygun herbisitler kullanılarak yapılmıştır.

Yapılan toprak analizleri de dikkate alınarak, kullanılabilir durumdaki besin maddelerini tamamlayacak şekilde Özkan ve Ülger (2011) belirttiği uygun gübre dozu uyarınca dekara 20 kg saf N, 8 kg P₂O₅ ve 8 kg K₂O olacak şekilde, azotun yaklaşık 1/3'lük kısmı ile fosfor ve potasyumun tamamı ekimle birlikte tabana, azotun kalan kısmı bitkilerin tepe püskülü çıkarma



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döneminden bir hafta öncesine kadar olan peryotta tercihen bölünerek verilmiştir. Ekim, tavlı toprağa yapılmış, çıkış sırasında ve çıkıştan sonra bitkiler V5-V6 evresine gelinceye kadar, gerekli olduğu durumda yağmurlama sulama yapılmıştır. Bu dönemden sonra damla sulama sistemi ile sulamaya devam edilmiştir. Bitkilerin vegetatif ve generatif dönemlerini kapsayan büyüme ve gelişme sürecinde, bölgemizde mısırdaki zarar oluşturan hastalık ve zararlıların gözlemi yapılarak, gerek duyulduğunda kimyasal mücadele yapılmıştır.

Hasat işlemi, her parselin ortadaki iki sırasında, parsel başından ve sonundan 0.5 m'lik kısım hariç 4 m'lik kısımdaki koçanlar elle koparılarak yapılmıştır. Parselden elde edilen koçanlar kavuzlarından ayrılarak koçan harman makinesinde danelenmiştir.

İncelenen Bitkisel Özellikler

Araştırmada; Anderson ve ark. (1984), Ülger ve ark. (1997), Kara (2006)'nın kullandıkları metodlar uyarınca, bitki sayısı, bitki sap kalınlığı (mm), koçan boyu (cm), koçanda dane sayısı (adet), koçanda dane ağırlığı (g/koçan), bin dane ağırlığı (g), dane verimi (kg/da), patlama hacmine (cm³/g) ilişkin gözlem ve ölçümler yapılmıştır.

$$\text{Patlama hacmi (cm}^3\text{/g)} = \frac{\text{Toplam patlama hacmi (cm}^3\text{)}}{\text{Patlatılan ürünün ağırlığı (g)}}$$

Eşitliğine göre belirlenmiştir.

Araştırmada Elde Edilen Verilerin Değerlendirilmesi

Bölünmüş parseller deneme desenine göre kurulan çalışmada, elde edilen verilerin varyans analizleri yapılmış ve uygulamalar arasında görülen farklılıkların gruplandırmaları EGF testine göre yapılmıştır. Analizlerin yapılmasında PC uyumlu Mstat-c istatistik programı kullanılmıştır.

3. BULGULAR VE TARTIŞMA

Çukurova Koşullarında cin mısırının farklı sıra üzeri mesafelerde yetiştirilmesiyle elde edilen bitki sayısı, sap kalınlığı, koçan boyu ve koçanda dane sayısına ilişkin ortalama veriler Çizelge 3'de verilmiştir.



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Çizelge 3. Bitki sayısı, sap kalınlığı, koçan boyu ve koçanda dane sayısına ilişkin ortalama veriler

Ekim sıklığı	Bitki sayısı (adet/da)	Sap kalınlığı (mm)	Koçan boyu (cm)	Koçanda dane sayısı
6 cm	16031 A	15.6 C	16.6 C	570 B
10 cm	12238 B	15.4 C	17.2 BC	570 B
14 cm	9032 C	18.6 B	18.1 B	607 AB
18 cm	6317 D	21.6 A	19.6 A	660 A
22 cm	5428 D	21.7 A	19.9 A	660 A
Çeşitler				
Elacin	9724	18.2	17.5	599
Baharcin	10105	18.7	17.7	582
R997	9600	18.9	19.6	659
EGF %5				
Ekim sıklığı	1326	1.63	1.35	73.5
Çeşit	öd	öd	öd	öd

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Farklı sıra üzeri ekim sıklığı uygulamalarının etkisi incelendiğinde (Çizelge 3), hasat öncesi dönemde en yüksek bitki sayısının 16031 bitki/da ile 6 cm sıra üzeri ekim sıklığından, en düşük bitki sayısının ise 5428 bitki/da ile 22 cm sıra üzeri ekim sıklığında elde edildiği görülmektedir. Cin mısırında birim alanda farklı bitki yoğunluklarının etkisini inceleyen Lakshmi ve ark (2014), dane verimi ve diğer bitkisel özellikler yönünden en uygun ekim sıklığının 45 x 20 cm olduğunu; Naneli ve ark (2019), inceledikleri tüm bitkisel özelliklerin birim alandaki bitki yoğunluğundan önemli düzeyde etkilendiğini ve en yüksek dane veriminin metrekarede 9 bitki sıklığından elde edildiğini bildirmişlerdir.

En yüksek sap kalınlığının 21.7 mm ile 22 cm sıra üzeri ekim sıklığından, en düşük sap kalınlığının ise 15.4 mm ile 10 cm sıra üzeri ekim sıklığından elde edildiği görülmektedir. Sıra üzeri mesafe arttıkça bitkilerin yaşam alanları artmakta ve bu durum da bitkilerin saplarının daha iyi gelişmesine neden olmaktadır. Saptamış olduğumuz bulgular, mısırdaki seyrek ekimlerde sap kalınlığının arttığını bildiren White (1986), Sağlamtimur ve ark (1994), Fernandez ve ark (1999), Şener ve ark (2004)'nın saptadıkları bulgularla benzerlik göstermektedir.

Farklı ekim sıklıklarına göre en yüksek koçan boyunun 19.9 cm ile 22 cm sıra üzeri ekim sıklığından, en düşük koçan boyunun ise 16.6 cm ile 6 cm sıra üzeri ekim sıklığından elde edildiği görülmektedir (Çizelge 3). Sıra üzeri mesafe arttıkça, koçan boyunda uzama olduğunu, Konuşkan ve Gözübenli (2001), Şener ve ark. (2004) ve Eşiyok vd. (2004), Saruhan ve Şireli (2005), Kara (2006), Şirikçi (2006), Bhatt (2012) ve Moretti (2012)'nin yapmış oldukları çalışmalarda tespit etmişlerdir.



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En yüksek koçanda dane sayısının 18 ve 22 cm sıra üzeri ekim sıklığından (660 dane/koçan) en düşük koçanda dane sayısının ise 570 adet ile 6 cm sıra üzeri ekim sıklığından elde edildiği görülmektedir. Koçanda dane sayısı yönünden elde ettiğimiz bulgular, benzer konuda araştırma yürüten Ülger ve ark (1996), Turgut ve ark (1997), Govil ve Pandey (1999), Turgut (2000), Yılmaz (2005) ve Kara (2006)'nın bulguları ile benzerlik içerisindedir.

Çizelge 4. Koçanda dane ağırlığı, bin dane ağırlığı, dane verimi ve patlama hacmine ilişkin ortalama veriler

Ekim sıklığı	Koçanda dane ağırlığı (g)	Bin dane ağırlığı (g)	Dane verimi (kg/da)	Patlama hacmi (cm ³ /g)
6 cm	79.4 C	149.1 C	420.7	22.3
10 cm	81.4 C	150.9 BC	446.7	23.9
14 cm	89.3 BC	157.9 AB	445.7	24.5
18 cm	97.4 AB	162.6 A	412.0	23.2
22 cm	103.7 A	165.3 A	385.3	22.9
Çeşitler				
Elacin	93.5	169.5	395.4 B	21.9
Baharcin	91.9	162.4	488.6 A	23.5
R997	85.4	139.5	382.2 B	24.7
EGF %5				
Ekim sıklığı	12.5	7.45	öd	öd
Çeşit	öd	öd	85.2	öd

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Çizelge 4'ün incelenmesinden, en yüksek koçanda dane ağırlığının 103.7 g ile 22 cm sıra üzeri ekim sıklığından, en düşük koçanda dane ağırlığının ise 79.3 g ile 6 cm sıra üzeri ekim sıklığından elde edildiği görülmektedir. Koçanda dane ağırlığı doğrudan dane verimi ile ilişkili bir özellik olup, genellikle koçanda sıra sayısı, sıradaki dane sayısı ve dane iriliği etkisi altındadır. Koçanda dane ağırlığı ile ilgili elde ettiğimiz bulgular, seyrek ekimlerde koçanda dane ağırlığının sık ekimlere göre daha yüksek olduğunu bildiren Akçin ve ark (1993), Ülger ve ark (1996), Konuşkan (2000), Öktem ve ark (2001)'in bulguları ile uyum içerisindedir.

Araştırmada en yüksek bin dane ağırlığının 165.3 g ile 22 cm sıra üzeri ekim sıklığından, en düşük bin dane ağırlığının ise 149.1 g ile 6 cm sıra üzeri ekim sıklığından elde edildiği görülmektedir. Elacin çeşidinde saptanan ortalama bin dane ağırlığının (169.5 g) R997çeşidinde saptanan bin dane ağırlığından (139.5 g) daha yüksek olduğu görülmektedir. Elde ettiğimiz bulgular, mısırdaki seyrek ekimlerde saptanan bin dane ağırlığının sık ekimlere kıyasla daha yüksek olduğunu bildiren Konuşkan ve Gözübenli (2001), Öktem ve ark (2001), Brunus ve Abbas (2002), Kara (2006)'nın bulguları ile benzerlik göstermektedir.



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Çizelge 4'den en yüksek dane veriminin 488.6 kg/da ile Baharcin çeşidinden elde edildiği, R997 ve Elacin çeşitlerinde saptanan dane verimi değerlerinin ise sırasıyla 382.2 ve 395.4 kg/da olduğu saptanmıştır. Farklı sıra üzeri ekim sıklığı uygulamalarından elde edilen ortalama dane verimi değerleri arasındaki fark istatistiki olarak önemli olmamakla birlikte, en yüksek dane veriminin 446.7 kg/da ile 10 cm sıra üzeri ekim sıklığından elde edildiği, bunu 445.7 kg/da ile 14 cm sıra üzeri sıklığın takip ettiği ve en düşük dane veriminin de en seyrek ekimlerden yani sıra üzeri 22 cm ekim sıklığından (385.3 kg/da) elde edildiği görülmektedir. Bu verilere göre Çukurova Bölgesi birinci ürün koşullarında cin mısırında en uygun sıra üzeri ekim sıklığının 10-14 cm dolayında olduğunu söylemek mümkündür. Cin mısırında farklı bitki yoğunluğunun dane verimine etkisini araştıran Gözübenli ve konuşkan (2010), Hatay ikinci ürün koşullarında dane verimi için en uygun ekim sıklığının 18 kg/da N dozunda 8800 bitki/da bitki yoğunluğundan, de S. Rossato Junior ve ark (2013) Brezilya koşullarında cin mısırında en yüksek dane veriminin 6000-8000 arası bitki/da bitki yoğunluğundan, Naneli ve ark (2019), en yüksek dane veriminin 9 bitki/m² ekim sıklığından elde edildiğini rapor etmişlerdir.

İstatistiki olarak önemsiz bulunmakla birlikte farklı sıra üzeri ekim sıklıklarında en yüksek patlama hacmi 24.5 cm³/g ile 14 cm sıra üzeri mesafeden elde edilirken, en düşük 22.3 cm³/g ile 6 cm sıra üzeri ekim sıklığından elde edilmiştir. Aynı çizelgeden, cin mısırı çeşitlerinde en yüksek patlama hacmi 24.7 cm³/g ile R997 çeşidinde saptanırken, Elacin ve Baharcin çeşitlerinde sırasıyla 21.9 ve 23.5 cm³/g patlama hacmi saptanmıştır.



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KAYNAKLAR

Anderson EL, Kamprath EJ, Moll RH (1984). Nitrogen fertility effects on accumulation, remobilization, and partitioning of nitrogen and dry matter in corn genotypes differing in prolificacy. *Agronomy Journal*, 76; 397-404

Bhatt, P. S., 2012. Response of Sweet Corn Hybrid to Varying Plant Densities and Nitrogen Levels. *African Journal of Agricultural Research*, 7(46), pp. 6158- 6166.

Bruns, H.A., Abbas, H.K., 2002. Effects of Intra-Row Spacing on Maize Growth in the Mid-South. *Agronomy Abstracts*, Vol; 48:21-27,USA.

Eşiyok, D., Bozokalfa, M.K., Uğur, A., 2004, Farklı Lokasyonlarda Yetiştirilen Şeker Mısır Çeşitlerinin Verim, Kalite ve Teknolojik özelliklerinin Belirlenmesi, Ege Üniversitesi Ziraat Fakültesi Dergisi, 2004, 41 (1), 1-9.

FAO, 2019. <http://www.fao.org/faostat/en/#data/QC>.

Farnworth, J., Said, S.A., 1984. The Effect of Plant Population on Local Roumi Maize Grain Yield When Grown under Irrigation, Dhamar Agricultural Improvement Centre, No:45, 3pp

Fernandez Neto, C., Silva, P.S.L Silva, N.L., 1999. Maize Spacing and Grain Yield. *Field Crop Abstracts* Vol:52. No: 7

Govil, S. R., and Pandey, H. N., 1999. Growth Responses of Maize to Crop Density. *Field Crop Abs.*, Vol: 59, No:8.

Gözübenli, H. ve Konuşkan, Ö. 2010. Nitrogen Dose and Plant Density Effects on Popcorn Grain Yield. *Afr. J. Biotechnol.*, 9(25): 3828-3832.

Hansen, R., 2012. Popcorn Profili, a national information resource for value-added agriculture.

Kara, B., 2006. Çukurova Koşullarında Değişik Bitki Sıklıkları ve Farklı Azot Dozlarında Mısırın Verim ve Verim Özellikleri ile Azot Alım ve Kullanım Ekinliğinin Belirlenmesi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Doktora Tezi, 162s. Adana.

Konuşkan, Ö., ve Gözübenli, H., 2001. Hatay Koşullarında II. Ürün Olarak Yetiştirilen Bazı Melez Mısır Çeşitlerinde Bitki Sıklığının Verim ve Verimle İlgili Özelliklere Etkisi. *Tarla Bitkileri Merkezi Araştırma Enstitüsü Dergisi*, 10(1-2): 50-57.

Lakshmi, Y.S., Sreelatha, D., Pradeep, T., 2014. Rainfed Popcorn Productivity as Influenced by Plant Densities and Nitrogen Levels. *Indian J. Dryland Agric. Res. & Dev.* 29(2) : 28-33.



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Lilburn, M. S., 1994. Research Note: The Use of Popcorn in Diets for Growing, Turkeys. Maize Abstracts, January 1994, Volume:10, No:1, p.83.

Lucas, E.O., Remison, S.U., 1984. Effect of Population Density on Yield and Dry-Matter Partition of Maize Varieties in Nigeria. Indian J. of Agric. Sci., 54(4): 284-290

Merlo, E.F., Fornasier, D., And Sanchez, A.L., 1988. Evaluation of Seven Pop-corn (Zea mays L.) Cultivars at Three Sowing Densities. Cientifica, 16(2): 245–251

Moretti, N. N. M., 2012. Responce of Yield and Quality to Plant Density and Nitrigon Fertilizer Levels İn Sweet Corn. California State University Master tezi, Fresno, 2012, 57 pages.

Naneli. İ., Sakin, M.A., Özsoy, A., 2019. Tokat-Kazova Koşullarında Farklı Ekim Sıklıklarının Bazı Cin Mısır Çeşitlerinin Verim Özellikleri Üzerine Etkisi. Tokat Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü.3.Uluslar Arası ÜNİDOKAP Karadeniz Sempozyumu. ISBN: 978-605-80568-1-7 486s.

Öktem, A., Ülger, A.C. ve Kırtok, Y., 2001. Cin Mısırında (ZeamaysevertaSturt.) Farklı Azot Dozları ve Sıra Üzeri Mesafelerinin Tane Verimi ve Bazı Agronomik Özelliklere Etkisi. Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 16(2): 83-92.

Özgürel, M., 1980. Bitki Sıklığının Mısır Bitkisinin Su Tüketimi ile Verime Etkileri Üzerine Araştırmalar. Ege Ü.Zir. Fak. Yay. No:380

Özkan, A., ÜLGER, A., 2011. Çukurova Ekolojik Koşullarında Değişik Azot Dozu Uygulamalarının İki Cin Mısırı (Zea mays L. everta Sturt.) Çeşidinde Tane Verimi ve Bazı Tarımsal Özelliklere Etkisi". Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi 21 (2011): 198-208

Sağlamtimur, T., Tansı, V., Düzgün, M., ve Kızılsimşek, M., 1994. Çukurova Koşullarında Mısırın En Uygun Bitki Sıklığının Saptanması Üzerine Araştırmalar. Türkiye I. Tarla Bitkileri Kongresi, Eylül 1994, Bornova/ İzmir.

Saruhan, V., Şireli, H.D., 2005. Mısır Bitkisinde (Zea mays L.) Farklı Azot Dozları ve Bitki Sıklığının Koçan, Sap, ve Yaprak Verimlerine Etkisi Üzerine Bir Araştırma. Harran Üniversitesi Ziraat Fakültesi Dergisi, 2005, 9 (2):4553.

Şener, O., Gözübenli, H., Konuşkan, O., Kılınç, M., 2004. The Effect of Intra-Row Spacings on The Grain Yield and Some Agronomic Characteristics of Maize (Zea mays L.) Hybrids. Asian Journal of Plant Sciences 3 (4),429- 432.



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Şirikci, M., 2006. Kahramanmaraş Koşullarında Üç Mısır Çeşidinde Farklı Bitki Sıklığının Verim ve Bazı Özelliklere Etkisi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, 116s, Adana.

Turgut, İ., Doğan, R., Yürür, N., 1997. Bursa Ekolojik Koşullarında Yetiştirilen Bazı Atıdışı Hibrit Mısır (*Zea mays indentata sturt*) Çeşitlerinde Bitki Sıklığının Verim Ve Verim Ögelerine Etkisi. Türkiye II. Tarla Bitkileri Kongresi 143-147s, Samsun.

Turgut, İ., 2000. Bursa Koşullarında Yetiştirilen Şeker Mısırında (*Zea mays Saccharata Sturt.*) Bitki Sıklığının ve Azot Dozlarının Taze Koçan Verimi ile Verim Ögeleri Üzerine Etkisi. Turkish Journal of Agriculture and Forestry, 2000, 24 (3): 341-347

Ülger, A.C., Tansı, V., Sağlamtimur, T., Kızıllı, M., Çakır, B., Yücel, C., Baytekin, H., Öktem, A., 1996. Güneydoğu Anadolu Bölgesinde İkinci Ürün Mısırdaki Bitki Sıklığı ve Azot Gübrelemesinin Tane ve Hasıl Verimi ve Bazı Tarımsal Karakterlerine Etkisi Üzerine Araştırmalar. Çukurova Üniversitesi Ziraat Fakültesi GAP Tarımsal Araştırma İnceleme ve Geliştirme Proje Paketi Kesin Sonuç Raporu, Proje No, 94, 45s. Adana.

Ülger, A.C., 1998. Farklı azot dozu ve sıra üzeri mesafelerinin patlak mısırdaki (*Zea mays everta Sturt.*) tane verimi ve bazı tarımsal özelliklere etkisi. Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 13(1): 1

Ülger, A.C., 1998b. Mısır Bitkisinde Farklı Sıra Arası ve Sıra Üzeri Uzunluklarının Tane Verimi ve Bazı Tarımsal Özelliklere Etkisi. Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 13(3), 95-104. Adana.

Ülger, A.C., İbrikçi, H., Çakır, B., Güzel, N., 1997. Influence of nitrogen rates and row spacing on corn yield, protein content and other plant parameters. Journal of Plant Nutrition. 20:1697-1709.

Wang, C.S., Tsao, S.H., and Liu, D.J., 1987. The Effect of Population Density on the Accumulation of Dry Matter in Maize. Journal of Agricultural Research of China, 36(1): 15–28

White, J. M., 1986. Effect of Plant Spacing and Planting Date of Sweet Corn on Muck Soil in the Spring. Proceeding of the Florida State Horticultural Society, 97:52, S:163.



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Yıldırım, Ö., Baytekin, H., 2003. Mısırdaki Bitki Sıklığının Yeşil Ot ve Tane Verimi ile Bazı Tarımsal Karakterlere Etkisi. Türkiye 5. Tarla Bitkileri Kongresi, 13-17 Ekim 2003, Diyarbakır, 448-452s.

Yılmaz, M.F., 2005. Kahramanmaraş Koşullarında II. Ürün Mısır Bitkisinde (*Zea mays* L.) Farklı Sıra Üzeri Mesafeler ve Azot Dozlarının Verim ve Verim Unsurları ile Tohum Kalitesine Etkisi. Kahramanmaraş Sütçü İmam Üniversitesi, Tarla Bitkileri Anabilim Dalı, Yüksek Lisans Tezi, 56s.



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**FARKLI AZOT DOZU UYGULAMALARININ CİN MISIRINDA DANE VERİMİ,
BAZI AGROMORFOLOJİK KARAKTERLER VE DANE PATLAMA
ÖZELLİKLERİNE ETKİSİNİN BELİRLENMESİ**

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ÖZET

Bu araştırma, 2019 yılında, Çukurova Üniversitesi, ana ürün mısır yetiştirme sezonunda, iki cin mısırı çeşidi (Baharcin ve R997) ile, 6 farklı azot dozu uygulanarak (0, 10, 15, 20, 25, 30 kg N/da), bölünmüş parseller deneme desenine göre, 3 tekerrürlü olarak yürütülmüştür.

Araştırmadan elde edilen sonuçlara göre, farklı azot dozu uygulamaları arasındaki farkın, bitki boyu, koçan uzunluğu, koçanda dane sayısı, koçanda dane ağırlığı, bin dane ağırlığı, dane verimi, ve patlama hacmi; cin mısırı çeşitleri arasındaki farkın bin dane ağırlığı yönünden istatistiki olarak önemli olduğu saptanmıştır. Cin mısırı çeşitlerinin farklı azot dozlarına tepkileri farklı olmuş, Baharcin çeşidinde en yüksek dane verimi 20 kg/da N dozundan elde edilirken, R997 çeşidinde 30 kg/da N dozundan elde edilmiştir. Bu durum farklı çeşitlerin azot kullanım etkinliğinin farklı olduğunu ve azotlu gübre uygulamalarında bu durumun göz önünde bulundurulması gerektiğini ortaya koymaktadır.

Anahtar Kelimeler: Cin mısırı, azot dozu, dane verimi, patlama özellikleri



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**DETERMINATION OF THE EFFECTS OF DIFFERENT NITROGEN DOSE
APPLICATIONS ON GRAIN YIELD, SOME AGROMORPHOLOGICAL CHARACTERS
AND POPPING PROPERTIES OF POPCORN**

ABSTRACT

This study was conducted with 3 replications, according to split plot design by treatment of 6 different nitrogen doses (0, 10, 15, 20, 25, 30 kg/da N) with two Popcorn varieties (Baharcin and R997) in the main crop growing conditions of Çukurova University, in 2019. According to the results, significant differences detected between the different N doses for the plant height, ear length, number of kernels per ear, grain weight per ear, 1000 grain weight, grain yield and the popping volume while, significant differences between the varieties for 1000 grain weight. and significant N dose x variety interaction determined for ear length. The response of the popcorn varieties found to be different as highest grain yield was obtained from the 20 kg/da N treatment for Baharcin variety while, highest grain yield obtained from the 30 kg/da N treatment for R997 variety. This situation reveals that the nitrogen use efficiency of different varieties is different and this should be taken into account in nitrogen fertilizer applications.

Keywords: Popcorn, nitrogen doses, grain yield, popping properties



1. GİRİŞ

Cin mısırının (*Zea mays* Everta) orijini Amerika kıtası olup, sert mısırdan mutasyon yoluyla geliştiği bildirilmiştir (Ziegler, 2001). Cin mısırını diğer mısır türlerinden ayıran en önemli özelliği, daneleri ısıtıldığında sahip olduğu sert yapılı nişastanın genişlererek patlaması ve danelerin kelebek kanadı gibi açılarak opak kar gibi bir görünüm almasıdır. Bu özelliği, cin mısırının tüm dünyada çerezlik olarak tüketilmesini yaygınlaştırmıştır. Cin mısırının çerezlik endüstrisinde ilk kullanımı ABD’de 1880’lerde yaygınlaşmaya başlamıştır. Bu dönemden itibaren cin mısırı tüm dünyada yayılış göstermiş ve çerezlik olarak tüketimi giderek artış göstermiştir. Son yıllarda dünya ile paralel olarak ülkemizde de cin mısırı tüketimi patlamış mısır formunda çerezlik olarak giderek artış göstermiştir. Cin mısırının ülkemizde ekim alanı, üretim ve verimine ilişkin resmi bir istatistik olmamakla birlikte, ülkemiz cin mısırı üretimi yapan sektör temsilcileri ile yapılan görüşmelerden derlenen bilgilere göre, ülkemizde 2018 yılında yaklaşık 80-85 bin da cin mısırı ekimi yapıldığı, ekim alanlarının yoğun olarak Elbistan (40-50 bin da), Tarsus (10-15 bin da), Aydın ve Denizli yöresi (15 bin da) ve Şanlıurfa (5-10 bin da) bölgelerinde olduğu görülmektedir. Ülkemiz çerezlik cin mısırı ihtiyacının yıllık ortalama 40 bin ton civarında olduğu ve toplam üretimin bu ihtiyacı karşıladığı, yıllara bağlı olarak üretim fazlası 15-20 bin ton yurt dışına ihraç edildiği ve ortalama verimin dekara 600-650 kg civarında olduğu saptanmıştır.

Cin mısırı bitki formu olarak danelik mısıra kıyasla daha küçük bitkisel form ve dane düşük dane verimine sahiptir. Bu nedenle toplam besin maddesi ve azot tüketimi danelik mısıra kıyasla daha düşük olmasına rağmen, üreticiler bu durumu göz ardı etmekte ve danelik mısıra eşit miktarda azot uygulamaktadır. Bu durum hem çevre kirliliği hem de ekonomik olarak önemli kayıplara neden olmaktadır (Özkan ve Ülger, 2011). Azot, bitkisel üretimde noksanlığı en belirgin görülen ve en çok gereksinim duyulan, aynı zamanda verimi arttırıcı etkisi en önemli girdi olarak kullanılan bitki besin elementidir (Russel ve Balko, 1980). Cin mısırında azot uygulama zamanı ve miktarının önemli olduğu, sıfır azot dozundan 18 kg/ha’a artan azot dozu uygulamasının cin mısırında bitki boyu, yaprak alan indeksi, koçan uzunluğu, koçanda sıradaki dane sayısı, bin dane ağırlığı ve dane verimini olumlu etkilediği bildirilmiştir (Pricinotto ve ark., 2014). Sönmez (2000), danelik mısırdaki farklı azot dozlarının etkisini incelediği araştırmada, azotlu gübrelemenin bitki boyu, koçan uzunluğu, koçan dane sayısı, koçan dane ağırlığı, bin dane ağırlığı ve dane verimi üzerine önemli etkisi olduğunu; Can ve Akman (2014), farklı azot dozlarının şeker mısırında bitki boyu, ilk koçan yüksekliği, taze



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koçan verimi ve taze koçanlarda nitrat birikimi üzerine etkisinin önemli olduğunu, sap çapı, koçan çapı, koçan boyu, tek koçan ağırlığı, koçanda sıra sayısı, koçanda dane sayısı, pazarlanabilir koçan sayısı, taze koçandaki danelerde ham protein oranı ile şeker oranının farklı azot dozlarından etkilenmediğini bildirmişlerdir.

Bu araştırmanın amacı;Çukurova Bölgesinde birinci ürün yetiştirme koşullarında cin mısırında uygun azot dozunu belirlemeye yönelik olarak, farklı azot dozlarının etkisini araştırmaktır.

2. MATERYAL VE METOD

Araştırmada, farklı tohumculuk firmalarından temin edilen ve Çukurova Koşullarında mısır yetiştiriciliğinde tarımı yapılan Baharcin ve R997 cin mısır çeşitleri materyal olarak kullanılmıştır.Araştırmada 6 farklı azot dozu (0, 10, 15, 20, 25, 30 kg N/da) uygulanmıştır. Azot kaynağı olarak %46 lık Üre gübresi kullanılmıştır. Her bir azot dozu 3 eşit parçaya bölünerek 1/3'ü ekimle birlikte, kalan kısmı ise çıkış sonrası 2 eşit parçaya bölünerek uygulanmıştır.Toprak analiz sonuçlarına göre, Bitki Besleme ve Toprak Bilimi Bölümü araştırmaacılarının tavsiyesi de dikkate alınara, ekim öncesi 8 kg/da P_2O_5 ve 8 kg/da K_2O olacak şekilde Potasyum Sülfat, Triple Süperfosfat ve % 22 lik Çinko Sülfat gübrelere kullanılarak gübreleme yapılmıştır. Araştırmaya ilişkin tarla denemeleri, 2019 yılı mısır yetiştirme sezonunda Çukurova Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü Araştırma ve Uygulama Alanında kurulmuştur.

Deneme Yerinin Toprak Özellikleri

Araştırma alanı topraklarının 0-30 cm toprak derinliğinden alınan toprak örneklerinin Çukurova Üniversitesi Ziraat Fakültesi, Bitki Besleme ve Toprak Bilimi laboratuvarında yapılan toprak analiz sonuçları aşağıda Çizelge 1’de verilmiştir.

Çizelge 1. Araştırmanın yürütüldüğü Çukurova Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü araştırma alanı toprak analiz sonucu

pH	Toplam azot (%)	EC (mmhos cm^{-1})		Organik Madde (%)	$CaCO_3$ (%)	Tekstür Sınıfı
7.6	0.34	0.8	Tuzsuz	1.39	31.42	C

Kaynak: Southern Ziraat Laboratuvarı, 2019.

Deneme alanı toprağı, taşınmış ana materyalden oluşmasından dolayı toprak oluş işlemlerinden zamanın etkileri belirgin bir şekilde görülmektedir. A ve C horizonlarından oluşmuş genç bir



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topraktır (Ortaç, 1996). Deneme alanının yer aldığı toprak serisi, Menzilat Serisi olup, toprak serileri içerisindeki oranı %10.5'tir (Özbek ve ark., 1974). Organik madde oranı orta düzeyde (%1.39) ve hafif tuzludur. Hafif alkali yapılı olup, orta düzeyde kireçlidir. Menzilat toprakları düz, drenajları iyi, orta tekstürlü derin toprak yapıda olup, toprak yüzeyinde bulunan taşlılık, toprağın işlenmesi ve su tutma kapasitelerinin düşük olması sorunları ortaya çıkabilmektedir (Özkan, 2007).

Deneme Yerinin İklim Özellikleri

Denemenin yürütüldüğü Adana ilinde Akdeniz iklimi etkili olmaktadır. Bu nedenle kışları ılık ve yağışlı, yazları sıcak ve kurak geçmektedir. Uzun yıllara ve denemenin yürütüldüğü 2019 yılına ait iklim değerleri Çizelge 2 de verilmiştir.

Çizelge 2. Denemenin kurulduğu yere ilişkin 2019 yetiştirme yılında saptanan bazı meteorolojik değerler ile uzun yıllar ortalaması

Aylar	Minimum Sıcaklık (°C)		Maksimum Sıcaklık (°C)		Ortalama Sıcaklık (°C)		Toplam Yağış (mm)		Nisbi Nem (%)	
	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar
Mart	2.3	8.2	26.4	19.4	13.8	13.4	96.5	65.1	69.0	68.2
Nisan	7.0	11.8	32.0	23.7	17.0	17.5	71.1	51.1	67.0	64.2
Mayıs	11.8	15.7	39.4	28.2	24.1	21.7	2.6	47.1	57.6	58.3
Haziran	18.7	19.7	37.5	31.7	27.1	25.6	21.3	20.5	68.7	64.2
Temmuz	21.6	22.9	36.3	33.9	28.4	28.2	30.9	6.2	68.8	68.2
Ağustos	22.9	23.3	39.6	34.7	29.6	28.7	0.0	5.5	68.0	68.3
Eylül	24.9	20.1	35.9	33.1	29.3	26.1	0.0	17.6	69.6	68.3

Kaynak: Adana Meteoroloji İşleri Bölge Müdürlüğü, Adana, 2019.

Adana ilinde uzun yıllara ait iklim verilerine göre yağışların genellikle 15 Eylül-15 Nisan tarihleri arasında düştüğü görülmektedir. Çizelge 3.2 incelendiğinde görülebileceği gibi, Adana ekolojik koşullarda mısır yetiştirme periyodu (Nisan-Eylül) içinde yeterince yağış olmadığından, mısır için gerekli olan su, sulama suyundan karşılanmıştır. Çalışmanın yürütüldüğü 2019 yılında en yüksek sıcaklık Ağustos ayında kaydedilmiştir. Denemenin yürütüldüğü yılda uzun sıcaklık ortalamaları arasında fazla bir değişim gözlenmemiştir. 2019 yılı mısır yetiştirme döneminde iklim değerleri yönünden mısır yetiştirilmesi için olumsuz bir durum yaşanmamış olup, yetiştirme mevsimini kapsayan aylarda ortalama sıcaklık değerinin genel olarak uzun yıllar ortalamasından daha yüksek olduğu görülmektedir.



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Deneme Deseni, Ekim ve Bakım İşlemleri

Araştırmaya ilişkin deneme, çeşitler (Baharcin ve R997) ana parsellere, farklı azot dozları (0, 10, 15, 20, 25 ve 30 kg N/da) alt parsellere gelecek şekilde bölünmüş parseller deneme desenine göre 3 tekrarlamalı olarak düzenlenmiştir. Denemenin yürütüldüğü alandan bazı fiziksel ve kimyasal özelliklerini belirlemek için toprak örnekleri alınmış ve bu topraklarda ekim öncesi $\text{NO}_3\text{-N}$ ve $\text{NH}_4\text{-N}$ 'u analizi sonucu dikkate alınarak gübreleme yapılmıştır. Her bir azot dozu için parseller 4 m uzunluğunda, sıra arası 70 cm ve sıra üzeri 16 cm olarak hazırlanmıştır. Her alt parselin arasına, azot dozları arasında kontaminasyonu engellemek amacıyla 2 sıra kenar tesiri ekilmiştir. Ekim, her bir sıra üzeri mesafe için özel hazırlanmış ve işaretlenmiş ekim çıtalı kullanılarak, markörle açılan sıralara elle 11 Nisan 2019'da yapılmıştır. Herhangi bir kuş zararına karşı ekim yerine file çekilmiştir.

Toprak pullukla derin sürümü yapıldıktan sonra, tohum yatağı hazırlamak için kültivatör ve diskli goble ile sürüm yapılmıştır. Diskli goblenin son uygulamasından önce çinko sülfat, fosfor ve potasyumun tamamı toprağa karıştırılarak verilmiştir. Fosforlu gübre olarak Triple Süper Fosfat (8 kg/da saf P_2O_5 olacak şekilde); potasyumlu gübre olarakta Potasyum Sülfat (8 kg/da saf K_2O olacak şekilde); çinko kaynağı olarakta Çinko Sülfat (1.350 kg %22 lik ZnSO_4) kullanılmıştır.

Azot kaynağı olarak Üre (% 46) kullanılmıştır. Her bir azot dozu 3 eşit parçaya bölünerek 1/3'ü ekimle birlikte, kalan kısmı ise çıkış sonrası 2 eşit parçaya bölünerek uygulanmıştır.

Yabancı otlarla mücadele, traktör çapalaması, elle çapalama ve uygun herbisitler kullanılarak yapılmıştır. Görülen yabancı otlara karşı çıkış öncesi 225 g/L Isoxaflutole + 90 g/l Thiencarbazone-methyl + 150 g/L Cyprosulfamide (30 ml/da)aktifine sahip yabancı ot ilacı kullanılmıştır. Ayrıca sap kurdu ve koçan kurduna karşı 50 g/L Lambda- cyhalothrin(100 cc/da) aktifli ilaç kullanılmıştır.

Hasat işlemi, her parselin ortadaki iki sırasında, parsel başından ve sonundan 0.5 m'lik kısım hariç 4 m'lik kısımdaki koçanlar elle koparılarak yapılmıştır. Parselden elde edilen koçanlar kavuzlarından ayrılarak koçan harman makinesinde danelenmiştir.

İncelenen Bitkisel Özellikler

Araştırmada; Anderson ve ark. (1984), Ülger ve ark. (1997), Kara (2006)'nın kullandıkları metodlar uyarınca, bitki boyu (cm), koçan uzunluğu (cm), koçanda dane sayısı (adet/koçan),



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koçanda dane ağırlığı (g/koçan), bin dane ağırlığı (g), dane verimine (kg/da) ilişkin gözlem ve ölçümler yapılmıştır.

Patlama hacmi (cm³/g) : Her bir parselden nem miktarı belirlendikten sonra iki adet 50 g örnek tartılarak sayılmış ve bunlar Gökmen (2004) ve Ertaş ve ark. (2009)'nın belirttiği yöntemler dikkate alınarak elektrikli mısır patlatma cihazında patlatılmış, daha sonra 2000 ml lik dereceli cam silindirde patlayan ürünün hacmi ölçülerek aşağıdaki formüle göre cm³ /g cinsinden hesaplanmıştır.

$$\text{Patlama hacmi (cm}^3\text{/g)} = \frac{\text{Toplam patlama hacmi (cm}^3\text{)}}{\text{Patlatılan ürünün ağırlığı (g)}}$$

Bölünmüş parseller deneme desenine göre kurulan çalışmada, elde edilen verilerin varyans analizleri yapılmış ve uygulamalar arasında görülen farklılıkların gruplandırmaları EGF testine göre yapılmıştır. Analizlerin yapılmasında PC uyumlu Mstat-c istatistik programı kullanılmıştır.

3. BULGULAR VE TARTIŞMA

Çukurova Koşullarında cin mısırının farklı azot dozlarında yetiştirilmesiyle elde edilen bitki boyu, koçan uzunluğu, koçan boyu ve koçanda dane sayısına ilişkin ortalama veriler Çizelge 3'de verilmiştir.



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Çizelge 3. Bitki boyu, koçan uzunluğu, koçanda dane sayısı ve koçanda dane ağırlığına ilişkin ortalama veriler

Azot dozları (kg/da)	Bitki boyu (cm)	Koçan uzunluğu (cm)	Koçanda dane sayısı	Koçanda dane ağırlığı
0	233.3 C	16.67 C	515.00 B	60.19 B
10	238.5 BC	18.86 AB	526.16 B	70.77 AB
15	251.0 AB	18.56 B	526.83 B	72.70 A
20	250.5 AB	18.86 AB	578.00 AB	76.06 A
25	254.8 A	18.87 AB	607.50 A	79.39 A
30	254.1 AB	19.54 A	608.83 A	80.39 A
Çeşitler				
Baharcin	262.6	18.05	509.10	71.83
R997	231.4	19.07	611.66	74.67
EGF %5				
Azot dozu	15.76	0.966	32.94	10.65
Çeşit	öd	öd	öd	öd

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 3), en yüksek bitki boyunun 254.8 cm ile 25 kg/da N dozundan, en düşük bitki boyunun ise 233.3 cm ile 0 kg/da N dozundan elde edildiği görülmektedir. 0 ve 10 kg/da azot uygulamalarında saptanan bitki boyu değerleri birbirine yakın ve sırasıyla 233.3 ve 238.5 cm olurken, 15 kg/da azot dozunda bitki boyunda dikkat çekici bir artış yaşanmış ve 251 cm olmuştur. Farklı azot dozlarının cin mısırında bitki boyu üzerine etkilerine ilişkin saptadığımız bulgular; farklı azot dozlarının mısırdaki bitki boyu üzerinde önemli fark yarattığını belirten Gökmen ve ark. (2001), Alıcı (2005), Kara (2006), Özkan ve Ülger (2011), Can ve Akman (2014)'ün bulguları ile benzerlik göstermektedir.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 4), ortalama olarak koçan uzunluğu en yüksek 19.54 cm ile 30 kg/da N dozunda belirlenirken, en düşük koçan uzunluğun 16.67 cm ile 0 kg/da N dozundan elde edildiği görülmektedir. Farklı azot dozlarının cin mısırında koçan uzunluğu üzerine etkilerine ilişkin saptadığımız bulgular; farklı azot dozlarının mısırdaki koçan uzunluğu üzerinde önemli fark yarattığını belirten Saruhan ve Şireli (2005) ve Kara (2006)'nın bulguları ile benzerlik göstermektedir.

Azot dozu x çeşit interaksyonu yönünden cin mısırı çeşitleri arasında saptanan fark istatistikî düzeyde önemli bulunmuştur. Ortalama verilere göre R-997 çeşidinde saptanan ortalama koçan uzunluğunun (19.07 cm), Baharcin çeşidinde saptanan koçan uzunluğundan (18.05 cm) daha yüksek olduğu Çizelge 4.5'den görülmektedir. Bu bulgular Paradkar ve Sharma (1993); Kaplan



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ve Aktaş (1993); Sezer ve Yanbeyi (1997); Ülger (1998); Alıcı (2005)'in yaptıkları çalışmalarla uyum içerisinde.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 3), koçanda dane sayısı en yüksek 608.83adet/koçanile 30 kg/da N dozundan, en düşük ise 515.00 adet/koçan ile 0 kg/da N dozundan elde edildiği görülmektedir. Diğer azot dozu uygulamalarında saptanan koçanda dane sayısı, bunlar arasında değişim göstermiştir. Çizelge 3'ün izlenmesinden görüleceği gibi, mısırdaki koçandaki dane sayısı değerleri, azot dozuna bağlı olarak artış göstermektedir. Çalışmamızdaki bulgularımıza benzer olarak, Ülger ve ark.(1997), Presterl ve ark. (2003)'nın yapmış oldukları çalışmalarda, artan azot dozlarının koçandaki tane sayısını artırdığını bildirmişlerdir.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 3), en yüksek koçanda dane ağırlığı 80.39 g/koçan ile 30 kg/da N dozundan, en düşük koçanda dane ağırlığı ise 60.19 g/koçan ile 0 kg/da N dozundan elde edildiği görülmektedir. Diğer azot dozu uygulamalarında saptanan koçanda dane ağırlığı değerleri, bunlar arasında değişim göstermiştir. Benzer konuda yürüttüğü araştırmada Gözübenli (1997) azot dozu miktarı arttıkça koçanda dane ağırlığının arttığını ve istatistiksel olarak farkın önemli olduğunu bildirmektedir.

Çukurova koşullarında cin mısırının farklı azot dozlarında yetiştirilmesinden elde edilen bin dane ağırlığı, dane verimi ve patlama hacmine ilişkin ortalama veriler Çizelge 4'de verilmiştir.

Çizelge 4. Bin dane ağırlığı, dane verimi ve patlama hacmine ilişkin ortalama veriler

Azot dozları (kg/da)	Bin dane ağırlığı (g)	Dane verimi (kg/da)	Patlama hacmi (cm ³ /g)
0	144.1 B	258.21 C	27.02 B
10	155.0 A	464.46 B	26.81 B
15	160.0 A	481.12 B	28.59 AB
20	159.3 A	552.97 AB	27.28 B
25	157.4 A	601.06 A	30.68 A
30	157.9 A	622.08 A	30.50 A
Çeşitler			
Baharcin	170.4 A	483.28	28.35
R997	140.8 B	510.01	28.60
EGF %5			
Azot dozu	0.924	110.19	3.111
Çeşit	10.75	öd	öd

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 4), bin dane ağırlığının en yüksek 160.0g ile 15 kg/da N dozundan, en düşük bin dane ağırlığı ise 144.1g ile 0 kg/da N



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dozundan elde edildiği görülmektedir. Diğer azot dozu uygulamalarında saptanan bin dane ağırlığı değerleri, bunlar arasında değişim göstermiştir. Bin tane ağırlığının artan azotlu gübrelerden olumlu etkilendiği gözlenmektedir. Çalışmamızda elde edilen bulgular, Çokkızgın (2002), Amaral ve ark. (2005), Kara (2006)'ın sonuçları ile benzerlik göstermiştir.

Baharcin çeşidinde saptanan ortalama bin dane ağırlığının (170.4 g) R-997 çeşidinde saptanan bin dane ağırlığından (140.8 g) daha yüksek olduğu Çizelge 4'de görülmektedir. Bizim bulgularımızla benzer olarak Belen (1999) ve Özkan (2007) bin tane ağırlığının çeşitlere göre değiştiğini saptamışlardır.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 4), en yüksek dane veriminin 622.08 kg/da ile 30 kg/da N dozundan, en düşük dane veriminin ise 258.21 kg/da ile 0 kg/da N dozundan elde edildiği görülmektedir. Diğer azot dozu uygulamalarında saptanan dane verimi değerleri, bunlar arasında değişim göstermiştir. Dane verimi, mısırdaki en önemli bitkisel özelliklerin başında gelmekte olup, azot dozu arttıkça tane veriminin arttığı, William ve Randall (1997), Schmidt ve ark. (1998), Ülger (1998a), Uslu ve Karaaltın (1999), Allen ve ark. (2000), Öktem ve ark. (2001), Presterl ve ark. (2003), Saruhan ve Şireli (2005) tarafından da rapor edilmiştir.

Farklı azot dozu uygulamalarının etkisi incelendiğinde (Çizelge 9), patlama hacmi en yüksek 30.68 cm³/g ile 25 kg/da N dozundan, en düşük patlama hacmi ise 26.81 cm³/g ile 10 kg/da N dozundan elde edildiği görülmektedir. Diğer azot dozu uygulamalarında saptanan patlama hacmi değerleri, bunlar arasında değişim göstermiştir. Elde ettiğimiz sonuçların aksine Özkan (2007)'de yaptığı çalışmada azot dozları arasında istatistiksel olarak fark görülmediğini belirtmiştir.

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KAYNAKLAR

Alıcı, S., 2005. Kahramanmaraş Koşullarında Farklı Azot Dozları ile Sıra Üzeri Ekim Mesafelerinin II. Ürün Mısır (*Zea mays* L.) Bitkisinde Verim, Verim Unsurları ve Bazı Tarımsal Karakterlere Etkisi Üzerine Bir Araştırma. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Doktora Tezi, 137s, Adana.

Allen T., H., Potter. K. N., and Morrison. J. E., 2000. Tillage System, Fertilizer Nitrogen Rate and Timing Effect on Corn Yields in the Texas Blackland Prairie. *Agron. J.*, 93:1119-1124.

Amaral, C.P.R., Filho, D.F., Farinelli, R., Barbosa, J.K., 2005. Row Spacing, Population Density and Nitrogen Fertilization in Maize. *Rev. Bras. Cienc. Solo* Vol. 29, No:3, Vicosa May/June 2005.

Anderson, E.L., Kamprath, E.J., Moll, R.H., 1984. Nitrogen fertility effects on accumulation, remobilization, and partitioning of nitrogen and dry matter in corn genotypes differing in prolificacy. *Agronomy Journal*, 76; 397-404

Belen, S., 1999. Hibrit ve Populasyon Cinmısırlarının (*Zea mays everta* Sturt.) Tokat-Kazova Koşullarında Verim ve Diğer Bazı Özelliklerinin Belirlenmesi Üzerine Bir Araştırma, GOP.Ü. Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 48 s.

Can, M., Akman, Z. 2014. Uşak Ekolojik Şartlarında Farklı Azot Dozlarının Şeker Mısırın (*Zea mays Saccharata* Sturt.) Verim ve Kalite Özelliklerine Etkisi. Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi 9(2): 93- 101.

Çokkızgın, A., 2001. Kahramanmaraş Koşullarında Farklı Azot Dozları ile Sıra Üzeri Ekim Mesafelerinin II. Ürün Mısır (*Zea mays* L.) Bitkisinde Verim, Verim Unsurları ve Fizyolojik Özelliklere Etkisi. 4. Tarla Bitkileri Kongresi, 17-21 Eylül 2001, S: 215-219, Tekirdağ.

Ertaş, N., Soylu, S., and Bilgiçli, N., 2009. Effect of kernel properties and popping methods on popcorn quality of different corn cultivars. *J. of Food Engin.* 32: 478-496.

Gökmen, S. ve Sakin, M. A., 2001a. Farklı Cin Mısırları (*Zea mays everta*.) Genotiplerinde Verim, Verim Unsurları Ve Bazı Kalite özelliklerinin Belirlenmesi Üzerinde Bir Araştırma, Türkiye 4. Tarla Bitkileri kongresi, 17-21 Eylül 2001, s.253-257, Tekirdağ.

Gökmen, S. ve Sakin, M. A., 2001b. Cin mısırında Patlamayı Etkileyen Faktörler, Ziraat Mühendisliği Dergisi.



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Gökmen, S. 2004. Effect of moisture content and popping method on popping characteristics of popcorn. J. of Food Engin. 65: 357-362.

Gözübenli, H., 1997. Değişik Azot Uygulamalarında II. Ürün Olarak Yetiştirilen Bazı Mısır Genotiplerinin Azot Kullanım Etkinliğinin Saptanması. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri Bölümü Anabilim Dalı Doktora Tezi. 217 s. Adana.

Kaplan, M., ve Aktaş, M., 1993. Amonyum Nitrat ve Üre Gübrelerinin Hibrid Mısırdaki Etkinliklerinin Karşılaştırılması ve Bu Bitkinin Azotlu Gübre İsteğinin Belirlenmesi. Doğa-Tarım. Journal of Agricultural and Forestry, 17; 649-657

Kara, B., 2006. Çukurova Koşullarında Değişik Bitki Sıklıkları ve Farklı Azot Dozlarında Mısırdaki Verim ve Verim Özellikleri ile Azot Alım ve Kullanım Etkinliğinin Belirlenmesi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Doktora Tezi, 162s. Adana.

Ortaç, İ., 1996. Çukurova Üniversitesi Ziraat Fakültesi Toprak Bölümü. BAP. Gelişme Raporu.

Öktem, A., Ülger, A.C. ve Kırtok, Y., 2001. Cin Mısırdaki (ZeamaysevertaSturt.) Farklı Azot Dozları ve Sıra Üzeri Mesafelerinin Tane Verimi ve Bazı Agronomik Özelliklere Etkisi. Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 16(2): 83-92.

Özkan, A., 2007. Çukurova koşullarında değişik azot dozu uygulamalarının iki cin mısırdaki (Zea mays everta Sturt.) çeşidinde tane verimi, tarımsal özellikler ve bazı kalite özelliklerine etkisi, Ç.Ü Fen Bilimleri Enstitüsü, Doktora Tezi.

Özkan, A., Ülger, A., 2011. Çukurova Ekolojik Koşullarında Değişik Azot Dozu Uygulamalarının İki Cin Mısırdaki (Zea mays L. everta Sturt.) Çeşidinde Tane Verimi ve Bazı Tarımsal Özelliklere Etkisi". Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi 21 (2011): 198-208

Paradkar, V. K., and Sharma, R. K., 1993. Effect of Nitrogen Fertilization Maize (Zea mays L) Varieties under Rainfed Condition. Indian Journal of Agronomy, 38(2);303-304.

Presterl, T., G. Seitz, M. Landbeck, E. M. Thiemt, W., and Geiger, H. H., 2003. Improving Nitrogen-Use Efficiency in European Maize. Crop Science 43:1259-1265.

Pricinotto, L. F., Zucareli, C., Fonseca, I. C. B., Oliveira, M. A., Ferreira, A. S., Spolaor, L. T. 2014. Trinexapac-ethyl in the vegetative and reproductive performance of corn. African Journal of Agricultural Research, Nairobi, v. 10, n. 14, p. 1735-1742, 2015. DOI: 10.5897/AJAR2014.8613.



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Russel, W., and Balko, L.G., 1980. Response of Corn İnbred Lines and Single Crosses to Nitrogen Fertilizer. 35 th Annual Corn & Sorgum Research Conference, 48.67.

Saruhan, V., Şireli, H.D., 2005. Mısır Bitkisinde (*Zea mays* L.) Farklı Azot Dozları ve Bitki Sıklığının Koçan, Sap, ve Yaprak Verimlerine Etkisi Üzerine Bir Araştırma. Harran Üniversitesi Ziraat Fakültesi Dergisi, 2005, 9 (2):4553.

Schmidt, J. P., Redulla, C. A., Kluitenberg, G. J., Schrock, M. D., And Taylor, R. K., 1998. Variable N Application for Irrigated Corn: Nitrogen-Use Efficiency and Yield Potential. Plains Soil Fertility Conference. Kansas State University, Manhattan, Kansas.

Sezer, İ., Yanbeyi, S., 1997. Çarşamba Ovasında Yetiştirilen Cin Mısırdaki (*Zea mays* L.) Bitki Sıklığı ve Azotlu Gübrenin Tane Verimi, Verim Komponentleri ve Bazı Bitkisel Karakterler Üzerine Etkisi. O.M.Ü., Ziraat Fakültesi, Tarla Bitkileri Bölümü. Türkiye II. Tarla Bitkileri Kongresi. 22-25 Eylül, Samsun, (128-133s).

Sönmez, F., 2001. Azotun Bazı Mısır Çeşitlerinde Tane Verimi ve Verim Komponentlerine Etkisi. Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi, 18(1), 107-112.

Uslu, Ö. S., ve Karaaltın, S., 1999. Kahramanmaraş Koşullarında II. Ürün Olarak Yetiştirilen Mısır (*Zea mays* L) Bitkisinde Farklı Azot Dozlarının Büyüme ve Fizyolojik Özelliklere Etkisi. Türkiye III. Tarla Bitkileri Kongresi, 15-18 Kasım 1999, Adana 434-439.

Ülger, A. C., Ibriki, H., Cakir, B., Ve Güzel, N., 1997. Influence of Nitrogen Rates and Row Spacing on Corn Yield, Protein Content and Other Plant Parameters. J. of Plant Nutrition. 20:1697-1709.

Ülger, A. C., 1998a. Farklı Azot Dozu ve Sıra Üzeri Mesafelerinin Patlak Mısırdaki (*Zea mays* everta Sturt) Tane Verimi ve Bazı Tarımsal Özelliklere Etkisi. Ç.Ü.Z.F. Dergisi, 13 (1) 155-164, Adana.

Ülger, A. C., 1998b. Mısır Bitkisinde Farklı Sıra Arası ve Sıra Üzeri Uzunluklarının Tane Verimi ve Bazı Tarımsal Özelliklere Etkisi. Ç.Ü.Z.F. Dergisi, 13 (3): 95 -104, Adana

William, J. E., and Randall, G. W., 1997. Fate of Fertilizer Nitrogen an Affected by Time and Rate of Application on Corn. Soil Sci. Soc. Am. J. 61:1695-1703

Ziegler K.E., 2001. Specialty Corn, Popcorn, Ed:Halluer A.R. pp:206.



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**SİVAS EKOLOJİK KOŞULLARINDA BAZI KIŞLIK ARPA (*Hordeum vulgare* L.)
ÇEŞİTLERİNİN ADAPTASYON YETENEKLERİNİN BELİRLENMESİ**

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ÖZET

Dünya’da buğday, mısır ve çeltikten sonra dördüncü sırada kültürü yapılmakta olan arpa, Türkiye’de buğdaydan sonra ikinci sırada yer almaktadır. Ülkemizde arpa üretiminin % 90’ı hayvan yemi olarak kullanılırken yaklaşık %5’i ise gıda, malt ve bira endüstrisinin ham maddesi olarak kullanılmaktadır. Türkiye, dünya üzerinde arpanın önemli gen merkezlerinden birisidir. Türkiye’nin en önemli tahıl yetiştirme alanı olan Orta Anadolu ve Geçit Bölgelerinde büyük oranda kışlık ekim yapılır ve verimi etkileyen en önemli etkilerin başında iklimsel farklılıklar gelir. Araştırmada, Sivas ili ekolojik koşullarında kışlık yetiştiriciliğe en uygun arpa (*Hordeum vulgare* L.) çeşidini belirleyebilmek amacıyla on bir farklı arpa (Konevi-89, Aydanhanım, Tokak 157/37, Karatay-94, Larende, Kral 97, Baronesse, Arta, Bolayır, Sladoran ve Dicktoo) genotipi kullanılmıştır. Deneme, tesadüf blokları deneme desenine göre üç tekerrürlü olacak şekilde yürütülmüştür. Araştırmada bitki boyu (BB), çıkışta bitki sayısı (ÇBS), kış sonrası (mart ayında) bitki sayısı (MRTS), Kış sonrası (mayıs ayında) bitki sayısı (MYSS) ve tane verimi (TV) özellikleri incelenmiştir. Elde edilen ortalama veriler üzerinden yapılan varyans analizinde, incelenen bütün özelliklerin istatistiksel olarak 0.01 önem düzeyinde anlamlı olduğu saptanmıştır. Çalışma sonucunda çeşitlere ait ortalama bitki boyu 74.29 cm, çıkışta bitki sayısı 195.58 adet, kış sonrası (mart ayında) bitki sayısı 170.21 adet, kış sonrası (mayıs ayında) bitki sayısı 165.49 adet ve tane verimi 43.57 kg/da olarak elde edilmiştir. Çeşit ortalamlarına göre en yüksek bitki boyu (83.33 cm) Aydanhanım çeşidinden, çıkışta bitki sayısı (217.67 adet) Aydanhanım çeşidinden, kış sonrası (mart ayında) bitki sayısı (194.00 adet) Konevi-89 çeşidinden, kış sonrası (mayıs ayında) bitki sayısı (192.00 adet) Aydanhanım çeşidinden ve tane verimi (74.07 kg/da) Konevi-89 çeşidinden elde edilmiştir. Araştırma bulgularına göre Sivas ekolojik koşullarında kışlık yetiştiriciliğe uygun olabilecek on bir arpa genotipi arasında,



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Konevi-89 ve Aydanhanım çeşitleri, bazı agro-morfolojik özellikler açısından daha üstün performansa sahip oldukları saptanmıştır. Araştırmada materyal olarak kullanılan arpa genotiplerinin Sivas iklim koşullarında kışlık yetiştiricilik için değerlendirilebileceği, ancak iklimsel değişiklikler ve elde edilen bulguların güvenilirliği açısından çalışmanın daha uzun yıllar yürütülmesi gerektiği fikri oluşmuştur.

Anahtar Kelimeler: Arpa, kışlık ekim, tane verimi, bitki sayısı, bitki boyu



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**DETERMINATION OF THE ADAPTATION PERFORMANCE OF SOME WINTER
BARLEY (*Hordeum vulgare* L.) VARIETIES IN SİVAS ECOLOGICAL CONDITIONS**

ABSTRACT

Barley, which is cultivated in the fourth place in the world after wheat, corn and paddy, is in the second place after wheat in Turkey. While 90% of barley production in our country is used as animal feed, approximately 5% is used as raw material for food, malt and beer industry. Turkey is one of the important gene centers of barley in the world. In Central Anatolia and the Transition Regions, which are the most important grain growing areas of Turkey, a large amount of winter planting is done and climatic events are the most important factors affecting the yield. In the study, eleven different barley (*Hordeum vulgare* L.) (Konevi-89, Aydanhanım, Tokak 157/37, Karatay-94, Larende, Kral 97, Baronesse, Arta, Bolayır, Sladoran and Dicktoo) cultivars were used. The experiment was conducted in a randomized block design with three replications. In the study, plant height (BB), number of plants at emergence (ÇBS), number of plants (MRTS) in March, number of plants (MYSS) and grain yield (TV) in May were examined. In the analysis of variance performed on the mean data obtained, it was determined that all the analyzed features were statistically significant at the 0.01 significance level. As a result of the study, the average plant height of the cultivars was 74.29 cm, the number of plants at emergence was 195.58, the number of plants in March was 170.21, the number of plants in May was 165.49 and the grain yield was 43.57 kg/da. According to the average of varieties, the highest plant height (83.33 cm) is from Aydanhanım variety, the number of plants at emergence (217.67 units) is from Aydanhanım variety, the number of plants in March (194.00 units) is from Konevi-89 variety, the number of plants in May (192.00 units) is from Aydanhanım variety and grain yield (74.07 kg/da) were obtained from Konevi-89 variety. According to the research findings, Konevi-89 and Aydanhanım varieties were found to have superior performance in terms of some agro-morphological characteristics among the eleven barley genotypes suitable for winter cultivation in Sivas ecological conditions. It was thought that the barley genotypes used as material in the research could be evaluated for winter cultivation in Sivas climate conditions, but the study should be carried out for many years in terms of climatic changes and the reliability of the findings.

Keywords: Barley, winter sowing, grain yield, number of plants, plant height



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1.GİRİŞ

Türkiye çok sayıda bitki türünün gen merkezi konumundadır. Ayrıca tarımı yapılan bitkilerin çeşitliliği bakımından dünyanın en zengin ülkelerinden biridir. Türkiye'yi bitki çeşitliliği bakımında bu kadar önemli yapan nedenler; iklim farklılıkları, topografik çeşitlilikler, jeolojik çeşitlilikler, deniz, göl, akarsu, gibi değişik su ortamı çeşitlilikleri, yükselti farkları ve ekolojik farklılıklardır (1,2). Arpa (*Hordeum vulgare* L.); Poaceae (*Gramineae*) familyasından serin iklim tahılları içerisinde rejenerasyon kabiliyeti en yüksek olan tür olup, yazlık ve kışlık ekimi yapılabilmektedir (3). Arpa, dünya genelinde mısır, buğday ve çeltikten sonra, Türkiye'de ise buğdaydan sonra en çok ekim alanı ile üretimi yapılan en önemli tahıl cinsidir. Arpa çoğunlukla serin iklim tahılıdır (4). Ülkemizde her yıl işlenen alanlar, toplam tahıl ekili alanlar ve serin iklim tahılı ekili alanlar içerisindeki arpa oranı dünya değerlerine göre daha yüksektir. Buradan Türkiye'de arpanın dünyaya göre daha fazla oranda ekilip üretilen bir serin iklim tahılı olduğu açıkça anlaşılmaktadır (5).

Geçmiş yıllardan beri insan beslenmesinde kullanılan arpa, kültüre alınan ilk bitkilerden biridir. Tanesi % 9-15 oranında protein ve % 50-70 oranında nişasta içerdiği için dünya genelinde ve ülkemizde yemlik ve maltlık olmak üzere iki temel amaç için yetiştirilmekte ve ıslah edilmektedir (6,7,9). Dünya ve ülkemiz ekonomisinin başlıca gelir kaynağını oluşturan tahıl grubu içerisinde yer almaktadır. Hayvan yemi olarak tüketilen tahıllar içerisinde yem değeri bakımından arpa en üstün olanıdır (8). Arpa farklı amaçlarla kullanılan sağlıklı bir tahıl olması ve birçok gıdada katkı olarak kullanılabilme özelliği nedeniyle geleceğin tahılı olarak nitelendirilmekte ve arpanın insan beslenmesinde kullanım olanaklarının artırılması için çalışmalar yapılmaya devam edilmektedir (9). Arpada yetiştirme teknikleri ile tane verimi arasında, tane verimi ile de agronomik karakterler arasında önemli ve olumlu interaksiyon olduğu belirtilmiştir (10). Arpanın kışlık olarak yetiştiriciliğinde donmaya karşı tolerans, esas olarak düşük sıcaklığın kontrolü ile geliştirilebilmektedir. Dona tolerans, kış mevsimine dayanıklılığının ana bileşenidir. Kışlık arpa, donma zararına karşı çok duyarlı olup, şiddetli kışlar bu üründe yoğun kış zararına neden olabilmektedir. Özellikle ılık ve yağışlı iklimden sonra ve bitkiler karla kapalı olmadığında, hafif donlar bile çok tehlikeli olabilmektedir (11). Bu nedenle, erkenci, verimi yüksek aynı zamanda hastalıklara dayanıklı ve bölge ekolojisine uygun çeşitlerin geliştirilmesi veya ülke genelinde geliştirilmiş yazlık ve alternatif arpa genotiplerinin adaptasyon kabiliyetlerinin denenmesi faydalı olacaktır.



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Arpa ülkemizde çok değişik ekolojilerde yetiştirildiği için çeşitlerin verim performansları da çevre koşullarına göre değişmektedir. Birim alandan bitkisel üretimin artırılması ancak, üretim bölgesinin ekolojik koşullarına uyum sağlayan çeşitlerin bulunması ve uygun agronomik uygulamaların saptanması ile sağlanabilmektedir (12). Kışları soğuk ve sert geçen İç Anadolu ve Doğu Anadolu bölgelerimizde, kışlık yetiştiriciliğe uygun arpa çeşitlerinin belirlenmesi ve geliştirilmesi büyük önem arz etmektedir. Bu araştırma, onbir adet arpa çeşidinin (Konevi-89, Aydanhanım, Tokak 157/37, Karatay-94, Larende, Kral 97, Baronesse, Arta, Bolayır, Sladoran ve Dicktoo) Sivas ekolojik koşullarında bazı morfolojik özellikler bakımından incelenerek adaptasyonunun belirlenmesi amacıyla yürütülmüştür.

2.MATERYAL ve METOD

Araştırma Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi, Tarımsal Ar-Ge Merkezinde 2020-21 yetiştirme sezonunda yürütülmüştür. Denemede 11 arpa genotipi materyal olarak kullanılmıştır. Tarla denemeleri, tesadüf blokları deneme desenine göre 3 tekrarlamalı olarak yürütülmüştür.

Uzun yıllar ortalamasına göre yetiştirme yılında yağışların aylara göre dağılımı düzensiz ve ortalamanın altında gerçekleşmiştir. Ekim sonrası düzenli çimlenme-çıkış sağlanarak bitkiler 3-4 yapraklı halde kışa girmiştir. En düşük sıcaklıkların yaşandığı Aralık (-8.6°C), Ocak (-15.8°C) ve Şubat (-18.4°C) aylarında, kar yağışı mevsim normallerinin altında gerçekleştiği için bitkiler bu dönemi kar örtüsüz bir şekilde geçirmiştir. Çıkış sonrası sonbaharda bir bitki sayımı ve kış sonrası ilkbaharda iki kez bitki sayımı yapılmıştır.

Ekim işlemleri 25 Ekim 2020 tarihinde el ile yapılmış, her parsel 1.2 m x 4.0 m boyutlarında olmak üzere 20 cm aralıklı 6 bitki sırası içermiştir. Parseller, 8 kg/da azot ve 5 kg/da P_2O_5 olacak şekilde gübrelenmiş, fosforun tamamı ile azotun yarısı ekimle birlikte, azotun diğer yarısı ise ilkbaharda sapa kalkma başlangıcında elle serpilerek uygulanmıştır.

Parsellerde gelişen yabancı otlar elle yolunarak uzaklaştırılmıştır. Hasat olgunluğu döneminde, parsel kenarlarından birer sıra, parsel uçlarından 0.5 m'lik kısımlar ayrılmış, geri kalan bitkiler orakla hasat edilmiştir. Üç gün tarlada kurutulan bitkiler tartılarak toplam verim belirlenmiş, daha sonra harman makinesi ile harman edilmiştir.

Araştırmada, bitki boyu (cm), çıkışta bitki sayısı (adet), mart ayında bitki sayısı (adet), mayıs ayında bitki sayısı (adet) ve tane verimi (kg/da) gibi agro-morfolojik özellikler incelenmiştir. İstatistiki analizler SAS istatistik programında Proc GLM prosedürüne göre yapılmıştır. Ayrıca



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Pearson korelasyonunu ve biplot analizi XLSTAT (www.xlstat.com) istatistik paket programı kullanılarak istatistik analize tabi tutulmuştur.

Tablo 1. Sivas ili 2020-2021 yetiştirme sezonuna ait iklim verileri.

	Yıl	Aylar										Toplam veya Ortalama
		Ekim	Kasım	Aralık	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	
Yağış (mm)	2020-	8.2	28.6	21.9	75.2	15.3	60.0	18.5	22.3	34.8	6.0	276.8
	2021	21.5	31.9	28.8	48.8	39.4	51.3	42.1	32.2	38.8	9.2	343.8
Uzun Yıllar												
En Düşük Sıcaklık	2020-	2.6										
	2021	28.1										
En Yüksek Sıcaklık	2020-	14.7	-6.7	-8.6	-15.8	-18.4	-7.4	-1.6	-1.8	5.6	11.2	-4.1
	2021	13.4	18.6	12.8	18.6	15.3	14.1	25.7	33.5	31.7	39.2	23.7
Ortalama Sıcaklık	2020-		4.4	1.7	0.7	0.0	2.7	10.9	15.9	15.8	21.9	8.9
	2021		5.6	2.4	-0.6	1.1	5.4	9.9	15.3	18.3	21.6	11.3
Uzun Yıllar												
Nispi Nem (%)	2020-	31.6	68.1	75.2	69.5	67.6	65.1	52.7	44.4	52.9	46.1	57.3
	2021	52.4	65.6	68.6	70.1	60.2	66.3	61.0	60.6	54.5	51.9	55.5
Uzun Yıllar												

Tablo 1’den izlendiği üzere, araştırmanın yürütüldüğü Ekim 2020-Temmuz 2021 ayları arasında en düşük sıcaklık değeri 2021 yılı şubat ayında (-18.4°C); en yüksek sıcaklık değeri ise 2021 yılı temmuz ayında (39.2°C) saptanmıştır. Denemenin yürütüldüğü yetiştirme yılında en düşük ortalama nispi nem değeri 2020 yılı %31.6 değeri ile Ekim ayında, en yüksek ortalama nispi nem değeri ise yine 2020 yılı %75.2 değeri ile aralık ayında saptanmıştır. Araştırma sürecinde gerçekleşen toplam yağış miktarlarına bakıldığında ise en düşük değer 2021 yılı temmuz ayında (6.0 mm); en yüksek değer ise 2021 yılı ocak ayında (75.2 mm) saptanmıştır.

3.BULGULAR ve TARTIŞMA

Arpa çeşitlerinde incelenen bitki boyu (cm), çıkışta bitki sayısı (adet), mart ayında bitki sayısı (adet), mayıs ayında bitki sayısı (adet) ve tane verimine (kg/da) ait veriler Tablo 2’de verilmiştir.



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Tablo 2. Arpa çeşitlerinde incelenen bitki boyu (cm), çıkışta bitki sayısı (adet), mart ayında bitki sayısı (adet), mayıs ayında bitki sayısı (adet) ve tane verimine (kg/da) ait veriler

Genotip	BB	ÇBS	MRTS	MYSS	TV
	**	**	**	**	**
Konevi-89	77.37 b	214.33 a	194.00 a	191.33 a	74.07 a
Aydanhanım	83.33 a	217.67 a	193.33 a	192.00 a	63.55 bc
Tokak	72.27 cd	201.67 b	183.00 b	182.00 b	66.76 ab
Karatay-94	73.20 c	197.67 bc	177.33 c	175.67 c	57.71 c
Larende	78.00 b	195.33 b-d	164.67 f	161.67 e	44.33 d
Kral 97	97.30 e	191.67 cd	169.33 e	166.33 d	40.24 de
Baronesse	72.10 cd	196.67 bc	162.33 fg	160.00 e	33.89 ef
Arta	69.00 de	185.00 ef	172.67 d	156.00 f	28.31 fg
Bolayır	72.27 cd	189.33 de	160.67 g	154.00 f	28.96 f
Sladoran	72.93 c	182.67 f	142.33 ı	140.33 g	20.76 g
Dicktoo	79.37 b	179.33 f	152.67 h	141.00 g	20.64 g
Ortalama	74.29	195.58	170.21	165.49	43.57
CV (%)	2.90	1.95	1.10	1.34	10.96

BB:Bitki boyu, ÇBS: Çıkışta bitki sayısı, MRTS: mart ayında bitki sayısı, MYSS: mayıs ayında bitki sayısı, TV: tane verimi. **:0,01 düzeyinde önemli

Tablo 2'e göre incelenen özellikler çeşitler arasında istatistiki olarak önemli derecede farklılık göstermiştir. Çalışmada materyal olarak kullanılan arpa çeşitlerinde bitki boyu 69.00-97.30 cm, çıkışta bitki sayısı 179.33-217.67 adet arasında değişim göstermiştir (Tablo 2). Bafra ovası ekolojik koşullarında 12 arpa çeşidi ile yapılan bir çalışmada ortalama bitki boyu 85.2 cm olarak saptanmıştır (13). Farklı arpa çeşitleri ile verim özelliklerini belirlemek için yapılan başka bir çalışmada ortalama bitki boyu 107.4 cm olarak belirlenmiştir (14). Benzer çalışmalardan elde edilen bulgular verilerimiz ile örtüşmektedir. Tablo 2 incelendiğinde çeşitler arasında mart ayında bitki sayısı en yüksek 194.00 adet ile Konevi-89 çeşidinde, en düşük 142.33 adet ile Sladoran çeşidinden elde edilmiştir. Çeşitler arasında mayıs ayında bitki sayısı ortalama 165.49 adet olarak saptanmış olup en yüksek bitki sayısı 192.00 adet ile Aydanhanım çeşidinden elde edilmiştir. Sonbaharda çıkışlar tamamlandığında parsellerde yapılan bitki sayımlarında, en yüksek çıkış Aydanhanım çeşidinde %90.0 oranında gözlenmiştir. Bir başka deyişle kış zararına bağlı en düşük oranda bitki ölümü, Aydanhanım çeşidinde %9.30 olarak belirlenmiştir. İlkbaharda mart ve mayıs ayı olmak üzere parsellerde iki kez bitki sayımı yapılmıştır. Mart ayında en yüksek oranda çıkış Konevi-89 çeşidinde %80.83 oranında gözlenirken, Mayıs ayında en yüksek oranda çıkış Aydanhanım çeşidinde %80.00 oranında gözlenmiştir. Adak (1991) Ankara ekolojik koşullarında arpa çeşitleri ile yaptığı çalışmada 1 m'lik sıralarda kış öncesi bitki sayısının 45.67-49.67 adet arasında ve kıştan çıkışta bitki sayısının 2.00-49.33 adet



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arasında değiştiğini rapor etmiştir (15). Bangladeş ekolojik koşullarında arpa ile farklı ekim sıklıklarında yapılan bir araştırmada, tohum sıklığı arttıkça metrekaresindeki bitki sayısının ve bitki boyunun arttığı belirtilmiştir (16). Ankara ekolojik koşullarında iki arpa çeşidi ile yürütülen başka bir çalışmada, her iki çeşitte de tohum sıklığı arttıkça metrekaresinde bitki sayısının arttığı belirtilmiştir (17). Çeşitler arasında, en yüksek tane verimi 74.07 kg/da ile Konevi-89 çeşidinde gözlenirken, en düşük tane verimi 20.64 kg/da ile Dicktoo çeşidinde gözlenmiştir (Tablo 2). Bafra ovası ekolojik koşullarında 12 arpa çeşidi ile yapılan bir çalışmada ortalama tane verimi 319.7 kg/da olarak saptanmıştır (13). Farklı arpa çeşitleri ile verim özelliklerini belirlemek için yapılan başka bir çalışmada ortalama tane verimi 571 kg/da olarak belirlenmiştir (14). Yapılan benzer çalışmalarda arpada tane verimi, çalışmadan elde ettiğimiz bulgulara göre daha yüksek saptanmıştır. Yöremiz koşullarında, en düşük sıcaklıkların yaşandığı Aralık (-8.6°C), Ocak (-15.8°C) ve Şubat (-18.4°C) aylarında, kış periyodu kar örtüsüz geçmiştir. Kış periyodunu kar örtüsüz geçiren bitkilerin soğuğa tolerans düzeylerinin azaldığı ve bu durumun bitki ölümlerini arttırdığı dolayısıyla tane verimini olumsuz yönde etkilediği fikrini uyandırmaktadır.

Tablo 3: Arpa çeşitlerinde incelenen özelliklere ait korelasyon katsayıları

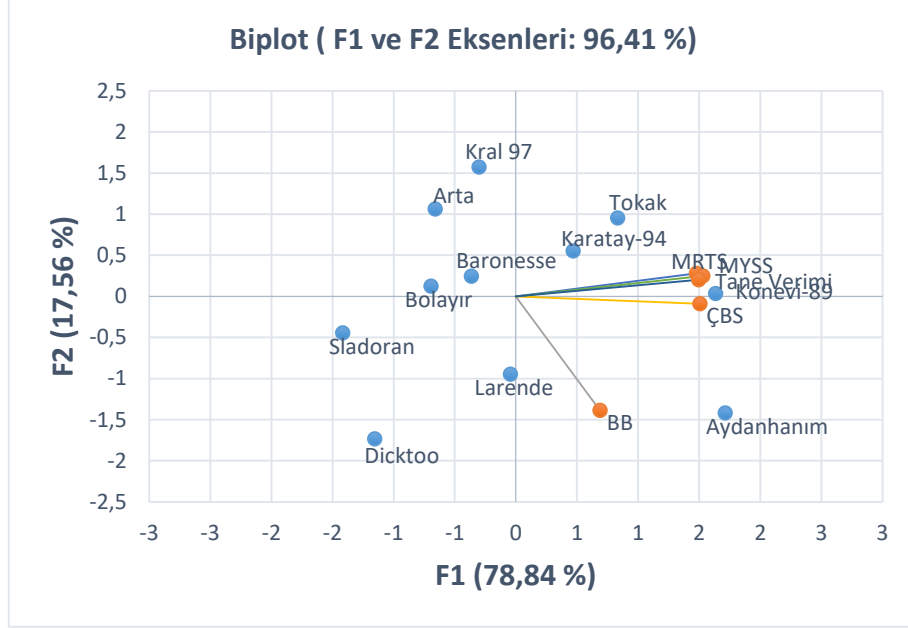
Özellikler	BB	ÇBS	MRTS	MYSS	TV
BB	1	0.470	0.271	0.293	0.314
ÇBS		1	0.881**	0.948**	0.905**
MRTS			1	0.963**	0.909**
MYSS				1	0.968**
TV					1

BB:Bitki boyu, ÇBS:Çıkışta bitki sayısı, MRTS: mart ayında bitki sayısı, MYSS: mayıs ayında bitki sayısı, TV:tane verimi. **:0,01 düzeyinde önemli

Tablo 3'te incelenen özellikler arasındaki korelasyon katsayıları verilmiştir. Çıkışta bitki sayısı ile mart ayında bitki sayısı (0.881**), mayıs ayında bitki sayısı (0.948**) ve tane verimine (0.905**) arasında pozitif ve anlamlı bir korelasyon saptanmıştır. Bitki boyu ile incelenen diğer özellikler arasında pozitif korelasyon saptanmıştır fakat anlamlı bulunmamıştır (Tablo 3).



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BB:Bitki boyu, ÇBS:Çıkışta bitki sayısı, MRTS: mart ayında bitki sayısı, MYSS: mayıs ayında bitki sayısı, TV:tane verimi.

Şekil 1: Çeşitler ile incelenen özellikler arasındaki ilişkiyi gösteren biplot grafiği

Çeşitler ve incelenen özellikler arasındaki ilişkiyi görsel olarak incelemek ve değerlendirmek amacıyla oluşturulan biplot grafiği şekil 1’de verilmiştir. %78.84’ünü F1’in (Ana Bileşen 1) ve %17.56’sını F2’nin (Ana Bileşen 2) temsil ettiği grafik, varyasyonun toplam %94.41’ini açıklamaktadır (Şekil 1). İncelenen özelliklerden mart ayında bitki sayısı, mayıs ayında bitki sayısı ve tane verimine aynı grupta yer almış olup, bu grupta Tokak, Karatay-94 ve Konevi-89 çeşitleri yer almıştır. Şekil 1’e bakıldığında, bitki boyu ve çıkıştaki bitki sayısının yer aldığı grupta ön plana çıkan çeşit Aydanhanım olmuştur. Şekil 1’e göre materyal olarak fazla gen kaynakları kullanılarak yapılacak çalışmalarda bitki boyu ile pozitif bir korelasyona sahip olan Larende ve Aydanhanım çeşitlerinin kullanılmasının ve aynı şekilde ilkbahar ve sonbahar dönemlerinde çıkıştaki bitki sayısı ile pozitif bir ilişkiye sahip olan Konevi-89, Karatay-94 ve Tokak çeşitlerinin kullanılmasının daha faydalı olacağı düşünülmektedir.

4. SONUÇ

Kışları soğuk ve sert geçen İç Anadolu ve Doğu Anadolu bölgelerimizde, kışlık yetiştiriciliğe uygun arpa çeşitlerinin belirlenmesi ve geliştirilmesi büyük önem arz etmektedir. Sivas ekolojik koşullarında kışlık yetiştiriciliğe uygun olabilecek on bir arpa genotipi arasında,



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Konevi-89 ve Aydanhanım çeşitleri, bazı agro-morfolojik özellikler açısından daha üstün performansa sahip oldukları saptanmıştır. Araştırmada materyal olarak kullanılan arpa genotiplerinin Sivas iklim koşullarında kışlık yetiştiricilik için değerlendirilebileceği, ancak iklimsel değişiklikler ve elde edilen bulguların güvenilirliği açısından çalışmanın daha uzun yıllar yürütülmesi gerektiği fikri oluşmuştur.



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KAYNAKLAR

- Atalay, İ. (1994). *Türkiye vejetasyon coğrafyası*. Ege Üniversitesi Basımevi.
- Çelik, S., 2003. *Centaurea L. Cinsi psephelloidea (Boiss) sosn. Seksiyonuna ait türlerin ekolojik özellikleri*. Doktora tezi. Anadolu Üniversitesi Fen Bilimleri Enstitüsü. Eskişehir.
- Öztürk, İ., Avcı, R. ve Kahraman, T., 2007, Trakya Bölgesinde yetiştirilen bazı arpa (*Hordeum vulgare L.*) çeşitlerinin verim ve verim unsurları ile bazı kalite özelliklerinin belirlenmesi, U. Ü. Ziraat Fakültesi Dergisi, 21 (1), 59-68.
- Baum, M., Van Korff, M., Guo, P., Lakew, B., Udupa, S.M., Sayed, H., Choumane, W., Grando, S. and Ceccarelli, S. 2007. Molecular approaches and breeding strategies for drought tolerance in barley. *Genomic Assisted Crop Improvement*, 2; 51–79.
- Geçit, H. H. 2016. *Serin İklim Tahılları (Buğday, Arpa, Yulaf, Triticale)*. Ankara Üniversitesi Ziraat Fakültesi yayınları: 1640, Ders Kitabı, Ankara, 822 s.
- Kılınç, M., Kırtok, Y. ve Yağbasanlar, T., 1992, Çukurova koşullarına uygun arpa çeşitlerinin geliştirilmesi üzerine araştırmalar. II, Arpa-Malt Semineri (s 205218), 25-27.
- Waszkiewicz-Robak, B., Karwowska, W. ve Swiderski, F., 2005, Beta-glukan jako składnik żywności funkcjonalnej, *Bromatologia i Chemia Toksykologiczna*, 3 (38), 301-306
- Sayım, İ., Akar, T., Ergün, N. ve Aydoğan, S., 2013, Ülkemizde arpa ıslahı çalışmaları ve tohumculuğu., *TÜRKTOB*, 2 (8), 14-19.
- Köten, M., Ünsal, S. ve Atlı, A., 2013, Arpanın insan gıdası olarak değerlendirilmesi, *Türk Tarım–Gıda Bilim ve Teknoloji Dergisi*, 1 (2), 51-55.
- Tomer, S. B. ve Prasad, G. H., 1999, Path coefficient analysis in Barley, Department of Agricultural Botany, S.D.J. Pos Graduate College Chandesar Azamgarh, India R., Vol (8), 1-2.
- Tantau, H., Balko, C., Brettschneider, B., Melz, G. and Dorffling, K. 2004. Improved frost tolerance and winter survival in winter barley (*Hordeum vulgare L.*) by in vitro selection of proline over accumulating lines. *Euphytica*, 139; 19–32.
- İmamoğlu, A., & Yılmaz, N. (2012). Bursa Ekolojik Koşullarında Bazı Arpa (*Hordeum vulgare L.*) genotiplerinin verim ve bazı kalite özelliklerinin belirlenmesi. *Anadolu Ege Tarımsal Araştırma Enstitüsü Dergisi*, 22(2), 13-36.
- Sirat, A., & Sezer, İ. (2009). Bafra Ovası Koşullarına Uygun Arpa (*Hordeum Vulgare L.*) Çeşitlerinin Belirlenmesi. *Anadolu Tarım Bilimleri Dergisi*, 24(3), 167-173.



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Ergün, N., Aydoğan, S., Sayım, İ., Karakaya, A., & Oğuz, A. Ç. (2017). Arpa (*Hordeum vulgare* L.) köy çeşitlerinde tane verimi ve bazı tarımsal özelliklerin incelenmesi. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, 26(2), 180-189.

Adak, M. S. (1991). Ankara koşullarında arpada (*Hordeum vulgare* L.) kış öncesi büyüme ve gelişmenin verim ve bazı bitki karakterlerine etkisi.

Torofder, G.S. and Hossain, M.A. 1991. Effect of nitrogen and seed rate on the yield of barley under rainfed condition. *Annals of Bangladesh Agricultural*.

Kaydan, D. 2003. Arpada ekim yöntemleri ve ekim sıklıklarının verim ve verim öğeleri üzerine etkileri. Ankara Üniv. Fen Bilimleri Ens. Doktora Tezi, 134 say., Ankara.



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SİVAS EKOLOJİK KOŞULLARINDA BAZI EKMEKLİK BUĞDAY (*Triticum aestivum* L.) ÇEŞİTLERİNİN VERİM VE VERİM UNSURLARININ BELİRLENMESİ

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ÖZET

Dünyada, artan nüfusa paralel olarak buğday tüketim miktarı artmıştır ancak, ekim alanları iklimsel değişiklikler, tarım alanlarının amaçları dışında kullanımına ve sulamaya açılmasına bağlı olarak giderek azalmaktadır. Ülkemizde 2020 yılında 6.92 milyon ha alanda toplam 20.5 milyon ton buğday üretimi yapılmıştır. Üretilen bu miktarın 16.5 milyon tonu ekmeklik buğdaydır. Buğday üretimimizin arttırılabilmesi için birim alandan yüksek verim alınmasına, biyotik ve abiyotik stres koşullarına dayanıklı, üstün kaliteli ve yüksek verimli çeşitlerin ıslahı ve uygun kültürel teknikler kullanarak yetiştirmesine bağlıdır. Araştırmada, Sivas ili ekolojik koşullarına en uygun ekmeklik buğday çeşidini belirleyebilmek amacıyla farklı yıllarda tescil edilmiş on yedi ekmeklik buğday (Altay, Gerek, Sönmez 2001, Mesut, Ahmet ağa, Nacibey, Harmankaya, Eraybey, Konya 2002, Karahan 99, Kınacı 97, Dağdaş 94, Es26, Ekiz, Bezostaja, Reis ve Müfitbey) çeşidi kullanılmıştır. Deneme tesadüf blokları deneme desenine göre 4 tekerrürlü olacak şekilde yürütülmüştür. Araştırmada bitki boyu (BB), başak uzunluğu (BU), başakçık sayısı (BS), başakta tane sayısı (BTS), başakta tane ağırlığı (BTA), bin tane ağırlığı (BinTA) ve tane verimi (TV) özellikleri incelenmiştir. BTA haricinde incelenen diğer özellikler istatistiki olarak önemli bulunmuştur. Çalışma sonucunda çeşitlere ait ortalama BB 66.60 cm, BU 8.25 cm, BS 15.04 adet, BTS 36.24 adet, BTA 1.18 g, BinTA 32.55 g, TV 269.25 kg/da olarak saptanmıştır. Çeşit ortalamalarına göre en yüksek BB (82.80 cm) Dağdaş 94 çeşidinden, BU (9.32 cm) Karahan 99 çeşidinden, BS (16.80 adet) Ahmet ağa çeşidinden, BTS (42.20 adet) Ahmet ağa çeşidinden, BTA (1.39 g) Konya 2002 çeşidinden, BinTA (37.77 g) Dağdaş 94 çeşidinden ve TV (328.25 kg/da) Dağdaş 94 çeşidinden elde edilmiştir. İncelenen özellikler arasındaki korelasyon analizinde, TV ile BU arasında negatif, BS, BTS, BTA ve BinTA arasında pozitif bir ilişki olduğu ancak istatistiksel olarak önemsiz olduğu saptanmıştır. Ayrıca, BinTA ile BU, BS ve BTS arasında pozitif bir ilişki olmasına karşın, istatistiksel olarak anlamsız olduğu belirlenmiştir. Bunun yanında diğer özellikler arasında pozitif ve istatistiksel olarak önemli ve anlamlı bir ilişki olduğu saptanmıştır.

Anahtar kelimeler: Ekmeklik buğday, tane verimi, çeşit, morfolojik özellikler, agronomik özellikler



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**DETERMINATION OF YIELD AND YIELD COMPONENTS OF SOME BREAD
WHEAT (*Triticum aestivum* L.) VARIETIES IN SİVAS ECOLOGICAL CONDITIONS**

ABSTRACT

In the world, the amount of wheat consumption has increased in parallel with the increasing population, but the cultivation areas are gradually decreasing due to climatic changes, use of agricultural lands for purposes other than their intended use and open to irrigation. In our country, a total of 20.5 million tons of wheat was produced in an area of 6.92 million hectares in 2020. 16.5 million tons of this amount produced belongs to bread wheat. In order to increase our wheat production, it depends on obtaining high yield from the unit area, breeding high quality and high yielding varieties resistant to biotic and abiotic stress conditions and using appropriate cultural techniques. In the research, seventeen bread wheat (Altay, Gerek, Sönmez 2001, Mesut, Ahmet ağa, Nacibey, Harmankaya, Eraybey, Konya 2002, Karahan 99, Kınacı 97, Dağdaş 94, Es26, Ekiz, Bezostaja, Reis and Müfitbey) varieties registered in different years were used in order to determine the most suitable bread wheat variety for the ecological conditions of Sivas province. The experiment was carried out in a randomized complete block design with 4 replications. In the study, plant height (PH), spike length (SL), spikelet number (SN), grain number per spike (GNS), grain weight per spike (GWS), thousand kernel weight (TKW) and grain yield (GY) traits were investigated. Except for GWS, other traits examined were found to be statistically significant. As a result of the study, the average of the varieties PH 66.60 cm, SL 8.25 cm, SN 15.04, GNS 36.24, GWS 1.18 g, TKW 32.55 g and GY 269.25 kg/da were found. According to the variety averages, the PH (82.80 cm) from Dagdas 94 variety, SL (9.32 cm) from Karahan 99 variety, SN (16.80 pieces) from Ahmet ağa variety, GNS (42.20 pieces) from Ahmetaga variety, GWS (1.39 g) from Konya 2002 variety, TKW(37.77 g) from Dagdas 94 variety, GY (328.25 kg/da) from Dagdas 94 variety were obtained. In the correlation analysis between the examined traits, it was determined that there was a negative relationship between TV and BU, and a positive relationship between SN, GNS, GWS and TKW, but it was statistically insignificant. In addition, although there was a positive relationship between TKW and BU, BS and BTS, it was found to be statistically insignificant. In addition, it was determined that there was a positive and statistically significant relationship between other traits.

Keywords: Bread wheat, grain yield, variety, morphological traits, agronomical traits



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GİRİŞ

Tahılların insan beslenmesindeki yeri, çok farklı kullanım alanlarından dolayı her geçen gün daha fazla önem kazanmaktadır (Sakin ve ark., 2015). Dünyada artan nüfusa bağlı olarak buğday tüketimi artmakta ancak, buğday ekim alanları giderek azalmaktadır. Dünyada 2020 yılında toplam buğday üretimi 780 milyon tona yükselmiştir (FAO, 2021). Ülkemizde ise 2020 yılında, 6.92 milyon hektar alanda buğday üretimi yapılmış ve toplam 20.5 milyon ton buğday üretilmiştir. Üretilen buğday miktarının 16.5 milyon tonluk kısmı ekmeklik buğdaydır. Ülkemizde ekmeklik buğdayın ekim alanı içindeki payı yaklaşık olarak %83 dolaylarındadır (TÜİK, 2020).

Ülkemizde, buğday ekimi yapılabilecek alanların artık son sınırına kadar gelinmiş, hatta buğday yetiştiriciliğine elverişli olmayan topraklarda dahi üretim yapılmaya başlanmıştır. Bu nedenle birim alanda verimin artırılması, biyotik ve abiyotik stres koşullarına toleranslı ve üstün kaliteli çeşitlerin ıslah edilmesi büyük önem taşımaktadır (Mut ve ark., 2005). Abiyotik stres faktörlerinden birisi olan kuraklık hem dünyada hem de ülkemizde yağışa bağımlı olarak yapılan yetiştiriciliği kısıtlayan en önemli faktörlerden birisidir. Türkiye’de buğday yetiştirilen alanların büyük bir bölümü kuru tarım yapılan alanlarda bulunmaktadır ve bu alanların önemli bir kısmı Orta Anadolu ve geçit bölgelerinde yer almaktadır (Öztürk, 1999). Günümüzde sayıları hızla artan ekmeklik buğday çeşitlerinden bölgeye en uygun ve verim potansiyeli yüksek olanın tespit edilip, üretiminin yaygınlaştırılması sağlanmalıdır (Özen ve Akman, 2015). Çevre ve yetiştirme koşulları buğdayda verim ve kaliteyi etkileyen en önemli unsurların başında gelmesinden dolayı çeşit özelliklerini en iyi yansıtacağı bölgelerde üretiminin yapılması gerekmektedir (Kendal ve Doğan, 2013). Kullanılan çeşidin üretimi yapılacak olan bölgeye adaptasyonu, genotip ve safiyeti verim üzerinde oldukça etkilidir. Genotipin verim potansiyelinin yüksek olması, verimi oldukça artırmaktadır (Cook ve Veseth, 1991). Yüksek tane verimi ve kalite sadece yetiştirilmekte olduğu bölgeye uygun çeşitlerin ıslahına değil, verim, verim bileşenleri ve kaliteye etki eden özelliklerin birbirleriyle olan dolaylı ya da doğrudan ilişkileriyle de ilgili olabilmektedir (Güngör ve Dumlupınar, 2019). Farklı agromorfolojik özelliklerin verim ile arasındaki ilişkilerin bilinmesi, ıslah programlarının ve seleksiyonun daha doğru bir şekilde yapılmasına katkı sağlayacaktır (Göksoy ve ark., 2002). Bu nedenle verim ve verim bileşenleri arasındaki ilişkilerin belirlenebilmesi için korelasyon katsayılarından yararlanılmaktadır (Saleem ve ark., 2006; Bilgin ve ark., 2008; Khan ve ark., 2010; Laei ve ark., 2012; Zafarnadei ve ark., 2013).



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Soğuk zararının kışları sert geçen bölgelerde tane verimi ve kalitesini önemli ölçüde etkileyen faktörlerden olduğu ve çeşitlerin düşük sıcaklıklara farklı tepkiler vermesi nedeniyle bölgeye uyumlu çeşitlerin belirlenmesi oldukça önemlidir (Aktaş ve ark., 2017). Farklı yıllarda tescil edilmiş on yedi ekmeklik buğday çeşidi kullanılarak yürütülen bu çalışmada, bazı tarımsal özellikler bakımından verim ve verim unsurları üzerine Sivas ekolojik koşullarına en uygun çeşidin belirlenmesi çalışmanın temel amacını oluşturmaktadır.

MATERYAL VE METOD

Araştırma Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi, Tarımsal Ar-Ge Merkezinde 2020-2021 yetiştirme sezonunda yürütülmüştür. Denemenin yürütüldüğü Sivas ili 39° 56' kuzey paralelleri ile 32° 51' doğu meridyenleri arasında yer almakta olup, rakımı 1285 m'dir. Araştırmanın yürütüldüğü Kasım 2020-Temmuz 2021 ayları arasında en düşük sıcaklık değeri 2021 yılı şubat ayında (-18.4°C), en yüksek sıcaklık değeri ise 2021 yılı temmuz ayında (39.2°C) gerçekleşmiştir. Denemenin yürütüldüğü yetiştirme yılında en düşük ortalama nispi nem değeri 2021 yılı mayıs ayında (%44.4), en yüksek ortalama nispi nem değeri ise yine 2020 yılı Aralık ayında (%75.2) saptanmıştır. Araştırma sürecinde gerçekleşen toplam yağış miktarlarına bakıldığında ise en düşük değer 2021 yılı temmuz ayında (6.0 mm); en yüksek değer ise 2021 yılı ocak ayında (75.2 mm) saptanmıştır (Anonim, 2021). Denemenin yürütüldüğü 2020-2021 yetiştirme sezonuna ait iklim verileri Çizelge 1'de verilmiştir.

Çizelge 1. Sivas ili 2020-2021 yetiştirme sezonuna ait iklim verileri.

	Yıl	Aylar									Toplam veya Ortalama
		Kasım	Aralık	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	
Yağış (mm)	2020- 2021 Uzun Yıllar	28.6 31.9	21.9 28.8	75.2 48.8	15.3 39.4	60.0 51.3	18.5 42.1	22.3 32.2	34.8 38.8	6.0 9.2	268.6 322.4
En Düşük Sıcaklık (°C)	2020- 2021										
En Yüksek Sıcaklık (°C)	2020- 2021	-6.7	-8.6	-15.8	-18.4	-7.4	-1.6	-1.8	5.6	11.2	-4.8
Ortalama Sıcaklık (°C)	2020- 2021	18.6	12.8	18.6	15.3	14.1	25.7	33.5	31.7	39.2	23.3
	2020- 2021	4.4	1.7	0.7	0.0	2.7	10.9	15.9	15.8	21.9	8.3
	Uzun Yıllar	5.6	2.4	-0.6	1.1	5.4	9.9	15.3	18.3	21.6	11.1
Nispi Nem (%)	2020- 2021	68.1	75.2	69.5	67.6	65.1	52.7	44.4	52.9	46.1	60.2
	Uzun Yıllar	65.6	68.6	70.1	60.2	66.3	61.0	60.6	54.5	51.9	55.9



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Denemede farklı yıllarda tescil ettirilmiş 17 adet ekmeklik buğday (Altay, Gerek, Sönmez 2001, Mesut, Ahmet ağa, Nacibey, Harmankaya, Eraybey, Konya 2002, Karahan 99, Kınacı 97, Dağdaş 94, Es26, Ekiz, Bezostaja, Reis ve Müfitbey) çeşidi materyal olarak kullanılmıştır. Tarla denemeleri, tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülmüştür. Ekimler parsel mibzeri, hasatlar ise parsel biçerdöveri ile yapılmıştır. Ekimde parsel alanı 7.8 m², hasatta ise 6 m²'dir. Ekim sıklığı m²'de 500 tohum olacak şekilde planlanmıştır. Yetiştirme süresi boyunca gerekli kültürel işlemler eksiksiz olarak yerine getirilmiş, dekara 6 kg fosfor (P₂O₅) ile 15 kg azot (N) olacak şekilde gübreleme yapılmıştır. Fosforun tamamı ekimle birlikte taban gübresi olarak, azotun 1/3'ü ekimle, 1/3'ü kardeşlenme döneminde ve kalan 1/3'ü de sapa kalkma dönemlerinde elle serpilerek verilmiştir. Yabancı otlarla mücadele herbisit kullanılarak gerçekleştirilmiştir. Araştırmada, bitki boyu (BB), başak uzunluğu (BU), başakçık sayısı (BS), başakta tane sayısı (BTS), başakta tane ağırlığı (BTA), bin tane ağırlığı (BinTA) ve tane verimi (TV) özellikleri incelenmiştir. İstatistiki analizler SAS istatistik programında Proc anova prosedürüne göre yapılmıştır.

BULGULAR VE TARTIŞMA

Araştırmada materyal olarak kullanılan ekmeklik buğday çeşitlerinin bitki boyuna ait ortalama değerler Çizelge 2'de verilmiştir. Araştırmada bitki boyuna ilişkin çeşitler arasındaki farkların istatistiksel olarak %1 düzeyinde önemli olduğu belirlenmiştir. Çalışmada bitki boyuna ait değerler 59.05 ile 82.80 cm arasında değişiklik göstermiş ve ortalama olarak 66.60 cm olduğu saptanmıştır. En uzun bitki boyu Dağdaş 94, en kısa bitki boyu ise Ekiz çeşidinden elde edilmiştir. Bitki boyu buğdayda, çeşidin sahip olduğu genetik yapıya, yıl içerisindeki iklim, toprak ve yetiştirme koşullarına bağlı olarak değişiklik gösterebileceği farklı lokasyonlarda yapılan çalışmalar ile bildirilmiştir (Doğan ve ark., 2014; Sakin ve ark., 2015; Kara ve ark., 2016; Mut ve ark., 2017).

Çalışmada, başak uzunluğuna ilişkin ekmeklik buğday çeşitleri arasındaki farklar istatistiksel bakımdan %1 düzeyinde önemli bulunmuştur. Verilerden elde edilen ortalama değerler 7.09 ile 9.32 cm arasında değişiklik göstermiş ve ortalama başak uzunluğu 8.25 cm olarak saptanmıştır. Ortalama değerlere göre en yüksek başak uzunluğu Karahan 99, en düşük başak uzunluğu ise Mesut çeşidinden elde edilmiştir (Çizelge 2). Farklı bölgelerde yürütülen çalışmalarda başak uzunluğunun, Doğan ve ark., 2014, 6.9 ile 8.8 cm, Naneli ve ark., 2015, 8 ile 9.87, Aydoğan ve Soylu, 2017, 8.87 ile 11.10 cm arasında değişiklik gösterdiğini bildirmişlerdir. Başak



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uzunluğunun artması, başakta tane sayısı dolayısı ile de verimde artış sağlanması anlamı taşıdığından, ıslah programlarında başak uzunluğu yüksek bitkilerin seçilmesi oldukça önem arz etmektedir (Özgen, 1989).

Başakta başakçık sayısı bakımından çeşitler arasındaki farklar istatistiksel olarak %1 düzeyinde önemli olduğu saptanmıştır. Ortalama değerler incelendiğinde başakçık sayıları 13.00 ile 16.80 adet arasında değişiklik gösterdiği belirlenmiştir. En yüksek başakçık sayısı Ahmetağa çeşidinden elde edilirken, en düşük başakçık sayısı Reis çeşidinden elde edilmiştir (Çizelge 2). Farklı araştırmacılar tarafından yürütülen çalışmalarda ortalama başakçık sayısını, Kurt ve Yağdı (2013), 17.3-19.5 adet, Erdoğan (2018), 17.5-20.2 adet ve Güngör ve Dumlupınar (2019), 16.5-21.2 adet arasında değiştiğini bildirmişlerdir. Araştırmada saptanan başakçık sayısının, diğer çalışmalara kıyasla daha düşük olmasının nedeni, iklim koşullarına bağlı olarak sapa kalkma döneminde yağış miktarının düşük gerçekleşmesinden kaynaklandığı düşünülebilir.

Çizelge 2. Ekmeklik buğday genotiplerine ait ortalama ve C.V. değerleri.

		BB	BU	BS	BTS	BTA	BinTA	TV
		**	**	**	**	NS	**	NS
GENOTİP	Altay	69.28 c-e	8.54 a-d	15.05 b-d	37.78 ab	1.24 a-c	32.23 b-e	264.33 ab
	Gerek	70.65 c-d	8.41 b-d	15.13 b-d	35.93 b-d	1.17 a-c	32.41 b-e	296.58 ab
	Sönmez 2001	63.68 b-g	8.55 a-d	14.50 cd	37.30 a-c	1.21 a-c	32.34 b-e	220.33 ab
	Mesut	61.23 d-g	7.09 f	15.35 b-d	35.85 b-d	1.17 a-c	32.63 b-e	228.83 ab
	Ahmet aga	62.25 c-g	8.04 de	16.80 a	42.20 a	1.24 a-c	29.35 e	305.17 a
	Nacibey	69.15 b-f	8.54 a-d	15.00 b-d	37.65 ab	1.23 a-c	32.72 b-e	305.92 a
	Harmankaya	60.15 e-g	7.57 ef	14.53 cd	34.30 b-d	1.14 a-c	33.46 b-e	321.84 a
	Eraybey	72.25 b	7.60 ef	13.95 de	38.63 ab	1.18 a-c	30.57 de	273.42 ab
	Konya 2002	67.00 b-g	8.96 ab	15.15 b-d	39.15 ab	1.39 a	35.23 a-c	256.75 ab
	Karahan 99	71.83 bc	9.32 a	14.85 b-d	35.20 b-d	1.18 a-c	33.19 b-e	269.92 ab
	Kınacı 97	63.83 b-g	8.07 de	14.80 b-d	38.18 ab	1.12 a-c	29.16 e	280.42 ab
	Dağdaş 94	82.80 a	8.36 b-e	15.63 a-c	35.13 b-d	1.33 ab	37.77 a	328.25 a
	Es26	64.08 b-g	8.06 de	14.68 b-d	31.13 d	0.98 c	31.18 c-e	292.83 ab
	Ekiz	59.05 g	8.92 a-c	15.80 a-c	37.90 ab	1.12 a-c	29.26 e	238.50 ab
	Bezostaja	59.58 fg	8.11 c-e	15.43 a-d	31.93 cd	1.09 bc	33.80 a-d	168.83 b
	Reis	62.40 c-g	8.33 b-e	13.00 e	30.88 d	0.98 c	31.75 c-e	248.34 ab
	Müfitbey	72.98 b	7.81 d-f	16.10 ab	37.03 a-c	1.36 ab	36.32 ab	276.92 ab
ORTALAMA		66.60	8.25	15.04	36.24	1.18	32.55	269.25
CV(%)		8.60	5.92	5.85	9.30	14.45	8.05	28.54

** : 0.01 düzeyinde önemli, NS: Önemli değil, BB: Bitki boyu, BU: Başak uzunluğu, BS: Başakçık sayısı, BTS: Başakta tane sayısı,

BTA: Başakta tane ağırlığı, BinTA: Bin tane ağırlığı, TV: Tane verimi

Başaktaki tane sayısı bakımından çeşitler arasındaki farklar istatistiksel olarak %1 düzeyinde önemli bulunmuştur (Çizelge 2). Elde edilen ortalamalara göre başaktaki tane sayısı 30.88-42.20 adet arasında değişiklik göstermiş, ortalama olarak 36.24 adet olarak saptanmıştır. Çizelge 2 incelendiğinde en yüksek başaktaki tane sayısı Ahmetağa, en düşük başaktaki tane sayısı ise Reis çeşidinden elde edilmiştir. Başakta tane sayısı generatif dönemdeki sapa kalkma



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ve çiçeklenme arasında belirlenmektedir (Kirby, 1988). Araştırma sonuçlarına benzerlik gösteren farklı çalışmalarda, çeşitlere göre başaktaki tane sayısının değişiklik gösterdiği bildirilmiştir (Bayram ve ark., 2017; Altındal ve Akgün, 2018; Güngör ve Dumlupınar, 2019). Araştırmada, başaktaki tane ağırlığı açısından çeşitler arasındaki farklar istatistiksel olarak önemsiz olduğu, başaktaki tane ağırlığının 0.98-1.39 g arasında değişiklik gösterdiği, ortalama olarak 1.18 g tane ağırlığının elde edildiği saptanmıştır. En yüksek başaktaki tane ağırlığına Konya 2002 çeşidinin, en düşük başaktaki tane ağırlığı ise Es26 ve Reis çeşitlerinin sahip olduğu saptanmıştır (Çizelge 2). Farklı araştırmacılar tarafından yapılan çalışmalarda, Özen ve Akman (2015), 0.9-1.9 g, Aydoğan ve Soylu (2017), 1.33-2.07 g ve Altındal ve Akgün (2018), 0.76-1.94 g arasında değişiklik gösterdiğini bildirmişlerdir. Araştırmadan elde edilen başaktaki tane ağırlığı verilerinin, benzer çalışmalardan elde edilen bulgulara göre daha düşük olmasının nedeni, çiçeklenme ve tane dolum döneminde gerçekleşen yağışların düzensiz ve az düşmesi olarak gösterilebilir (Çizelge 1).

Bin tane ağırlığı bakımından, ekmeklik buğday çeşitleri arasındaki farklar istatistiksel olarak %1 düzeyinde önemli olduğu saptanmıştır. Elde edilen ortalama değerlere göre bin tane ağırlığı 29.16 g ile 37.77 g arasında değişiklik gösterirken, ortalama olarak 32.55 g olduğu belirlenmiştir. En yüksek bin tane ağırlığı Dağdaş 94 çeşidinden elde edilirken, en düşük bin tane ağırlığı Kınacı 97 çeşidinden elde edilmiştir (Çizelge 2). Buğdayda tane ağırlığı ve verime etki eden unsurlar çiçeklenmeden sonraki dönemde ve çevre şartları tarafından belirlenir (Wiegand ve ark., 1981). Farklı araştırmacılar tarafından yürütülen çalışmalarda, Sakin ve ark. (2015), 39.7-46.3 g, Aydoğan ve Soylu (2017), 30.9-45.88g ve Albayrak ve ark. (2020), 37.40-45.99 g arasında değişiklik gösterdiğini bildirmişlerdir. Tane dolum döneminde düzensiz ve az düşen yağışlardan dolayı bin tane ağırlığı, diğer araştırmacıların sonuçlarına göre daha düşük olduğu saptanmıştır (Çizelge 1).

Tane verimi özelliğine ilişkin ekmeklik buğday çeşitleri arasındaki farklar istatistiksel olarak önemli bulunmamıştır. Çeşitlere ait ortalama veriler incelendiğinde tane verimi 168.83-328.25 kg/da arasında değişiklik gösterirken, ortalama 269.25 kg/da olduğu belirlenmiştir. En yüksek tane verimi Dağdaş 94 çeşidinden elde edilirken, en düşük tane verimi Bezostaja çeşidinden elde edilmiştir (Çizelge 2). Farklı araştırmacılar tarafından yürütülen çalışmalarda, Sakin ve ark. (2015), 258.4-452.0 kg/da, Aydoğdu ve Soylu (2017), 447.42-709.08 kg/da ve Altındal ve Akgün (2018), 209.02-363.86 kg/da arasında değişiklik gösterdiğini bildirmişlerdir. Birim alandan elde edilen tane verimi, ıslahçılar tarafından buğdayda hem ıslah hem de yetiştiricilik



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açısından her zaman için en önemli karakterlerden birisi olmuştur (Özen ve Akman, 2015). Tane verimine etki eden başak uzunluğu, başakçık sayısı, başaktaki tane ağırlığı ve bin tane ağırlığı gibi karakterlerin ortalama değerlerden daha düşük olması, çeşitlerden elde edilen verimin düşük olmasına neden olmuştur. Bitkilerin çıkış sonrasında kar örtüsü altında geçirmesi gereken dönemde (Ocak, Şubat ve Mart), kar yağışının az oluşuna bağlı olarak çeşitler soğuktan daha fazla etkilenmiştir. Bunun yanında yetiştirme sezonunda yaşanan özellikle çiçeklenme ve tane dolum (Nisan-Haziran) dönemindeki yağışların ortalamanın altında değerlere sahip oluşu verim kaybına sebep olarak gösterilebilir (Çizelge 1).

Verime etki eden unsurlar ile tane verimi arasındaki ilişkileri inceleme amacıyla ortalama veriler üzerinden yapılan korelasyon analiz sonuçları Çizelge 3'te verilmiştir. İlgili çizelge incelendiğinde bitki boyu ile başak uzunluğu ($r=0.257$) arasında istatistiksel olarak %5 düzeyinde önemli ve pozitif bir ilişki saptanmıştır. Başakçık sayısı ile bitki boyu ($r=0.055$) arasında pozitif yönlü fakat istatistiksel olarak önemsiz bir ilişki olduğu, başak uzunluğu ($r=0.353$) arasında ise pozitif yönlü ve istatistiksel olarak %1 düzeyinde önemli olduğu belirlenmiştir.

Çizelge 3. İncelenen özellikler arası korelasyon katsayıları.

*: 0.05 düzeyinde önemli, **: 0.01 düzeyinde önemli, NS: önemli değil, BB: Bitki Boyu, BU: Başak

	BB	BU	BS	BTS	BTA	BinTA
BU	0.257*	1.000				
BS	0.055 ^{NS}	0.353**	1.000			
BTS	0.320**	0.419**	0.533**	1.000		
BTA	0.618**	0.438**	0.433**	0.801**	1.000	
BinTA	0.631**	0.199 ^{NS}	0.093 ^{NS}	0.127 ^{NS}	0.691**	1.000
TV	0.362**	-0.074 ^{NS}	0.065 ^{NS}	0.132 ^{NS}	0.149 ^{NS}	0.098 ^{NS}

Uzunluğu, BS: Başakçık Sayısı, BTS: Başakta Tane Sayısı, BTA: Başakta Tane Ağırlığı, BinTA: Bin

Tane Ağırlığı, TV: Tane Verimi

Bin tane ağırlığı ile bitki boyu ($r=0.631$) ve başaktaki tane ağırlığı ($r=0.691$) arasında istatistiksel olarak %1 düzeyinde pozitif ve önemli, başak uzunluğu ($r=0.199$), başakçık sayısı ($r=0.093$) ve başaktaki tane sayısı ($r=0.127$) arasında pozitif yönlü fakat istatistiksel olarak önemsiz bir ilişki olduğu belirlenmiştir. Tane verimi ile bitki boyu ($r=0.362$) arasında pozitif ve istatistiksel olarak %1 düzeyinde önemli, başak uzunluğu ($r=-0.074$) arasında negatif yönlü, başakçık sayısı ($r=0.065$), başaktaki tane sayısı ($r=0.132$), başaktaki tane ağırlığı ($r=0.149$) ve bin tane ağırlığı ($r=0.098$) arasında pozitif yönlü fakat istatistiksel olarak önemsiz bir ilişki olduğu saptanmıştır. Başaktaki tane ağırlığı ile bitki boyu ($r=0.618$), başak uzunluğu ($r=0.438$), başakçık sayısı ($r=0.433$) ve başaktaki tane sayısı ($r=0.801$) arasında pozitif yönlü ve istatistiksel olarak %1



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düzeyinde önemli bulunmuştur. Başaktaki tane sayısı ile bitki boyu ($r=0.320$), başak uzunluğu ($r=0.419$) ve başakçık sayısı ($r=0.533$) arasında pozitif yönlü ve istatistiksel olarak %1 düzeyinde önemli olduğu saptanmıştır. Çalışma sonuçlarımız birçok araştırmacının bulguları ile paralellik göstermektedir (Yağdı, 2001; Özberk ve ark., 2002; Bayram ve ark., 2017).

SONUÇ

İklimsel değişikliklerin yoğun bir şekilde hissedildiği günümüzde, yöre koşullarına adapte olabilecek genotiplerin belirlenmesi için yürütülen çalışmalar büyük önem taşımaktadır. Bu kapsamda, adaptasyon çalışmalarının düzenli olarak yıllar boyunca yürütülmesi gerekmektedir. Sivas ekolojik koşullarına uyumlu olabileceği düşünülen, farklı yıllarda tescil ettirilmiş on yedi ekmeklik buğday çeşidi ile yürütülen çalışmada, Dağdaş 94, Ahmetağa, Konya 2002 ve Karahan 99 çeşitlerinin farklı agro-morfolojik karakterler bakımından üstün performans gösterdikleri saptanmıştır. Kışlık yetiştiricilikte değerlendirilebileceği düşünülen üstün çeşitlerin değişen iklim faktörleri dikkate alındığında, elde edilen bulguların sürekliliği ve güvenilirliklerinin belirlenebilmesi açısından uzun yıllar denemelerin sürdürülmesi gerektiği düşünülmektedir.



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KAYNAKLAR

Aktaş, H., Erdemci, İ., Karaman, M., Kendal, E., TEkdal, S. (2017). Bazı kışlık ekmeklik buğday genotiplerinin tane verimi ve bazı kalite özellikleri bakımından GGE biplot analiz yöntemi ile değerlendirilmesi. *Türk Doğa ve Fen Dergisi*, 6(1), 43-51.

Altındal, D., Akgün, İ. (2018). Isparta ve burdur lokasyonlarından toplanan ekmeklik buğday genotiplerinin verim ve verim özelliklerinin belirlenmesi. *Ziraat Fakültesi Dergisi*, 357-367.

Anonim. (2021). Sivas Meteoroloji İl Müdürlüğü, 2021.

Aydoğan, S., Soylu, S. (2017). Ekmeklik buğday çeşitlerinin verim ve verim öğeleri ile bazı kalite özelliklerinin belirlenmesi. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, 26(1), 24-30.

Bayram, S., Öztürk, A., Aydın, M. (2017). Ekmeklik buğday genotiplerinin Erzurum koşullarında tane verimi ve verim unsurları yönünden değerlendirilmesi. *Yüzüncü Yıl Üniversitesi, Tarım Bilimleri Dergisi*, 27(4): 569-579.

Bilgin, O., Korkut, K.Z., Başer, İ., Dağlıoğlu, O., Öztürk, İ., Kahraman, T. (2008). Determination of variability between grain yield and yield components of durum wheat varieties (*Triticum durum* Desf.) in Thrace region. *Tekirdağ Ziraat Fakültesi Dergisi* 5(2): 101-109.

Cook, R.J., Veseth, R.J. (1991). Wheat health management. *The American Phytopathological Society*. St. Paul. Minnesota 55121, USA.

Doğan, Y., Toğay, Y., Toğay, N. (2014). Türkiye’de tescil edilmiş bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitlerinin Mardin-Kızıltepe koşullarında verim ve bazı verim özelliklerinin belirlenmesi. *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 24(3), 241-247.

Erdoğan, E. (2018). Amik Ovası koşullarında bazı ekmeklik buğday (*Triticum aestivum* L.) genotiplerinin fizyolojik, morfolojik ve kalite özelliklerinin belirlenmesi. Hatay Mustafa Kemal Üniversitesi, Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı Yüksek Lisans Tezi, s.55, Hatay.

FAO. (2021). Dünya Gıda Örgütü, 2021.

Göksoy, A.T., Türkeç, A., Turan, Z.M. (2002). Yeni geliştirilen sentetik ayçiçeği (*Helianthus annuus* L.) çeşitlerinde verim ve bazı verim komponentlerinin korelasyonu ve path analizi. *Uludağ Üniversitesi Ziraat Fakültesi Dergisi* 16(1): 139-150.



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Güngör, H., Dumlupınar, Z. (2019). Bolu koşullarında bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitlerinin verim, verim unsurları ve kalite yönünden değerlendirilmesi. *KSÜ Tarım ve Doğa Dergisi*, 6(1), 44-51.

Kara, R., Dalkılıç, A.Y., Gezginç, H., Yılmaz, M.F. (2016). Kahramanmaraş koşullarında bazı ekmeklik buğday çeşitlerinin verim ve verim unsurları yönünden değerlendirilmesi. *Türk Tarım ve Doğa Bilimleri Dergisi*, 3(2): 172- 183.

Kendal, E., Doğan, Y. (2013). Ekmeklik Buğday (*Triticum aestivum* L.) Genotiplerinin tane verimi ve bazı kalite özelliklerinin belirlenmesi. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 2012, 29(1), 113-121.

Khan, A.J., Azam, F., Ali, A. (2010). Relationship of morphological traits and grain yield in recombinant inbred wheat lines grown under drought conditions. *Pakistan Journal of Botany* 42(1): 259-267.

Kirby, E.J.M. (1988). Analysis of leaf, stem and ear growth in wheat from terminal spikelet stage to anthesis. *Field Crops Research*, 18: 127-140.

Kurt, Ö., Yağdı, K. (2013). Bazı ileri ekmeklik buğday (*Triticum aestivum* L.) hatlarının Bursa koşullarında verim özellikleri yönünden performansının araştırılması. *U.Ü. Ziraat Fakültesi Dergisi*, 2013(2): 19-31.

Laei, G., Afshari, H., Kamali, M.R.J., Hassanzadeh, A.A. (2012). Study yield and yield components comparison correlation some physiological characteristics. 20 genotypes of bread wheat. *Annals of Biological Research* 3(9): 4343-435.

Mut, Z., Aydın, N., Özcan, H., Bayramoğlu, H.O. (2005). Orta Karadeniz Bölgesinde ekmeklik buğday (*Triticum aestivum* L.) genotiplerinin verim ve bazı kalite özelliklerinin belirlenmesi. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 22 (2): 85-93.

Mut, Z., Erbaş Köse, Ö., Akay, H. (2017). Bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitlerinin tane verimi ve kalite özelliklerinin belirlenmesi. *Anadolu Tarım Bilimleri Dergisi*, 32: 85-95.

Naneli, İ., Sakin, M. A., Kırıl, A. S. (2015). Tokat-Kazova şartlarında bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitlerinin verim ve kalite özelliklerinin belirlenmesi. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 32(1), 91-103.

Özberk, İ., Özberk, F., Coşkun, Y. (2002). Harran ovası koşullarında ekmeklik buğdayda verim ve bazı verim öğeleri arasındaki ilişkiler, *Harran Üniversitesi Ziraat Fakültesi Dergisi*.



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Özen, S., Akman, Z. (2014). Yozgat ekolojik koşullarında bazı ekmeklik buğday çeşitlerinin verim ve kalite özelliklerinin belirlenmesi. *Ziraat Fakültesi Dergisi*, 10(1), 35-43.

Özgen M (1989). Kışlık ekmeklik buğdayda (*Triticum aestivum* L.) Melez Gücü. *Turkish Journal of Agriculture and Forestry*. 13(3b): 1190-1201.

Öztürk, A. (1999). Kuraklığın kışlık buğdayın gelişmesi ve verimine etkisi. *Turkish Journal of Agriculture and Forestry*, 23(1), 531-540.

Sakin, M.A., Naneli, İ., Göy, A.G., Özdemir, K. (2015). Bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitliliğinin Tokat-Zile verim ve verim bileşenlerinin çalışmalarının. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 32 (3), 119-132.

Sakin, M.A., Naneli, İ., İsmailoğlu, A.Y. ve Özdemir, K. (2017). Tokat Kazova koşullarında bazı ekmeklik buğday (*Triticum aestivum* L.) çeşitlerinin kuru ve sululu şartlarda verim ile kalite özelliklerinin belirlenmesi. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 34(Ek sayı): 87-96.

Saleem, U., Khalig, I., Mahmood, T., Muhammad, R. (2006). Phenotypic and genotypic correlation coefficient between yield and yield components in wheat. *Journal Agricultural Research* 44(1): 1-6.

TÜİK, (2020). Türkiye İstatistik Kurumu, 2020.

Yağdı, K. (2001). "Bursa ekolojik koşullarında ekmeklik buğdaylarda (*Triticum aestivum* L.) verim ve verime etkili bazı özelliklerin korelasyonu ve path analizi". *Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 15(1), 11-18.

Zafarnaderi, N., Aharizad, S., Mohammadi, S.A. (2013). Relationship between grain yield and related agronomic traits in bread wheat recombinant inbred lines under water deficit condition. *Annals of Biological Research* 4(4): 7-11.

Wiegand, C.L., Gebermann, A.H., Cuellar, J.A. (1981). Development and yield of hard red winter wheats under semitropical conditions. *Agronomy Journal*, 73(1): 29-37.



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ÖZET

Teknolojinin gelişmesiyle birlikte dijital dünyada düşünme sürecinin sınırları zorlanmış ve normal beyin ile yapay beyin birleştirilmeye çalışılmışlardır. Devam eden keşif sürecinde tamamen yeni bir yapay zekâ alanı oluşturulmuştur. Nihai olarak bir insanın yapay zekaya sahip bir makine yapabileceği görülmüştür. Yapay zekâ, başarı oranını en üst düzeye çıkarmak için gelişmesi gereken bilgisayar biliminin etki alanına girmektedir. Artan dünya nüfusu ile birlikte çiftçiler tarafından kullanılan geleneksel yöntemlerin yerini uygulama kolaylığı ve yüksek verim getiren modern yöntemler almıştır. Daha iyi verim alabilmek için bitki hastalıkları, depolama yönetimi eksikliği, ilaç kontrolü, yabancı ot yönetimi, sulama ve su yönetimi eksikliği gibi tarım alanlarında meydana gelen sorunların zamanında ve doğru bir şekilde çözümlenmesi gerekmektedir. Tüm bu sorunlar yapay zekanın insanlara sunduğu farklı tekniklerle çözülebilmektedir. Yapılan birçok deney ile tarım uygulamalarının otomasyonunun işgücü ve zaman tasarrufu sağladığı ve topraktan elde edilen kazancı artırdığı kanıtlanmıştır. Tarımda yapay zekanın kullanılmasına yönelik kısa bir genel bakış elde etmek amacıyla yapılan bu derlemede bazı araştırmacıların yapay zekâ ve otomasyon ile ilgili çalışmaları da bulunmaktadır.

Anahtar Kelimeler: Yapay zekâ, Tarım, Otomasyon



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**THE PLACE AND IMPORTANCE OF ARTIFICIAL INTELLIGENCE
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ABSTRACT

The limits of the thinking process in the digital world were pushed and they tried to combine the normal brain with the artificial brain with the development of technology. In the ongoing exploration process, a completely new field of artificial intelligence has been created. Finally, it has been seen that a human can make a machine with artificial intelligence. Artificial intelligence falls under the domain of computer science, which must evolve to maximize its success rate. Traditional methods used by farmers have been replaced by modern methods that bring ease of application and high efficiency with the increasing world population. In order to get better yields, problems occurring in agricultural areas such as lack of storage management, weed management, water management, pesticide control, plant diseases, and irrigation need to be resolved in a timely and correct manner. All these problems can be solved with different techniques that artificial intelligence offers to people. It has been proven that the automation of agricultural practices saves labor and time and increases the gain from the soil according to lots of research. In this review, which was made to obtain a brief overview of the use of artificial intelligence in agriculture, some researchers also have studies on artificial intelligence and automation relevant to agricultural production.

Keywords: Artificial intelligence, Agriculture, Automation



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GİRİŞ

Yapay zekâ tıp bilimi, eğitim, finans, tarım, sanayi, güvenlik ve diğer birçok sektöre zamanla nüfuz etmiştir. Yapay zekânın uygulanması, makinelerin öğrenme sürecini içermektedir. Bu da bizi yapay zekâ alanındaki “Makine öğrenimi” alanına sürüklemektedir. Makine öğreniminin tek amacı, belirli bir sorunu çözmek için kendisine verilen görevi yerine getirebilmesi adına makineyi geçmiş deneyimler ve istatistiksel verilerle beslemektir (Jha ve ark 2019). Bu sayede yapay zekâ teknolojileri; depolanmış olan bilgileri esas alarak nasıl kararlar alınabileceğini, yürütülecek eylem planının nasıl oluşabileceğini ve örnek verilerden öğrenerek veya uzmanları sorgulayarak bilgisayarda nasıl işlenebilir bilgiler edinebileceğini de içermektedir (Terzi ve ark 2019).

Bilgisayarların tarımda kullanımı ilk olarak 1983 yılında rapor edilmiştir (Baker ve ark. 1983). Tarımda var olan sorunları çözmek için veri tabanlarından (Mortinello 1988) başlayarak karar destek sistemlerine (Thorpe ve ark. 1992) kadar farklı yaklaşımlar önerilmiştir. Bu çözümlerden, yapay zekâ uygulayan sistemlerin doğruluk ve sağlamlık açısından en mükemmel performansı gösterdiği tespit edilmiştir (Banerjee ve ark 2018).

Tarımın teknoloji ile takip edilmesi, pratikte insan müdahalelerinin azaltılmasını sağlamaktadır. Gıda talebi gün geçtikçe artmakta ve insanlar modern yöntemler uygulanmadan yürütülen tarımda artan talebi karşılayamamaktadır. Birçok önemli yöntem, çiftçilere daha iyi mahsul ve uygun tarla yönetimi sağlamak ve nihayetinde insanın en önemli ihtiyacı olan gıda varlığına önemli ölçüde yardımcı olmaktadır (Jha ve ark 2019).

YAPAY ZEKÂ VE TARIM İLİŞKİSİ

Yapay zekânın oluşturduğu yöntemlerle ilgili olarak aşağıdaki gruplandırılma yapılmaktadır (Alpaydın 2004, Terzi ve ark. 2019):

Kümeleme: Geçmiş verilere göre hangi sınıf içerisinde bulunduğu bilinmeyen verilerin benzerliklerine göre farklı kümelere ayrılması işlemidir.

Sınıflandırma: Geçmiş verilere göre hangi sınıf içerisinde bulunduğu bilinen verilerin hangi sınıfta olacağını belirleme işlemidir.

Özellik Belirleme: Çok fazla geçmiş verinin bulunduğu durumda, verilerin sınıfını belirleyebilecek özellikler belirlenmektedir. Belirleme işlemi esnasında mevcut özelliklerin bir alt küme oluşturabilmesinin yanı sıra bu özelliklerin birleşiminden de yeni özellikler oluşturulabilmektedir.



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Regresyon (Eğri Uydurma): Süreklilik gösteren sayısal değerleri içeren geçmiş verilerden bir eğri modeli oluşturma işlemidir.

İlişki Çıkarımı: İki ayrı verinin birlikte yer aldığı durumun analiz edildiği ve en çok birlikte olanların belirlendiği işlemidir.

Makine öğrenimi, yapay zekâ ve bilgisayarla görme alanlarında uzun süredir devam eden çok çeşitli sorunlarla karşılaşmış ve genellikle uzun süredir devam eden performans engellerini aşmaya yetecek kadar önemli gelişmeler kaydedilmiştir. Birden fazla alanda bu başarılar, derin öğrenmenin daha da geniş uygulanabilirliğine yol açan gelişmiş araçların ve metodolojilerin geliştirilmesine ilham vermiştir (Lemley ve ark 2017). Derin öğrenme, birden fazla gizli katman içeren yapay sinir ağları ve ilgili makine öğrenme algoritmalarının incelenmesidir (Deng ve Yuo, 2014). Derin öğrenme geniş bir erişime sahiptir. Birçok sektörde uygulanması açısından muazzam ilerlemeler kaydedilmiştir. Derin öğrenmeyi kullanmak, makine öğrenimine göre ek bir avantajdır ve makine öğrenimine yoğun bilgiler sağlamaktadır (Jha ve ark 2019).

Tüm bu yöntemler ile günümüzde geçmişteki verilerden ve deneyimlerden gelen verileri analiz etmeyi, konuşma ve yüz tanımayı, hava durumu tahminini, tıbbi teşhisleri ve zirai teşhisleri içeren birçok uygulama mevcuttur. Veri bilimi alanının bu kadar büyük ölçüde gelişmesinin nedeni makine öğrenimidir. Makine öğrenimi, akıllı makineleri oluşturmaya yönelik matematiksel bir yaklaşımdır (Jha ve ark 2019; Terzi ve ark 2019).

Yapay zeka teknikleri kullanılarak tarımda; bitkilerin sınıflandırılması, bitkisel üretim planlamaları, bitki zararlı, hastalık ve yabancı otlarının tespiti, verim tahmini, işletme kararlarının alınması, uygulama kararlarının alınması, tarım robotlarında rota belirlenmesi, ürün rotasyonunun belirlenmesi, sulama yönetimi, uygun gübre-makina ve alet seçimi, uygun yem rasyonlarının hazırlanması, hayvan hastalıklarının tespiti, hayvan davranışlarının belirlenmesi gibi pek çok konuda araştırmacılar tarafından çalışmalar yapılmıştır (Terzi ve ark 2019; Çizelge 1).



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Çizelge 1. Yapay zekâ teknikleri ile yürütülen bazı çalışmalar.

Çalışma Konusu	Kaynak
Su kaynaklarının tespiti	Faridi ve ark., 2018
Tarımsal potansiyelin belirlenmesi	Kurniasih ve ark., 2018
Hastalık sınıflandırılması	Oppenheim and Shani, 2017
Üretimde enerji tüketimi	Khoshnevisan ve ark., 2015
Tarımsal atık işlenmesi	Liu ve ark., 2018
Arazi kullanım optimizasyonu	Li ve Parrott, 2016
Hastalık tespiti	Arya ve ark., 2018
Otomatik arazi sınıflandırılması	Haklı ve Uğuz, 2017
Toprak mekanik direnç tahmini	Hosseini ve ark., 2016
Ürün kurutma işlemi	Khawas ve ark., 2015
Hayvansal üretimde sistem analizi	Vasquez ve ark., 2018
Tarım makinelerinde durum tespiti	Martinez ve ark., 2015
Yabancı ot kontrolü	Partel ve ark., 2019
Yabancı ot tespiti	Sabzi ve Abbaspour-Gilandeh, 2018
Yeşillik tanımlama	Romeo ve ark., 2013
Hastalık tanıma ve sınıflandırma	Zhang ve ark., 2018
Sulama yönetimi	Nguyen ve ark., 2017
Toprak azot içeriği tahmini	Zhang ve ark., 2019
Toprak erozyonu tahmini	Yakupoglu ve ark., 2008
Don kontrolü	Sungur ve Altun, 2010
Hayvan davranışı sınıflandırma	Gutierrez-Galan ve ark., 2018
Hayvan besleme yönetimi	Sivamani ve ark., 2017
Bitki yaprak hastalığı tespiti	Singh and Misra, 2017
Bitki tanımlama	Yiğit ve ark., 2019

Yapay zekâ sistemleri sayesinde tarlanın bulunduğu bölgedeki hava ve toprağın sıcaklık ve nemi gerçek zamanlı olarak ölçülebilmekte, GSM bağlantısı yoluyla da makine öğrenmesi algoritmalarına bağlı olarak girdi oluşturulabilmektedir. Bu aşamadan sonra nesnelerin internet uygulamaları üzerinde bu veriler yorumlanabilmektedir. Nem ve sıcaklık değerlerinin anlık olarak alınabilmesi ve haftalık tahminlerin yapılabilmesiyle ürünlerde oluşabilecek zararlı üremesi, mantar hastalıkları gibi sorunlar önceden tahmin edilebilmekte ve sulama miktarının ayarlanması gibi bakım işlemleri de yürütülebilmektedir. Bu şekilde ürünlerin herhangi bir zarara uğramadan önce gerekli önlemleri alınıp gereksiz maliyetlerden kaçınmak ve verimi artırmak mümkün olmaktadır (Uzun ve ark 2018)



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Dron teknolojisinde meydana gelen yenilikler ve gelişmeler tarımda dron uygulamaları ile tarla konumlama, ölçülendirme, haritalama ve zirai ilaçlama gibi işlemlerin kolay bir şekilde yapılabilmesini sağlamıştır. Çiftçiler dronlar yardımıyla tarlasında oluşan sorunları havadan takip ederek hızlı bir şekilde müdahale edebilmektedir. Geleneksel olarak yürütülen pestisit püskürtücülerin yerini artık dron sistemleri almıştır. Pestisit uygulamasının hızı dronlar ile 40 kat arttığı görülmüştür. Ayrıca dronlar ile akıllı sulama sistemleri kullanılarak %90 su ve %30-40 pestisit tasarrufu sağlanmaktadır. (Yılmaz ve ark. 2021)

Ekim işlemi yapılacak olan tarlanın tüm alanını çiftçi robotlar analiz ederek tohumları en verimli noktalara ekebilmektedir. Ayrıca tarlada bulunan yabancı otları belirleyerek tarım ilacı uygulayıp temizleyen robotlar sayesinde yabancı otlara yönelik yapılacak olan ilaçlama oranı düşürülmekte ve insan emeğinden de tasarruf sağlanmaktadır (Yılmaz ve Soysal, 2021)

SONUÇ

Geleneksel olarak yürütülen tarım faaliyetlerinden elde edilen verimler tam olarak yeterli değildir. Yapay zekâ teknolojileri ile kırsal kalkınmada verim ve üretimi artırmaya yönelik uygulamalar bu verim açığını kapatacak kapasitededir. Bu teknolojilerin tarım alanlarına yeterli düzeyde entegre olması ve buna yönelik yapılacak olan faaliyetlerin teşvik edilmesi gerekmektedir.



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KAYNAKLAR

Arya, M.S., Anjali, K., Unni, D. 2018. Detection of Unhealthy Plant Leaves Using Image Processing and Genetic Algorithm with Arduino. IEEE, 978-1-5386-4208-5/18.

Bannerjee, G., Sarkar, U., Das, S., & Ghosh, I. (2018). Artificial intelligence in agriculture: A literature survey. International Journal of Scientific Research in Computer Science Applications and Management Studies, 7(3), 1-6.

D.N. Baker, J.R. Lambert, J.M. McKinion (1983). 'GOSSYM: A simulator of cotton crop growth and yield' Technical bulletin, Agricultural Experiment Station, South Carolina, USA,

Deng, L., Yu, D. (2014). "Deep Learning: Methods and Applications" (PDF). Foundations and Trends in Signal Processing. 7 (3–4): 199–200.

Faridi M., Verma S., Mukherjee S. 2018. Integration of GIS, Spatial Data Mining, and Fuzzy Logic for Agricultural Intelligence. In: Pant M., Ray K., Sharma T., Rawat S., Bandyopadhyay A. (eds) Soft Computing: Theories and Applications. Advances in Intelligent Systems and Computing, vol 583. Springer, Singapore.

Haklı, H. ve Uğuz, H. 2017. A novel approach for automated land partitioning using genetic algorithm. Expert Systems with Applications 82 (2017) 10–18.

Hosseini, M., Naeini, S.A.M., Dehghani, A.A. 2016. Estimation of Soil Mechanical Resistance Parameter by Using Particle Swarm Optimization, Genetic Algorithm and Multiple Regression Methods. Soil and Tillage Research, Volume 157, April 2016, Pages 32-42.

Jha, K., Doshi, A., Patel, P., & Shah, M. (2019). A comprehensive review on automation in agriculture using artificial intelligence. *Artificial Intelligence in Agriculture*, 2, 1-12.

K. W. Thorpe, R. L. Ridgway, R. E. Webb (1992). "A computerized data management and decision support system for gypsy moth management in suburban parks," *Computers and electronics in agriculture*, vol. 6 no. 4, pp. 333-345

Khawas, P., Dash, K.K., Das, A.J., Deka, S.C. 2015. Drying Technology an International Journal. Modeling and Optimization of the Process Parameters in Vacuum Drying of Culinary Banana (Musa ABB) Slices by Application of Artificial Neural Network and Genetic Algorithm.

Khoshnevisan, B., Rafiee, S., Iqbal, J., Shamshirband, S., Omid, M., Anuar, N.B., Abdulwahab, A.W. 2015. A Comparative Study Between Artificial Neural Networks and



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Adaptive Neuro-Fuzzy Inference Systems for Modeling Energy Consumption in Greenhouse Tomato Production: A Case Study in Isfahan Province. *The Journal of Agricultural Science* 17 (2015) 49-62.

Kurniasih, D., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A. 2018. The uses of fuzzy logic method for finding agriculture and livestock value of potential village. *International Journal of Engineering & Technology*, 7 (3) (2018) 1091-1095.

Lemley, J., Bazrafkan, S., & Corcoran, P. (2017). Deep Learning for Consumer Devices and Services: Pushing the limits for machine learning, artificial intelligence, and computer vision. *IEEE Consumer Electronics Magazine*, 6(2), 48-56.

Li, X. and Parrott, L. 2016. An improved Genetic Algorithm for spatial optimization of multi-objective and multi-site land use allocation. *Computers, Environment and Urban Systems* 59 (2016) 184–194.

Liu, Z.W., Liang, F.N., Liu, Y.Z. 2018. Applied Thermal Engineering. Artificial neural network modeling of biosorption process using agricultural wastes in a rotating packed bed. *Applied Thermal Engineering*, Volume 140, 25 July 2018, Pages 95-101.

Martinez, V.M., Gil, F.J.G., Gil, J.G., Gonzalez, R.R. 2015. An Artificial Neural Network based expert system fitted with Genetic Algorithms for detecting the status of several rotary components in agro-industrial machines using a single vibration signal. *Expert Systems with Applications* 42 (2015) 6433–6441.

Nguyen, D.C.H., Ascough, J.C., Maier, H.R., Dandy, G.C., Andales, A.A. 2017. Optimization of Irrigation Scheduling Using Ant Colony Algorithms and an Advanced Cropping System Model. *Environmental Modelling & Software*, Volume 97, November 2017, Pages 32-45.

Oppenheim, D. and Shani, G. 2017. Potato Disease Classification Using Convolution Neural Networks. 8 (2017) 244-249.

P. Martiniello (1988). "Development of a database computer management system for retrieval on varietal field evaluation and plant breeding information in agriculture," *Computers and electronics in agriculture*, vol. 2 no. 3, pp. 183-192.

Partel, V., Kakarla, S.C., Ampatzidis, Y. 2019. Development and evaluation of a low-cost and smart technology for precision weed management utilizing artificial intelligence. *Computers and Electronics in Agriculture* 157 (2019) 339–350.



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Romeo, J., Pajares, G., Montalvo, M., Guerrero, J.M., Guijarro, M., de la Cruz, J.M. 2013. A new Expert System for Greennees Identification in Agriculture Images. *Expert Systems with Applications* 40 (2013) 2275–2286.

Sabzi, S. and Abbaspour-Gilandeh, Y. 2018. Using video processing to classify potato plant and three types of weed using hybrid of artificial neural network and partinle swarm algorithm. *Measurement* 126 (2018) 22–36.

Terzi İ., Özgüven M.M., Altaş Z., Uygun T. (2019) Tarımda Yapay Zeka Kullanımı, International Erciyes Agriculture, Animal & Food Sciences Conference 24-27 April, Erciyes University, Kayseri/Turkey

Uzun Y., Bilban M., Arıkan H. (2018). Tarım ve Kırsal Kalkınmada Yapay Zekâ Kullanımı

VI. KOP Bölgesel Kalkınma Sempozyumu-KOPBKS, 26-28 Ekim, Konya

Vasquez, R.P., Aguilar, A.A., Lopez, M.V., Rivero, L.G., Rodriguez, A.A., Rojas, A.A. 2018. Expert system based on a fuzzy logic model for the analysis of the sustainable livestock production dynamic system. *Computers and Electronics in Agriculture*.

Yakupoğlu, T., Özdemir, N., Ekberli, İ. (2008). Toprak Erozyonu Çalışmalarında Bulanık Mantık Uygulamaları. *Anadolu Tarım Bilimleri Dergisi*, Cilt 23, Sayı 2, Sayfalar 121-130.

Yılmaz, A, & Soysal, S. (2021). The Necessity of Autonomous Systems In Agriculture. *Agricultural Researches Resourcebook*, (pp. 301-322).

Yılmaz, A., Soydemir, E.H., Çiftçi V. (2021, June). Use of Drone Technology in Agricultural Areas, In Behcet Kir and S. Seydosoglu (Eds.), 3rd International Conference on Food, Agriculture and Veterinary Proceedings Book (pp. 361- 366), Izmir, Turkey

Zhang, Y., Lee, W.S., Li, M., Zheng, L., Ritenour, M.A. 2018. Non-destructive recognition and classification of citrus fruit blemishes based on ant colony optimized spectral information. *Postharvest Biology and Technology*, Volume 143, September 2018, Pages 119-128.

Zhang, Y., Li, M., Zheng, L., Qin, Q., Lee, W.S. 2019. Spectral Features Extraction for Estimation of Soil Total Nitrogen Content Based on Modified Ant Colony Optimization Algorithm. *Geoderma* 333 (2019) 23–34.



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DOKU KÜLTÜRÜ İLE VİRÜSTEN ARI PATATES TOHURLUĞU ÜRETİMİ

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ÖZET

Dünya nüfusunun sürekli olarak artması nedeniyle gıda yetiştirmek için gereken kaynaklar azalmaktadır. Patates (*Solanum tuberosum* L.), dünyadaki en önemli gıda kaynaklarından olup, dünya çapında 1,5 milyardan fazla insanın beslenme düzeninin önemli bir parçasıdır. Arazi kullanımı açısından oldukça verimli olmasının yanı sıra patates bitkisi tüketicilere çok çeşitli kompleks karbonhidratlar, proteinler, vitaminler ve bitkisel besinler sunmaktadır. Bilim adamları patatesin, aktif ve sağlıklı bir yaşam için gerekli olan bir bitki olduğunu, insanlığın beslenme ihtiyacını karşılamak için yeterli, güvenli ve besleyici gıdaya erişimi olduğu ileri dönemlerde gıda güvenliğini sağlamak için kilit bir role sahip olacağına inanmaktadır. Patates bitkisinde enfeksiyona sebep olan virüsler tohumluk yumrular ile yetiştirme dönemi içerisinde vektörlerle ya da mekaniksel olarak taşınabildiği gibi yıldan yıla da taşınabilmektedir. Tohumluğun kısa sürede bozulmasına neden olan bu durum genelde üç yıldan sonra verimde çok önemli kayıpların oluşmasına sebep olmaktadır. Ayrıca virüsler patatesta metabolizma işlevleri ile doğrudan bir ilişkiye sahip olduğundan oluşacak virüs hastalıkları kimyasal müdahaleler ile kontrol edilememektedir. Bu sebeple, virüs hastalıklarının neden olduğu kayıpların önlenmesi adına virüsten ari tohumluk üretilmesi büyük önem taşımaktadır. Bu derlemede doku kültürü ile elde edilen virüsten ari patates tohumluğunun üretimi ve önemi aktarılacaktır.

Anahtar Kelimeler: *Solanum tuberosum* L., Patates, İn vitro, Doku kültürü



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VIRUS-FREE POTATO SEED PRODUCTION BY TISSUE CULTURE

ABSTRACT

As the world's population is constantly increasing, the resources needed to grow food are decreasing. Potato (*Solanum tuberosum* L.) is one of the most important food sources in the world and an important part of the diet of more than 1.5 billion people worldwide. In addition to being highly productive in terms of land use, the potato plant offers consumers a wide variety of complex carbohydrates, proteins, vitamins, and phytonutrients. Scientists believe that the potato is an essential plant for an active and healthy life and will play a key role in ensuring food security in the future when humanity has access to sufficient, safe, and nutritious food to meet its nutritional needs. Viruses that cause infection in the potato plant can be transmitted by vectors or mechanically during the growing period with seed tubers, as well as from year to year. This situation, which causes the seed to deteriorate in a short time, causes very important losses in yield, generally after three years. In addition, since viruses have a direct relationship with the metabolic functions of potatoes, the resulting viral diseases cannot be controlled by chemical interventions. For this reason, it is of great importance to produce virus-free seeds in order to prevent losses caused by virus diseases. In this review, the production and importance of virus-free potato seed obtained by tissue culture will be explained.

Keywords: *Solanum tuberosum* L., Potato, In vitro, Tissue culture



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GİRİŞ

Patates üretiminde dünya çapındaki kademeli artış, özellikle modern yetiştirme yöntemleri ile birleştirildiğinde, gelecekteki gıda teminine ve beslenme sorunlarının çözümüne yardımcı olacaktır. Patates yetiştirme programlarının temel odak noktası, mevcut çeşitlere göre gübre, su ve toprak gibi daha az üretim kaynağı kullanarak verimi ve kaliteyi artırmaktır. Ayrıca bu programlar pestisit ihtiyacını azaltmak ve böylece çevre sağlığını korumak veya iyileştirmek için başlıca haşerelere ve hastalıklara karşı dirençli çeşitlerin belirlenmesine odaklanmıştır. Modern yetiştirme teknikleri ile ilgili olarak endüstri, tüketicilere yıl boyunca besleyici ve yüksek kaliteli patatesler sunmak için üretim, işleme, depolama ve pazarlama yöntemlerini devamlı olarak geliştirmektedir (Navarre ve Pavék, 2014)

Patateslerin mikro yumru oluşturma yeteneği biyolojik ve tarımsal açıdan büyük öneme sahiptir. Patates üretimi için doku kültüründe kullanılan yöntemler on yıllar boyunca büyük ölçüde değişmemiştir. Bu yöntemlere Uluslararası Patates Merkezi (CIP) ve Gıda ve Tarım Organizasyonu (FAO) gibi endüstriyel web sitelerinde çevrimiçi olarak kolayca ulaşılabilmektedir (Davidson ve Xie, 2014).

Bir biyolojik kaynak olarak mikro yumrular, patates çeşitlerinin genetik koleksiyonlarda korunmasını sağlamayı mümkün kılmaktadır (Oves ve Zhevora, 2015; Bamberg ve ark, 2016). Tarımda mikro yumrular patates tohumluğu üretimi için yaygın olarak kullanılmaktadır (Naik ve Buckseth, 2018; Sergey vd., 2020). Elde edilen mikro yumruların avantajları; mevsimselliğin olmaması, uzun süreli depolama olasılığı, nakliye sırasında yüksek dayanıklılık ve dikim kolaylığıdır (Wrobel, 2015).

İN VİTRO PATATES ÜRETİMİ

Ticari patates üretimi, fabrikasyon işlemlerinde yüksek derecede pratik deneyim ve teknik beceri gerektiren karmaşık ve son derece uzmanlık gerektiren ticari bir işlemdir. Gelişmekte olan çoğu ülkede, yumru ve kök mahsullerinin verimleri, tohumdan kaynaklı zararlılar ve hastalıklar nedeniyle önemli ölçüde potansiyellerinin altına düşmektedir (Clark ve Moyer, 1988). Sistematik olmayan bir şekilde vejetatif olarak çoğaltılan ve viral bir hastalıkla enfekte olan patates mahsullerinde patojen, bir vejetatif nesilden diğerine geçmektedir. Patateslerde hastalığa neden olan yaklaşık 23 virüs ve virüs benzeri organizma bulunmaktadır. Viral hastalıkların varlığı, patates çeşitlerinin veriminin düşük olmasının önemli bir nedenlerindendir (Siddique ve Hussaain, 1988). Virüslerin enfeksiyonundan kaynaklanan verim azalması, bazı



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zamanlarda %75'e kadar çıkabilmektedir (Rashid, 1987). PVX tek başına %15-30 verim azalmasına neden olmakta iken (Mellor ve Stace-Smith, 1987), PLRV ve PVY yumru verimini %50-80 oranında azaltmaktadır (deBokx, 1972). Patates iğ yumru viroidinin (PSTV) ise %64 oranında verimi azalttığı görülmüştür (Sing ve ark, 1971). Bu verilerden yola çıkarak, çiftçilerin ekim için ihtiyaç duyduğu virüssüz patates tohumluğunu almaları oldukça önemlidir. Patates üretiminin en büyük kısıtlaması, istenen çeşitlerde makul fiyatlı, kaliteli tohum yumrularının yetersiz teminidir (Crissman, 1987; Rasco ve Aromin, 1994). Birçok ülke geniş çapta kaliteli ve sertifikalı virüssüz tohumluk patates ithal etmekte ve bu sebeple büyük miktarda döviz kaybetmektedir.

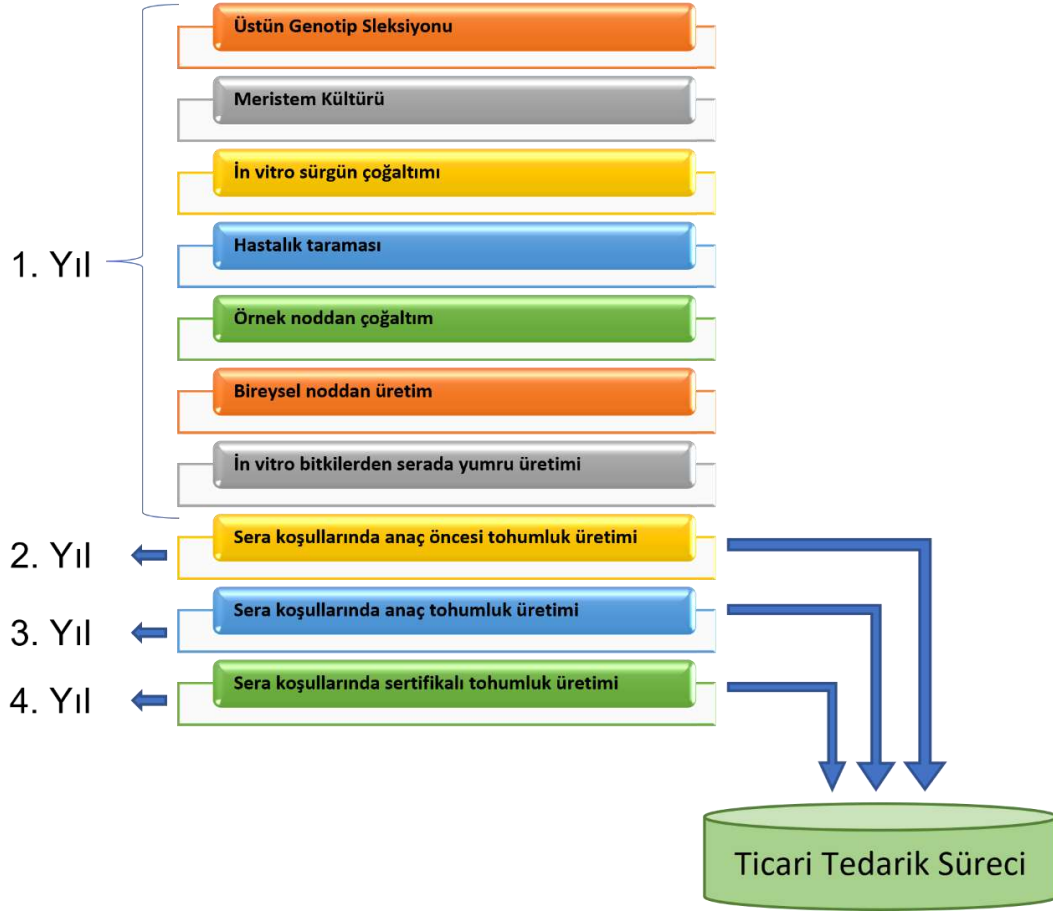
Birçok araştırmacı, patateslerde mikro yumruların in vitro indüksiyonu için farklı büyüme düzenleyicileri kullanmıştır (Tugrul ve Samanci 2001; Hossain, 2005). Bazı araştırmalar, in vitro tüberizasyonun fotoperiyot oranı, hormonal kombinasyon, besin kompozisyonları vb. gibi çeşitli faktörler tarafından kontrol edildiğini ortaya koymuştur (El-Sawy ve ark 2007; Bodoni ve Chauhan, 2009).

İn vitro üretim tekniği birçok ülkede hastalıksız patates tohumluğu elde etmek için kullanılmıştır (Wang ve Hu, 1982; Islam ve Chowdhury, 1998; Khan ve ark 2003). Günümüzde patates mikro yumrularının toplu olarak çoğaltılması için biyoreaktör sistemleri kullanılabilmektedir (Xuan ve ark., 2003).

Apikal meristem, bir sürgünün ucundaki farklılaşmamış olan yeni mikroskobik dokudur. Henüz bitkinin vasküler sistemine katılmamış olan bu meristematik doku, hastalıklı bitkilerde bile çoğu zaman virüssüzdür. Bu nedenle, bitkinin apikal meristeminden alınan eksplantların kültüre alınması bu dokuların büyümelerine ve sağlıklı, hastalıksız bitkiler üretmelerine olanak tanımaktadır. Bu teknik meristem kültürü olarak bilinmektedir (Kyte ve ark. 2013). Meristem kültürü tekniğinin bitkide virüsü yok ettiğine dair raporlar bulunmaktadır (Nagib ve ark., 2003; Al-Taeb ve ark 2011; Feyissa ve Dusagga 2011). Mikro yumrular, mini yumrular (temel tohum) üretmek için kontrollü bir ortamda ekilmektedir. Süreç içerisinde mini yumrular çiftçilere satılacak olan sertifikalı tohumu üretmek için tohum üretim zincirine girmektedir (Koleva Gudeva ve ark., 2012) In vitro patates tohumluğunun üretim sürecini ele alan örnek görsel Şekil 1'de verilmiştir.



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Şekil 1. In vitro patates tohumluğu üretim süreci

Günümüzde, patates mikro yumrularının oluşumunun ve büyümesinin tüm aşamaları için optimum koşulların oluşturulmasına katkıda bulunan çeşitli teknolojiler geliştirilmiştir (Hosseininejadian ve Naderidarbaghshahi, 2018; Naik ve Buckseth, 2018). Çeşitli yenilikler ve iyileştirmeler ile in vitro bitkilerden üretim verimliliği yüksek oranda artarken, çoğaltım maliyetleri de düşmüştür. Nispeten fakir bölgelerde bile, dünya çapında uygulanabilecek teknolojilerin daha fazla kullanılması için oldukça fazla potansiyel bulunmaktadır (Navarre ve Pavék, 2014)

SONUÇ

Dünyadaki en önemli besin kaynaklarından olan patatesin viral hastalıklar sebebiyle oluşacak verim kayıplarının önüne geçilmesi gerekmektedir. Patates tohumluğundan viral hastalıkları arındırmak adına izlenecek yolların başında meristem kültürü gelmektedir. Meristem kültürünün deneysel sonuçları virüssüz patates tohumluğu üretimi için bu tekniğin ticari olarak kullanımını zorunlu kılmaktadır.



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KAYNAKLAR

I-Taleb, M. M., Hassawi, D. S., Abu-Romman, S. M. (2011). Production of virus free potato plants using meristem culture from cultivars grown under Jordanian environment. *American-Eurasian Journal of Agricultural & Environmental Sciences*, 11(4), 467-472.

Badoni, A., Chauhan, J. S. (2009). Effect of growth regulators on meristem-tip development and in vitro multiplication of potato cultivar 'Kufri Himalini'. *Nature and Science*, 7(9), 31-34.

Bamberg, J. B., Martin, M. W., Abad, J., Jenderek, M. M., Tanner, J., Donnelly, D. J., Nassar, A. M. K., Veilleux, R. E., Novy, R. G. (2016). In vitro technology at the US potato Genebank. *In vitro Cellular Dev. Biol. – Plant* 52 : 213-25.

Clark, C.A., J.W. Moyer, (1988). Compendium of Sweet Potato Diseases. The American Phytopathological Society, St. Paul, Minnesota, USA.

Coleman, K.W., Danielle, J.D., Coleman, S.E., (2001). Potato microtuber as research tools: A Review. *Am J Potato Res.* 78: 47-55.

Crissman, C. (1987). Identifying Strengths and Weaknesses in Seed Programs. The Social Sciences at CIP. Report of the Third Social Science Planning Conference. CiP, pp: 262-272.

Davidson, R. D., Xie, K. (2014). Seed potato production. *The potato: botany, production and uses*, 115-132.

deBokx, JA, (1972). Virus of potato and seed-potato production. *Cent. Agric. Publ. Doc*, Wageningen, pp: 9.

El-Sawy, A, Bekheet, S., Aly, U.I. (2007). Morphological and molecular characterization of potato microtubers production on coumarin inducing medium. *In J Agri Biol.* 9(5): 675-680.

Feyissa, T., Dugassa, G. (2011). In vitro production of virus-free sweet potato [*Ipomoea batatas* (L.) Lam] by meristem culture and thermotherapy. *SINET: Ethiopian Journal of Science*, 34(1), 17-28.

Hossain, M.J. (2005). In vitro Microtuberisation in Potato Obtained from Diverse Sources. *Plant Tissue Cult. & Biotech.* 15(2): 157-166.

Hosseinejad, J., Naderidarbaghshahi, M. (2018). Effects of biological growth stimulants on physiological traits and yield of potato (*Solanum tuberosum* L.) in minituber production system. *Research on Crops*, 19(1), 58-61.



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Islam, M.S., Chowdhury A.R. (1998). Virus free stock production of some indigenous potato varieties of Bangladesh. *Plant Tissue Culture*. 8 (1): 41-47.

Khan, M.S., Hoque, R.H., Sarker, H., Muehlebach P. (2003). Detection of important plant viruses in in vitro regenerated potato plants by double antibody sandwich method of ELISA. *Plant Tissue Culture* 13(1): 21-29.

Koleva Gudeva, L., Mitrev, S., Trajkova, F., Ilievski, M. (2012). Micropropagation of Potato *Solanum tuberosum* L. *Electronic Journal of Biology*, 8(3), 45-49.

Kyte, L., Kleyn, J., Scoggins, H., Bridgen, M. (2013). *Plants from test tubes: An introduction to micropropagation*. Timber Press.

Mellor, F.C., Stace-Smith, R. (1987). Virus-free potatoes through meristem culture. In: *Biotechnology in Agriculture and Forestry: Potato.* (Ed. Y.P.S.Bajaj.) Springer-Verlag, Berlin, pp: 30-39.

Nagib, A., Hossain, S. A., Alam, M. F., Hossain, M. M., Islam, R., Sultana, R. S. (2003). Virus free potato tuber seed production through meristem culture in tropical Asia. *Asian J. Plant Sci*, 2(8), 616-622.

Naik, P., Buckseth, T. (2018). Recent advances in virus elimination and tissue culture for quality potato seed production. In: Gosal, S. and Wani, S. (Eds). *Biotechnologies of crop improvement*. Cham: Springer, Vol. 1. pp. 131-58.

Navarre, D., Goyer, A., Payyavula, R., Hellmann, H. (2014). 18 Nutritional Characteristics of Potatoes. *The Potato: Botany, Production and Uses*, 310.

Navarre, R., Pavek, M.J. (Eds.). (2014). *The potato: botany, production and uses*. CABI, IX-X.

Oves, E.V., Zhevora, S.V. (2015). Modern methods of conservation of varietal resources of potatoes. *Potatoes and vegetables* 12 : 21-23.

Rasco, E.T., Aromin, F.B. (1994). The Potato in its Third Frontier In: (Ed. Rasco, E.T. and F.B. Aromin, 1994). *Proceedings of the Fourth APA Triennial Conference*, APA, pp: 1-24.

Rashid, M.M. (1987). Problems of production of true potato seeds in Bangladesh. *Proc. Workshop of TPS Res. in Bangladesh*. PRC. BARI. Joydevpur, pp: 5-7.

Sergey, L. R., Aleksey, V. M., Aleksey, L. B., Nadezhda, N. D. (2020). Development and implementation of modern biotechnological module for year-round virus-free potato (*Solanum tuberosum*) mini-tuber production. *Res. Crops* 21 : 529-33.



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Siddique, M.A., MM. Hussain, (1988). Production of local potato varieties (in Bangali). Bangladesh-Netherlands seed multiplication project, BADC, Dhaka, pp: 20.

Simko, I. (1993) Effect of Kinetin, Paclobutrazol and Their Interactions on the Micropropagation of Potato Stem Segments Cultured in vitro in the Light". Plant Growth Reg., 12: 23-27.

Singh, R, Finnie, R.E., Bagnall, R.H. (1971). Losses due to the potato spindle tuber virus. Am. Potato J., 48: 262-267.

Tovar, P.R., Estrada, L., Dodds J.H. (1985). Induction and use of in vitro potato tubers. CIP Circular, International Potato Center 13: 1-4.

Tugrul, S., Samanci, B. (2001). Factors affecting tuber formation in potato (*Solanum tuberosum* L.) Potato Abstr. 26: 86.

Wang, P.J., Hu, C.Y., (1982). In vitro mass tuberization and virus-free seed potato production in Taiwan. Am Po J. 59: 33-37.

Wrobel, S. (2015). Assessment of potato microtuber and in vitro plantlet seed multiplication in field conditions-Growth, development and yield. Field Crops Res. 178 : 26-33.

Xuan, C.P., Debasis, C., Eun, J. H. Kee, Y.P. (2003). A simple method for mass production of potato microtubers using a bioreactor system. Current Science, 84(8): 1129-1132.

Zobayed, S.M.A., Armstrong, J., Armstrong, M. (2001) Micropropagation of Potato: Evaluation of Closed, Difusive and Forced Ventilation on Growth and Tuberization, Annals of Botany 87: 53-59.



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BİTKİ ISLAHINDA HAPLOİD TEKNİĞİNİN AVANTAJLARI

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ÖZET

Somatik hücrelerde kromozom sayısı, bulundukları bitki türündeki gamet hücrelerinin kromozom sayısı kadar olan bitkilere haploid bitki denilmektedir. Bu bitkilerin homolog kromozomlardan yalnızca bir takımını içermesi, resesif karakterlerin ortaya çıkmasına olanak tanımaktadır. Ayrıca haploid bitkilerin kromozomlarının katlanması ile %100 homozigot saf hatlar oluşabilmektedir. Böylelikle ıslah sonrası uzun süreçlere ihtiyaç duyulan saflaştırma işlemi, birkaç ay gibi çok kısa bir süre içerisinde yapılabilmektedir. Bu sayede F1 hibrit çeşit ıslahı programları ve kombinasyon ıslahında zaman olarak yüksek kazanç sağlanmaktadır. Haploidizasyon yöntemi resesif mutasyonları açığa çıkarmada başvurulabilecek en etkili işlemdir. Haploid bitkilerdeki resesif genler, dominant genler tarafından bastırılmayacağından, dihaploid hatlarda genetik açılımı izlemek gerekmektedir. Çeşitli yöntemlerle haploid bitkilerin kromozom sayısının iki katına çıkarılarak homozigot fertil bitkilerin (2n) elde edilmesine “dihaploidizasyon” ve bu bitkilere “doubled haploid” ler denilmektedir. Double haploid bitkiler içerisinden alınan saf hatlar F1 melez çeşitlerinin ıslahında ebeveynler olarak kullanılabilir. Diploid türlerde gerçek üreme hatlarının anında üretimi, ıslah programında birkaç nesil tasarrufu sağlamaktadır. Diğer taraftan, seçim saf hatlarda erken nesil ayırma hatlarına göre çok daha etkili olup kantitatif özellik değerlendirilmesi de programda daha erken başlayabilmektedir. Bu durumda zamandan ve yerden tasarruf sağlanmaktadır. Bu derlemede haploid bitki ıslahının gelişimi ve avantajları değerlendirilmiştir.

Anahtar Kelimeler: Haploid, Double Haploid, Bitki Islahı



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ADVANTAGES OF HAPLOID TECHNIQUE IN PLANT BREEDING

ABSTRACT

Plants whose chromosome numbers in somatic cells are equal to the number of chromosomes in the gamete cells of the plant type they are in are called haploid plants. The fact that these plants contain only one set of homologous chromosomes allows the emergence of recessive characters. In addition, 100% homozygous pure lines can be formed by doubling the chromosomes of haploid plants. Thus, the purification process, which requires long processes after improvement, can be carried out in a very short time, such as a few months. In this way, high time savings are achieved in F1 hybrid variety breeding programs and combination breeding. The Haploidization method is the most effective process that can be applied to reveal recessive mutations. Since recessive genes in haploid plants cannot be suppressed by dominant genes, it is necessary to monitor genetic expansion in dihaploid lines. Obtaining homozygous fertile plants ($2n$) by doubling the chromosome number of haploid plants by various methods is called "dihaploidization" and these plants are called "doubled haploids". Pure lines from double haploid plants can be used as parents in breeding F1 hybrid varieties. The immediate production of true breeding lines in diploid species saves several generations in the breeding program. On the other hand, the selection is much more effective in pure lines than in early generation separation lines, and quantitative trait evaluation can start earlier in the program. In this case, time and space are saved. In this review, the development and advantages of haploid plant breeding are evaluated.

Keywords: Haploid, Double Haploid, Plant Breeding



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GİRİŞ

Tarımsal üretimin başlangıcından bu yana, sürekli artan popülasyonları beslemek adına daha fazla ve daha kaliteli ürünler yetiştirmek için sürekli bir çaba gösterilmiştir. Bu nedenle mevcut bitki çeşitliliği yeterli bulunmayıp yeni yüksek verimli çeşitlerin geliştirilmesi tüm bitki ıslahçıların ortak hedefleri arasında olmuştur. (Jain ve ark 1996). Haploid bitkiler, diploid bitkilere göre morfolojik yapıları bakımından daha küçüktürler. Normal bir bitkideki tüm organlar ve yapılara sahip oldukları halde, diploidlere kıyasla boyları daha kısa, hücreleri daha küçük ve yaprakları daha dardır. Çiçek yapıları da diploid bitkilere oranla daha küçük olan haploid bitkiler, hücrelerindeki kromozom sayıları bakımından indirgenen gametlerin yapısını gösteren bitkilerdir. Gamet oluşturmamaları için tohum bağlayamayan ve kısır olan haploid bitkilerin ıslah süreçlerinde değerlendirilebilmeleri için yeniden verimli diploid bitkilere dönüştürülmeleri gerekmektedir. Haploid bitkilerin kromozom sayılarının spontan olarak veya bazı kimyasallar kullanılarak katlanması ile ait oldukları türün kromozom sayısına ($2n$) yeniden kavuşturulmasına ‘dihaploidizasyon’ adı verilmektedir. Bu işlem sonucunda ıslah için mutlak homozigot bitkiler elde edilmiş olur. Dihaploidizasyon yolu ile bitki materyallerinin kısa sürede durağan hale getirilip ıslah programlarında kullanılması günümüzde buğday, arpa, çeltik, mısır, kolza, patlıcan, kavun ve biber gibi pek çok bitki türünde başarıyla uygulanmıştır (Murovec ve Bohanec, 2011).

Haploid bitkiler, mikrospor veya olgunlaşmamış polen gelişim aşamasında erkek gametofitik hücrelerin in vitro kültürü yoluyla üretilmektedir. Haploid kalluslardan embriyolar gelişerek sürgün ve kök oluşumu sağlanmaktadır (Feriie ve Keller 1997). Swanson ve ark. (1988)’nın yapmış oldukları çalışmada, herbisite toleranslı bitkilerin in vitro mikrospor kültürü ile geliştirildiği ifade edilmektedir. Haploid embriyolar ve katlanmış double haploid bitkiler mutasyon ıslahı, genetik mühendisliği, biyokimya ve fizyoloji çalışmalarında ve ayrıca transgenik bitkilerin elde edilmesinde kullanılmaktadır (Swanson and Erickson 1989).

Double haploidler (DH) kullanılarak saf hatların üretilmesi, geleneksel yöntemlere göre çeşitli avantajlara sahiptir. DH üretim sistemleri kullanılarak, bir nesilde homozigotluk elde edilmekte ve birkaç neslin kendi kendine tozlaşma ihtiyacı ortadan kaldırılmaktadır. Özellikle tek yıllık mahsullerde ve uzun yavru dönemi olan mahsullerde zamandan tasarruf önemlidir. Kendi kendine uyumsuz türler, ikievrekli türler ve kendi kendine tozlaşma nedeniyle akrabalı yetiştirme depresyonundan muzdarip türler için, haploidi, akraba soyları geliştirmenin tek yolu olabilir (Murovec ve Bohanec, 2011).



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HAPLOİD VE DOUBLE HAPLOİD BİTKİ ISLAHI

Haploitlerin uyarılması ve yenilenmesi, ardından kromozomların kendiliğinden veya uyarılarak iki katına çıkması, çeşitli tarımsal türlerin ileri ıslah programlarında yaygın olarak kullanılmaktadır. Kuşkonmaz, arpa, *Brassica juncea*, kolza, çeltik, tütün, tritikale ve buğday gibi bitkilerin çeşit üretimi için bu teknik başarıyla kullanılmış ve diğer türler dahil toplamda 290'dan fazla çeşit piyasaya sürülmüştür. DH teknolojisinde dikkate alınması gereken bir diğer özellik ise üreme stratejisidir. Bazı yetiştiriciler daha sonraki nesillerden DH hatları oluşturmayı tercih etse de üreme süreci içinde, DH hatları F1 neslinden en kısa sürede indüklenebilmektedir (F1 bitkilerindeki gametlerin F2 neslini temsil ettiği unutulmamalıdır). F2 neslinde indüksiyon bir seçenek olarak önerilmektedir. Bununla birlikte, Choo ve ark. (1982), DH ve tek tohumlu iniş yöntemlerini karşılaştırarak, rekombinant numunesinde hiçbir fark olmadığını raporlamıştır.

Double haploidlerin üreme sürecindeki rolü büyük ölçüde bitkilerin üreme şekline bağlıdır. Kendi kendine tozlaşan türlerde, nihai çeşitleri temsil edebilirler. Melez üretimde veya çapraz tozlanan türlerin test çaprazlarında ebeveyn hatlar olarak değerlendirilebilirler. Kendi kendine tozlaşan türlerdeki temel üreme şeması, istenen genotiplerin çaprazlanmasıyla başlamakta ve her iki ebeveynin kromozom setlerini içeren melezlere yol açmaktadır. Gamet oluşumu sırasında rekombinasyonlar, double haploid üretim sürecinde sabitlenen yeni gen kombinasyonlarını mümkün kılmaktadır. Bu nedenle double haploidler tamamen homozigot bir durumda ebeveyn genomlarının rekombinant ürünlerini temsil etmektedir. Yıllar boyunca agronomik performansın büyük ölçekli test edilmesini kolaylaştıran gerçek üreme hatları olarak yayılabilirler. Tam homozigotluk nedeniyle, resesif aleller bir nesilde sabitlendiğinden ve doğrudan ifade edildiğinden hem kalitatif hem de kantitatif karakterler için seçimin verimliliği artmaktadır (Murovec ve Bohanec, 2011).

Kendi kendine tozlaşan türlerde olduğu gibi, çapraz tozlaşan türlerde double haploidlerin kullanımı seçim verimliliğini artırmakta ve tekrarlanan seçimin herhangi bir veya her döngüsünde kullanılabilir. Double haploid teknolojisi, genlerin bir nesilde hızlı bir şekilde sabitlenmesi ve zararlı alellerin popülasyonlardan erken ortadan kaldırılması yoluyla bu sorunların üstesinden gelmeye yardımcı olur. Geri kazanılan rekombinasyon ürünleri böylece daha uygun gen kombinasyonlarını temsil eder. Çeşitlerdeki heterozigotluğun ve heterojenliğin tamamen yokluğunun çevresel değişikliklere ve değiştirilmiş kırpma sistemlerine karşı daha savunmasız olduğu düşünülse de bunların tam homozigotluğu, nesiller boyunca gerçek üreme



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ve istikrarlı tarla performansı sağlamaktadır. Kromozom katlanmasını takiben, DH bitkileri bakım ve daha fazla çoğalma için kendi kendine üretilmektedir. Güçlü bir şekilde kendi kendine uyuşmazlığı olan çapraz tozlanan türlerde, uyumsuzluk reaksiyonunun üstesinden gelmek için çeşitli teknikler kullanılmaktadır. Örneğin Kanola'da tomurcuk tozlaşması, CO² ile zenginleştirilmiş bir atmosferde işleme tabi tutularak (Nakanishi & Hinata, 1973) veya gibberellik asit, sodyum klorür, üre veya amonyum sülfatın stigmalar üzerine uygulanmasıyla (Sun ve ark, 2005) arttırılmaktadır. Alternatif olarak, DH hatları klonal olarak çoğaltılabilmekte ve bu durumda mikro çoğaltım genellikle en iyi seçim olmaktadır (Murovec ve Bohanec, 2011). Mutasyon ıslahı, double haploid tekniklerinin süreci hızlandırmaya yardımcı olabileceği başka bir bitki iyileştirme alanıdır. Rejenerantların homozigotluğu ve gerçek üreme yayılımı, mutajenik tedaviden sonra ilk nesilde mutasyonların sabitlenmesini sağlamaktadır. Mutasyona uğramış tüm özellikler hemen belirlenmekte ve ilk nesilde hem çekinik hem de baskın mutantların kendi kendine tozlanmasına ihtiyaç duyulmadan taranmaktadır. İlk seçenек, çimlenme ve çiçeklenme sırasında haploid kültür için donör materyal olarak kullanılan M1 gametleri üreten uyuyan tohumlara mutajenik tedavi uygulanmasıdır. İkinci seçenек, haploid hücrelerin in vitro mutajenik tedavisine dayanmaktadır. Mutajenik ajan genellikle, nükleer füzyon yoluyla spontan dihaploidizasyonun neden olduğu heterozigotluk ve kimerizmi önlemek için tek çekirdekli aşamada mikrospor izolasyonundan hemen sonra, ilk nükleer bölünmeden önce uygulanmaktadır. İn vitro mutajenik tedaviyi, hastalık ve herbisit direnci gibi istenen özelliklerin in vitro seçimi takip edebilmektedir (Murovec ve Bohanec, 2011).

Işınlanmış polen tarafından uyarılan maternal haploidlerin üretimi, bazı durumlarda, yöntemin çok zahmetli olması nedeniyle kullanımı sınırladığı gösterilen etkili bir emaskülasyon gerektirmektedir. Örneğin soğandaki böyle bir engelin üstesinden gelmek için, donör bitkiler olarak sadece erkek-steril donör bitkiler kullanılmıştır. Ancak sitoplazmik olarak kalıtsal erkek kısırlığına sahip olan bu tür hatların pratik kullanımı çok sınırlıdır. Haploid üretimini etkileyen faktörlerin dışında, in situ haploid üretimini kontrol eden ana faktör ışınlama dozudur. Daha düşük dozlarda, generatif çekirdek kısmen hasar görmekte ve bu nedenle yumurta hücresini dölleme kapasitesini korumaktadır. Işınlama dozundaki artış toplam gelişen embriyo sayısında azalmaya neden olmaktadır. Ancak elde edilen rejenerantlar çoğunlukla haploid kökenlidir. Çoğu bitki türünde, haploid bitkileri kurtarmak için in vitro embriyo kurtarma işlemi gereklidir. Olgun tohumların toplanması sadece kivi (Pandey ve ark., 1990), soğan (Dore ve Marie, 1993), mandalina (Froelicher ve ark., 2007) ve Tütün (Pandey ve Phung, 1982) türleri için rapor



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edilmiştir. Yukarıda bahsedilen bitkiler için bile tohumların in vitro çimlenmesi haploid bitkilerin geri kazanımını arttırmıştır.

SONUÇ

Double haploidi, heterozigot donör bitkilerden tek adımda tamamen homozigot hatların üretimi için oldukça verimli bir yöntem olmaya devam etmektedir. İyi kurulmuş ıslah protokolleri olan türler ağırlıklı olarak tarla bitkileri veya sebzelere aittir, ancak üretim teknikleri meyve ve süs bitkileri ve diğer uzun ömürlü bitkiler de dahil olmak üzere çoğu bitki türü için de geliştirilmektedir. Haploid indüksiyon tekniği günümüzde, geliştirilmiş mutasyon ıslahı, geri çaprazlama, melez ıslahı ve genetik transformasyon gibi birkaç yeni ıslah başarısını mümkün kılarak, diğer biyoteknolojik uygulamalarla verimli bir şekilde birleştirilebilir.



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KAYNAKLAR

Choo, T. M., E. Reinbergs, S. J. Park, (1982). Comparison of frequency distributions of doubled haploid and single seed descent lines in barley. *Theor. Appl. Genet.* 61: 215-218.

Dore, C., F. Marie, (1993). Production of gynogenic plants of onion (*Allium cepa* L.) after crossing with irradiated pollen. *Plant Breed.* 111: 142-147.

Ferrie, A. M. R., Keller, W. A. (1997). Production of haploids in Brassica spp. via microspore culture. In *Plant Tissue Culture Manual* (pp. 829-845). Springer, Dordrecht.

Froelicher, Y., Bassene, J. B., Jedidi-Neji, E., Dambier, D., Morillon, R., Bernardini, G., ... & Ollitrault, P. (2007). Induced parthenogenesis in mandarin for haploid production: induction procedures and genetic analysis of plantlets. *Plant Cell Reports*, 26(7), 937-944.

Jain, S. M., Sopory, S. K., Veilleux, R. (Eds.). (1996). *In Vitro Haploid Production in Higher Plants: Volume 2: Applications* (Vol. 24). Springer Science & Business Media.

Kasha, K. J., Maluszynski, M. (2003). Production of doubled haploids in crop plants. An introduction. In *Doubled haploid production in crop plants* (pp. 1-4). Springer, Dordrecht.

Maluszynski, M., Kasha, K., Forster, B. P., Szarejko, I. (Eds.). (2003). *Doubled haploid production in crop plants: a manual*. Springer Science & Business Media.

Murovec, J., Bohanec, B. (2011). Haploids and doubled haploids in plant breeding. *Plant Breeding*, Dr. Ibromkhim Abdurakhmonov (Ed.).–2012.–P, 87-106.

Nakanishi, T. Hinata, K. (1973). Effective time for CO₂ gas treatment in overcoming selfincompatibility in Brassica. *Plant and Cell Physiology*, Vol. 14, No. 5, (October 1973), pp. 873-879, ISSN 0032-0781

Pandey, K. K., Phung, M. (1982). ‘Hertwig effect’ in plants: induced parthenogenesis through the use of irradiated pollen. *Theoretical and Applied Genetics*, 62(4), 295-300.

Pandey, K.K., Przywara, L., Sanders P.M. (1990). Induced parthenogenesis in kiwifruit (*Actinidia deliciosa*) through the use of lethally irradiated pollen. *Euphytica* 51: 1-9

Sun, W., Pan, Q., Liu, Z., Meng, Y., Zhang, T., Wang, H., Zeng, X. (2005). Overcoming self-incompatibility in *Eruca sativa* by chemical treatment of stigmas. *Plant Genetic Resources*, 3(1), 13-18.



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Swanson E.B, Coumans M.P., Brown G.L., Patel J.D., Beversdorf W.D. (1988). The characterization of herbicide-tolerant plants in *Brassica napus* L. after in vitro selection of microspores and protoplasts. *Plant Cell Rep* 7: 83–87.

Swanson E.B, Erickson L.R. (1989). Haploid transformation in *Brassica napus* using an octopineproducing strain of *Agrobacterium tumefaciens*. *Theor Appl Genet* 78: 831–835.



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**ÇUKUROVA KOŞULLARINDA DANELİK MISIRDA (*Zea mays* L.) FARKLI EKİM
ZAMANLARININ DANE VERİMİ VE BAZI BİTKİSEL ÖZELLİKLER ÜZERİNE
ETKİSİNİN BELİRLENMESİ**

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ÖZET

Bu araştırma Çukurova Bölgesi ana ürün koşullarında danelik mısırdaki (DKC 6761, DKC 5364 ve 72 MAY 80) farklı ekim tarihlerinin (1 Şubat, 20 Şubat, 10 Mart, 30 Mart, 20 Nisan) dane verimi ve diğer bazı bitkisel özelliklere etkisini belirlemek amacıyla, Çukurova Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Araştırma ve Uygulama Alanında, 2019 yılında bölünmüş parseller deneme desenine göre, üç tekerrürlü olarak yürütülmüştür. Araştırmada farklı ekim zamanlarının bitki boyu, bitkide sap kalınlığı, koçan boyu, koçan çapı, koçanda dane sayısı, koçanda dane ağırlığı, hektolitre ağırlığı, nem içeriği ve dane verimi özelliklerine etkisi incelenmiş olup, en yüksek dane verimi 10 Mart ve 30 Mart ekimlerinden saptanmıştır.

Anahtar Kelimeler: Danelik mısır, ekim zamanı, bitkisel özellik, dane verimi



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**DETERMINATION OF THE EFFECT OF DIFFERENT SOWING TIMES ON
GRAIN YIELD AND SOME PLANT CHARACTERISTICS OF DENT CORN (*Zea
mays* L.) IN ÇUKUROVA REGION CONDITIONS**

ABSTRACT

This research was conducted to determine the effects of different sowing times (1 February, 20 February, 10 March, 30 March, 20 April) on grain yield and several plant characters of dent corn (DKC 6761, DKC 5364 and 72 MAY 80) in the main product conditions of Çukurova Region, in the Cukurova University Faculty of Agriculture, Department of Field Crops, according to split plot design with three replication.. The effect of different sowing dates were evaluated for plant height, stem diameter, ear lenth, ear diameter, number of grains per ear, 1000 grain weight, grain weight per ear, hectolitre weight, moisture content and grain yield. It was determined that the highest grain yield was obtained from the 10 and 30 March sowings.

Keywords: Dent corn, sowing time, grain yield, plant characters



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1. GİRİŞ

Ülkemizde tahıllar içerisinde buğday ve arpadan sonra en geniş ekim alanına sahip olan mısırın, 2004 yılında 545 bin hektar olan ekim alanı 2019 yılına gelindiğinde 638 bin hektara yükselmiştir. Benzer şekilde 2004 yılında 3 milyon ton olan üretim miktarı da 2019 yılında 6 milyon tona yükselmiştir. Son 15 yıllık süreçte ülkemizde gerek mısır ekim alanında (%17.06) gerekse üretim miktarında (%100) bir artış söz konusu olup (TÜİK, 2019), bu artışa neden olan ana faktörün birim alandaki verim artışı olduğu bildirilmiştir (Saygı ve Toklu, 2017). Ayrıca ekim alanlarının %68'ini danelik, %32'sini silajlık mısırın oluşturduğu mısır tarımı başta Akdeniz bölgesi olmak üzere Karadeniz Bölgesi, Marmara, Ege ve Güneydoğu Anadolu bölgesini kapsayan yaklaşık 60 ilimizde yoğunlaşmaktadır (ZMO, 2016).

Akdeniz Bölgesi yaklaşık 186 bin hektarı danelik, 22 bin hektarı silajlık olmak üzere toplam 198 bin hektar mısır ekim alanı ve 1.6 milyon ton dane mısır ve 948 bin ton silajlık mısır üretimi ile ülkemizde ilk sırada yer almaktadır. Adana ise 91 bin hektar ekim alanı ve 1 milyon tonluk dane mısır üretimi ile ülkemiz mısır ekim alanı ve üretimi yönünden ilk sırada yer almaktadır (ZMO, 2016). Mısırın ülkemiz ve bölgemiz için bu kadar önemli bir ürün olmasından dolayı hem mısır ıslahı hem de yetiştirme tekniklerine yönelik yoğun araştırmalara ihtiyaç olduğu açıktır.

Mısır tarımında çok sayıda yetiştirme tekniği kullanılmaktadır. Bu tekniklerden biri olan ekim zamanı olup, tane verimini etkileyen önemli faktörlerden birisidir. Ekim zamanının değişimi bitkinin farklı büyüme ve gelişme dönemlerini etkileyen farklı iklimsel değerlere (sıcaklık, ışık, nem vb.) maruz kalmasına neden olmaktadır. Bu iklimsel değerlerin değişmesi bitkideki büyüme parametrelerinin tamamını da etkilemektedir. Bunun sonucunda bitkinin dane verimi de etkilenmektedir (Koca ve Turgut, 2012; Kırac, 2018)

Burcu (2016), ekim zamanındaki gecikmenin, kuru madde oranı yanında tepe püskülü çıkarma süresi ve koçan püskülü çıkarma süresini de azalttığını; Atasever (2018) farklı mısır çeşitlerinin farklı ekim zamanlarındaki performanslarını belirlemek için bu tip araştırmaların sürdürülmesine ihtiyaç olduğunu rapor etmişlerdir.

Mısır tarımında birim alandan yüksek verim elde edebilmek için önemli faktörlerden birisi uygun ekim zamanının belirlenmesi ve ekimin bu dönemde yapılmasıdır. Çukurova Bölgesi koşullarında son yıllara kadar birinci ürün koşullarında mısır ekimi genellikle Mart ayı içerisinde yapılmakta idi. Ancak son yıllarda üreticiler ekim tarihini Şubat ayı başlarına kadar çekmiş bulunmaktadır. Bu durum, bölgede mısır üretiminde optimum ekim zamanının



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belirlenmesi için arařtırmalar yapılması gerekliliđini ortaya koymuřtur. Bu alıřmanın amacı; ukurova Blgesi kořullarında danelik mısırdaki (*Zea mays* L.) farklı ekim zamanlarının dane verimi ve bazı bitkisel zellikler zerine etkisinin belirlenmesidir.

2. MATERYAL VE METOD

Arařtırmada, farklı tohumculuk firmaları tarafından tescil ettirilen ve lkemizin mısır yetiřtirilen farklı blgelerinde yaygın olarak yetiřtiriciliđi yapılan 3 adet mısır eřidi (72 May 80, DKC 6761 ve DKC 5364) materyal olarak kullanılmıřtır. Arařtırmaya iliřkin tarla denemeleri, 2019 yılı mısır yetiřtirme sezonunda ukurova niversitesi, Ziraat Fakltesi, Tarla Bitkileri Blm Arařtırma ve Uygulama Alanında (37°0'49.86"K enlem ve 35°21'32.00"D Boylamında) kurulup yrtlmřtr.

Deneme Yerinin İklim zellikleri

Denemenin yrtldđ Adana ilinde etkili olan Akdeniz ikliminde kışları ılık ve yađıřlı, yazları sıcak ve kurak gemektedir. Uzun yıllara ve denemenin yrtldđ 2019 yılına ait iklim deđerleri izelge 1' de verilmiřtir.

izelge 3. Denemenin kurulduđu yere iliřkin 2019 yetiřtirme yılında saptanan bazı meteorolojik deđerler ile uzun yıllar ortalaması

Aylar	Minimum Sıcaklık (°C)		Maksimum Sıcaklık (°C)		Ortalama Sıcaklık (°C)		Toplam Yađıř (mm)		Nisbi Nem (%)	
	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar	2019	Uzun Yıllar
řubat	7.9	5.9	17.1	16.1	11.8	10.5	97.8	89.7	72.1	71.0
Mart	2.3	8.2	26.4	19.4	13.8	13.4	96.5	65.1	69.0	68.2
Nisan	7.0	11.8	32.0	23.7	17.0	17.5	71.1	51.1	67.0	64.2
Mayıs	11.8	15.7	39.4	28.2	24.1	21.7	2.6	47.1	57.6	58.3
Haziran	18.7	19.7	37.5	31.7	27.1	25.6	21.3	20.5	68.7	64.2
Temmuz	21.6	22.9	36.3	33.9	28.4	28.2	30.9	6.2	68.8	68.2
Ađustos	22.9	23.3	39.6	34.7	29.6	28.7	0.0	5.5	68.0	68.3
Eyll	20.1	24.9	35.9	33.1	29.3	26.1	0.0	17.6	69.6	68.3

izelge 1'in incelenmesinden de grldđ zere deneme sresince llen minimum sıcaklık deđerleri řubat ayı minimum sıcaklık deđerlerinin aksine uzun yıllar ortalamasından daha dřk, maksimum sıcaklıđı ise uzun yıllar ortalamasından daha yksek olmuřtur. Denemenin yrtldđ 2019 yılı yetiřtirme mevsimini kapsayan aylarda ortalama sıcaklık deđerinin genel olarak uzun yıllar ortalamasından daha yksek olduđu grlmektedir. Ayrıca denemenin



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yürütüldüğü sezon ve uzun yıllar yağış miktarı incelendiğinde Nisan, Ağustos ve Eylül aylarının aksine denemenin yürütüldüğü sezonda yağış miktarı uzun yıllar yağış miktarından daha fazla olduğu görülmektedir.

Deneme Yerinin Toprak Özellikleri

Araştırma alanı topraklarının 0-30 cm toprak derinliğinden alınan toprak örneklerinin Çukurova Üniversitesi Ziraat Fakültesi, Bitki Besleme ve Toprak Bilimi laboratuvarında yapılan toprak analiz sonuçları aşağıda Çizelge 2’de verilmiştir.

Çizelge 4. Araştırmanın yürütüldüğü Çukurova Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü araştırma alanı toprak analiz sonucu

pH	EC (mmhos cm ⁻¹)		Organik Madde (%)	CaCO ₃ (%)	Tekstür Sınıfı
7,125±0,21	0,36±0,00	Tuzsuz	1,32	27,2±0,5	C

Kaynak: Ç.Ü. Ziraat Fakültesi, Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarı Analiz Sonuçları, 2019

Denemenin yürütüldüğü alan, Seyhan nehri yan kollarının getirdiği genç alüvyal topraklardan oluşmaktadır. Deneme alanı toprakları C horizonuna sahip olup, orta derin ve derin profillidir. Organik madde oranı orta düzeyde (%1.32) ve tuzsuzdur. Hafif alkali yapılı olup, orta düzeyde kireçlidir.

Deneme Deseni, Ekim ve Bakım İşlemleri

Araştırmaya ilişkin deneme 2019 yılında üç farklı danelik mısır çeşidi (72 MAY 80, DKC 6761 ve DKC 5364) ile beş farklı ekim zamanı (1 Şubat, 20 Şubat, 10 Mart, 30 Mart, 20 Nisan) bölünmüş parseller deneme desenine göre üç tekrarlamalı olarak yürütülmüştür. Deneme parselleri ekim zamanı ana parsellere, çeşitler alt parsellere gelecek şekilde her parselde sıra arası sabit 70 cm olacak şekilde ayarlanmıştır. Ekim, markörle açılan sıralara elle yapılmıştır. Ekimde her bir noktaya 2 tohum, 6-7 cm derinlikte ekilmiş olup, çıkıştan sonra bitkiler 15-20 cm boya ulaştığında tekleme yapılmıştır. Denemede Yabancı otlarla mücadelede elle ve traktör ile çapalama ve uygun herbisitler kullanılarak yapılmıştır. Bitkiler yetiştirme süresi boyunca toplam 30 kg/da saf azot, 10 kg/da P₂O₅ ve 10 kg/da K₂O olacak şekilde topraktaki besin elementleri de dikkate alınarak gübreleme yapılmış, azotun 10 kg/da’lık kısmı ile fosfor ve potasyumun tamamı ekimle birlikte taban gübresi olarak verilmiş, azotun kalan kısmı bitkiler 40-50 cm boya ulaştıklarında sıra aralarına gübre makinesi ile üst gübreleme olarak uygulanmıştır. Ekim, tavlı toprağa yapılmış, çıkış sırasında ve çıkıştan sonra bitkiler 5-6



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yapraklı devreye gelinceye kadar, gerekli olduğu durumda yağmurlama sulama yapılmıştır. Bitkilerin vejetatif ve generatif dönemlerini kapsayan büyüme ve gelişme sürecinde, bölgemizde mısırdaki zarar oluşturan hastalık ve zararlıların gözlemi yapılmıştır.

Hasat işlemi, her parselin ortadaki iki sırasında, parsel başından ve sonundan 0.5 m'lik kısım hariç 4 m'lik kısımdaki koçanlar elle koparılarak yapılmış olup parselden elde edilecek koçanlar kavuzlarından ayrılmış, koçan harman makinesinde danelenmiştir.

İncelenen Bitkisel Özellikler

Araştırmada, bitkisel özelliklere ilişkin gözlem ve ölçümler; Anderson ve ark. (1984), Ülger ve ark. (1997), Kara (2006)'nın kullandıkları metodlar uyarınca, bitki boyu (cm), bitkide sap kalınlığı (cm), koçan boyu (cm), koçan çapı (mm), koçanda dane sayısı (adet/koçan), koçanda dane ağırlığı (g/koçan), hektolitre ağırlığı (kg/hl), nem içeriği, bin dane ağırlığı (g), dane verimi (kg/da) için yapılmıştır.

Araştırmada Elde Edilen Verilerin Değerlendirilmesi

Bölünmüş parseller deneme desenine göre yürütülmüş olan çalışmada, elde edilen verilerin varyans analizleri PC uyumlu Mstat-c istatistik paket programı kullanılarak, uygulamalar arasında görülen farklılıkların gruplandırmaları EGF (LSD) testine göre yapılmıştır.

3. BULGULAR VE TARTIŞMA

Çukurova Koşullarında danelik mısırın farklı ekim zamanlarında yetiştirilmesiyle elde edilen bitki sayısı, sap kalınlığı, koçan boyu ve koçanda dane sayısına ilişkin ortalama veriler Çizelge 3'de verilmiştir.

Çizelge 4.2'nin incelenmesinden görüldüğü üzere, araştırmada materyal olarak kullanılan üç danelik mısır çeşidi bitki boyu yönünden önemli farklılık göstermiş olup bitki boyu değerleri 238.3-265.9 cm arasında değişmektedir. En yüksek bitki boyu değerleri (265.9 cm) 72 MAY 80 mısır çeşidinden elde edilirken en düşük bitki boyu değeri DKC5364 (243.3 cm) çeşidinden elde edildiği görülmektedir. Farklı ekim zamanları açısından bakıldığında ortalama bitki boyu değerleri yönünden istatistiksel olarak önemli bir farklılık görülmemekle birlikte, bitki boyu değerleri 226.9-272.4 cm arasında değişim göstermiştir. En yüksek bitki boyu değeri 20 Şubat tarihinde (272.4 cm) en düşük bitki boyu değeri ise 10 Mart tarihinde (226.9 cm) gözlenmiştir (Çizelge 4.2). Konu ile ilgili yürüttükleri çalışmada Kaya ve Kuşaksız (2012), ekim zamanının bitki boyuna etkisinin bazı aylarda meydana gelen sıcaklık ve diğer meteorolojik faktörlerle ilişkili olabileceğini; Seydoşoğlu ve Saruhan (2017), mısırdaki ekim zamanlarının bitki boyuna



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etkisinin önemsiz, çeşitlerin etkisinin ise önemli olduğunu ve bitki boyu değerlerinin yüksek oranda genetik faktörlerin etkisi altında olduğunu bildirmişlerdir.

Çizelge 3. Bitki boyu, sap kalınlığı, koçan boyu, koçan çapı ve koçanda dane sayısına ilişkin ortalama veriler

Ekim zamanı	Bitki boyu (cm)	Sap kalınlığı (mm)	Koçan boyu (cm)	Koçan çapı (mm)	Koçanda dane sayısı
1 Şubat	248.1	19.11	19.11 A	46.17 A	534.61 A
20 Şubat	272.4	21.62	19.68 A	47.21 A	594.46 A
10 Mart	226.9	18.56	18.82 A	46.70 A	571.37 A
30 Mart	248.6	21.62	18.82 A	46.50 A	565.74 A
20 Nisan	249.7	21.97	17.18 B	41.03 B	421.52 B
Çeşitler					
DKC 6761	238.3 B	19.07 B	17.23 B	48.21 A	526.39
DKC 5364	243.3 B	21.77 A	19.29 A	45.45 B	531.02
72 MAY 80	265.9 A	21.37 A	19.65 A	42.90 C	555.21
EGF %5					
Ekim zamanı	öd	öd	1.17	2.46	76.58
Çeşit	10.2	2.21	öd	1.90	öd

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Farklı ekim zamanları bakımından bitkide sap kalınlığı değerleri 18.56-21.97 mm arasında, değişim göstermiştir. Araştırmada materyal olarak kullanılan üç danelik mısır çeşidi bitkide sap kalınlığı yönünden önemli farklılık göstermiş olup bitkide sap kalınlığı değerleri 19.07-21.77 mm arasında değişmektedir. DKC 5364 mısır çeşidi (21.77 mm) ve 72 MAY 80 mısır çeşidinde (21.37 mm) saptanan bitkide sap kalınlığı değerinin DKC 6761 (19.07 mm) çeşite göre önemli düzeyde daha yüksek olduğu görülmektedir. Konu ile ilgili yürüttükleri araştırmada Kavut ve Soya (2012), bitkinin toprak üstünde dik olarak yükselmesinde ve yaprak, çiçek ve koçan gibi organları taşımasında etkili olan sap kalınlığının bitkinin rüzgar, su gibi sebeplerden dolayı yatmasını engellemekte olduğunu bildirmiştir.

Çizelge 3'ün incelenmesinden görüldüğü gibi araştırmada materyal olarak kullanılan üç danelik mısır çeşidi koçan boyu yönünden önemli farklılık göstermiş olup, koçan boyu değerleri 17.23-19.65 cm arasında değişim göstermiştir. 72 MAY 80 mısır çeşidi (19.65 cm) ve DKC 5364 mısır çeşidinde (19.29 cm) saptanan koçan boyu değerinin DKC 6761 (17.23 cm) çeşite göre önemli düzeyde daha yüksek olduğu görülmektedir. Farklı ekim zamanları açısından bakıldığında, ortalama koçan boyu değerleri 17.18-19.68 cm arasında değişim göstermiştir. En yüksek koçan boyu değeri 20 Şubat tarihli ekim zamanından (19.68 cm) en düşük koçan boyu değeri ise 20 Nisan tarihli ekim zamanından elde edildiği (17.18 cm) gözlenmiştir. Elde edilen sonuçlar, koçan boyu değerinin ekim zamanının çok gecikmesi durumunda azaldığını



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göstermekte olup, bu durum Beiragi ve ark. (2011)'nın elde ettiği bulgular ile benzerlik göstermektedir.

Danelik mısır çeşitlerinin ortalama koçanda dane sayısının 526.3 ile 555.2 arasında değişim gösterdiği, en yüksek 72 MAY 80, en düşük ise DKC 6761 çeşidinde saptandığı görülmektedir. Farklı ekim zamanlarının koçanda dane sayısı üzerine etkisi incelendiğinde (Çizelge 3) ortalama 421.52 ile 594.46 arasında değişim gösterdiği belirlenmiştir. En yüksek koçanda dane sayısı değeri 20 Şubat tarihli ekim zamanından (594.46 adet) en düşük koçanda dane sayısı değeri ise 20 Nisan tarihli ekim zamanından (594.46 adet) elde edilmiştir. Elde edilen bulgular, erken ekimlerde koçanda dane sayısının yüksek olduğunu bildiren Cesurer (1999)'un bulguları ile benzerlik, erken ekimlerde koçanda dane sayısının azaldığını bildiren Alan ve ark. (2011)'in çalışması ile de farklılık göstermektedir.

Çukurova Koşullarında danelik mısırın farklı ekim zamanlarında yetiştirilmesiyle elde edilen koçanda dane ağırlığı, hektolitreye ağırlığı, dane nem içeriği, bin dane ağırlığı ve dane verimine ilişkin ortalama veriler Çizelge 4'de verilmiştir.

Çizelge 4. Bitki sayısı, sap kalınlığı, koçan boyu ve koçanda dane sayısına ilişkin ortalama veriler

Ekim zamanı	Koçanda dane ağırlığı (g)	Hektolitreye ağırlığı (kg/hl)	Dane nem içeriği (%)	Bin dane ağırlığı (g)	Dane verimi (kg/da)
1 Şubat	173.92 A	71.39 A	13.27 B	328.44	750.03 BC
20 Şubat	187.52 A	72.20 A	12.86 B	344.67	623.86 CD
10 Mart	182.28 A	72.46 A	12.88 B	325.22	1019.57 AB
30 Mart	179.77 A	72.49 A	13.16 B	340.00	1231.35 A
20 Nisan	109.92 B	69.22 B	14.48 A	322.33	451.19 D
Çeşitler					
DKC 6761	178.01	69.43 C	13.56	338.40	821.77 AB
DKC 5364	154.97	71.47 B	12.82	326.40	710.35 B
72 MAY 80	167.06	73.76 A	13.60	331.60	913.47 A
EGF %5					
Ekim zamanı	34.53	2.002	0.89	öd	278.3
Çeşit	öd	1.55	öd	öd	158.0

Aynı harf grubuna giren değerler *:%5 önem seviyesine göre farklı değildir.

Farklı ekim zamanları açısından bakıldığında, ortalama koçanda dane ağırlığı değerleri yönünden istatistiksel olarak önemli bir farklılık görülmekle birlikte koçanda dane ağırlığı değerleri 109.92-187.52 g/koçan arasında değişim göstermiştir. En yüksek koçanda dane ağırlığı değeri 20 Şubat tarihinde (187.52 g) en düşük koçanda dane ağırlığı değeri ise 20 Nisan tarihinde (109.92 g) gözlenmiştir (Çizelge 4). Danelik mısır çeşitlerinde ortalama koçanda dane ağırlığı değerlerinin 154.9 ile 178.01 g arasında değiştiği saptanmıştır.



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Ortalama hektolitre ağırlığı değerlerinin 69.22-72.49 kg arasında değişim gösterdiği saptanmıştır. En yüksek hektolitre ağırlığı değeri 30 mart tarihinde (72.49 kg) en düşük hektolitre ağırlığı değeri ise 20 Nisan tarihinde (69.22 kg) gözlenmiştir (Çizelge 4). Üç danelik mısır çeşidi hektolitre ağırlığı yönünden önemli düzeyde farklılık göstermiştir. Hektolitre ağırlığı değerleri 69.43-73.76 kg/hl arasında değişmektedir. En yüksek hektolitre ağırlığı (73.76 kg/hl) 72 MAY 80 mısır çeşidinden elde edilirken en düşük hektolitre ağırlığı (69.43 kg/hl) DKC 6761 danelik mısır çeşidinden elde edilmiştir.

Çizelge 4'ün incelenmesinden görüldüğü gibi, araştırmada materyal olarak kullanılan üç danelik mısır çeşidi, nem içeriği yönünden önemli farklılık göstermemiştir. Nem içeriği değerleri % 12.82-13.60 arasında değişmektedir. Farklı ekim zamanları açısından bakıldığında, ortalama nem içeriği değerleri yönünden istatistiksel olarak önemli farklılık saptanmış olup, % 12.86-14.48 arasında değişim göstermiştir. En yüksek nem içeriği değeri 20 Nisan tarihinde (%14.48) en düşük nem içeriği değeri ise 20 Şubat tarihinde (%12.86) gözlenmiştir.

Araştırmada materyal olarak kullanılan üç danelik mısır çeşidi ve farklı ekim zamanları arasında bin dane ağırlığı yönünden önemli farklılıklar saptanmamıştır. Çeşitler yönünden bin dane ağırlığı değerleri 326.40-338.40 g arasında, farklı ekim zamanları yönünden 322.33-344.67 g arasında değişim göstermiştir.

Farklı ekim zamanlarına göre elde edilen dane verimi değerlerine göre en yüksek dane veriminin 10 ve 30 Mart tarihli ekim zamanından (1231.35 kg/da) en düşük dane veriminin ise 20 Nisan tarihli ekim zamanından elde edildiği (451.19 kg/da) gözlenmiştir. Şubat ayı içerisinde ve Nisan ayı sonunda yapılan ekimlerde verimin düşük olması, mısırdan normalden daha erken ekim yapılması yada ekimde geç kalınması halinde tane veriminin önemli derecede düşmesine yol açtığını göstermektedir.



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KAYNAKLAR

Alan, Ö., Sönmez, K., Budak, Z., Kutlu, İ., & Ayter, N. G. (2011). Eskişehir Ekolojik Koşullarında Ekim Zamanının Şeker Mısırın (*Zea mays saccharata* Sturt.) Verim ve Tarımsal Özellikleri Üzerine Etkisi. *Selçuk Tarım Bilimleri Dergisi*, 25(4), 34-41.

Anderson, E.L., Kamprath, E.J., Moll, R.H., 1984. Nitrogen fertility effects on accumulation, remobilization, and partitioning of nitrogen and dry matter in corn genotypes differing in prolificacy. *Agronomy Journal*, 76; 397-404

Atasever, M. (2018). Ekim Zamanının Amik Ovası Koşullarında Yetiştirilen Mısır (*Zea mays* L.) Çeşitlerinde Silaj ve Tane Verimine Etkisi. *T.C. Mustafa Kemal Üniversitesi Fen Bilimleri Enstitüsü Yüksek Lisans Tezi*.

Beiragi, M. A., Khorasani, S. K., Shojaei, S. H., Dadresan, M., Mostafavi, K., & Golbashi, M. (2011). A study on effects of planting dates on growth and yield of 18 corn hybrids (*Zea mays* L.). *Journal of Experimental Agriculture International*, 110-120.

Kaya, Ç., & Kuşaksız, T. (2012). Farklı Ekim Zamanlarında Yetiştirilen Mısır (*Zea Mays* L.) Çeşitlerinde Verim ve Verimle İlgili Bazı Özelliklerin Belirlenmesi. *ANADOLU Ege Tarımsal Araştırma Enstitüsü Dergisi*, 22(2), 48-58.

Kara, B., 2006. Çukurova Koşullarında Değişik Bitki Sıklıkları ve Farklı Azot Dozlarında Mısırın Verim ve Verim Özellikleri ile Azot Alım ve Kullanım Ekinliğinin Belirlenmesi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Doktora Tezi, 162s. Adana.

Kıraç, N. (2018). Hatay Mustafa Kemal Üniversitesi Fen Bilimleri Enstitüsü Tarla Bitkileri Anabilim Dalı Yüksek Lisans Tezi.

Koca, Y. O., & Turgut, İ. (2012). Mısrda (*Zea Mays* L.) Farklı Ekim Zamanlarının Tane Verimine, Kuru Madde Birikimine, Yaprak Alanı İndeksine Ve Bazı Büyüme Parametrelerine Etkisi. *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi*, 9(1), 1-10.

Seydoğlu, S., & Saruhan, V. (2017). Farklı Ekim zamanlarının bazı silajlık mısır çeşitlerinde verim ve verim unsurlarına etkisinin belirlenmesi. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 54(4), 377-383.

TÜİK. (2019). http://www.tuik.gov.tr/PreTablo.do?alt_id=1001. Son Erişim Tarihi: 01.05.2020.



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Ülger, A. C., Ibrikci, H., Cakir, B., Ve Güzel, N., 1997. Influence of Nitrogen Rates and Row Spacing on Corn Yield, Protein Content and Other Plant Parameters. J. of Plant Nutrition. 20:1697-1709.

ZMO. (2016). <http://www.tarimpusulasi.com/tarim/2016-uretim-sezonunda-misir-uretim-rekoltesinin-63-milyon-ton-olmasi-bekleniyor/14651?> *Son Erişim Tarihi: 01.05.2020.*



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**GENEL ÖZELLİKLERİ VE UYGULAMASI İLE ORTALAMALARIN ANALİZİ
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ÖZET

Bu çalışmada, Ortalamaların Analizi (Analysis of Mean, ANOM), genel özellikleri ile açıklanarak, bağcılık alanından sağlanan veri seti ile uygulama yapılmıştır. Uygulama materyali olarak; Van ilinde aynı bağda yetişen sekiz yerli üzüm çeşidinin (Al Üzüm, Bedar, Keçimemesi, Süleymani, Şemdinli, Tayifi, Çekirdeksiz, Beyaz Üzüm) mineral madde içerikleri (Fosfor (P), Kalsiyum (Ca), Magnezyum (Mg), Demir (Fe), Mangan (Mn), Bakır (Cu), Çinko (Zn), Bor (B) ve Selenyum (Se)) kullanılmıştır. Çalışmada yönteme ilişkin tüm istatistik hesaplamalar için MINITAB (ver: 14) istatistik paket programı kullanılmıştır. Ortalamaların analizi (ANOM), Varyans analizine (ANOVA) alternatif olarak, ortalamaların genel ortalamadan farklı olup olmadığını test etmeye yönelik geliştirilmiş olan grafiksel bir yöntemdir. Grafikte, gruplar veya faktör seviyelerine ait ortalamalar ile genel ortalama ve karar sınırları birlikte gösterilir. Alt ve üst karar sınırlarının dışında kalan ortalamaların, genel ortalamadan istatistik olarak önemli derecede farklı olduğu varsayılır. Varyans analizi, grup veya faktör seviyelerinin ortalamalarını birbiri ile karşılaştırırken, ortalamaların analizi genel ortalama ile karşılaştırır. Ortalamaların analizi görsel olarak önemli farklılıkları belirlemekte ve böylece kalite kontrolünde de kullanılabilir. Diğer yandan grafiksel sonuçlar kolaylıkla yorumlanabilmektedir. Herhangi bir grup ortalamasının, diğerlerinden farklı olup olmadığını belirlemek için ANOVA’da önce F testi yapılmakta ve sonra post-hoc testlere başvurulmaktadır. Böylece ANOVA iki aşamalı bir yaklaşım sunmaktadır. Diğer yandan bazı durumlarda, F testi ile post-hoc testler, birbirleri ile çelişkili sonuçlar verebilmektedir. Oysaki ANOM, grupları birlikte ele almakta ve tek seferde her grubun ortalamasını genel ortalama ile karşılaştırmaktadır. Sonuç olarak; ANOM’un, MINITAB paket programında yer alıyor olması, sonuçları grafiksel olarak sunması ve böylece sonuçların araştırmacılar tarafından kolaylıkla anlaşılabilir ve yorumlanabilir olması gibi özellikleri ile rahatlıkla tercih edilebilir olduğu söylenebilir.

Anahtar Kelimeler: Karar sınırı, çoklu karşılaştırma *Vitis vinifera* L., mineral



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ANALYSIS OF MEANS (ANOM) WITH GENERAL CHARACTERISTICS AND ITS APPLICATION

ABSTRACT

In this study, Analysis of Mean (ANOM) was explained with its general characteristics and an application was performed with the data set obtained from the viticulture. In application, mineral content (Phosphorus (P), Calcium (Ca), Magnesium (Mg), Iron (Fe) Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B) and Selenium (Se)) of eight local grape varieties (Al Üzüm, Bedar, Keçimemesi, Süleymani, Şemdinli, Tayifi, Çekirdeksiz, Beyaz Üzüm) grown in the same vineyard in Van were used. In the study, MINITAB (ver: 14) statistical package program was used for all statistical calculations relating with the method. Analysis of means (ANOM), as an alternative to Analysis of variance (ANOVA), is a graphical method developed to test whether the means differ from the overall mean. In the graph, the means of the groups or factor levels, as well as the overall mean and decision limits, are shown. Means outside the lower and upper decision limits are assumed to be statistically significant different from the overall mean. Analysis of variance compares the means of group or factor levels with each other, while Analysis of means compares them with the overall mean. Analysis of means detects visually significant differences and can be used in quality control. On the other hand, graphical results can be easily interpreted. In order to determine whether any group mean is different from the others, the F test is first performed in ANOVA and then post-hoc tests are applied. Thus, ANOVA offers a two-stage approach. On the other hand, in some cases, the F test and post-hoc tests may give contradictory results. However, ANOM considers the groups together and compares the mean of each group at once with the overall mean. As a result; it can be stated that ANOM is easily preferred with its features such as being included in the MINITAB package program, presenting the results graphically, and thus the results can be easily understood and interpreted by the researchers.

Keywords: Decision limit, multiple comparisons, *Vitis vinifera* L., mineral



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1. GİRİŞ

Bilimsel çalışmalarda, ilgilenilen sürekli değişken bakımından, bu değişkene etkili olabileceği düşünülen herhangi bir faktör seviyeleri veya gruplar arasında fark olup olmadığını belirlemek üzere, yaygın kullanılan istatistik yöntemlerden birisi de Varyans analizidir. Bazı ön şartlara (varsayımlara) sahip olan Varyans analizi (ANOVA) sonucunda, test hipotezinin ret edilmesi durumunda, farklı grupları belirlemek üzere, post-hoc (çoklu karşılaştırma testleri) testlere başvurulur. Çoklu karşılaştırma testleri, genel olarak grupların birbirinden olan farklılıklarını belirler. Ancak başta kalite kontrolü olmak üzere birçok durumda, grupların veya faktör seviyelerinin, genel ortalamadan farkları test edilmek istenebilir. Bu durumda, kısaca ANOM olarak bilinen ortalamaların analizine (Analysis of Mean) başvurulabilir.

Ryan (2011) tarafından bildirildiğine göre ANOM, ilk olarak Ott (1958) tarafından önerilmiş ve Ott (1967) tarafından literatüre girmiştir. Daha sonra yine Ott (1975) birçok örnekle yöntemi açıklarken, yöntemin Matematiksel kavramlar ile genişletilmesi Schilling (1973a,b) ve Nelson (1983)' un çalışmaları ile olmuştur.

ANOM, grup ortalamalarını genel ortalama ile karşılaştırarak, sonuçları görsel olarak sunan ve böylece yorumlama kolaylığı sağlayan grafiksel bir yöntemdir. Yalnızca ortalamalar için değil, aynı zamanda oranlar için de kullanılabilir. Yapılan literatür incelemesinde yöntemle ilgili Türkçe literatürün sınırlı sayıda olduğu gözlenmiş ve buradan hareketle çalışmada, Ortalamaların Analizi (Analysis of Mean, ANOM), genel özellikleri ile açıklanarak, bağıcılık alanından sağlanan veri seti ile uygulama yapılmıştır.

2. MATERYAL VE YÖNTEM

2.1. Materyal

Çalışmada uygulama materyali olarak; Van ilinde aynı bağda yetişen sekiz yerli üzüm çeşidinin (Al Üzüm, Bedar, Keçimemesi, Süleymani, Şemdinli, Tayifi, Çekirdeksiz, Beyaz Üzüm) mineral madde içerikleri (Fosfor (P), Kalsiyum (Ca), Magnezyum (Mg), Demir (Fe), Mangan (Mn), Bakır (Cu), Çinko (Zn), Bor (B) ve Selenyum (Se)) kullanılmıştır.

2.2. Yöntem

ANOM, grup ortalamalarının genel ortalamadan istatistik olarak önemli derecede farklı olup olmadığını belirlemek üzere, güven aralığı tipi bir yaklaşım sunar. Güven aralığının alt ve üst sınırlarına benzer şekilde, Üst karar çizgisi (UKÇ, Upper decision line) ve Alt karar çizgisi (AKÇ, Lower decision line) hesaplanır. Bu karar çizgilerinin ortasında genel ortalama yer alır.



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Grup ortalamaları noktalarla olarak gösterilir. Grafikte, alt ve üst karar çizgilerinin dışına düşen ortalamalar, genel ortalamadan istatistik olarak önemli derecede farklı olarak yorumlanır. Üst karar çizgisinin üzerinde yer alan ortalamaların, genel ortalamadan (istatistik olarak) önemli derecede yüksek olduğu, alt karar çizgisinin altında yer alan ortalamaların ise önemli derecede düşük olduğu varsayılır.

Yöntemin en önemli kısmı olan Üst karar çizgisi (UKÇ, Upper decision line) ve Alt karar çizgisi (AKÇ, Lower decision line) aşağıdaki gibi hesaplanır.

$$UKÇ = \bar{\bar{X}} + h_{g,n_j} \sqrt{\frac{S_p^2 (g-1)}{n}} \text{ ve } AKÇ = \bar{\bar{X}} - h_{g,n_j} \sqrt{\frac{S_p^2 (g-1)}{n}} \quad (j = 1, 2, \dots, g)$$

Eşitlikte;

g; çalışmadaki grup sayısı

n_j ; j. gruptaki gözlem sayısı (örnek genişliği)

n; Gruplarda gözlem sayısının eşit olması durumunda toplam gözlem sayısı

$\bar{\bar{X}}$; Genel ortalama $[\bar{\bar{X}} = (\bar{X}_1 + \bar{X}_2 + \dots + \bar{X}_g) / g]$

S_p^2 ; Toplanmış varyans $S_p^2 = (S_1^2 + S_2^2 + \dots + S_g^2) / g$

h_{g,n_j} ; g grup ve n_j eşit sayıda gözlem için Nelson h istatistiği kritik tablo değeridir.

ANOM'un uygulanabilmesi iki önşart veya varsayım gereklidir. Bunlardan birincisi grupların alındığı popülasyonların yaklaşık olarak normal dağılım göstermesidir. İkincisi ise grup varyanslarının homojenliği önşartıdır. Örnek genişliğini küçük olması durumunda saçılım grafiği ya da diğer görsel teknikleri ile önşartların sağlanıp sağlanmadığına karar vermek zor olabilir. Bunun yerine, veri setindeki merkezi eğilim ölçüleri ve varyasyon ölçülerine bakılarak karar verilebilir.

Çalışmada, önce mineraller bakımından çeşitler arasında fark olup olmadığını belirlemek amacıyla Tek yönlü varyans analizi (ANOVA) yapılmıştır. Varyans analizini takiben farklı çeşitleri belirlemek üzere Tukey çoklu karşılaştırma testi yapılmıştır. İstatistik hesaplamalar için MINITAB (ver: 14) istatistik paket programı kullanılmıştır.



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3. BULGULAR VE TARTIŞMA

Çalışmada ele alınan özellikler bakımından çeşitlere göre tanımlayıcı istatistikler ve karşılaştırma sonuçları Tablo 1'de verilmiştir. Tablo 1'de görüldüğü üzere, tüm mineraller bakımından çeşitler arası farklılık istatistik olarak önemli bulunmuştur ($p < 0.01$). Yapılan çoklu karşılaştırma testine göre özellikle potasyum için çeşitler arasındaki farklılıklar için çıkan ortalamaların olduğu görülmektedir. Çeşitlerin genel ortalamadan olan farklılıklarını belirlemek ve daha anlaşılabilir olarak sunmak amacıyla, her mineral için ANOM grafikleri oluşturulmuştur. Mineral maddelerden Fosfor (P) için oluşturulan ANOM grafiği Şekil 1'de verilmiştir

Şekil 1'de görüldüğü üzere Fosfor (P) bakımından genel ortalama 181.08 olarak bulunurken, Alt karar çizgisi 174. 87, üst karar çizgisi ise 187.30 olarak bulunmuştur. Çeşitlerden yalnızca ikisi (Al Üzüm ve Keçimemesi) genel ortalamadan istatistik olarak önemli düzeyde farklı bulunmazken, Beyaz Üzüm, Çekirdeksiz ve Şemdinli çeşitleri, genel ortalamanın altında, Bedar ve Süleymani çeşitleri ise (genel ortalamanın) üzerinde bulunmuştur.

Tablo 1. Özellikler için çeşitlere göre tanımlayıcı istatistikler ve karşılaştırma sonuçları

	Çeşitler	Ort.	St. Hata	p		Çeşitler	Ort.	St. Hata	p
P	Al Üzüm	177.87 d	0.79	0.001	Mn	Al Üzüm	0.95 a	0.01	0.001
	Şemdinli	149.45 f	0.69			Şemdinli	0.75 b	0.01	
	Tayifi	192.90 b	2.36			Tayifi	0.51 d	0.01	
	Keçimemesi	184.09 c	4.03			Keçimemesi	0.58 c	0.01	
	Bedar	212.70 a	1.65			Bedar	0.73 b	0.01	
	Çekirdeksiz	156.55 e	0.63			Çekirdeksiz	0.59 c	0.01	
	Beyaz Üzüm	161.93 e	1.51			Beyaz Üzüm	0.56 c	0.02	
	Süleymani	213.17 a	0.60			Süleymani	0.76 b	0.02	
	Total	181.08	5.90			Total	0.68	0.03	
K	Al Üzüm	1288.74 b	11.39	0.001	Cu	Al Üzüm	0.63 c	0.02	0.001
	Şemdinli	1395.70 ab	5.76			Şemdinli	0.48 d	0.01	
	Tayifi	1447.20 ab	1.67			Tayifi	0.72 b	0.01	
	Keçimemesi	1333.56 ab	2.69			Keçimemesi	0.75 b	0.04	
	Bedar	1321.70 ab	8.47			Bedar	0.92 a	0.01	
	Çekirdeksiz	1395.76 ab	4.60			Çekirdeksiz	0.63 c	0.02	
	Beyaz Üzüm	1703.13 a	101.20			Beyaz Üzüm	0.08 e	0.02	
	Süleymani	1435.65 ab	15.10			Süleymani	0.91 a	0.01	
	Total	1415.18	32.56			Total	0.64	0.06	
Ca	Al Üzüm	278.08 d	16.56	0.001	Zn	Al Üzüm	1.28 f	0.01	0.001
	Şemdinli	284.63 d	1.53			Şemdinli	1.45 c	0.01	
	Tayifi	318.01 bc	2.36			Tayifi	1.39 e	0.01	
	Keçimemesi	302.70 cd	2.76			Keçimemesi	1.35 e	0.01	
	Bedar	375.57 a	3.60			Bedar	1.41 c	0.01	



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	Çekirdeksiz	294.29 cd	5.96			Çekirdeksiz	1.43 c	0.02	
	Beyaz Üzüm	271.77 d	6.51			Beyaz Üzüm	1.62 b	0.02	
	Süleymanı	334.41 b	15.97			Süleymanı	1.88 a	0.02	
	Total	307.43	8.64			Total	1.47	0.04	
Mg	Al Üzüm	89.35 a	0.88	0.003	B	Al Üzüm	0.02 c	0.01	0.003
	Şemdinli	80.37 b	3.89			Şemdinli	0.04 bc	0.01	
	Tayifi	92.34 a	1.80			Tayifi	0.05 b	0.01	
	Keçimemesi	95.38 a	2.54			Keçimemesi	0.07 a	0.01	
	Bedar	95.75 a	2.65			Bedar	0.02 c	0.01	
	Çekirdeksiz	88.37 a	0.91			Çekirdeksiz	0.04 bc	0.01	
	Beyaz Üzüm	78.95 b	1.42			Beyaz Üzüm	0.04 bc	0.01	
	Süleymanı	91.24 a	0.74			Süleymanı	0.07 a	0.01	
	Total	88.97	1.61			Total	0.04	0.01	
Fe	Al Üzüm	5.23 e	0.11	0.001	Se	Al Üzüm	12.58 d	0.32	0.001
	Şemdinli	7.35 c	0.05			Şemdinli	14.62 bc	0.38	
	Tayifi	7.13 c	0.08			Tayifi	14.86 b	0.03	
	Keçimemesi	9.07 a	0.10			Keçimemesi	13.76 c	0.01	
	Bedar	8.91 a	0.01			Bedar	12.65 d	0.19	
	Çekirdeksiz	5.84 d	0.16			Çekirdeksiz	13.68 d	0.41	
	Beyaz Üzüm	8.18 b	0.03			Beyaz Üzüm	15.99 a	0.17	
	Süleymanı	8.94 a	0.06			Süleymanı	13.80 d	0.37	
	Total	7.58	0.35			Total	13.99	0.28	

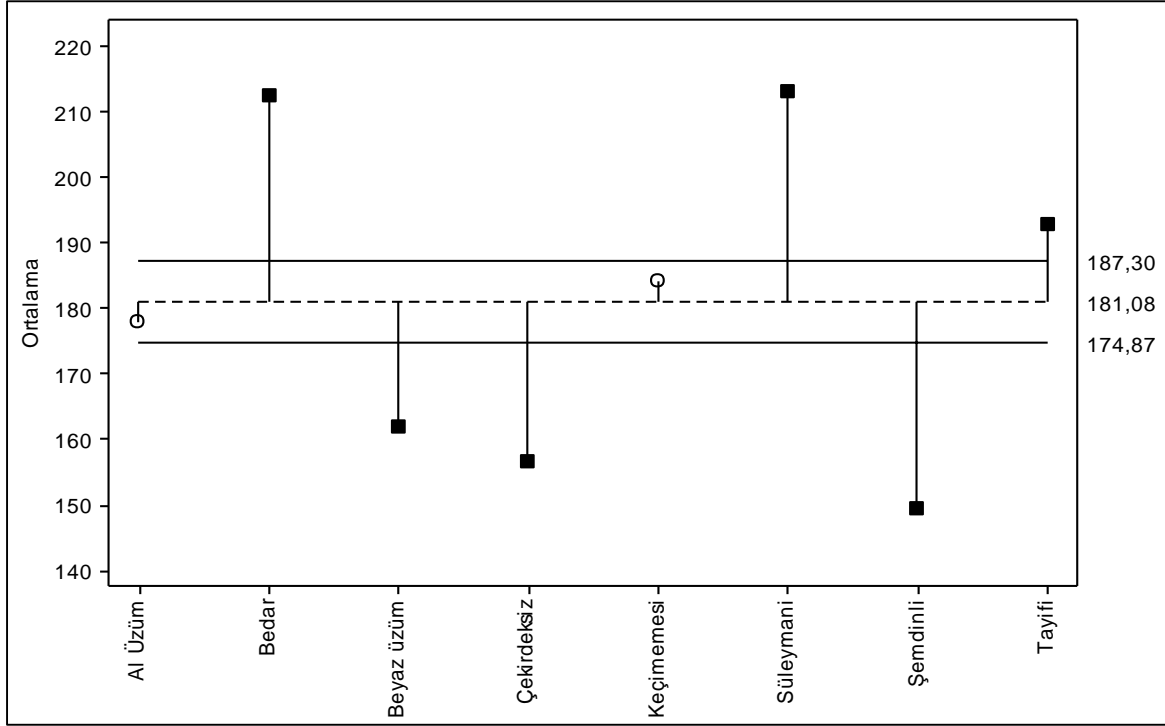
Her özellik için farklı harfi alan çeşitler arası fark istatistik olarak önemlidir.

Potasyum (K) için ANOM grafiğinin verilmiş olduğu Şekil 2 incelendiğinde; genel ortalama 1415.2 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 1295.0 ve 1535.4 olarak bulunmuştur.

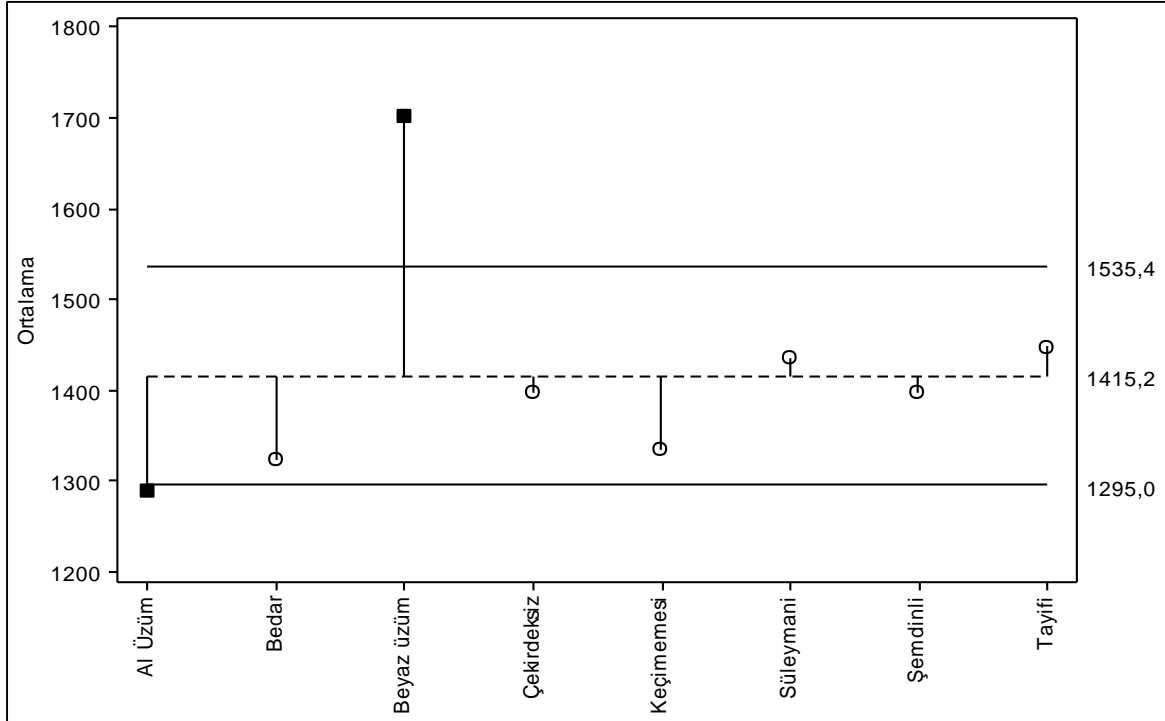
Çeşitlerden yalnızca al üzüm genel ortalamasının altında bulunurken, Beyaz üzüm ise genel ortalamadan üzerinde bulunmuştur. Diğer çeşitlerin ise genel ortalamadan olan farklılıkları istatistik olarak önemli bulunmamıştır.



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Şekil 1. Fosfor (P) için ANOM grafiği



Şekil 2. Potasyum (K) için ANOM grafiği

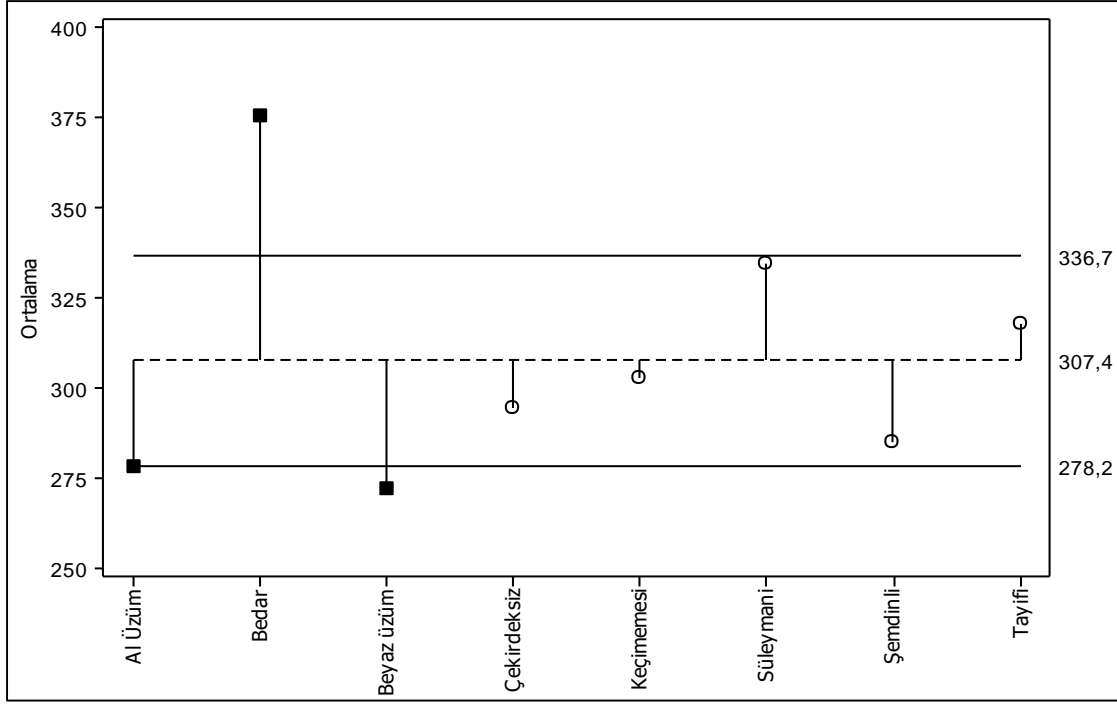
Kalsiyum (Ca) için ANOM grafiğinin verilmiş olduğu Şekil 3, incelendiğinde; genel ortalama 307.4 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 278.2 ve 336.7 olarak bulunmuştur.



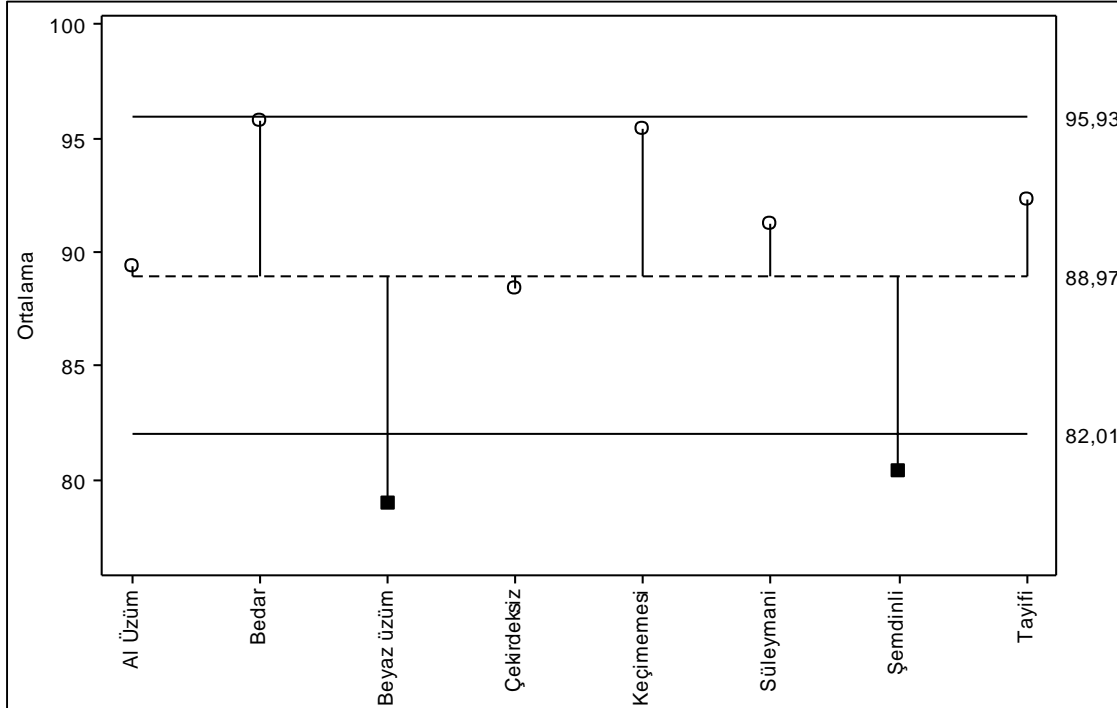
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Çeşitlerden Al Üzüm genel ortalamasının alt sınır seviyesinde ve Beyaz üzüm genel ortalamasının altında bulunurken, Bedar çeşidi ise genel ortalamadan önemli derecede yüksek bulunmuştur. Diğer çeşitlerin ise genel ortalamadan olan farklılıkları istatistik olarak önemli bulunmamıştır.



Şekil 3. Kalsiyum (Ca) için ANOM grafiği



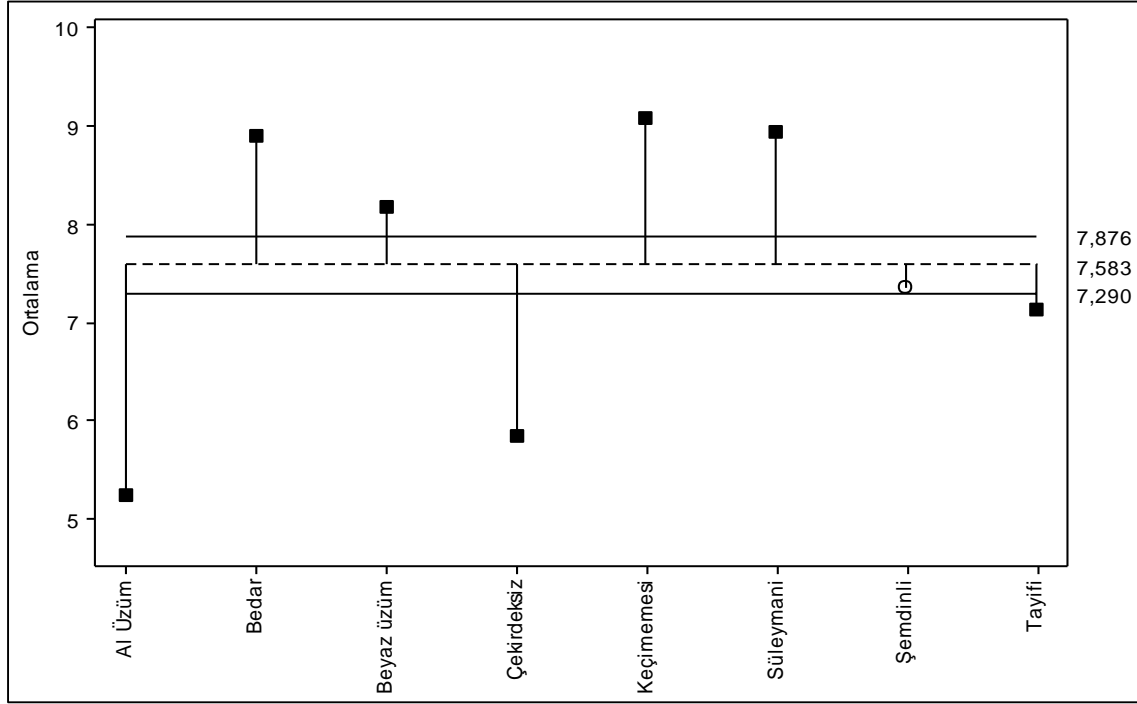
Şekil 4. Magnezyum (Mg) için ANOM grafiği



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Magnezyum (Mg) için ANOM grafiği Şekil 4’ te verilmiştir. Şekil 4 incelendiğinde; 88.97 olarak bulunan genel ortalamanın, Alt ve Üst karar çizgileri sırasıyla; 82.01 ve 95.93 olarak bulunmuştur. Çeşitlerden Beyaz üzüm ve Şemdinli çeşitleri genel ortalamanın altında bulunmuştur. Diğer çeşitlerin ise genel ortalama dan olan farklılıkları istatistik olarak önemli bulunmamıştır.

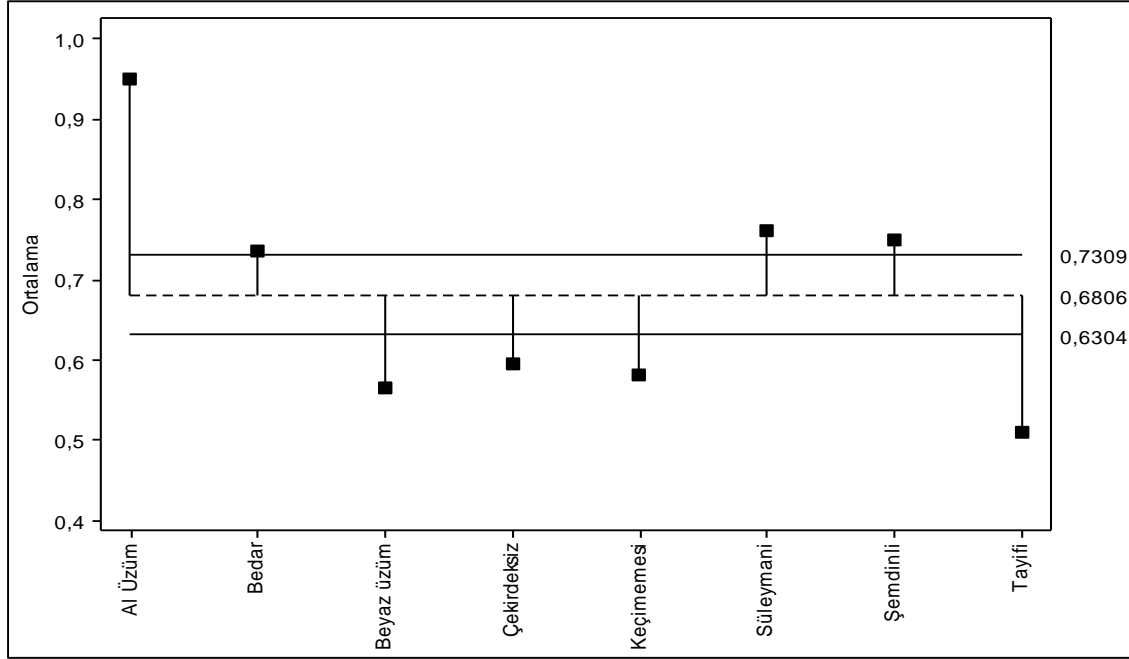


Şekil 5. Demir (Fe) için ANOM grafiği

Demir (Fe) için ANOM grafiğinin verilmiş olduğu Şekil 5 incelendiğinde; genel ortalama 7.583 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 7.290 ve 7.876 olarak bulunmuştur. Çeşitlerden Al üzüm, Çekirdeksiz üzüm ve Tayifi çeşitleri, genel ortalamanın altında bulunurken, Bedar, Beyaz üzüm, Keçimemesi ve Süleymani çeşitleri ise genel ortalamanın üzerinde bulunmuştur. Yalnızca Şemdinli, alt ve üst karar çizgileri arasında yer almıştır.

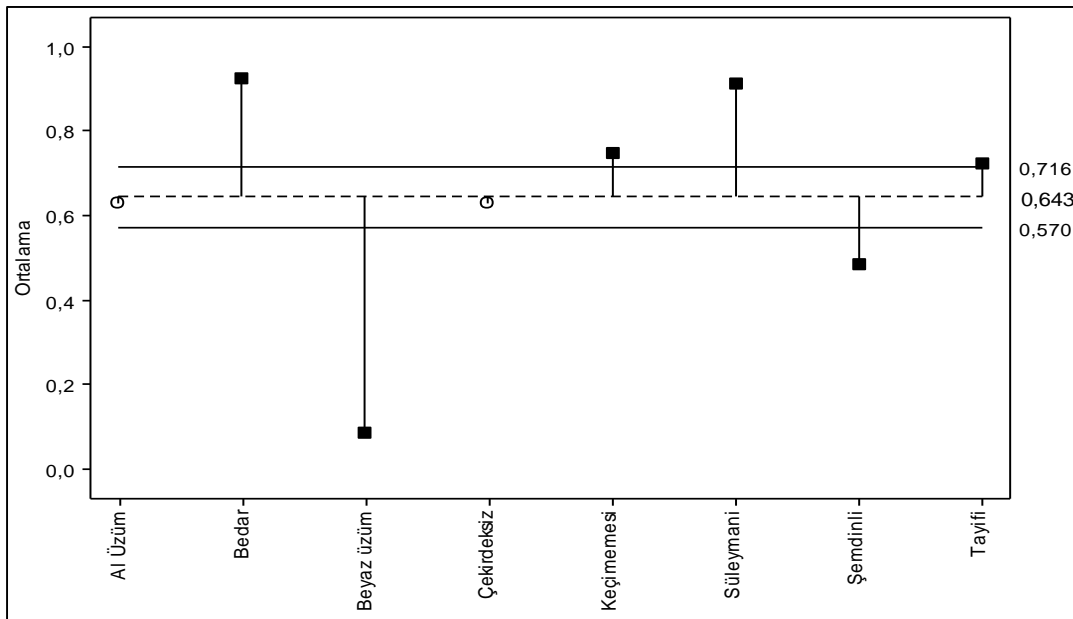


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Şekil 6. Manganez (Mn) için ANOM grafiği

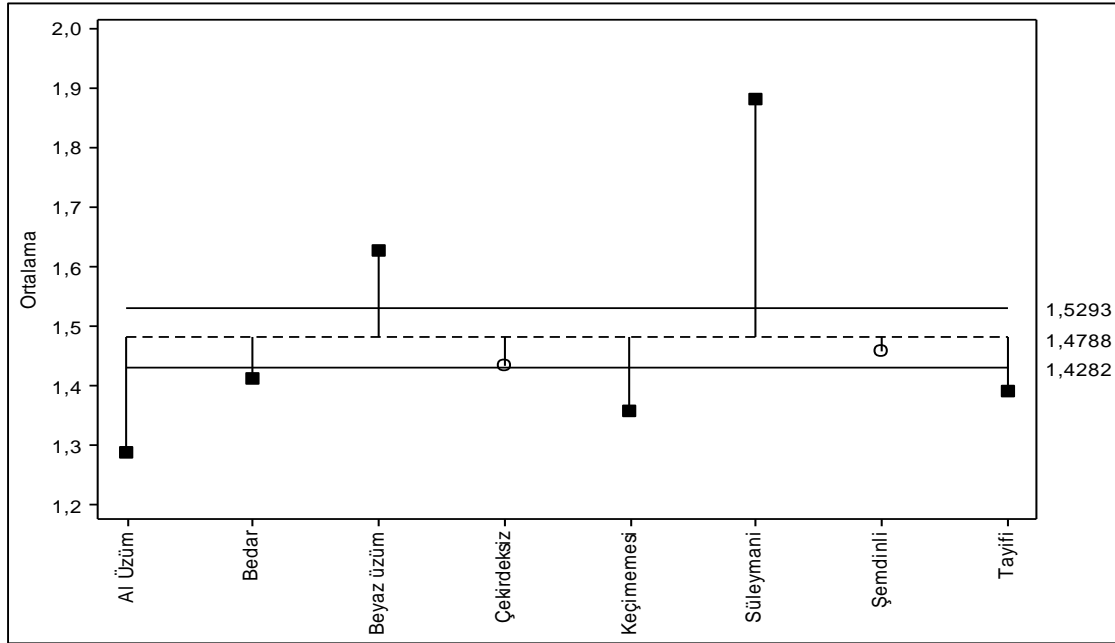
Manganez (Mn) için ANOM grafiği Şekil 6 da verilmiştir. Şekil 6, incelendiğinde; genel ortalama 0.6806 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 0.6304 ve 0.7309 olarak bulunmuştur. Çeşitlerden Bedar genel ortalamasının üst sınır seviyesinde yer alırken, Al Üzüm, Süleymani ve Şemdinli çeşitleri genel ortalamadan yüksek bulunmuştur. Beyaz üzüm, Çekirdeksiz üzüm, Keçimemesi ve Tayfi çeşitleri ise genel ortalamasının altında bulunmuştur.



Şekil 7. Bakır (Cu) için ANOM grafiği



Bakır (Cu) için genel ortalama 0.643 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 0.570 ve 0.716 olarak bulunmuştur (Şekil 7). Tayifi çeşidi genel ortalamanın üst sınır seviyesinde yer alırken, Bedar, Keçimemesi ve Süleymani çeşitleri genel ortalamadan yüksek bulunmuştur. Beyaz üzüm ve Şemdinli çeşitleri genel ortalamadan önemli derecede düşük bulunmuştur. Çekirdeksiz ve Al üzüm çeşitleri, alt ve üst karar çizgileri arasında yer almış, diğer bir ifade ile genel ortalamadan olan farklılıkları istatistik olarak önemli bulunmamıştır.

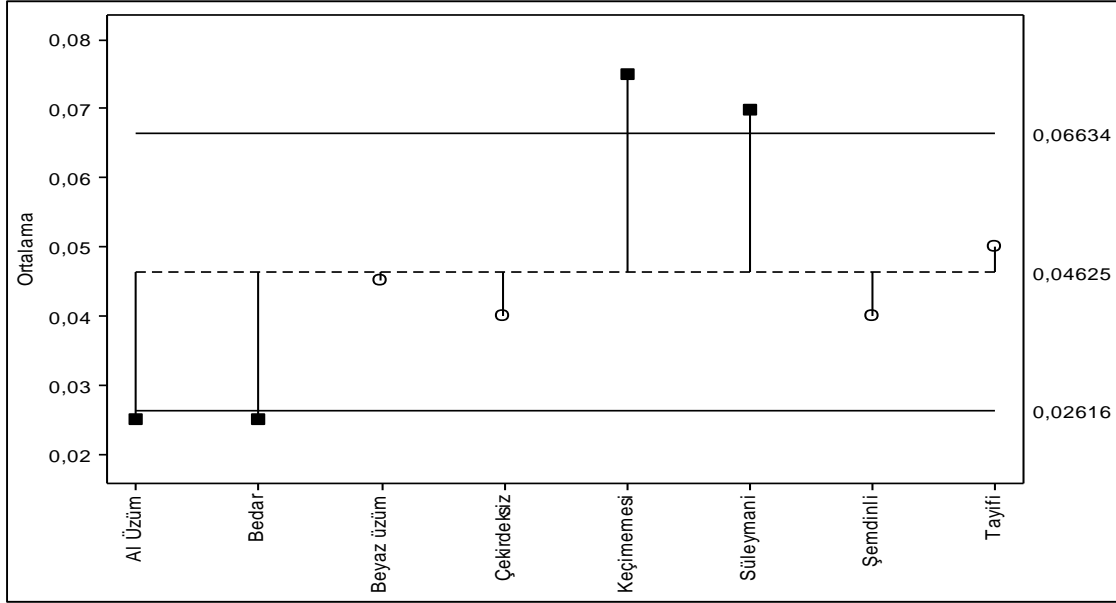


Şekil 8. Çinko (Zn) için ANOM grafiği

Çinko (Zn) için ANOM grafiğinin verilmiş olduğu Şekil 8, incelendiğinde; genel ortalama 1.4788 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 1.4282 ve 1.5293 olarak bulunmuştur. Al Üzüm, Bedar, Keçimemesi ve Tayifi çeşitlerinin ortalaması genel ortalamanın altında bulunurken, Beyaz üzüm ve Süleymani çeşitlerinin ortalamaları ise genel ortalamadan önemli derecede büyük bulunmuştur. Diğer çeşitlerin ise genel ortalamadan olan farklılıkları istatistik olarak önemli bulunmamıştır.

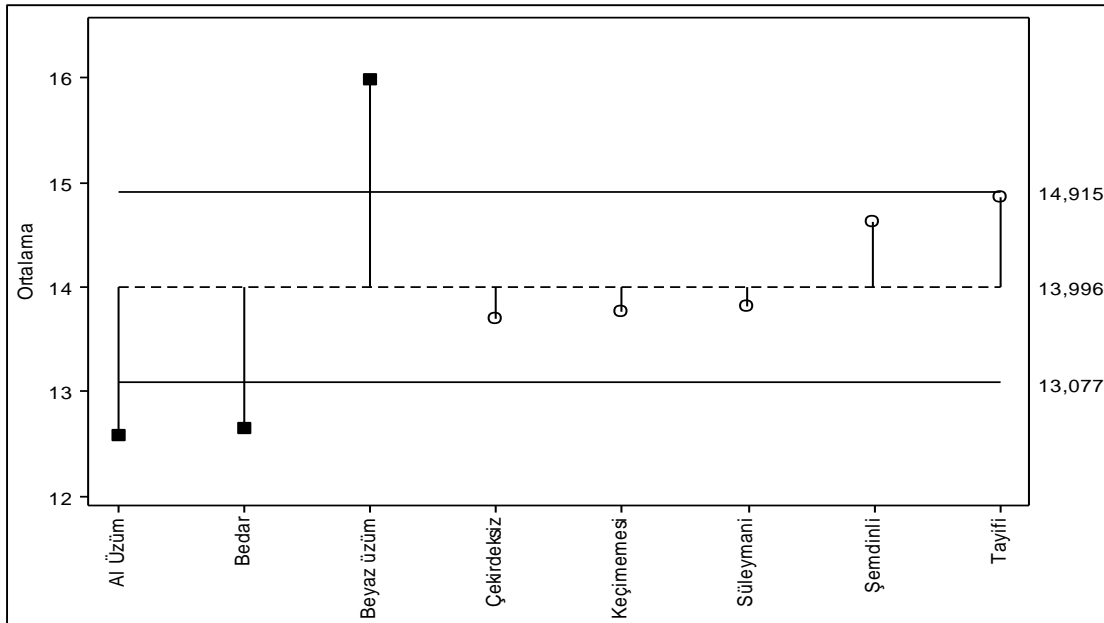


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Şekil 9. Bor (B) için ANOM grafiği

Bor (B) bakımından genel ortalama 0.04625 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 0.02616 ve 0.06634 olarak bulunmuştur (Şekil 9). Çeşitlerden, Al Üzüm ve Bedar, alt karar çizgisinin altında yer almıştır. Bu iki çeşidin ortalaması genel ortalamadan önemli derecede düşük bulunmuştur. Keçimemesi ve Süleymani çeşitleri ise genel ortalamadan önemli derecede büyük bulunmuştur. Diğer çeşitler, alt ve üst karar çizgileri arasında yer alarak genel ortalamadan istatistik olarak önemli farklılık göstermemiştir.



Şekil 10. Selenyum (Se) için ANOM grafiği



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Selenyum (Se) için ANOM grafiği Şekil 10'da verilmiştir. Şekil 10 incelendiğinde; genel ortalama 13.996 olarak bulunurken, Alt ve Üst karar çizgileri sırasıyla; 13.077 ve 14.915 olarak bulunmuştur. Çeşitlerden, Al Üzüm ve Bedar, genel ortalamanın altında yer alırken, Beyaz Üzüm ise genel ortalamadan önemli derecede büyük bulunmuştur. Diğer çeşitlerin genel ortalamadan olan farklılıkları istatistik olarak önemli bulunmamıştır.

Yaygın olarak kullanılan ANOVA, faktör seviyeleri veya gruplar arasında istatistik olarak önemli fark olup olmadığını belirler. ANOVA'da 'gruplar arası farkların önemli (anlamli) olmadığını' ifade eden test hipotezi (H_0) ret edildikten sonra, hangi gruplar veya seviyeler arasındaki farkların önemli olduğunu belirlemeye yönelik çoklu karşılaştırma testlerine (post-hoc testler) ihtiyaç duyulur. Bu anlamda ANOVA'nın, süreci iki aşamada tamamladığı düşünülebilir. Diğer yandan Jayalath ve Turner (2021), bazı durumlarda, F test istatistiği, önemli olduğu halde Tukey ya da diğer post-hoc testlere göre gruplar arasında önemli farklılıklar bulunamadığını ve diğer bir ifade ile çoklu karşılaştırma (post-hoc) test sonuçları ile F testi arasında uyumlu sonuçların elde edilemediğini belirtmişlerdir.

Prokeš ve ark. (2017) ANOM ve ANOVA'nın benzer sonuçlar verdiğini ve sonuçları grafiksel olarak sunması bakımından ANOM'un ANOVA'dan daha avantajlı olduğunu belirtmişlerdir. Benzer şekilde Parra ve Loaiza (2003), ANOM'un en önemli avantajlarından birisinin grafiksel sonuçlar vermesi ve böylece istatistikçi olmayan (işletmeci, teknisyen ve müdür) araştırmacılar tarafından da rahat anlaşılabilir ve kolay yorumlanabilir olması olduğunu belirtmişlerdir.

4. SONUÇ

ANOVA ile karşılaştırıldığında; ANOM ile analizler tek seferde yapılabilen ve post-hoc testlere ihtiyaç duyulmamaktadır. Sonuçlar, grafiksel olarak sunulmakta ve böylece sonuçlar, istatistikçi olmayan araştırmacılar tarafından da kolay anlaşılabilir ve yorumlanabilir olmaktadır. Ayrıca, ANOVA F testi ile çoklu karşılaştırma sonuçları arasında olası uyumsuzluklar ortadan kalmaktadır.



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KAYNAKLAR

Jayalath, K P, J. Turner (2021). Analysis of Means (ANOM) Concepts and Computations, Applications and Applied Mathematics: An International Journal (AAM), 16 (1), 75-96.

Parra, M.G. Loaiza, P.R. (2003) Application of Analysis of Means (ANOM) to Nested Designs for Improving the Visualization and Understanding of the Sources of Variation of Chemical and Pharmaceutical Processes, Quality Engineering, 15:4, 663-670, DOI: 10.1081/QEN-120018397.

Prokeš, L., Hegrová, J., Kanický, V., (2017). Analysis of Means (ANOM) as a Tool for Comparison of Sample Treatment Methods: Testing Various Mineralization Procedures for Selenium Determination in Biological Materials. Journal of AOAC International. (100) 1, 236 – 246.

Ryan, T. P. (2011). Statistical Methods for Quality Improvement, Third Edition. New York: John Wiley and Sons.



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**KATEGORİK TEMEL BİLEŞENLER ANALİZİ: GENEL ÖZELLİKLERİ VE
UYGULAMASI**

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ÖZET

Bilimsel araştırmaların birçoğunda ilgilenilen değişkenler, sürekli kategorik veya sıralı değişken tipinde olmaktadır. Diğer yandan bu değişkenler arasındaki ilişkiler de doğrusal veya doğrusal olmayan yapıda olabilmektedir. Doğrusal olmayan ilişkilerin incelenmesi, hesaplama ve yorumlamadaki güçlükler nedeniyle, doğrusal ilişkililere göre kısmen de olsa zordur. Diğer yandan, karışık değişken yapısındaki veri setlerinde doğrusal olmayan ilişkileri incelemeye yönelik istatistik yöntemler de sınırlıdır. Kategorik temel bileşenler analizi veya diğer adıyla Doğrusal olmayan temel bileşenler analizi, karışık (sürekli, kategorik, sıralı) yapıdaki değişkenleri içeren veri setlerinde; doğrusal ilişkilerin yanı sıra doğrusal olmayan ilişkileri de inceleyen Çok değişkenli analiz yöntemlerinden birisidir. Yöntemde genel olarak değişkenlerin kategorileri arasındaki ilişkiler belirlenir. Standart temel bileşenler analizi gibi bir boyut indirme yöntemi olan Kategorik temel bileşenler analizi, değişkenler arasındaki doğrusal ve/ya doğrusal olmayan ilişkileri, iki boyutlu uzayda görsel olarak sunmakta ve yorumlama kolaylığı sağlamaktadır. Veri setindeki tüm değişkenlerin sürekli değişken olması durumunda, Kategorik temel bileşenler analizi, Standart temel bileşenler analizi ile eşdeğer sonucu vermektedir. Kategorik ve sıralı değişkenleri içeren veri setlerinde, Kategorik temel bileşenler analizi, Optimal skorlama veya Optimal ölçekleme olarak bilinen sürece dayalı hesaplama yapmaktadır. Diğer bir ifade ile her kategorik değişkenin kategorilerine sayısal değer atamaktır. Böylece sayısal değişkenlere dönüştürülen kategorik değişkenlerle işlemler yürütülmektedir. Bu çalışmada, Kategorik temel bileşenler analizi, genel özellikleri ile açıklanmış ve bağıcılık alanından sağlanan veri seti ile uygulama yapılarak elde edilen sonuçlar yorumlanmıştır. Veri seti; Elazığ ilinde yetiştirilen Köhnü, Şilfoni, Ağın Beyazı ve Kırmızı yerel üzüm çeşitlerinin şeker (glikoz ve früktoz) ve organik asit (tartarik asit, malik asit, sitrik asit) özelliklerini içermektedir. Çalışma sonucunda; yöntemin avantajlarından bahsedilmiş ve birçok alanda kullanılabileceği vurgulanmıştır.

Anahtar Kelimeler: Optimal ölçekleme, boyut indirgeme *Vitis vinifera* L., organik asit



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**CATEGORICAL PRINCIPAL COMPONENT ANALYSIS: GENERAL PROPERTIES
AND APPLICATION**

ABSTRACT

In most scientific researches, the considered variables are continuous, categorical or ordinal type. On the other hand, the relationships between these variables can be linear or non-linear. Examination of nonlinear relationships is somewhat more difficult than linear relationships due to difficulties in calculation and interpretation. On the other hand, statistical methods for examining nonlinear relationships in mixed-variable data sets are also limited. Categorical principal components analysis or Nonlinear principal components analysis is one of the multivariate analysis methods that examine nonlinear relationships as well as linear relationships when data sets containing continuous, categorical or ordinal variables. In general, the relations between the categories of the variables are determined in the method. Categorical principal component analysis, which is a dimension reduction method like Standard principal component analysis, visually presents linear and/or nonlinear relationships between variables in two-dimensional space and provides ease of interpretation. If all the variables in the data set are continuous variables, Categorical principal component analysis gives the equivalent result with the Standard principal component analysis. On datasets containing categorical and ordinal variables, Categorical principal components analysis performs a process-based computation known as Optimal scoring or Optimal scaling. In other words, it is assigning numerical values to the categories of each categorical variable. Thus, operations are carried out with categorical variables converted into numerical variables. In this study, Categorical principal components analysis was explained with its general properties and the results obtained by applying the data set from the field of viticulture were interpreted. Data set; it contains sugar (glucose and fructose) and organic acid (tartaric acid, malic acid, citric acid) of Köhnü, Şilfoni, Ağın Beyazı and Kırmızı local grape varieties grown in Elazığ. In the results, the advantages of the method are mentioned and it is emphasized that it can be used in many areas.

Keywords: Optimal scaling, dimension reduction *Vitis vinifera* L., organic acid



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1. GİRİŞ

Bilimsel araştırmalara konu olan özellikler veya değişkenler arası ilişkiler; ilişki yapısına göre genel olarak “doğrusal” ve “doğrusal olmayan” ilişkiler olarak incelenebileceği gibi aralarında ilişki bulunmak istenen değişken sayısına göre de “basit” ve “çoklu” ilişkiler olarak incelenebilir. İki değişken arasındaki ilişki basit ilişki, olarak ifade edilirken, ikiden fazla değişken arasındaki ilişki çoklu ilişki olarak ifade edilir.

Kısmen de olsa kolay hesaplanabilir ve yorumlanabilir olması nedeniyle, doğrusal olmayan ilişkilerden daha çok doğrusal ilişkiler incelenmektedir. Diğer yandan, çoklu ilişkiler yerine, basit ilişkilerin incelenmesi tercih edilmektedir. Oysaki araştırmalara konu olan doğadaki değişkenler (özellikler) arası ilişkiler, doğrusal ve doğrusal olmayan yapıda olabileceği gibi çok sayıdaki değişken birbiri ile ilişkili olduğundan, basit ilişki olarak incelenemeyecek kadar karmaşıktır. Bu bağlamda, değişkenler arası ilişki yapısını, mümkün olduğu kadar orijinal yapıyı bozmadan, inceleyebilen istatistik yöntemlere ihtiyaç duyulmaktadır. Diğer yandan, değişkenler arasındaki ilişkileri incelemek üzere geliştirilen istatistik yöntemler de değişken tipine göre farklılık göstermektedir.

Yaygın kullanılan Çok değişkenli analiz yöntemlerinden birisi Temel Bileşenler Analizidir. Temel Bileşenler Analizi, tek başına bir analiz yöntemi olarak kullanılabileceği gibi diğer analiz yöntemleri ile birlikte de kullanılabilir. Genellikle boyut indirgeme amaçlı kullanılan Temel Bileşenler Analizi, bazı varsayımları gerektirir. Bunlardan en önemlisi; değişkenlerin sürekli değişken olması, Normal dağılım göstermesi ve aralarındaki ilişkilerin doğrusal olmasıdır. Ancak kategorik değişkenleri de içeren veri setlerinde ve doğrusal ilişkilerle birlikte doğrusal olmayan ilişkilerin de incelenmek istendiği durumlarda, Temel Bileşenler Analizinin yerine Kategorik Temel Bileşenler Analizinin kullanılması daha uygun olacaktır.

Kategorik (Doğrusal) olmayan Temel Bileşenler Analizi, farklı değişken tipini (sürekli, kategorik sıralı) içeren veri setlerinde, değişkenler arası doğrusal ilişkilerle birlikte doğrusal olmayan ilişkileri de inceleyen ve sonuçları genellikle iki boyutlu uzayda görsel olarak sunan çok değişkenli analiz yöntemlerinden birisidir. Bu çalışmada, Kategorik temel bileşenler analizi, genel özellikleri ile açıklanmış ve bağıcılık alanından sağlanan veri seti ile uygulama yapılmıştır.



2. MATERYAL VE YÖNTEM

2.1. Materyal

Çalışmada uygulama materyali olarak; Elazığ ilinde yetiştirilen Köhnü, Şilfoni, Ağın Beyazı ve Kırmızı yerel üzüm çeşitlerinin şeker (glikoz ve früktoz) ve organik asit (tartarik asit, malik asit, sitrik asit) özellikleri kullanılmıştır.

2.2. Yöntem

Optimal ölçekleme, kısaca kategorik değişkenin kategorilerine sayısal değer atamaktır. Böylece sayısal değişkenlere dönüştürülen kategorik değişkenler üzerinde bir çözüm elde edilebilmekte ve standart yöntemlerin (veya prosedürlerin) kullanılabilmesi mümkün olabilmektedir.

Kategorik Temel Bileşenler Analizi de optimal ölçeklemeyi kullanmaktadır. Kayıp fonksiyonu hesaplanmakta ve böylece minimum kayıpla orijinal gerçek uzaydaki ilişkiler daha düşük boyutlu bir uzayda gösterilmektedir (Karaman, 2019).

Kategorik Temel Bileşenler Analizi, sayısal dönüşümler yaparak X 'in nesne skorlarını bulmayı ve Y_j 'nin bir dizisini çeşitli yollarla kısıtlayarak minimize etmeyi amaçlamaktadır (Michailidis ve De Leeuw, 1998; Karaman, 2019). Böylece $j \in J$ ise $c=p$ ile ve $j \notin J$ ise $c=1$ ile aşağıdaki eşitlik minimize edilmektedir (Demir, 2010).

$$\sigma(X; Y) = n_w^{-1} \sum_j c^{-1} \text{tr} \left((X - G_j Y_j)' M_j W (X - G_j Y_j) \right) \quad j = 1, \dots, m \quad (1)$$

Kayıp fonksiyonu olarak bilinen (1) no'lu eşitlikte, X , $n \times p$ boyutlu nesne skorları;

Y , değişkenlerin çoklu ölçekleme seviyesindeki sentroid koordinatları (Y_j) ve çoklu nominal olmayan ölçekleme seviyesindeki vektör koordinatları (y_j, a_j) toplamı;

$n_w, \sum_{i=1}^n w_i$ eşitliği ile ağırlıklandırılmış gözlem sayısı;

G_j , elemanları $i = 1, \dots, n$ ve $r = 1, \dots, k_j$ olan $n \times k_j$ boyutlu j . değişkeninin ikili gösterge matrisi (i . gözlem j . değişkenin r . kategorisinde ise $g_{(j)ir} = 1$; i . gözlem, j . değişkenin r . kategorisinde değilse $g_{(j)ir} = 0$ olur.) (Gifi, 1990; Güç, 2015);

Y_j , $k_j \times p$ boyutlu sentroid koordinatları;

M_j , diyagonal elemanları $m_{(j)ii}$ olan $n \times n$ diyagonal matris (i . gözlem eksik ve j . değişken pasif olduğu zaman veya i . gözlem, j . değişkenin r . kategorisinde olduğu ve r . kategori sadece



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tamamlayıcı gözlemler tarafından kullanıldığı zaman $m_{(j)ii} = 0$ ve diğer durumlarda ise $m_{(j)ii} = v_j$ olur.);

W , diyagonal elemanları w_j olan $n \times n$ boyutlu diyagonal matrisi;

m , analiz edilen değişken sayısı ve

J , hangi değişkenlerin çoklu nominal ölçekleme seviyesine sahip olduğunu belirleyen indeks değeridir.

(1) no'lu eşitlik için gerekli diğer notasyonlar ise;

n , toplam analiz edilen tamamlayıcı gözlem sayısı; \square , boyut sayısı; \square_{\square} , \square_{\square} boyutlu çoklu nominal olmayan ölçekleme seviyesindeki değişkenlere ait kategori sayısı; \square_{\square} , i. gözlemin ağırlığı (i. gözlem ağırlıklandırılmamışsa $\square_{\square} = 1$ ve i. gözlem tamamlayıcı gözlemse $\square_{\square} = 0$ olur.) ve \square_{\square} , j. değişkenin kategorilerinin sayısıdır (IBM SPSS, 2011).

3. BULGULAR VE TARTIŞMA

Çalışmada ele alınan özellikler bakımından çeşitlere göre tanımlayıcı istatistikler ve karşılaştırma sonuçları Tablo 1'de verilmiştir. Tablo 1'de görüldüğü üzere, tüm özellikler bakımından çeşitler arası farklılık istatistik olarak önemli bulunmuştur ($p < 0.01$).



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Değişkenler		Ort.	SS	p
Glikoz	Köhnü	9.02	0.08	0.268
	Ağın Beyazı	8.67	0.21	
	Şilfoni	9.30	0.06	
	Kırmızı	9.34	0.38	
	Total	9.08	0.13	
Fruktoz	Köhnü	9.54	0.49	0.112
	Ağın Beyazı	8.67	0.29	
	Şilfoni	9.49	0.01	
	Kırmızı	10.03	0.02	
	Total	9.43	0.21	
Tartarik Asit	Köhnü	3.64 b	0.10	0.002
	Ağın Beyazı	3.18 c	0.03	
	Şilfoni	2.80 c	0.06	
	Kırmızı	4.38 a	0.16	
	Total	3.50 a	0.22	
Malik Asit	Köhnü	2.37 b	0.10	0.001
	Ağın Beyazı	1.15 c	0.02	
	Şilfoni	2.38 b	0.02	
	Kırmızı	3.77	0.06	
	Total	2.42	0.35	
Sitrik Asit	Köhnü	0.48 b	0.02	0.005
	Ağın Beyazı	0.33 a	0.01	
	Şilfoni	0.46 b	0.01	
	Kırmızı	0.60 a	0.03	
	Total	0.47	0.03	

Farklı harfi alan çeşitler arası fark önemlidir

Çalışmada ele alınan özellikler; “düşük” ve “yüksek” değer olarak iki kategoriye ayrılarak, çeşitlerle olan ilişkisini iki boyutlu uzayda göstermek üzere, Kategorik Temel Bileşenler Analizi (Categorical Principal Component Analysis) yapılmıştır. Analiz sonucu Tablo 1’ de özetlenmiştir. Tablo 1’ de görüldüğü üzere; birinci boyut varyansın % 56.54’ünü açıklarken, ikinci boyut % 26.19’unu açıklamıştır. İki boyutun birlikte varyans açıklama oranı ise % 82.73 olarak bulunmuştur.

Tablo 1. Kategorik Temel Bileşenler Analizi özet tablosu

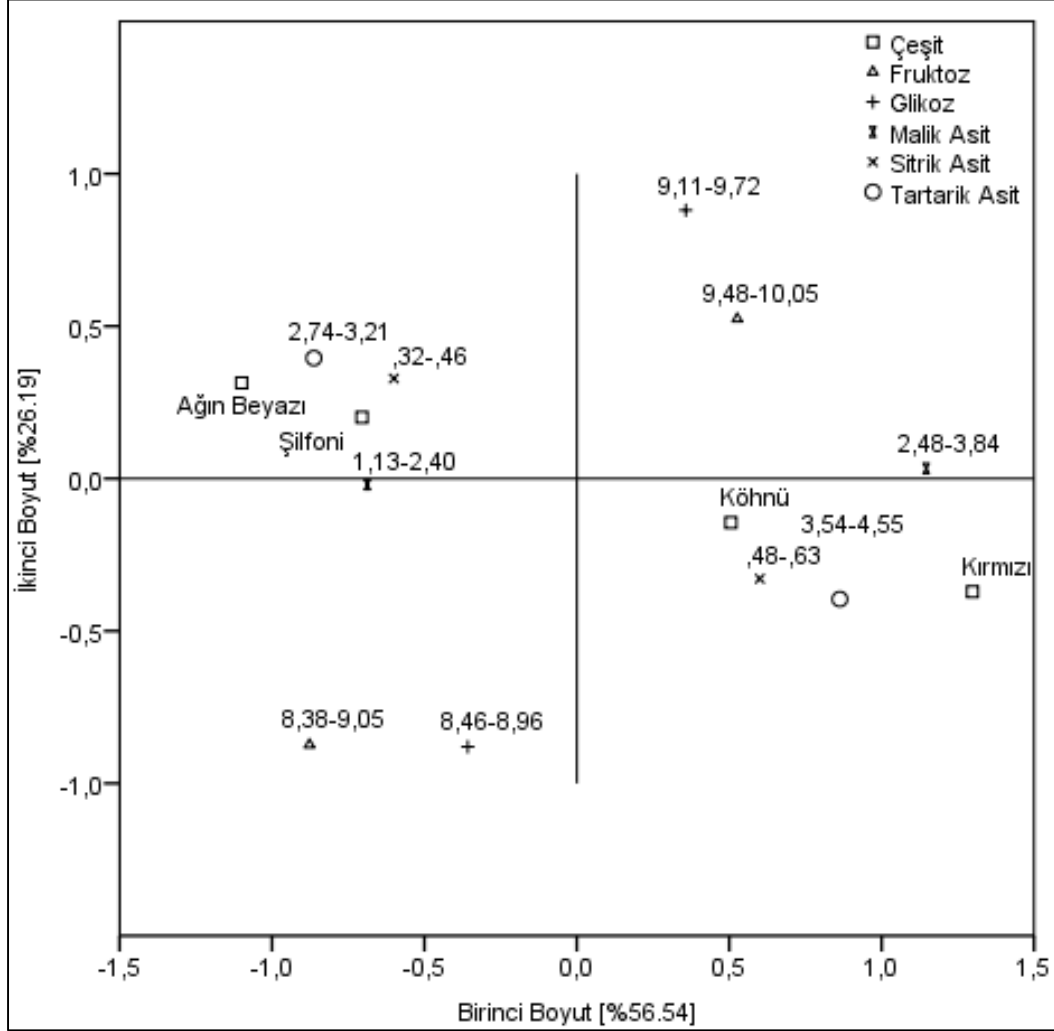
Boyut (Dimension)	Açıklanan Varyans oranı (Variance Accounted For)	
	Özdeğer (Eigenvalue)	% of Variance
1	3.39	56.54
2	1.57	26.19
Total	4.96	82.73



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Bu sonuçlara göre değişkenlerin kategorileri ve çeşitler arasındaki ilişkilerin 2 boyutlu uzaydaki görünümü Şekil 1'de verilmiştir.



Şekil 1. Çeşitler ve değişken kategorilerinin iki boyutlu uzaydaki konfigürasyonu

Şekil 1'de görüldüğü üzere; çeşitlerden Kırmızı ve Köhnü çeşidi, birbiri ile ilişkili olarak birinci boyuta göre pozitif (ikinci boyuta göre negatif) bölgede yer alırken, Ağın beyazı ve Şilfoni çeşitleri, yine birbiri ile yüksek korelasyonlu olarak, ikinci boyuta göre pozitif (birinci boyuta göre negatif) bölgede yer almış ve iki küme oluşturmuşlardır. Birinci boyuta göre adı geçen bu iki küme arasında negatif korelasyon bulunmuştur.

Organik asitlerden Tartarik asit, Malik asit ve Strik asitin yüksek değerleri, Kırmızı ve Köhnü üzüm çeşitleri ile aynı bölgede yer almıştır. Ağın Beyazı ve Şilfoni çeşitleri ise adı geçen üç organik asitin düşük değerleri ile aynı bölgede yer almıştır. Buna göre, Köhnü ve Kırmızı üzüm çeşitlerinin; adı geçen üç organik asit bakımından yüksek değerli ürünler üretme eğiliminde



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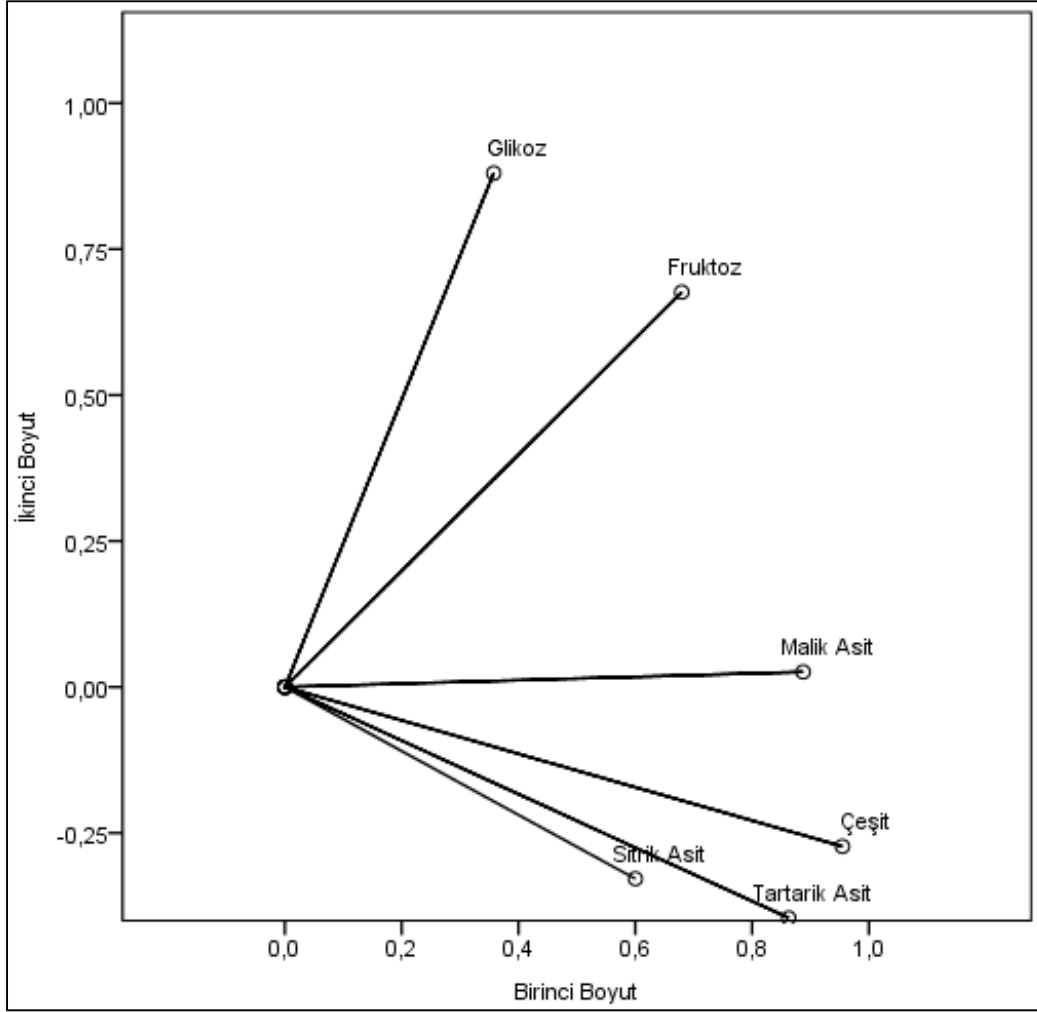


olan çeşitler olduğu, Ağın Beyazı ve Şilfoninin ise düşük organik asit içerikli çeşitler olduğu söylenebilir. Benzer şekilde, şekerlerden Glikoz ve Fruktozun düşük değerleri, Ağın Beyazı ve Şilfoni çeşitleri ile birlikte birinci boyuta göre negatif bölgede yer almıştır. Glikoz ve Fruktozun yüksek değerleri ise Köhnü ve Kırmızı çeşitlerle birlikte birinci boyuta göre pozitif bölgede yer almıştır. Dolayısıyla toplam varyansın yaklaşık % 57' sini tek başına açıklayan birinci boyuta göre; Köhnü ve Kırmızı çeşitlerinin kümesi, organik asitler ve şekerler bakımından yüksek içerikli çeşitler, Ağın Beyazı ve Şilfoni çeşitlerinin kümesinin ise düşük içerikli çeşitler olduğu söylenebilir.

Transforme edilmiş değişkenler arasındaki ilişkiler Tablo 2 ve Şekil 2'de gösterilmiştir. Tablo 2 ve Şekil 2 birlikte incelendiğinde, en yüksek korelasyon % 94.5 ile Çeşit ile Tartarik asit arasında gözlenirken, bunu % 83.9 ile Çeşit ile Malik asit, % 77.5 ile Glikoz ile Fruktoz ve Tartarik asit ile Malik asit arasındaki korelasyonlar izlemiştir.

Tablo 2. Transforme edilmiş değişkenler arasındaki korelasyonlar ve bileşen yükleri

	Transforme edilmiş değişkenler arasındaki korelasyonlar						Bileşen yükleri	
	Çeşit	Glikoz	Fruktoz	Tartarik Asit	Malik Asit	Sitrik Asit	Boyut 1	Boyut 2
Çeşit	1						0.955	-0.273
Glikoz	0.103	1					0.358	0.880
Fruktoz	0.458	0.775	1				0.679	0.676
Tartarik Asit	0.945	0.000	0.258	1			0.863	-0.395
Malik Asit	0.839	0.258	0.600	0.775	1		0.887	0.026
Sitrik Asit	0.628	0.000	0.258	0.500	0.258	1	0.600	-0.328



Şekil 2. Değişkenlerin iki boyutlu uzaydaki konfigürasyonu

Çalışmada, 4 çeşit, 2 şeker ve 3 organik asit arası ilişkiler, Kategorik Temel Bileşenler Analizi ile incelenmiştir. Analiz sonucunda da yaklaşık % 83 gibi yüksek varyans açıklama oranı ile 6 değişken 2 boyuta indirgenmiştir. Böylece, kategorik ve sürekli değişkenlerden oluşan toplam 6 değişken arasındaki doğrusal ve/veya doğrusal olmayan ilişkiler, iki boyutlu uzaya indirgenerek, kolay anlaşılabilir ve yorumlanabilir bir şekilde görsel olarak sunulabilmiştir.

4. SONUÇ

Sonuç olarak, birçok bilim alanında, farklı değişken tiplerini içeren çalışmalarda, doğrusal olmayan ilişkilerle birlikte doğrusal ilişkiler de bulunmak istendiğinde, bu ilişkileri, kolay yorumlanabilir ve basit anlaşılabilir olarak iki boyutlu uzayda sunabilmek bakımından Kategorik Temel Bileşenler Analizinin kullanılabileceği önerilebilir.



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KAYNAKLAR

Demir C 2010. Doğrusal Olmayan Temel Bileşenler Analizi ve Sağlık Alanında Uygulaması. Yüzüncü Yıl Üniversitesi Sağlık Bilimleri Enstitüsü Biyoistatistik ve Tıp Bilişimi Anabilim Dalı, Yüksek Lisans Tezi, 55 sy.

Gifi A 1990. Nonlinear Multivariate Analysis. John Wiley & Sons, New York, 579 p.

Güç K 2015. Türkiye’de Resmi Kurumlara Duyulan Güvenin Kategorik Regresyon ve Lojistik Regresyon Analizi İle İncelenmesi. Gazi Üniversitesi Fen Bilimleri Enstitüsü İstatistik Anabilim Dalı, Yüksek Lisans Tezi, 75 s.

IBM SPSS 2011. IBM SPSS Statistics 20 Algorithms. IBM, Inc., New York, 1069 s.

Jolliffe IT 1986. Principal Component Analysis. Springer-Verlag, New York, 487 s.

Karaman E 2019. Optimal Ölçekleme Teknikleri ve Bir Uygulama. İstanbul Üniversitesi Sosyal Bilimleri Enstitüsü İşletme Anabilim Dalı, Doktora Tezi, 108 s.

Michailidis G, De Leeuw J 1998. The Gifi System of Descriptive Multivariate Analysis. Statistical Science 13(4): 307-336.



**DETERMINATION OF GERMINATION CHARACTERISTICS OF MILK THISTLE
(*Silybum marianum* L.) PLANT UNDER SALT STRESS**

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ABSTRACT

In this study, it was aimed to determine the effects of salt stress on germination traits of milk thistle (*Silybum marianum* L.). The research was conducted in Siirt University, Faculty of Agriculture, Field Crops Laboratory under controlled conditions of 25 ± 1 °C. The milk thistle population of Samsun origin was used as plant material. The laboratory study was set up in petri dishes with 4 replications according to the randomized plot design. In the study; 0 mM, 50 mM, 100 mM, 150 mM and 200 mM doses of salt (NaCl) were the subject of this research. At the end of the 10th day in the experiment, measurements were made on 10 plants randomly selected from the plants in each petri dish. In the study; germination percentage, mean germination time, germination index, coefficient of uniformity of germination and germination energy parameters were examined. According to the results of the research; germination percentage 6.67-84.00%, mean germination time 2.23-5.50 day, germination index 0.31-12.71, coefficient of uniformity of germination 1.27-35.0 and germination energy 0.00-32.00 varied in ranges. Depending on the increase in salt concentrations, it was determined that there were significant decreases in the values of germination percentage, mean germination time, germination index, coefficient of uniformity of germination and germination energy.

Keywords: Milk thistle, *Silybum marianum*, NaCl, Germination Percentage, Germination energy



1. INTRODUCTION

Milk thistle (*Silybum marianum* L.) is an annual plant belonging to the Asteraceae family, grows natively in the Mediterranean and is widespread in other regions in the world (Sedghi et al., 2010). Milk thistle (*Silybum marianum* L.) is a plant used for nutraceutical purposes. *Silybum marianum*, which grows in the altitude range of 250-2400 m, has accelerated the development of varieties for yield and quality elements from the populations that show great genetically variance (Çelik, 2009). Although milk thistle has a wide spreading area, it mostly likes sunny, windless, warm regions. It was determined that there were 0.08-0.1% essential oil and 26-28% fixed oil in the seeds. Its seeds contain 1-6% silymarin (Gök et al., 2006). Other organs (leaves, flowers, roots) of the milk thistle do not contain silymarin. Silymarin mainly consists of three flavonolignan called silibin (36.3%), silidianin (5.9%) and silistirin (15.7%) (Sanchez-Sampedro et al., 2007). Plants may encounter unfavorable conditions that negatively affect their growth and development during their normal life processes. The conditions that affect or inhibit the growth, development and metabolism of plants are called stress. Germination and seedling formation are two important critical stages of the life cycle for a healthy plant development (Hubbard et al., 2012) and are the most sensitive periods of the plant (Yadav et al., 2011).

In the reports prepared by FAO/UNESCO, it is reported that there are 954 million hectares of salt-affected and productivity-restricted soils worldwide. It is stated that approximately 2 million hectares of land in Turkey is affected by salt (Anonim, 2018).

Plants are affected by salt stress in the growth environment during their growth and development stages (Kiremit et al., 2017). Resistance to salinity stress differs from plant to plant. The period when plants are most sensitive to salt stress is the germination period and seedling growth (Abo-Kassem, 2007; Zamani et al., 2010). In order to increase vegetative production in saline soils, it is more appropriate to grow salinity-tolerant plants. Salinity affects the germination rate and percentage, seedling growth and many germination parameters such as germination index, radicle and plumule length, fresh and dry weight in different methods depending on the plant species (Tekin and Bozcuk, 1998; Nasırı et al., 2014; Uyanık et al., 2014; Moghaddam et al., 2020; Özyazıcı and Açıkbash, 2021). This study was carried out to determine the effects of salt stress on the germination properties of milk thistle (*S.marianum* L.).



2. MATERIAL AND METHODS

The research was carried out in Siirt University Faculty of Agriculture, Department of Field Crops Laboratory. In the study, milk thistle (*S. marianum* L.) seeds from the Samsun population were used as plant material.

Four different salt doses (50, 100, 150 and 200 mM NaCl) and control treatments were considered as research subjects. A laboratory trial was set up according to a randomized plot trial design with 4 replications. Twenty-five seeds were used for each replication. Seeds were sterilized in 70% ethyl alcohol for 1 minute and rinsed 3 times with sterile water. Then, surface sterilization was carried out to cover the seeds with 10% sodium hypochlorite (NaOCl) for 5 minutes to deform the microorganisms on the seed surface. The sterilized seeds were placed between Whatman Grade 2 filter paper in Petri dishes (90 mm x 15 mm). Salt doses prepared at five different concentrations were applied to each petri dish as 3 ml. Petri dishes were left to germinate in an oven set at 25 ± 1 °C (BINDER, GmbH, Germany). Until the end of the study every 48 hours was added to petri dishes 3 ml of appropriate salt dose. Germination controls were made every 24 hours during the test, and the germination test was completed on the 10th day. While germination was detected in seeds, at least 2 mm rootlet emergence was accepted as a germination criterion (Scott et al., 1984; Soleymani and Shahrajabian, 2018).

The germination percentage (GP), mean germination time (MGT), germination index (GI), coefficient of uniformity of germination (CUG), and germination energy (GE) properties were examined in terms of the effect on germination development in different salt concentrations applied to milk thistle. GP, MGT, GI, CUG, and GE were calculated using the following formulas:

$$GP = (NGS/TS) \times 100$$

$$MGT = \sum(N_i T_i) / N_i$$

$$GI = \sum(G_i / T_i)$$

$$CUG = \sum n / \sum [(MGT - t)^2 n]$$

$$GE = (T_1/N) \times 100$$

NGS: the number of normally germinated seeds, TS: the total number of seeds, N_i : the number of seeds germinated on day, T_i : the number of days counted from the beginning of germination, G_i : the germination percentage on the i^{th} day, T_i : the days of the germination test, t : the time in days, starting from day 0, the day of sowing, n : the number of seeds completing germination on day t , T_1 : the number of seeds germinated on the first day, and N : the total number of seeds.



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The ArcSin transformation was applied to GP values before analysis of variance (Zar, 1996). The obtained data were subjected to analysis of variance according to the randomized plot trial design, and the differences between the means were checked by Tukey's multiple comparison test (Açıkgöz and Açıkgöz, 2001).

3. RESULTS AND DISCUSSION

The GP results of milk thistle plant different salt concentrations are presented in Figure 1. In terms of GP, the effect of different salt concentrations was found to be statistically significant at the $p < 0.01$ level.

In the research, in terms of GP, the highest value was determined in control (0 mM NaCl) with 84.00%, and the difference between 50 mM salt concentration was statistically insignificant. The lowest GP was determined 150 mM and 200 mM salt concentrations (6.67%). It was observed that the germination percentage decreased in parallel with the increase in salt concentrations.

When the effects of different salt concentrations were evaluated in terms of GP, it was determined that all salt concentrations, showed negative effects compared to the control. In studies conducted on many plant species, it was reported that salt concentrations had negative effects on the germination percentage (Liopa-Tsakalidi et al., 2011; Said-Al Ahl and Omer, 2011; El-Sabagh et al., 2015; Çamlıca and Yıldız, 2017; Hamdaoui et al., 2021; Özyazıcı and Açıkbaz, 2021).

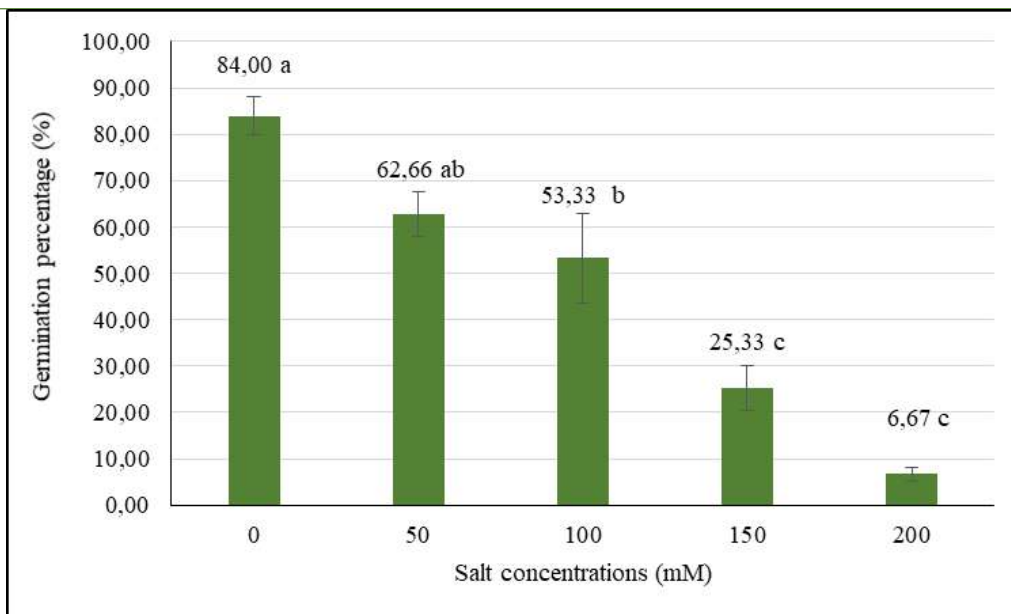


Figure 1. Germination percentage of milk thistle under salinity stress*

*: Results are means±standard error

The findings of the MGT are shown in Figure 2. The effect of different salt concentrations in terms of MGT was found to be statistically significant at the $p < 0.01$ level. When MGT were examined, the latest germination was determined as 5.5 days in the highest salt concentration (200 mM). There was no statistical difference between other salt concentrations (Figure 2). It was observed that the mean germination time increased as the salt concentration increased. As in this study, it was reported that salt concentrations significantly affected the MGT and increased the germination time in some other studies conducted on different plant species (Sedghi et al., 2010; Haghighi et al., 2012; Dorri et al., 2019).

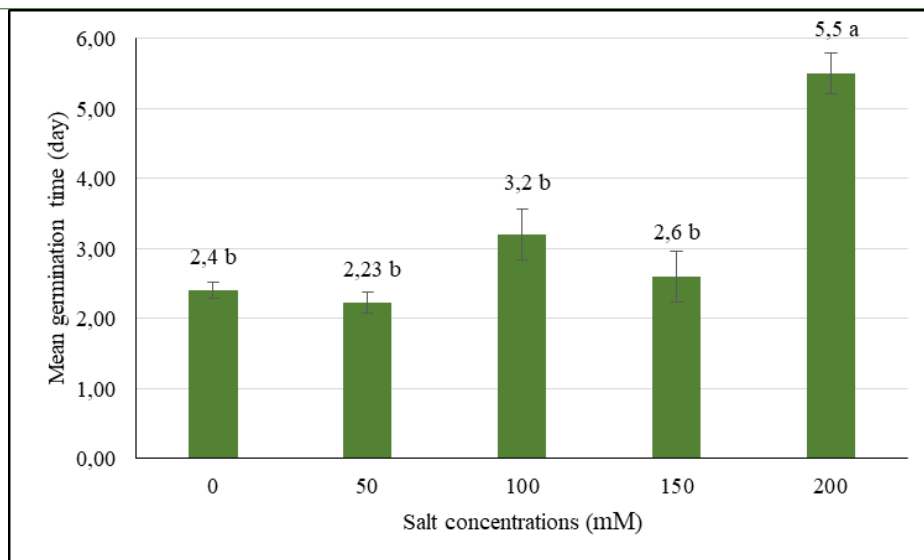


Figure 2. Mean germination time of milk thistle under salinity stress*

*: Results are means±standard error

Significant differences were found among salt concentrations in terms of GI ($p < 0.01$). GI increased when the salt concentrations decreased. The highest GI (12.71%) was observed in the control (Figure 3). Thus, many studies reported that the GI values of salinity stress decreased in plant species such as common bean (Cokkızgın, 2012), kinoa (Beyazçiçek and Yılmaz, 2020; Oral et al., 2020), sorgum (Atış, 2011), triticale (Altuner et al., 2019), safflower (Kurtuluş, 2020) and rapeseed (Balcı and Boydak, 2021).

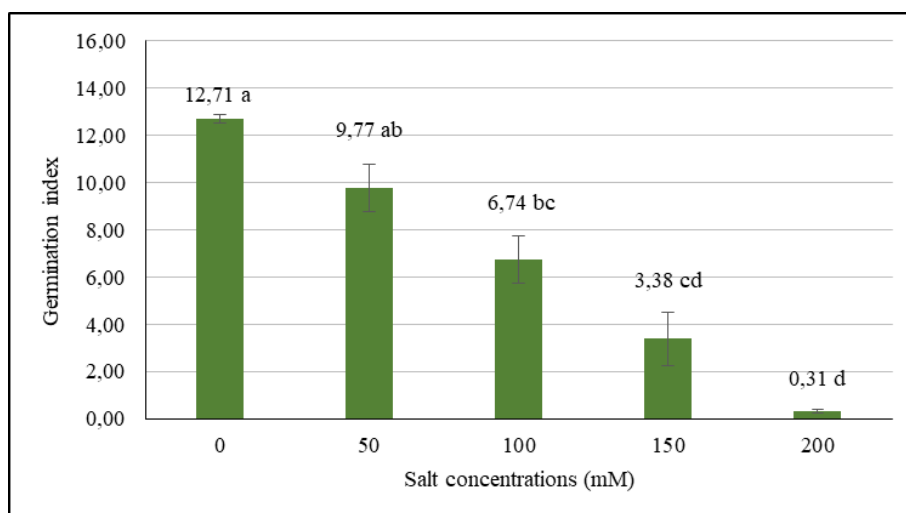


Figure 3. Germination index of milk thistle under salinity stress*

*: Results are means±standard error



The values related to the CUG determined in milk thistle in different salt concentrations are given in Figure 4. There were statistically significant differences at the $p<0.01$ level between different salt concentrations in terms of the CUG.

In terms of the CUG, the most uniform germination was determined in control and 50 mM salt applications. The CUG value decreased in parallel with the increase in salt concentrations (Figure 4). In a study on chickpea regarding germination uniformity, it was reported that different salt concentrations decreased the CUG compared to the control group (Ceritoğlu and Erman, 2020). Solouki and Moghaddam (2015) reported similar results in their study on the milk thistle plant.

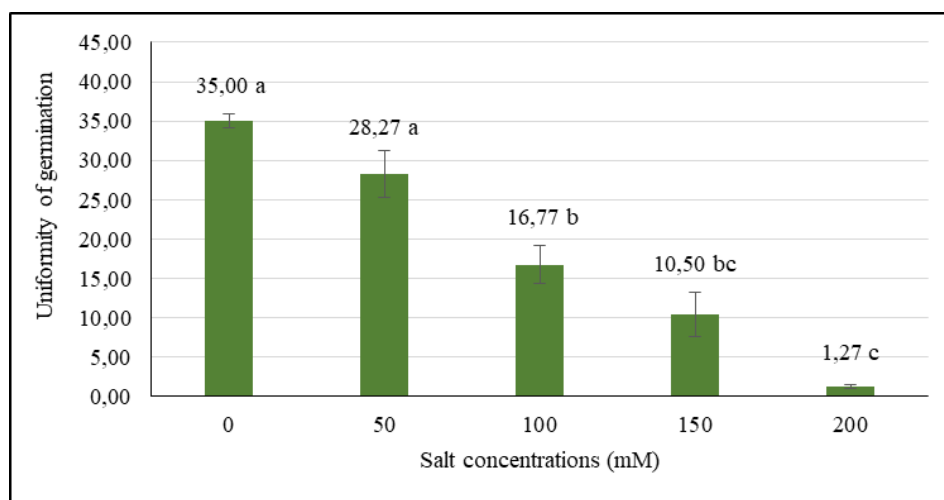


Figure 4. Coefficient of uniformity germination of milk thistle under salinity stress*
*: Results are means \pm standard error

Germination energy results are given in Figure 5. In terms of GE was found statistically significant difference between salt concentrations at $p<0.01$ level, germination energy decreased with increasing salt concentrations. While the highest value in terms of GE was found in the control group with 32.00, the lowest value was found at 200 mM salt concentration. Thus, many studies reported that the GE values of salinity stress decreased in plant species such as, lupin (Karagüzel, 2003), *Limonium sinense* Kuntze. and *Glycine soja* sieb. (Li, 2008), clover (Castroluna et al., 2014) and quinoa (Kuşcu et al., 2018).

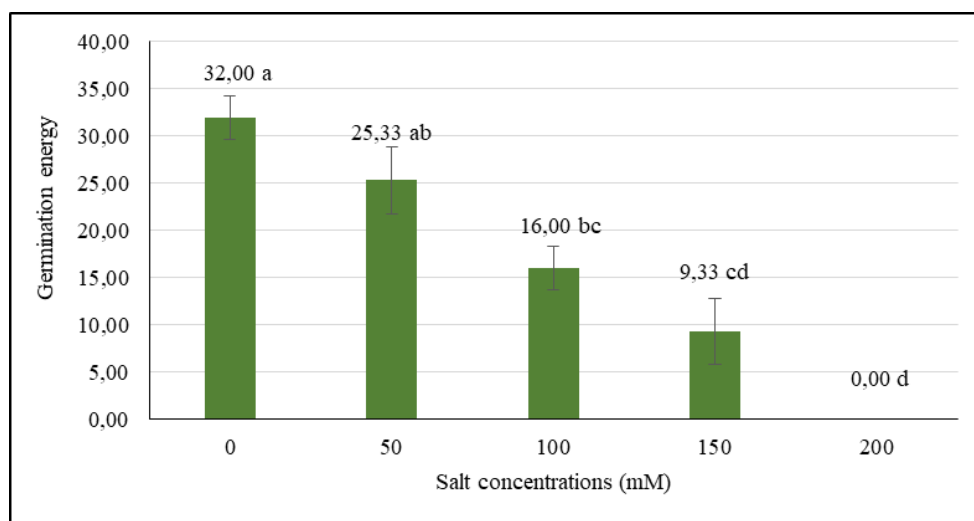


Figure 5. Germination energy of milk thistle under salinity stress*

*: Results are means \pm standard error

4. CONCLUSION

The results in this study showed that the salt concentrations from 0-200 mM had significantly effect on milk thistle seed germination. The highest germination percentage and germination uniformity were seen under control and 50 mM salt concentrations. The increase in salt concentration adversely affected all parameters and it was concluded that high concentrations inhibited germination.



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REFERENCES

- Abo-Kassem, E.E.M. (2007). Effects of salinity: Calcium interaction on growth and nucleic acid metabolism in five species of Chenopodiaceae. *Turkish Journal of Botany*, 31:125-134.
- Açıkgöz N, Açıkgöz N. (2001). Common mistakes in the statistical analyzes of agricultural experiments I. single factorials. *ANADOLU Journal of the Aegean Agricultural Research Institute*, 11(1): 135-147. (In Turkish).
- Altuner, F., Oral, E., Tunçtürk, R., Baran, İ. (2019). Effect of salt stress (NaCl) in the triticale (x Triticosecale Wittmack) applied pretreatment of gibberellic acid. *KSU Journal of Agriculture and Nature*, 22(Eksay 2): 235-242.
- Anonim, (2018). Tuzlu ve Alkali Alanlarda Kullanılabilecek Bazı Bitki Türlerinin Tespiti ve Adaptasyonu Projesi Sonuç Raporu. (<https://www.tarimorman.gov.tr/CEM/Belgeler/yay%C4%B1nlar/yay%C4%B1nlar%202019/KIRSEHIR%20Tuzlu%20Alkali%20Sonuc%20Raporu%20.pdf>) (Erişim tarihi: 13.12.2021).
- Atış, İ. (2011). Effects of salt stress on germination and seedling growth of some sorgum (*Sorghum bicolor* L. Moench) cultivars. *Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi*, 6(2): 58-67.
- Balcı, A.K., Boydak, E. (2021). The effect of NaCl concentrations on germination and emergence in different rapeseed (*Brassica napus* L.) Genotypes. *KSU Journal of Agriculture and Nature*, 24 (5): 1011-1020.
- Beyazçiçek, H., Yılmaz, Ş. (2020). The effect of salt stress on germination and early seedling growth of some foreign origin quinoa (*Chenopodium quinoa* Willd.) cultivars province. *Mustafa Kemal University Journal of Agricultural Sciences*, 25 (2):159-168.
- Castroluna, A., Ruiz, O.M., Quiroga, A.M., Ped-ranzani, H.E. (2014). Effects of salinity and drought stress on germination, biomass and growth in three varieties of *Medicago sativa* L. *Advances en Inventigacion Agropecuria*, 18(1): 39-50.
- Ceritoğlu, M., Erman, M. (2020). Mitigation of salinity stress on chickpea germination by salicylic acid priming. *International Journal of Agriculture and Wildlife Science*, 6(3): 582-591.
- Cokkızgın, A. (2012). Salinity stress in common bean (*Phaseolus vulgaris* L.) seed germination. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 40(1):177-182.



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Çelik, A.S. (2009). A study on determination of effect seed oil compositions and silimarin yield from seeds of *Silybum marianum* (L.) Gaertner cultivated in Konya ecological condition. Master Thesis, Selcuk University Graduate School of Natural and Applied Science, Konya, Turkey.

Dorri, M.A., Kamkar, B., Aghdasi, M., Safahani, A.R. (2019). Germination and seedling growth of *Silybum marianum* as a medicinal plant under salinity stress. *Plant Breeding and Seed Science*, 79: 25-38.

El-Sabagh, A., Omar, A.E., Saneoka, H., Barutçular, C. (2015). Physiological performance of soybean germination and seedling growth under salinity stress. *Dicle University Institute of Natural and Applied Science Journal*, 4(1): 6-15.

Gök, S. B., Erdoğan, Y., Kalınkara, E. C. (2006). Nutrasötik Bir Bitki: Meryemana Dikeni (*Silybum marianum*). Ekoloji Sempozyumu. (In Turkish).

Haghighi, M., Afifpour, Z., Mozafarian, M. (2012). The alleviation effect of silicon on seed germination and seedling growth of tomato under salinity stress. *Vegetable Crops Research Bulletin*, 76:119-126.

Hubbard, M., Germida, J., Vujanovic, V. (2012). Fungal endophytes improve wheat seed germination under heat and drought stress. *Botany*, 90:137-149.

Karagüzel, O. (2003). Influence of salt sources and concentrations on germination of *Lupinus varius* Native to South Anatolia. *Akdeniz University Journal of the Faculty of Agriculture*, 16(2): 211-220.

Kiremit, M.S., Hacıkamiloğlu, M.S., Arslan, H., Kurt, O. (2017). The effects of different irrigation water salinity levels on germination and early seedling development of flax (*Linum usitatissimum* L.). *Anadolu Journal of Agricultural Sciences*, 32: 350-357.

Kurtuluş, M. (2020). The effect of different salt concentrations on germination and emergence of some safflower (*Carthamus tinctorius* L.) variety. (Master thesis), *The Graduate School of Natural and Applied Science of Bingöl University*, Bingöl, Turkey.

Kuşçu, H., Çayğaracı, A., Ndayizeye, J.D.D. (2018). Effect of salt stress on germination parameters of some quinoa (*Chenopodium quinoa* Willd.) cultivars. *Journal of Agricultural Faculty of Uludag University*, 32(1): 89-99.

Liopa-Tsakalidi, A., Zakynthinos, G., Varzakas, T., Xynias, I.N. (2011). Effect of NaCl and GA₃ on seed germination and seedling growth of eleven medicinal and aromatic crops. *Journal of Medicinal Plants Research*, 5(17): 4065-4073.



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BINGOL, TURKEY**



Moghaddam, M., Farhadi, N., Panjtandoust, N., Ghanati, F. 2020. Seed germination, antioxidant enzymes activity and proline content in medicinal plant *Tagetes minuta* under salinity stress. *Plant Biosystems - An International Journal Dealing With All Aspects of Plant Biology*, 154(6): 835-842.

Nasırı, Y., Feyzi, P., Javanmard, A. (2014). Effects of hydro and hormonal seed priming on seed germination of milk thistle under saline stress condition. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 6(3):374-380.

Oral, E., Altuner, F., Tunçtürk, R., Baran, İ. (2020). The impact of salt (NaCl) stress on germination characteristics of gibberellic acid (GA3) pretreated quinoa (*Chenopodium quinoa* Willd.) seed. *KSU Journal of Agriculture and Nature*, 23(2): 349-356.

Özyazıcı, G., Açıkbaş, S. 2021. Determination of germination characteristics of fenugreek (*Trigonella foenum-graecum* L.) plant under salt stress. *II. International Hazar Scientific Research Congress, 10-11 April, Baku, Azerbaijan*.

Özyazıcı, M.A., Açıkbaş, S. 2021. Effects of different salt concentrations on germination and seedling growth of some sweet sorghum [*Sorghum bicolor* var. *saccharatum* (L.) Mohlenbr.] cultivars. *Turkish Journal of Agricultural Research*, 8(2): 133-143.

Said-Al Ahl, H.A.H., Omer, E.A. (2011). Medicinal and aromatic plants production under salt stress. A review. *Herba Polonica*, 57(1): 72-87.

Sanchez-Sampedro, A., Kimb, H.K., Choi, Y.H., Verpoorte, R., Corchete, P. (2007). Metabolomic alterations in elicitor treated *Silybum marianum* suspension cultures monitored by nuclear magnetic resonance spectroscopy. *Journal of Biotechnology*, 130:133-142.

Scott, S.J., Jones, R.A., Williams, W.A. (1984). Review of data analysis methods for seed germination. *Crop Science*, 24, 1192-1199.

Sedghi, M., Nemati, A., Amanpour-Balaneji, B., Gholipouri, A. (2010). Influence of different priming materials on germination and seedling establishment of milk thistle (*Silybum marianum*) under salinity stress. *World Applied Sciences Journal*, 11(5): 604-609.

Sedghi, M., Nemati, A., Esmailpour, B. (2010). Effect of seed priming on germination and seedling growth of two medicinal plants under salinity. *Emirates Journal of Food and Agriculture*, 22(2): 130-139.

Soleymani, A., Shahrajabian, M.H. (2018). Changes in germination and seedling growth of different cultivars of cumin to drought stress. *Cercetări Agronomice în Moldova*, 1(173): 91-100.



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Tekin, F., Bozcuk, S. (1998). Effects of salt and exogenous putrescine on seed germination and early seedling growth of *Helianthus annuus* L. var. Santafe. *Turkish Journal of Botany*, 22: 331-340.

Uyanık, M., Kara, Ş.M., Korkmaz, K. (2014). Determination of responses of some winter canola (*Brassica napus* L.) cultivars to salt stress at germination period. *Journal of Agricultural Sciences*, 20: 368-375.

Yadav, P.V., Kumari, M., Ahmed, Z. (2011). Chemical seed priming as simple technique to impart cold and salt stress tolerance in capsicum. *Journal of Crop Improvement*, 25: 497-503.

Zamani, S., Nezami, M.T., Habibi, D., Khorshidi, M.B. (2010). Effect of quantitative and qualitative performance of four canola cultivars (*Brassica napus* L.) to salinity conditions. *Advances in Environmental Biology*, 4(3): 422-427.

Zar, J.H. (1996). Biostatistical Analysis. 3rd ed. Prentice Hall, New Jersey, U.S.A. 662p.



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**TÜRKİYE'DEKİ ENDEMİK *Ranunculus poluninii* P.H. Davis İLE BAZI *Ranunculus*
L. TAKSONLARININ MOLEKÜLER FİLOGENİSİ VE SİSTEMATİK DURUMU**

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ÖZET

Dünyamızda, yaklaşık olarak 258650 tohumlu bitki taksonu (Spermatophyta) bulunmaktadır. Türkiye ise, yeryüzünde en zengin floraya sahip ülkelerden birisidir. Öyle ki, Avrupa kıtasının tümünde yayılış gösteren bitki taksonların sayısının, Türkiye’de yayılış gösteren bitki taksonlarının sayısı kadar olduğu bilinmektedir. Ranunculaceae (Düğünçiçeğigiller) kozmopolit bir familya olup Dünya’nın her yerinde yayılış göstermektedir. Ranunculaceae familyası dünyada 60 cins ve 2500 tür ile temsil edilmektedir, bu cinslerden bir tanesi olan *Ranunculus* 7 altcins ve 26 sekiyona ayrılmıştır. Bu çalışmada, *Ranunculus* taksonları arasındaki ilişkileri ve karakter evrimini anlamak için nükleer ITS markör sistemine dayanan moleküler filogenetik analizleri yapılmıştır. Özellikle Türkiye’ye endemik bir tür olan *Ranunculus poluninii* taksonunun çalışılan diğer *Ranunculus* türleri ile akrabalık derecesi araştırılmıştır. *R. poluninii* en yakın *R. diversifolius* ile benzerlik gösterdiği belirlenmiştir.

Anahtar Kelimeler: *Ranunculus poluninii*, *Ranunculus*, nrDNA, ITS, Filogeni



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**MOLECULAR PHYLOGENY AND SYSTEMATIC STATUS OF THE SOME
Ranunculus L. TAXA WITH ENDEMIC *Ranunculus poluninii* P.H. Davis FROM
TURKEY**

ABSTRACT

There are approximately 258650 seed plant taxa (Spermatophyta) in the world. Turkey is also one of the countries with the richest flora in the world. In fact, it has been reported that the number of plant taxa distributed throughout the European continent is as much as the number of plant taxa distributed in Turkey. Ranunculaceae is a cosmopolitan family and spreads all over the world. The Ranunculaceae family, which has 60 genera and 2500 species in the world, one of them is *Ranunculus* which was divided into 7 subgenus and 26 sections. In this study, molecular phylogenetic analyzes based on the nuclear ITS marker system were performed to understand the relationships and character evolution among *Ranunculus* taxa. In particular, the degree of kinship of the *Ranunculus poluninii* taxon, which is an endemic species to Turkey, with the other *Ranunculus* species studied was investigated. It has been determined that *R. poluninii* closely resembles *R. diversifolius*.

Key Word: *Ranunculus poluninii*, *Ranunculus*, nrDNA, ITS marker, Phylogeny



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1. INTRODUCTION

Turkey is one of the countries with the richest flora in the world. The main reasons why Turkey is rich in biodiversity are; It has three phytogeographical regions as Euro-Siberian, Mediterranean and Iran-Turanian, it has three different bioclimatic types, its topographic, geological, geomorphological and soil diversity, elevation differences between 0-5000 meters, different ecosystem types, the existence of different wetlands such as sea, lakes, streams, fresh, salty and soda lakes, the fact that they were less affected by glacial periods than other countries, the existence of the Anatolian Diagonal, which is a migration route of plants formed by high mountains, the ecological and floristic formation differences between the east and west of the diagonal and Turkey is located at the junction point of three continents (Asia, Europe and Africa) (Anonymous 2007).

"Flora of Turkey and The East Aegean Islands", which is the most comprehensive flora books written on the plants of our country, was written by British Botanist P.H. Davis. It was published by Davis in nine main volumes and an additional volume between 1965-1988, and the second supplementary volume of the work was published in 2000 under the editorship of Turkish Botanists (Davis et al. 1965-1985; Davis et al. 1988; Güner et al. 2000; Güner et al. 2012). In the Flora of Turkey, the total plant species was counted as 9222 and the total taxon as 12006. Among these taxa, 2981 species are endemic and the total number of endemic taxa is 3778 (28%) (Erik and Tarıkahya 2004; Çelik 2006). The Ranunculaceae is a cosmopolitan family that spreads all over the world. However, it has been reported that they spread more dominantly in the temperate and cold zones of the Northern and Southern hemispheres (Yıldız and Aktoklu 2012). The Ranunculaceae family, which has 60 genera and 2500 species in the world, is represented by 19 genera, 203 species and subspecies in Turkey with a total of 234 taxa. 62 taxa of these are endemic and the endemism rate is 26.5% (Ekmekçigil 2006; Seçmen et al. 2008; Yıldız and Aktoklu 2012; Yıldırım 2018). The family, which prefers the temperate and cool regions of both hemispheres, shows a high diversity especially in the temperate regions of the Northern hemisphere (Heywood et al. 2007; Yıldırım and Gül 2018). The genus *Ranunculus* was first described by Carl Linnaeus in 1753. Since the first worldwide classification of *Ranunculus* by Candolle in 1824, the genus has been revised several times, but the comprehensive classification is still incomplete. The most recent revision work on the genus *Ranunculus* was done by Tamura in 1995. With this study, *Ranunculus* was divided into 7 subgenus (*Batrachium*, *Coptidium*, *Crymodes*, *Ficaria*, *Gampsoceras*, *Pallasiantha* and



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Ranunculus) and 26 sections. *Ranunculus* subgenus has the most common and the highest number of taxa in the genus (Lehnebach 2008). Systematic studies of the genus could not be clarified due to the large number of species, poor representation of specimens from several regional flora, evolutionary similarity of certain morphological characters, and great variability. Today, with the use of molecular techniques; the phylogeny and evolutionary process of this genus is being tried to be completed (Lehnebach 2008).

Plant molecular phylogeny has been developing rapidly especially in the last 20 years and is frequently used in the classification of many plant groups (Wen et al., 1997; Watson et al., 2000; Masuda et al., 2009; Sonboli et al., 2011; Sonboli et al., 2012). The discovery of new phylogenetic analysis methods and the use of DNA and amino acid sequence analyzes contribute to molecular systematics. Sequence analyzes are very useful for phylogenetic analyzes in cases where morphological characters are insufficient in terms of phylogenetic information (Yokoyama et al., 2000). Because phylogeneticists generally think that the phylogeny of the sequences is very close to the phylogeny of organisms. Sequence analysis methods are used in many areas from finding the geographical origins of living things to molecularly proving the phylogenies of living things (Allan et al., 2004; Cohen and Weydmann, 2005).

There is no molecular study and literature information on the members of the *Ranunculus* genus, which spread naturally in our country, by determining the nrDNA ITS sequences. In this study, the *Ranunculus* taxa of the Eastern Anatolia region, in which *Ranunculus* taxa naturally spread, which are not floristically determined. The diversity of *Ranunculus* taxa in our study area, whether there are new taxa or not, and if any, new distribution situations that were not known until now were investigated. Also, the degree of relationship of *Ranunculus poluninii*, an endemic species to Turkey, with other *Ranunculus* species was investigated.

2. MATERIAL AND METHODS

2.1. Plant Material: Plant Material Was Obtained From Silica-Gel Dried Leaved Of Collected Specimens In The Wild. The Plant Materials Were Identified By Assoc Prof. Dr. M. Kurşat According To Flora Of Turkey And East Aegean Islands (Davis, P.H. 1965-1985). Voucher Specimens Were Deposited At The Molecular Biology And Genetics Laboratory Of Bingol University. Plant Taxa Used In This Study: *R. Trichophyllus* Chaix Ex Vill. Bitllis, Tatvan-Hizan Main Road, Around Kokarsu Village, Kocaçay 1725m, 18.05.2018; *R. Repens* L. Bitlis, Tatvan



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Hizan Main Road, Around Kokarsu Village, Meadow Lands, 1725 M, 18.05.2018; *R. Damascenus* Biss. & Gaill. Bitlis, The Road To Ahlat-Nemrut Crater Lake, Roadsides 1658 M, 16.05.2018; *R. Kotchy* Bois. Bitlis, Tatvan, 1 Km To Yoncabaşı Village, Meadow Lands 1742 M, 17.05.2018; *R. Arvensis* L. Bitlis, Sides Of Bitlis Tatvan Mainroad, 1786 M, 16.05.2018; *R. Poluninii* P.H. Davis Bitlis, Northern Hillside Of The Mount Kambos, Rocky Places, 1650-1800 M, 08.09.2018; *R. Cornutus* D.C. Bitlis, Northern Hillside Of The Mount Kambos, 1650-1800 M, 12.05.2018; *R. Polyanthemos* L. Bitlis, Tatvan Salıca Village, 1650 M, 01.06.2019; *R. Aucheri* Boiss Bitlis, Northernhillsideof The Mount Kambos, Rocky Places, 1650-1800 M, 21.05.2019; *R. Bulbiliferus* Boiss. &Hohen. Bitlis, Tatvan Kesan Valley, Slopes, 1800 M, 28.05.2019; *R. Cuneatus* Boiss. Bitlis, Bağan Village, Slopes, 1800 M, 28.05.2019; *R. Strigillosus* Boiss. & A. Huet Muş, Kortik Mountain, 2450 M, 16.07.2019; *R. Brachylobus* Boiss. & Hohen, Subsp. *Incisilobatus* P.H. Davis Muş, Kortik Mountain, 2450 M, 16.07.2019; *R. Diversifolius* Boiss. & Kotschy Van, Artos Mountain, Northern Slopes, 2200 M, 27.04.2018.

2.2. Dna Extraction, Amplification, And Sequencing: Total genomic DNA was extracted by modified protocol of the cetyltrimethylammonium bromide (CTAB) method (Doyle and Doyle 1987). Polymerase chain reaction (PCR) of the whole region of nrDNA ITS were performed using the ITS AB101 and ITS AB102 primers (Douzery et al., 1999). PCR amplifications were conducted according to the protocols described in Sonboli et al., (2010). Sequencing reactions were performed using ABI 3730 XL (Applied Biosystems).

2.3. Alignment And Phylogenetic Analyses: Phylogenetic analysis were undertaken using two data sets of samples and each included the sequences from the GenBank database of the National Center for Biotechnology Information (NCBI; <http://www.ncbi.nlm.nih.gov/>) were aligned using ClustalW (Thompson et al., 1994) software and subsequently checked visually. Indels were not treated in final datasets. Ultimately, evaluation carried out by grouping the data into three sets as nrDNA. The dataset was comprised of studied taxa ITS (ITS 1, 5.8S and ITS 2) sequences.

Variable sites, number of parsimony-informative sites, transition, transversion, genetic distance, nucleotide diversity, and divergence within species were computed as molecular diversitystatistics for each dataset using Molecular Evolutionary Genetics Analysis software (MEGA 11.0; Tamura et al., 2021). Ultimately, pylogenetic tree was constructed by Maximum Likelihood Method.



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3. RESULTS AND DISCUSSION

The Characteristics Of Sequences: The aligned data set of entire ITS a total of 32 taxa including 18 taxa from NCBI, ITS sequences length is 900 bp. The parsimony informative sites were 152 for nuclear DNA gene region (Table 1.)

Table 1. Numeric information of ITS

ITS	
Length of the aligned sequence (including all taxa without group)	901
GC% content (including all taxa without group)	52.1
Parsimony informative sites (including all taxa without group)	156

The Evolutionary Characteristics: The phylogenetic tree including *R. poluninii*, 32 *Ranunculus* taxa 18 taxa from NCBI were constructed by complete nrDNA ITS regions. As shown in the phylogenetic tree (Figure 1) *R. poluninii* is most closely related to *R. diversifolius*. The maximum likelihood analysis revealed a strict consensus tree with three main groups within the Ranunculaceae analyzed in this study. *R. brachylobus*, *R. poluninii*, *R. diversifolius* and *R. arvensis* were collected together and constitute one group and *R. strigillosus* came together and formed second group and *R. kotschy*, *R. polyanthemos*, *R. cornutus*, *R. repens*, *R. bulbiliferus* and *R. brachylobus* formed third group and *R. aucheri* and *R. cuneatus* formed fourth group and *R. R. damascenus* and *R. tricophyllus* were formed fifth group.

In 2005 Hörandl et al., one of the most detailed studies in literature about molecular systematics of *Ranunculus*, 200 *Ranunculus* taxa analyzed which were collected from many different parts of the world. Only one *Ranunculus* taxa, *Ranunculus sphaerospermus* was included in this study collected from Turkey. Not only ITS regions but also different molecular markers used to analyze phylogeny of different taxonomic relationships in several studies. One of them is Emadzade et al., (2010) compered 33 *Ranunculus* taxa collected from North America, Central Asia, Kashmir, Tibet, the Altai, the Himalayas and Taiwan, however any specimens collected from Turkey was added to this study.



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There is no data in the literature on the naturally occurring *Ranunculus* taxa in our country. For this reason, our study results emerge as the first data on the studied taxa. In order to fully reveal the molecular position of *Ranunculus*, the entire genus needs to be studied. We believe that by making an infraspecific comparison of the results found in the molecular analyzes, it will be useful to determine the places, locations, biodiversity, kinship relations and distribution areas of the species in the Flora of Turkey.

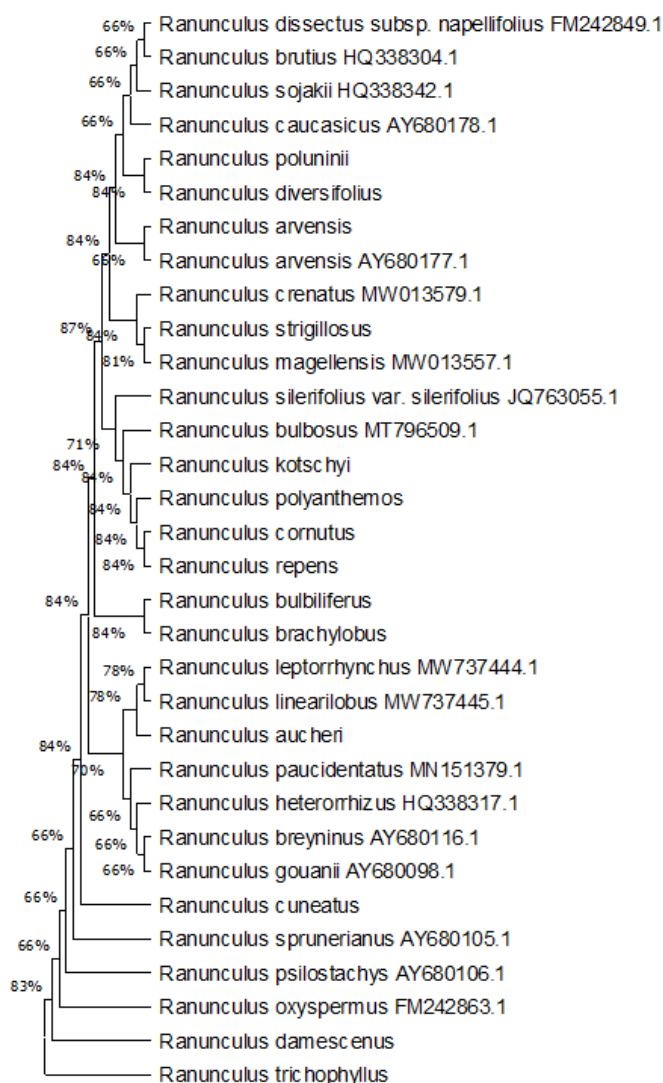


Figure 1. Maximum Likelihood tree based upon the Tamura-Nei model of nrDNA ITS region with 1000 bootstrap replicates.



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REFERENCES

- Allan, G.J. (2004). Francisco-Ortega, J., Santos-Guerra, A., Boerner, E., Zimmer, E.A., Molecular phylogenetic evidence for the geographic origin and classification of canary island lotus (Fabaceae: Loteae). *Molecular Phylogenetics and Evolution*, 32(1): 123-138.
- Anonymous, (2007). C. Çevre ve Orman Bakanlığı, Ulusal Biyolojik Çeşitlilik Stratejisi ve Eylem Planı. Ankara, (Erşim tarihi: 01.05.2020).
- Cohen, B.L., Weydmann, A. (2005). Molecular evidence that phoronids are a subtaxon of brachiopods (brachiopoda: phoronata) and that genetic divergence of metazoan phyla began long before the early cambrian. *Organisms Diversity & Evolution*, 5(4): 253-273.
- Çelik, T. (2006). Kesan Deresi (Bitlis) Florası. Yüksek Lisans Tezi, Yüzüncü Yıl Üniversitesi, Fen Bilimleri Enstitüsü, Van.
- Davis, P H. (1965-1985) (ed.) *Flora of Turkey and the east aegean islands*. Vol. 1-9, Edinburgh Univ. Press, Edinburgh.
- Davis, P.H., Mill, R.R., Tan K. (1988) (eds.) *Flora of Turkey and the east aegean islands*, Vol.10, Edinburgh Univ. Press, Edinburgh.
- Douzery, EJP., Pridgeon, AM., Kores, P., Linder, HP., Kurzweil, H., Chase, MW. (1999). Molecular phylogenetics of Diseae (Orchidaceae): A contribution from nuclear ribosomal ITS sequences. *Am J Bot* 86: 887-899.
- Doyle, J.J., Doyle, J.L. (1987). A rapid DNA isolation procedure for small quantities of fresh leaf tissue. *Phytochem Bull* 19: 11-15.
- Ekmekçigil, M. (2006). Ankara Üniversitesi Fen Fakültesi Herbaryumu (Ank) Ranunculaceae Familyası Revizyonu. Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Ankara.
- Emadzade, K., Lehnebach, C., Lockhart, P., Hörandl, E. (2010). A molecular phylogeny, morphology and classification of genera of Ranunculeae (Ranunculaceae). *Taxon*. 59(3) 809-828.
- Erik, S., Tarıkahya, B. (2004). Türkiye Florası Üzerine. *Kebikeç*, 17 (1): 139-163.
- Güner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M.T., (2012). Türkiye Bitkileri Listesi (Damarlı Bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını. İstanbul.
- Güner, A., Özhatay, N., Ekim, T., Baser, K.H.C. (2000). *Flora of Turkey and the East Aegean Islands*. Edinburgh University Press, Vol. 11, Edinburgh.



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Heywood, V.H., Brummitt, R.K., Culham, A., Seberg, O. (2007). Flowering Plant Families of The World. R. Bot. Gard. Kew.

Hörandl, E., Paun, O., Johansson, J.T., Lehnebach, C., Armstrong, T., Chen, L., Lockhart, P. (2005). Phylogenetic relationships and evolutionary traits in *Ranunculus* s.l. (Ranunculaceae) inferred from ITS sequence analysis. *Mol. Phylogenet. Evol.* 36, 305–327.

Lehnebach, C.A. (2008). Phylogenetic Affinities, Species Delimitation and Adaptive Radiation of New Zealand *Ranunculus*, Palmerson North, New Zealand: Massey University.

Masuda, Y., Yukawa, T., Kondo, K. (2009). Molecular phylogenetic analysis of members of *Chrysanthemum* and its related genera in the tribe Anthemideae, the Asteraceae in East Asia on the basis of the internal transcribed spacer (ITS) region and the external transcribed spacer (ETS) region of nrDNA. *Chrom Bot* 4: 25–36.

Seçmen, Ö., Gemici, Y., Görk, G., Bekat, L., Leblebici, E. (2008). Tohumlu Bitkiler Sistematiği. Ege Üniversitesi, Fen Fakültesi Kitaplar Serisi No: 116, 8. Baskı, İzmir.

Sonboli, A., Osaloo, S.K., Valles, J., Oberprieler, C. (2011). Systematic status and phylogenetic relationships of the enigmatic *Tanacetum paradoxum* Bornm. (Asteraceae, Anthemideae): evidences from nrDNA ITS, micromorphological and cytological data. *Plant Syst Evol* 292: 85-93.

Sonboli, A., Stroka, K., Osaloo, S.K., Oberprieler, C. (2012). Molecular phylogeny and taxonomy of *Tanacetum* L. (Compositae, Anthemideae) inferred from nrDNA ITS and cpDNA trnH-psbA sequence variation. *Plant Syst Evol* 298: 431-444.

Sonboli, A., Oberprieler, C. (2010). Phylogenetic relationship and taxonomic position of *Xylanthemum tianschanicum*(Krasch.) Muradyan (Compositae, Anthemideae) as inferred from nrDNA ITS data. *Biochem. Syst. Ecol.*, 38: 702-707.

Thompson, J.D. (1994). CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Res* 22: 4673-4680.

Watson, L.E., Evans, T.M., Boluarte, T. (2000). Molecular Phylogeny and Biogeography of Tribe Anthemideae (Asteraceae), Based on Chloroplast Gene *ndhF*. *Mol Phylogenet Evol* 15: 59-69.

Wen, J., Vanek-Krebitz, M., Hoffmann-Sommergruber, K., Scheiner, O., Breiteneder, H. (1997). The potential of *betv1* homologues, a nuclear multigene family, as phylogenetic markers in flowering plants. *Molecular Phylogenetics and Evolution*, 8(3): 317-333.



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Yıldırım, H., Gül, R. (2018). *Ranunculus bullatus* L.'nin (Ranunculaceae) Türkiye'de Varlığı Üzerine. *Bağbahçe Bilim Dergisi* 5(1): 10-14.

Yıldız, B., Aktoklu, E. (2012). Bitki Sistematiği, İlk Karasal Bitkilerden Bir Çeneklilere, Palme Yayıncılık, pp.189-193.

Yokoyama, J., Suzuki, M., Iwatsuki, K., Hasebe, M. (2000). Molecular phylogeny of *Coriaria*, with special emphasis on the disjunct distribution. *Molecular Phylogenetics and Evolution*, 14(1): 11-19.



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**TÜRKİYE'DEKİ ENDEMİK *Ranunculus bingoeldaghensis* Engin. İLE BAZI
Ranunculus L. TAKSONLARININ MOLEKÜLER FİLOGENİSİ**

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ÖZET

Ranunculaceae, dünyada yaklaşık 60 cinse ait 2500 türle temsil edilen ve tüm dünyaya yayılış gösteren geniş bir familyadır. Her iki yarım kürede de ılıman ve serin bölgeleri tercih eden bu aile, özellikle kuzey yarım kürede ılıman yüksek rakımlı bir görünüm göstermektedir. Ranunculaceae Türkiye'de 19 cins, 203 tür ve alttür/çeşit ile temsil edilmekte olup, 62 takson endemik olmak üzere toplam 234 takson ile endemizm oranı %26,5'tir. Bitki popülasyonları arasındaki çeşitlilik nadiren incelenir, ancak popülasyon içi ve popülasyonlar arası seviyelerde genetik çeşitliliği türlerle ilişkilendirir. Ranunculaceae, moleküler filogeni eksikliği ve cinsinin morfolojik özelliklerinin sınıflandırılması ve büyük çeşitliliği nedeniyle her zaman tartışmalı olmuştur. Bu çalışmada, *Ranunculus* türleri arasındaki ilişkileri ve karakter evrimini anlamak için nükleer ITS markör sistemine dayanan moleküler filogenetik analizleri rapor edilmektedir ayrıca Türkiye'ye endemik bir tür olan *Ranunculus bingoeldaghensis* türünün diğer *Ranunculaceae* türleri ile akrabalık derecesi araştırılmıştır. *R. bingoeldaghensis* en yakın *R. brachylobus* ile benzerlik gösterdiği belirlenmiştir.

Anahtar Kelimeler: *Ranunculus bingoeldaghensis*, *Ranunculus*, nrDNA, ITS, Filogeni



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**MOLECULAR PHYLOGENY OF THE SOME *Ranunculus* L. TAXA WITH
ENDEMIC *Ranunculus bingoeldaghensis* Engin. FROM TURKEY**

ABSTRACT

Ranunculaceae is a large family that is represented by 2500 species belonging to about 60 similar genera in the world and spreads almost all over the world. This family, which prefers temperate and cool regions in both hemispheres, shows a temperate high elevation view especially in the Northern hemisphere. Ranunculaceae is represented by 19 genera, 203 species and subspecies/varieties in Turkey, with a total of 234 taxa, of which 62 taxa are endemic and the endemism rate is 26.5%. Diversity among plant populations is rarely studied, but does correlate genetic diversity at intra- and inter-population levels with species. Ranunculaceae has always been controversial because the lack of molecular phylogeny and the classification and great diversity of morphological feature of its genera. We report here molecular phylogenetic analyses of 14 *Ranunculus* taxa based on nuclear ITS markers that provide a framework for understanding relationships and character evolution within the tribe. The degree of relationship of *Ranunculus bingoeldaghensis*, an endemic species to Turkey, with other *Ranunculus* species was investigated. It was determined that *R. bingoeldaghensis* closely resembled *R. brachylobus*.

Key Word: *Ranunculus bingoeldaghensis*, *Ranunculus*, nrDNA, ITS marker, Phylogeny



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1. INTRODUCTION

Ranunculus L. is generally the least known genus in Turkey and in the world. They are polymorphic plants with a high rate of polyploidy and high variation in both morphological and karyological characteristics (Goepfert, 1974). In general terms, 40% of this genus is hexaploid, 31% is tetraploid, and 28% is diploid (Goepfert, 1974).

Although many researchers have conducted phylogenetic, cytological, embryological, palynological, serological, karyotypic, hybridization in subspecies taxa and systematic studies, there is no satisfactory classification of this genus even at the divisional level (Goepfert, 1974; Radford et al., 1974; Julin, 1977; Julin, 1978; Tamura, 1962; Jensen, 1968). However, in the systematic studies carried out in Turkey to date, the suspicious parts (groups) of the genus have been tried to be based on a base; it was not possible to separate the species with a serious classification (Davis, 1960; Davis, 1965, 1988). Recent studies have focused on new taxon records and geographical distributions (Heywood and Tutin, 1964; Baytop and Özhatay, 1975; Tan, 1984; Paun et al., 2005; Özçelik ve Korkmaztürk, 2012; Özçelik and Korkmaztürk, 2013). Plant molecular phylogeny has been developing rapidly especially in the last 20 years and is frequently used in the classification of many plant groups (Wen et al., 1997; Watson et al., 2000; Masuda et al., 2009; Sonboli et al., 2011; Sonboli et al., 2012). The discovery of new phylogenetic analysis methods and the use of DNA and amino acid sequence analyzes contribute to molecular systematics. Sequence analyzes are very useful for phylogenetic analyzes in cases where morphological characters are insufficient in terms of phylogenetic information (Yokoyama et al., 2000). Because phylogeneticists generally think that the phylogeny of the sequences is very close to the phylogeny of organisms. Sequence analysis methods are used in many areas from finding the geographical origins of living things to molecularly proving the phylogenies of living things (Allan et al., 2004; Cohen and Weydmann, 2005).

Species belonging to the genus *Ranunculus* are very common plants in the world, so samples from different parts of the world have been studied by different researchers. In a study, nrITS sequences of species belonging to the genus *Ranunculus* collected from America, Europe, Africa and New Zealand were analyzed and the results were evaluated with the maximum parsimony method. The results obtained did not comply with the previous classification according to their morphological features and it was seen that they were divided into 19 subgroups in total (Hörandl et al., 2005). In another study by Paun et al., (2005), cpDNA matK-



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trnK regions were analyzed together with ITS regions. The results were analyzed by dividing into 8 groups. It was evaluated that quite different phylogenetic results were obtained according to the geographical regions where it was collected (Paun et al., 2005). In many studies such as these, nrDNA ITS and cpDNA trnL-F sequences, which are quite illuminating in phylogenetic afforestation, have been used, among other markers, in molecular systematic studies of species containing geophytes (Gandara et al., 2014). The results showed differences according to the geographical regions where the samples were collected.

There is no molecular study and literature information on the members of the *Ranunculus* genus, which spread naturally in our country, by determining the nrDNA ITS sequences. In this study, the *Ranunculus* taxa of the Eastern Anatolia region, in which *Ranunculus* taxa naturally spread, which are not floristically determined. The diversity of *Ranunculus* taxa in our study area, whether there are new taxa or not, and if any, new distribution situations that were not known until now were investigated. Also, the degree of relationship of *Ranunculus bingoeldaghensis*, an endemic species to Turkey, with other *Ranunculus* species was investigated

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28.05.2019; *R. strigillosus* Boiss. & A. Huet Muş, Kortik mountain, 2450 m, 16.07.2019; *R. brachylobus* Boiss. & Hohen, subsp. *incisilobatus* P.H. Davis Muş, Kortik mountain, 2450 m, 16.07.2019; *R. diversifolius* Boiss. & Kotschy Van, Artos mountain, northern slopes, 2200 m, 27.04.2018.

2.2. Dna Extraction, Amplification, And Sequencing: Total genomic DNA was extracted by modified protocol of the cetyltrimethylammonium bromide (CTAB) method (Doyle and Doyle 1987). Polymerase chain reaction (PCR) of the whole region of nrDNA ITS were performed using the ITS AB101 and ITS AB102 primers (Douzery et al., 1999). PCR amplifications were conducted according to the protocols described in Sonboli et al., (2010). Sequencing reactions were performed using ABI 3730 XL (Applied Biosystems).

2.3. Alignment And Phylogenetic Analyses: Phylogenetic analysis were undertaken using two data sets of samples and each included the sequences from the GenBank database of the National Center for Biotechnology Information (NCBI; <http://www.ncbi.nlm.nih.gov/>) were aligned using ClustalW (Thompson et al., 1994) software and subsequently checked visually. Indels were not treated in final datasets. Ultimately, evaluation carried out by grouping the data into three sets as nrDNA. The dataset was comprised of studied taxa ITS (ITS 1, 5.8S and ITS 2) sequences.

Variable sites, number of parsimony-informative sites, transition, transversion, genetic distance, nucleotide diversity, and divergence within species were computed as molecular diversity statistics for each dataset using Molecular Evolutionary Genetics Analysis software (MEGA 11.0; Tamura et al., 2021). Ultimately, phylogenetic tree was constructed by Maximum Likelihood Method.

3. RESULTS AND DISCUSSION

The Characteristics Of Sequences: The aligned data set of entire ITS a total of 32 taxa including 18 taxa from NCBI, ITS sequences length is 900 bp. The parsimony informative sites were 152 for nuclear DNA gene region (Table 1.)



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Table 1. Numeric information of ITS

ITS	
Length of the aligned sequence (including all taxa without group)	900
GC% content (including all taxa without group)	52.2
Parsimony informative sites (including all taxa without group)	152

The Evolutionary Characteristics: The phylogenetic tree including *R. bingoeldaghensis*, 32 *Ranunculus* taxa 18 taxa from NCBI were constructed by complete nrDNA ITS regions. As shown in the phylogenetic tree (Figure 1) *R. bingoeldaghensis* is most closely related to *R. brachylobus*. The maximum likelihood analysis revealed a strict consensus tree with three main groups within the *Ranunculus* analyzed in this study. *R. brachylobus*, *R. bingoeldaghensis*, *R. bulbiliferus*, *R. cuneatus* and *R. damascenus* were collected together and constitute one group. *R. kotchy*, *R. polyanthemus*, *R. cornutus*, *R. repens* and *R. arvensis* came together and formed second group and *R. strigillosus* and *R. trichophyllus* were formed third group.

In worldwide, one of the most detailed studies to date has been done by Hörandl et al., in 2005 performed phylogenetic analysis of 200 *Ranunculus* taxa collected from many different parts of the world. The basis of the study is based on the nrDNA ITS marker system. Only *Ranunculus sphaerospermus*, a single specimen collected from Turkey, was included in this study. *Ranunculus* is a very large and complex genus and most species of them are found in temperate arctic/subantarctic, and also grow in high mountain areas. Morphological adaptations and different vegetative reproduction strategies are among the important factors for its growth at high altitudes and different latitudes. High species diversity is observed within certain mountain systems. Therefore, the localization where they are collected is important in terms of adaptation and it varies in molecular terms.

The other detailed molecular taxonomy study about *Ranunculus* is belong to Emadzade et al., (2010) in which different marker systems were analyzed in terms of phylogeny. Among the 33



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species studied in Emadzade et al., (2010), only *R. trichophyllus* and *R. arvensis* were included in our study. The molecular phylogeny data of the other species used in this study were not found in any other publications. For this reason, our study results emerge as the first data on the studied taxa. In order to fully reveal the molecular position of *Ranunculus*, the entire genus needs to be studied. Despite the studies of its molecular phylogeny in which it was separated 17 sections, the molecular taxonomy of endemic species from different region of the world especially from Anatolia is poorly understood. Therefore *R. bingoeldaghensis* previously unstudied taxa naturally grown in Anatolia along with 13 other local species and 18 more related taxa from the NCBI were analyzed using the ITS marker region of the nuclear genome. With this study the degree of relationship of *R. bingoeldaghensis* with other studied species was determined.



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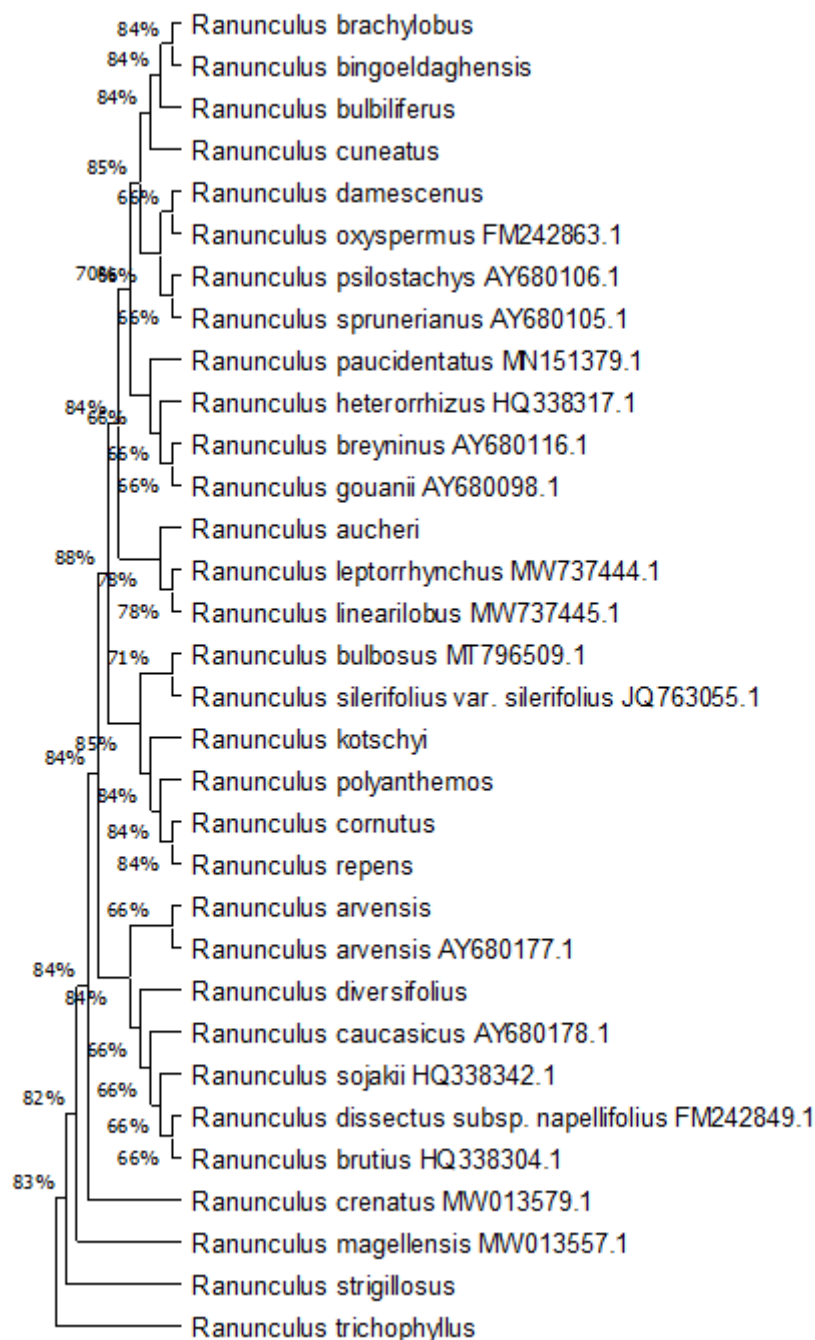


Figure 1. Maximum Likelihood tree based upon the Tamura-Nei model of nrDNA ITS region with 1000 bootstrap replicates.



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REFERENCES:

- Allan, G.J. (2004). Francisco-Ortega, J., Santos-Guerra, A., Boerner, E., Zimmer, E.A., Molecular phylogenetic evidence for the geographic origin and classification of canary island lotus (Fabaceae: Loteae). *Molecular Phylogenetics and Evolution*, 32(1): 123-138.
- Baytop, A., Özhatay, N. (1975). ISTE Herbaryumundaki Türkiye Bitkileri Örnekleri II: Ranunculaceae ve Paeoniaceae, *Ğst. Ecz. Fak. Mecm.*, 11: 227-253.
- Cohen, B.L., Weydmann, A. (2005). Molecular evidence that phoronids are a subtaxon of brachiopods (brachiopoda: phoronata) and that genetic divergence of metazoan phyla began long before the early cambrian. *Organisms Diversity & Evolution*, 5(4): 253-273.
- Davis, P.H. (1984–1988). *Flora of Turkey and the east aegean islands*, vol 8–10, Edinburgh Univ. Press, Edinburgh.
- Davis, P.H. (1965-1985) (ed.) *Flora of Turkey and the east aegean islands*. Vol. 1-9, Edinburgh Univ. Press, Edinburgh.
- Davis, P.H., Mill, R.R., Tan, K. (1988) (eds.) *Flora of Turkey and the east aegean islands*, Vol.10, Edinburgh Univ. Press, Edinburgh.
- Davis, P.H. (1960). Materials for a Flora of Turkey: IV, Ranunculaceae: II, Notes RBG, XXIII (2).
- Douzery, E.J.P., Pridgeon, A.M., Kores, P., Linder, H.P., Kurzweil, H., Chase, M.W. (1999). Molecular phylogenetics of Diseae (Orchidaceae): A contribution from nuclear ribosomal ITS sequences. *Am J Bot* 86: 887-899.
- Doyle, J.J., Doyle, J.L. (1987). A rapid DNA isolation procedure for small quantities of fresh leaf tissue. *Phytochem Bull* 19: 11-15.
- Emadzade, K., Lehnebach, C., Lockhart, P., Hörandl, E. (2010). A molecular phylogeny, morphology and classification of genera of Ranunculeae (Ranunculaceae). *Taxon*. 59(3) 809-828.
- Gandara, E., Specht. C.D., Sosa, V. (2014). Origin and diversification of the Milla clade (Brodiaeoideae, Asparagaceae) *Molecular Pylogenetşcs and Evolution* 75: 118-125.
- Goepfert, D. (1974). Caryotypes and DNA content in species of *Ranunculus* L. and Related Genera, *Bot. Notiser*, 127, 4.
- Jensen, U. (1968). Serologische Beitrage zur Sysmatik der Ranunculaceae I-II., *Bot. J., Stuttgart*, 88, 2-3.



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Julin, E. (1977). Some Bothnian subspecies in the *Ranunculus auricomus* Complex: Origin and Dispersal, Bot. Notiser, 130(3).

Julin, E. (1978). New subspecies of *Ranunculus auricomus* from Wastmanland, Sweden, Bot. Notiser, 131.

Heywood, V.H., Tutin, G.T. (1964). Flora Europaea Vol. I, Cambridge Univ. Press.

Hörandl, E., Paun, O., Johansson, J.T., Lehnebach, C., Armstrong, T., Chen, L., Lockhart, P. (2005). Phylogenetic relationships and evolutionary traits in *Ranunculus* s.l. (Ranunculaceae) inferred from ITS sequence analysis. Mol. Phylogenet. Evol. 36, 305–327.

Masuda, Y., Yukawa, T., Kondo, K. (2009). Molecular phylogenetic analysis of members of *Chrysanthemum* and its related genera in the tribe Anthemideae, the Asteraceae in East Asia on the basis of the internal transcribed spacer (ITS) region and the external transcribed spacer (ETS) region of nrDNA. *Chrom Bot* 4: 25–36.

Özçelik, H., Korkmaztürk, M. (2012). New Floristic Records of Ranunculaceae Family, SDU Journal of Science E-Journal, 7, 2: 100-111.

Özçelik, H., Korkmaztürk, M. (2013). GUL Herbaryumu'nun Ranunculaceae Familyası Envanteri, SDU Journal of Science (E-Journal), 8(1): 22-47.

Paun, O., Lehnebach, C., Johansson, J.T., Lockhart, P., Hörandl, E. (2005). Phylogenetic relationships and biogeography of *Ranunculus* and allied genera (Ranunculaceae) in the Mediterranean region and in the European Alpine System, *Taxon*, 54, 4: 911-932.

Radford, A.E., Dickison, W.C., Massey, J. R., Bell, C. R. (1974). Vascular Plant Systematics, Newyork.

Sonboli, A., Oberprieler, C. (2010). Phylogenetic relationship and taxonomic position of *Xylanthemum tianschanicum*(Krasch.) Muradyan (Compositae, Anthemideae) as inferred from nrDNA ITS data. *Biochem. Syst. Ecol.*, 38: 702-707.

Sonboli A, Osaloo SK, Valles J, Oberprieler C. (2011). Systematic status and phylogenetic relationships of the enigmatic *Tanacetum paradoxum* Bornm. (Asteraceae, Anthemideae): evidences from nrDNA ITS, micromorphological and cytological data. *Plant Syst Evol* 292: 85-93.

Sonboli, A., Stroka, K., Osaloo, S.K., Oberprieler, C. (2012). Molecular phylogeny and taxonomy of *Tanacetum* L. (Compositae, Anthemideae) inferred from nrDNA ITS and cpDNA trnH-psbA sequence variation. *Plant Syst Evol* 298: 431-444.



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Tamura, M. (1962). Ranunculaceae of Bhutan Collected by S. Nakao in 1958, *Acta Phytotax Geobot.*, XIX (2-3).

Tamura, K., Stecher, G., Peterson, D., Filipski, A., Kumar, S. (2013). MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution*: 30: 2725- 2729.

Tan, K. (1984). More New Taxa from South and East Anatolia, *Notes RBG*, 42 (1).

Thompson, J.D. (1994). CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Res* 22: 4673-4680.

Watson, L.E., Evans, T.M., Boluarte, T. (2000). Molecular Phylogeny and Biogeography of Tribe Anthemideae (Asteraceae), Based on Chloroplast Gene *ndhF*. *Mol Phylogenet Evol* 15: 59-69.

Wen, J., Vanek-Krebitz, M., Hoffmann-Sommergruber, K., Scheiner, O., Breiteneder, H. (1997). The potential of *betv1* homologues, a nuclear multigene family, as phylogenetic markers in flowering plants. *Molecular Phylogenetics and Evolution*, 8(3): 317-333.

Yokoyama, J., Suzuki, M., Iwatsuki, K., Hasebe, M. (2000). Molecular phylogeny of *Coriaria*, with special emphasis on the disjunct distribution. *Molecular Phylogenetics and Evolution*, 14(1): 11-19.



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**FARKLI ARAZİ KULLANIMLARI ALTINDA TOPRAKLARIN ALINABİLİR
FOSFOR VE POTASYUM İÇERİKLERİNİN MEKÂNSAL DAĞILIMI**

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ÖZET

Bitki besin elementlerinin arazideki yersel değişimlerinin belirlenmesi ve haritalanması hassas tarımın temel bir gereksinimidir. Bu çalışmada, yaklaşık 20 bin ha genişliğinde ve farklı arazi kullanımlarının yer aldığı Gever ovası topraklarının alınabilir fosfor (P) ve potasyum (K) konsantrasyonunun yersel değişimlerinin modellenmesi ve haritalanması amaçlanmıştır. Çalışma alanında 152 farklı noktadan ve 2 ayrı derinlikten (0-20 ve 20-40 cm) bozulmuş toprak örnekleri alınmış ve alınabilir P ve K içerikleri, parçacık büyüklük dağılımları (kum, kil ve silt içerikleri), organik madde (OM) içeriği, kireç içeriği (CaCO_3), toprak reaksiyonu (pH) ve elektriksel iletkenlik (EC) belirlenmiştir. Alınabilir P ve K içeriklerine ait yersel değişimlerin semivaryogram modellemesi yapılmış ve alansal dağılım haritaları oluşturulmuştur. Çalışma alanı topraklarının yarayışlı P içeriği oldukça düşük olup, yüzey ve yüzey altı topraklarında ortalama 3.68 ve 2.12 kg da⁻¹ (P_2O_5) idi. Türkiye topraklarının geneline göre oldukça düşük olan yarayışlı K içeriği ise yüzey ve yüzey altı topraklarında sırası ile 42.25 ve 32.77 kg da⁻¹ (K_2O) idi. Her iki bitki besin elementinin alansal dağılımlarının modellenmesinde en iyi sonuç üssel model ile elde edilmiştir. Mesafeye bağlı oto korelasyonun varlığını ifade eden range değerleri, alınabilir P için yüzey ve yüzey altında sırası ile 4080 m ve 4680 m'dir. Alınabilir K için ise range değerleri 3090 ve 1740 m idi. Sonuçlar, bitki gelişimi için oldukça önemli olan her iki bitki besin elementinin mesafeye bağlı olarak önemli bir değişim gösterdiğini ortaya koymaktadır. Gever Ovası için oluşturulan yersel değişim haritaları ovanın hemen hemen tamamında yarayışlı P ve K içeriklerinin yetersiz olduğunu ve bitkisel üretimde istenen verimin elde edilebilmesi için mutlaka P ve K içeren gübrelerin kullanılması gerektiğini ortaya koymuştur.

Anahtar Kelimeler: Yersel Değişim, Gever Ovası, Fosfor, Potasyum, Jeostatistik



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**SPATIAL DISTRIBUTION OF AVAILABLE PHOSPHORUS AND POTASSIUM
CONTENTS IN SOILS UNDER DIFFERENT LAND USES**

ABSTRACT

Determining and mapping spatial variability of plant nutrients in the field is a basic requirement of precision agriculture. The purpose of this study was to model and map the spatial variations of available soil phosphorus (P) and potassium (K) concentrations in Gever plain, which is approximately 20 thousand ha and has different land uses. In this study, 152 disturbed soil samples were collected from 0-20 and 20-40 cm depths and available P and K contents, particle size distribution (sand, clay and silt contents), organic matter (OM) content, lime content. (CaCO_3), soil reaction (pH) and electrical conductivity (EC) were determined. Semivariogram models for available P and K contents were performed and spatial distribution maps were constructed. Available P content of soils in the study area was quite low, with an average of 3.68 and 2.12 kg da^{-1} (P_2O_5) at surface and subsurface soils. Mean available K content, which was quite low compared to most of soils in Turkey, was 42.25 and 32.77 kg da^{-1} (K_2O) in the surface and subsurface soils, respectively. The best results in modelling the spatial distributions of both plant nutrients were obtained with the exponential model. Range values, expressing the presence of spatial autocorrelation, of available P were 4080 m and 4680 m at the surface and subsurface soils, respectively. The range values for available K content in surface and subsurface soils were 3090 and 1740 m, respectively. The results reveal that both plant nutrients, which are very important for plant growth, significantly change with the distance. The spatial distribution maps created for the Gever Plain revealed that the available P and K contents are insufficient in almost all of soils in the plain, therefore P and K-containing fertilizers must be used to obtain the desired yield in plant production.

Keywords: Spatial Distribution, Gever Plain, Phosphorus, Potassium, Geostatistics



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GİRİŞ

Bitki büyümesi ve gelişmesinde önemli bir yeri olan alınabilir P ve K'un topraktaki konsantrasyonlarının ve arazideki değişimlerinin belirlenmesi hassas tarım uygulamaları için oldukça önemlidir (Tian et al., 2021). Lauzon (2005), besin elementlerinin alana özgü değişimlerinin belirlenmesinin arazi sahiplerine/çiftçilere arazinin herhangi bir noktasında besin maddelerinin tam gereksinimlerini uygulama potansiyeli sunduğunu bildirmiştir. Bunu başarmanın tek yolu ise besin elementlerinin arazideki heterojen yapısının araştırılıp yersel değişimleri nin modellenmesi ve haritalanmasıdır. Besin elementlerinin yersel değişimini, değişimin şeklini ve nedenini belirleyebilmek için araziden örnekleme yapılması zorunludur. Çok geniş arazilerde az sayıda bir örnekleme ile doğru bir amenajman ve haritalama mümkün olmayacaktır. Bunun için yoğun bir toprak örneklenmesine ihtiyaç duyulmaktadır. Ancak çok yoğun bir toprak örnekleme gerektiren tasarımlar ise yüksek iş gücü, donanım ve maliyet nedeniyle tercih edilmemektedir. Nitekim ideal örnekleme sistemi en az sayıda örnek ile arazideki heterojenliği doğru bir şekilde belirleyebilen yöntemlerin kullanılmasıdır (Brady 1990, Budak, 2012). Bu amaçla kullanılan en yaygın yöntem ise jeostatistiksel yöntemlerdir (Goovaerts, 1998; Webster and Oliver, 2007; Vasu et al., 2017; Gao et al., 2019; Tian et al., 2021).

Jeoistatistik, arazilerin alana özgü yönetiminde yersel değişkenliği değerlendirmek için bir araç olarak kullanılmak üzere geliştirilmiştir. Jeostatistiğin amacı, yersel değişkenliği tahmin etmek için nokta bilgisini kullanmaktır (Tian et al., 2021). Yao et al., (2004) jeostatistik yönteminin, arazide toprak örneği alınmış noktaları göz önünde bulundurarak örneklenmemiş noktaların doğru tahmin edilmesinde kullanılan önemli bir teknoloji olduğunu bildirmiştir. Bu çalışmanın amacı, farklı arazi kullanımlarının bulunduğu Gever ovasında toprakların alınabilir P ve K içeriklerine ait yersel değişimlerin jeostatistiksel yöntemler ile modellenmesi ve haritalanmasıdır.

MATERYAL METOD

Çalışma Alanı

Çalışma alanı 37°36'22.99"K - 37°25'26.27"K enlemleri ile 44°23'36.76"D- 44° 5'28.22"D boylamları arasında yer alıp yaklaşık 20 bin ha'dan oluşmaktadır. Alanın denizden yüksekliği 1950 m, uzun yıllar (1979-2017) ortalama yağış miktarı 762 mm, yıllık ortalama buharlaşma miktarı ise 850 mm'dir. Çalışma alanında ekili alanlarda yoğunlukla buğday ve yonca olmak



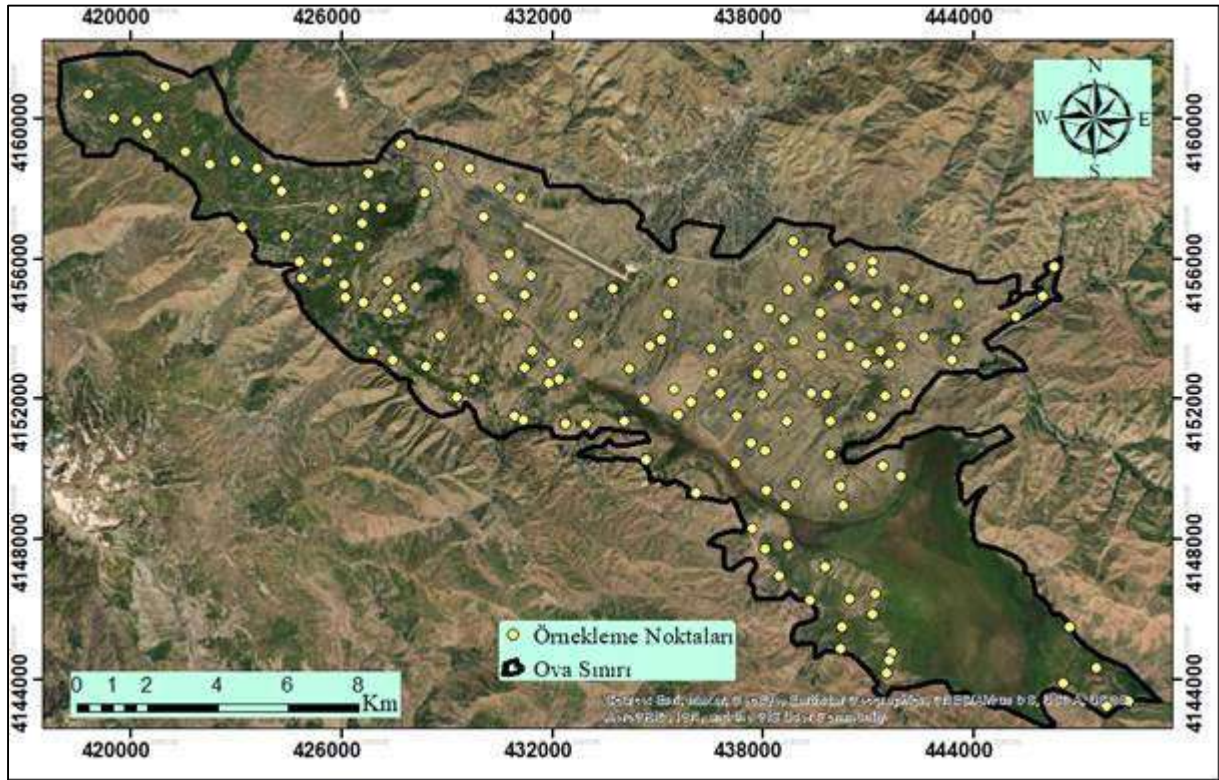
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üzere nohut ve fiğ yetiştiriciliği yapılmaktadır. Çayır-mera olarak kullanılan alanlarda ise çoğunlukla Bataklık Gülü, Yassı Hasır Otu, Tüylü Çayır Sazı, Deli Saz gibi bitkiler yetişmektedir.

Toprak Örnekleme

Çalışma alanını temsil edecek şekilde rastgele yöntemine göre 152 noktadan ve iki farklı (0-20 ve 20-40 cm) derinlikten olmak üzere toplam 304 toprak örneği alınmıştır (Şekil 1).



Toprak Analiz Yöntemleri

Arazide alınan bozulmuş toprak örnekleri oda sıcaklığında kurutulmuş ve 2 mm'lik elekten geçirilerek analize hazır hale getirilmiştir. Toprakların tekstür bileşenleri (kil, silt ve kum içeriği) hidrometre yöntemine göre (Gee ve Bauder, 1986); organik madde (OM), değiştirilmiş Walkey-Black metoduna göre (Nelson and Sommers, 1983); alınabilir fosfor (P) konsantrasyonu, sodyum bikarbonat (NaHCO_3) ekstraksiyon yöntemine göre (Olsen and Sommer, 1982); alınabilir potasyum (K) içeriği amonyum asetat ($1\text{N CH}_3\text{COONH}_4$, $\text{pH}=7.0$) yöntemine göre; toprakların kireç (CaCO_3) içeriği, Scheibler kalsimetresi yöntemine göre (Allison and Moodie, 1965); elektriksel iletkenlik (EC) ve toprak reaksiyonu (pH) ise 1:2 saf su çözeltisinde pH/EC metreyle belirlenmiştir (Rhoades and Chanduvi, 1999).



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İstatistiksel analizler

Analizleri yapılan toprak özelliklerine ait tanımlayıcı istatistik verileri (en küçük, en büyük, ortalama, standart sapma, çarpıklık ve basıklık) SPSS 22.0 paket programı kullanılarak elde edilmiştir.

Toprak Özelliklerine Ait Yersel Değişimlerin Modellenmesi ve Haritalanması

Alınabilir P ve K' ait yersel değişim analizleri ise GS+7.0 paket programında modellenmiş ve elde edilen model parametrelerinin kullanılarak ArcGIS 10.2 paket programı ile haritalanmıştır. Yersel değişim analizleri yapılmadan önce dağılımların normal olup olmadıkları kontrol edilmiştir. Her iki derinlik için alınabilir P değerleri normal dağılım göstermemiştir. Bu nedenle logaritmik dönüşüm uygulanmıştır. Araştırma kapsamında incelenen özelliklere ait semivariogramlar oluşturulurken yersel değişimi en iyi tanımlayan modelin seçiminde modele ait r^2 ve ölçüm hatalarının göstergesi olan artık kareler toplamı (Residual Sum of Squares, RSS) değerleri dikkate alınmıştır. En iyi modelin seçiminde r^2 değerinin 1.0'a ve RSS değerinin ise sıfır (0)'a yakın olanları tercih edilmiştir (Yang et al., 2011). Semivariogram ve çapraz değerlendirme sonucu elde edilen parametreler (nugget, sill, range, aktif lag değeri ve komşu sayısı) kullanılarak ArcGIS programının jeostatistik modülünde yer alan ordinary kriging yöntemi ile her bir toprak özelliği için yersel değişim haritaları üretilmiştir.

Bulgular Ve Tartışma

Çalışma alanında killi tekstürden kumlu tın tekstüre kadar değişen topraklar bulunmaktadır. Toprakların büyük çoğunluğu kireçsiz olup ortalama kireç içeriği yüzeyde % 5.58 yüzey altında ise % 5.86'dır. Alanda toprak pH'sı yüzey ve yüzey altında hafif asidik (6.21 ve 6.50) ve hafif alkali (7.85 ve 7.90) arasında değişmekte, EC ise oldukça düşük olup ortalama yüzey ve yüzey altında sırası ile 0.40 ve 0.31 dS m⁻¹'dir. Toprakların üretim kapasitesinin önemli bir göstergesi olan OM içeriği alanda yüzey ve yüzey altında sırası ile % 1.21 - 30.52 (ortalama %5.70) ve % 0.90 - 26.77 (ortalama % 3.16) arasında değişmektedir. Çalışma alanına ait toprakların alınabilir P ve K içeriklerine ait tanımlayıcı istatistik parametreleri ise Tablo 1'de verilmiştir. Alınabilir fosfor içeriği yüzey ve yüzey altında sırası ile 0.77 - 11.99 kg da⁻¹ (P₂O₅) ve 0.37 - 9.22 kg da⁻¹ (P₂O₅) arasında değişim göstermek olup ortalama 3.68 ve 2.12 kg da⁻¹ (P₂O₅)'dir. Ülgen ve Yurtseven (1995)'e göre çalışma alanını büyük çoğunluğu alınabilir P bakımından yetersizdir. Türkiye topraklarının geneline göre oldukça düşük olan yarayıslı K içeriği ise yüzey ve yüzey altı topraklarında sırası ile ortalama 42.25 ve 32.77 kg da⁻¹ (K₂O)'dır.



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(Tablo 1). Toprak özelliklerindeki değişkenliğin bir ifadesi olan % varyasyon katsayısı (VK) Wilding (1994)'e göre 3 gruba ayrılmaktadır. % VK <15 olanlar düşük derecede değişken, %16-35 arası orta derecede değişken 36'dan büyük değerler içinde yüksek derecede değişkendir. Alınabilir P ve K için elde edilen varyasyon katsayısı değerlerine göre her iki derinlikte de hem P (%VK= 214.77 ve 236.42) hem de K'un (%VK=152.18 ve 138.33) yüksek derecede değişkenlik gösterdiği görülmüştür (Tablo 1). Her iki bitki besin elementinin arazide yüksek derece de bir değişkenliğe sahip olmasının temel nedeni arazi kullanımındaki farklılıkların yanı sıra ana materyalin değişmesinden kaynaklanmaktadır. Özellikle tekstürdeki değişim alınabilir K konsantrasyonu üzerine önemli bir etki oluştururken organik madde ise alınabilir P konsantrasyonu üzerinde önemli bir etki oluşturmuştur. Nitekim her iki bitki besin elementinin ölçülen diğer toprak özellikleri ile olan korelasyon analizi sonuçlarına bakıldığında alınabilir K ile kil içeriği arasında $P<0.01$ düzeyinde önemli bir pozitif, kum ile de negatif bir ilişkiye sahip olduğu tespit edilmiştir. Alınabilir P ile organik madde arasında ise $P<0.05$ düzeyinde önemli bir pozitif ilişki tespit edilmiştir (Tablo 2).

Tablo 1. Alınabilir P ve K içeriğine ait bazı tanımlayıcı istatistikler

	Derinlik (cm)	En Küçük	En Büyük	Ortalama	Standart Sapma	VK (%)	Çarpıklık	Basıklık
Alınabilir P (kg da ⁻¹)	0-20	0.77	11.97	3.68	2.42	152.18	1.63	2.57
	20-40	0.37	9.22	2.12	1.53	138.33	2.24	6.03
Alınabilir K (kg da ⁻¹)	0-20	8.13	107.74	42.25	19.67	214.77	0.87	0.73
	20-40	8.57	83.21	32.77	13.86	236.42	0.84	0.91

Tablo 2. Alınabilir P ve K değerlerinin diğer toprak özellikleri ile olan korelasyon analizi sonuçları

	Derinlik (cm)	Kum	Kil	Silt	OM	pH	EC	Kireç içeriği	Alınabilir P
Alınabilir K	0-20	-0,430**	0,482**	0,116	-0,203*	0,100	-0,033	-0,139	0,308**
	20-40	-0,433**	0,523**	-0,022	-0,182*	0,072	0,091	-0,147	0,125
Alınabilir P	0-20	0,010	0,094	-0,066	0,194*	-0,087	0,124	-0,018	1,000
	20-40	0,123	-0,199*	0,071	0,161*	-0,097	-0,075	-0,050	1,000

Alınabilir P ve K için jeostatistiksel yöntemler kullanılarak elde edilen semivariogram modellerine ait parametreler Tablo 3'te verilmiştir. Her iki besin elementi için yersel değişimi en iyi tanımlayan model üssel (exponential) model olarak belirlenmiştir. Arazide iki nokta arasındaki toprak özelliğinin yersel değişim boyutunun karakterize edilmesinde uzaysal bağımlılık yaygın olarak kullanılmaktadır. Uzaysal bağımlılık değeri, nugget (Co) semivaryansın toplam semivaryansa (Co+C) oranının (Co/Co+C) yüzde olarak ifadesidir (Wang and Shao, 2013). Araştırmacılara göre uzaysal bağımlılık değeri ≤ 25 olduğunda



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toprak özelliğinin kuvvetli derecede, % 25 ile % 75 arasında orta derecede ve % 75'ten fazla olduğunda ise uzaysal bağımlılığın zayıf derecede olduğunu bildirmiştir. Hem alınabilir P hem de alınabilir K için uzaysal bağımlılık değerinin her iki derinlikte de % 25'ten küçük olduğundan kuvvetli derecede uzaysal bağımlılık göstermektedir. Örnekler arası uzaysal bağımlılığın kuvvetli olması kısa mesafelerde örnekler arası benzerliğin ortadan kalkmadığını ve uzun mesafelerde dahi devam ettiğini ifade etmektedir.

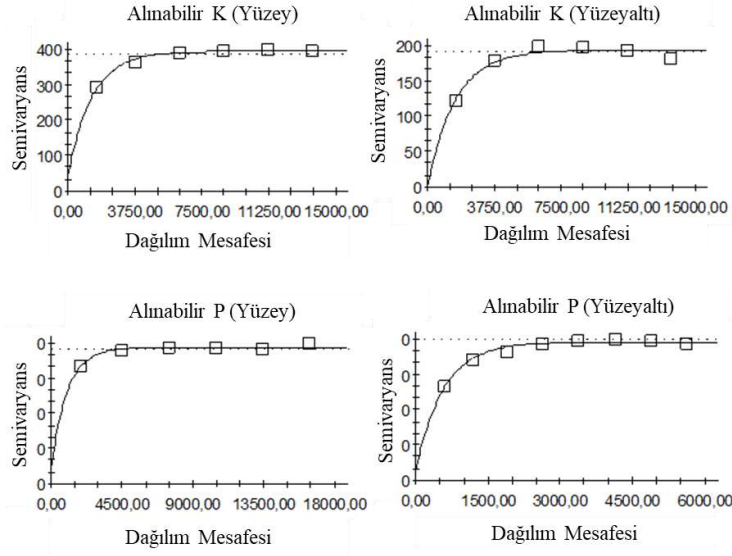
Tablo 3. Alınabilir P ve K için elde edilen semivariogram modellerine ait parametreler

Özelik	Derinlik cm	Model	Nugget	Sill	Range	UB %	RSS	r ²
Alınabilir K	0-20	Üssel	46	394.8	4080	11.6	188	0.98
	20-40	Üssel	0.1	194.5	4680	0.05	257	0.94
Alınabilir P	0-20	Üssel	0.04	0.35	3090	11.4	0.0002	0.92
	20-40	Üssel	0.024	0.32	1740	7.5	0.0002	0.98

Range değerleri tahmin edilen veya ölçülen iki nokta arasındaki benzerliğin devam ettiği mesafeyi vermektedir. Jeostatistiğin temelinde toprak örneği alınan iki nokta arasındaki benzerliğin mesafeye bağlı olarak azaldığı ve belirli bir mesafeden sonra benzerliğin tamamen yok olduğu varsayımı esastır (Deutsch and Journel, 1992). Üssel model sonucunda elde edilen range değerleri çalışma alanında alınabilir K konsantrasyonu bakımından iki nokta arasındaki benzerliğin yüzeyde 4080 m ve yüzey altında 4680 m'den sonra sona erdiğini göstermektedir. Alınabilir P için ise range değerleri alınabilir K' göre daha düşük olup yüzeyde 3090 m ve yüzey altında 1740 m olarak tespit edilmiştir (Tablo 3 ve Şekil 2). Alınabilir K kıyasla P değerinin daha kısa aralıklarla değişim gösterdiği ve bu nedenle de daha düşük range değerine sahip olduğu bir çok araştırmada rapor edilmiştir (Roger et al., 2014; Vasu et al., 2017; Budak ve ark., 2018). Arazi yönetim sistemleri yanı sıra toprak tekstür bileşenlerdeki değişimler ve organik madde içeriği topraktaki alınabilir P konsantrasyonunun yersel değişimi üzerinde önemli bir etki oluşturmaktadır ve çok kısa mesafelerde önemli bir yersel değişim gösterebilmektedir (Budak ve ark., 2018)



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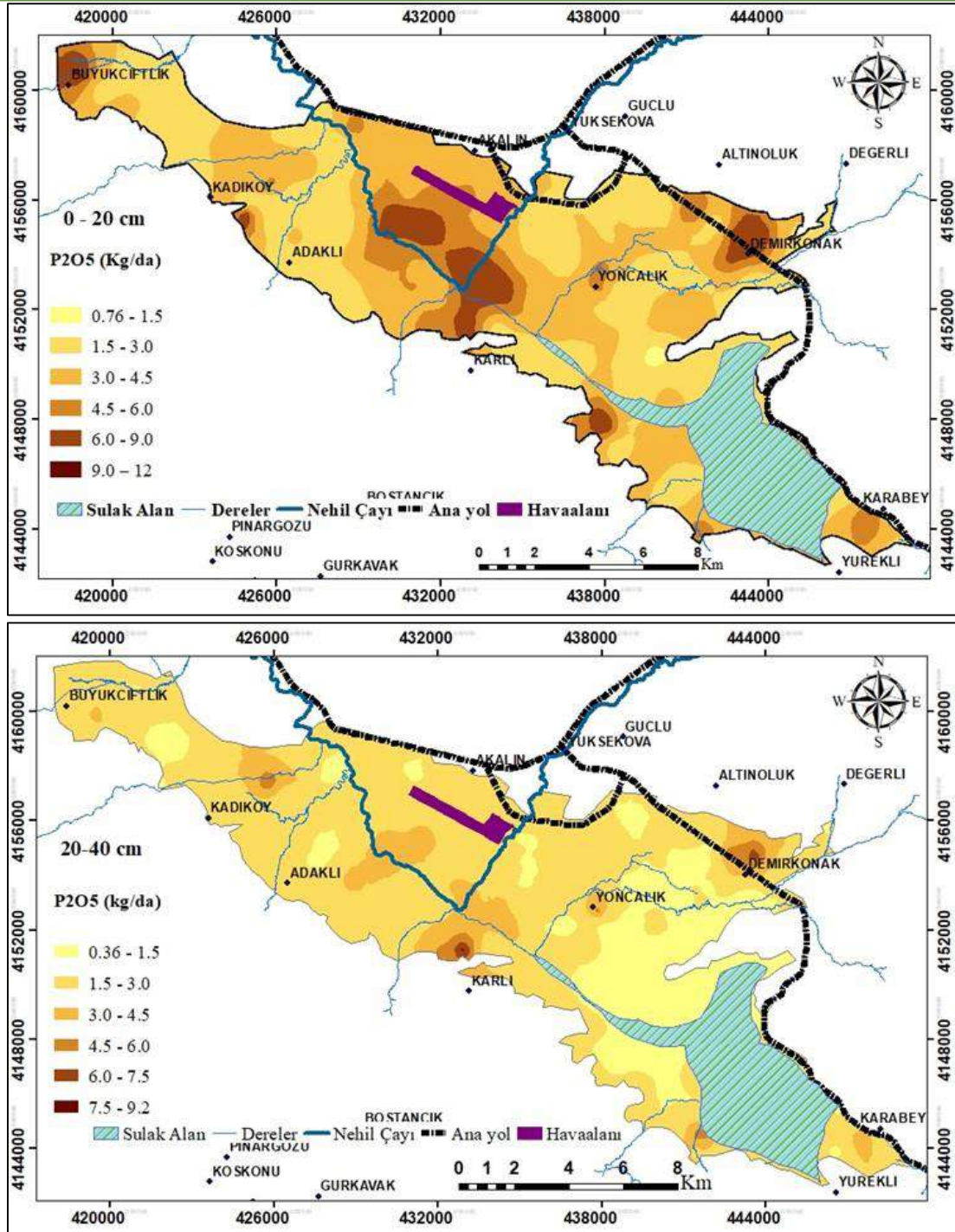


Şekil 2. Alınabilir P ve K için elde edilen semivariogram modelleri

Semivariogram modelleri oluşturulduktan sonra ordinary kriging yöntemi ile hazırlanan alınabilir P ve K'a ait yersel değişim haritaları şekil 3 ve 4'te verilmiştir. Bitki kök gelişimi üzerinde önemli bir etkisi olduğundan alınabilir P'un toprakta yeterli düzeyde bulunması oldukça önemlidir. Bu nedenle tarım arazilerinde P konsantrasyonlarına ait yersel değişimin dikkate alınması ve noksanlık/fazlalık olan alanların belirlenip gerekli tedbirlerin alınması gerekmektedir. Alınabilir P için hazırlanan yersel değişim haritaları incelendiğinde alanda P içeriği oldukça değişken bir desen sergilemektedir. Arazideki bu değişkenliğin temel nedeni ana materyal ve arazi kullanımlarındaki değişimden kaynaklanmaktadır. Yüzey topraklarında arazinin büyük çoğunluğunda alınabilir P bitkiler için yetersiz olan (3-6 kg/da P_2O_5 (Ülgen ve Yurtsever, 1995)) sınır değerinin altında çıkmıştır. Alanda P içeriğinin çok düşük çıkmasının temel nedeni tarım arazilerinde kimyasal gübrelemenin neredeyse hiç yapılmamasından kaynaklanmaktadır.



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Şekil 3. Alınabilir P'a ait yersel değişim haritaları

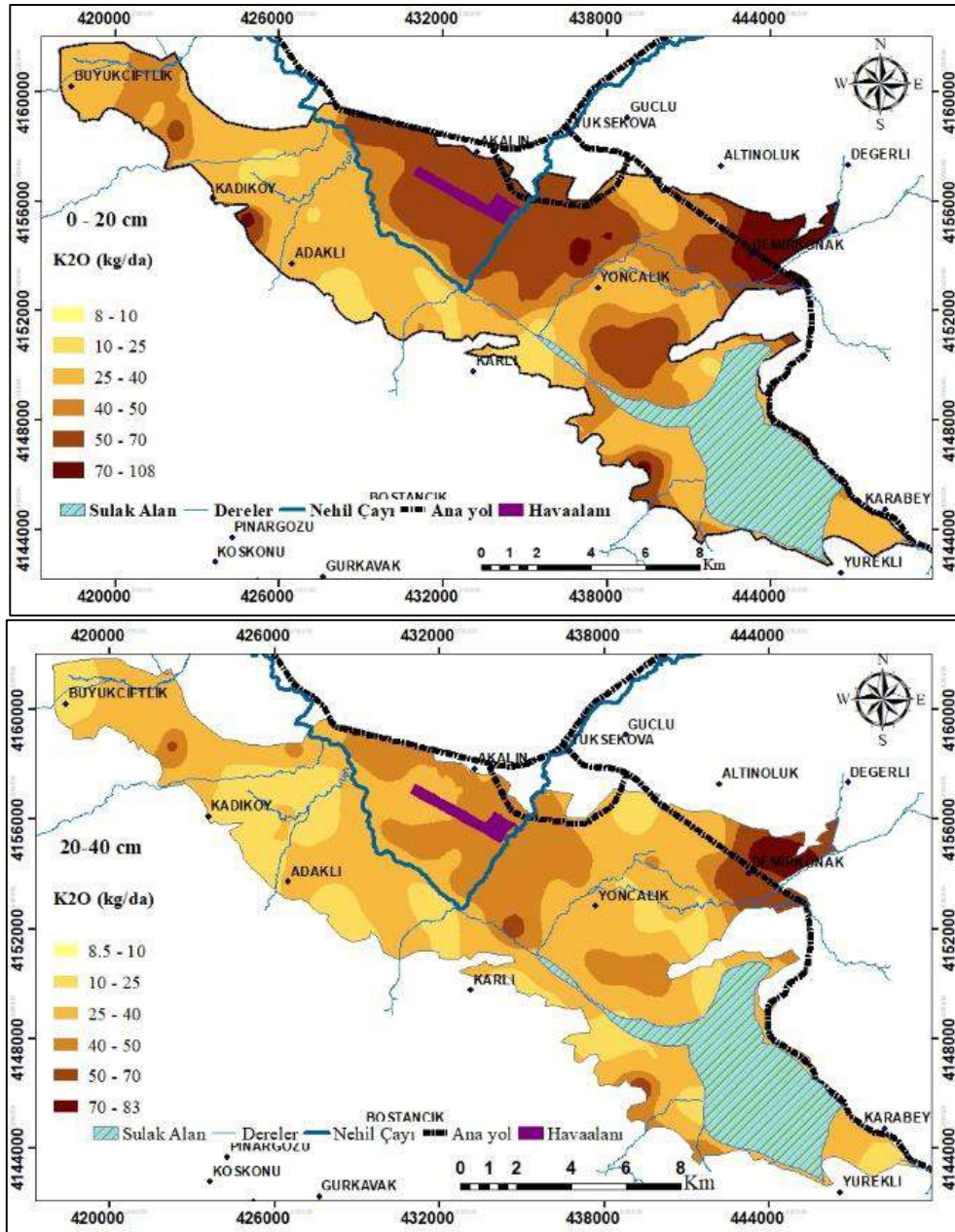
Bitkilerde metabolik işlemler ve ürün kalitesi üzerinde potasyumun önemli bir etkisi bulunmaktadır. Bu nedenle de arazideki heterojenliğin belirlenmesi potasyumlu gübre miktar ve uygulama deseni açısından önemlidir. Toprakta bitkisel üretimde istenilen verim ve kaliteyi elde etmek için alınabilir K'un toprakta $30 \text{ kg da}^{-1} \text{ K}_2\text{O}$ (Ülgen ve Yurtsever, 1995) ve daha



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fazla olması gerekmektedir. Alınabilir K için elde edilen yersel değişim haritaları ele alındığında arazi boyunca önemli bir değişkenlik söz konusu olup çalışma alanının güneyinde yer alan arazilerin neredeyse tamamında bitkisel üretim için alınabilir K'un yetersiz olduğu görülmektedir. Alanın orta kısımları ile kuzey ve kuzey doğu kısımlarında ise yeterli olduğu tespit edilmiştir. Alanda alınabilir K'un çok değişken olması toprak tekstüründeki değişkenlikten kaynaklanmaktadır. Nitekim kil içeriğinin arttığı alanlarda toprakta alınabilir K konsantrasyonu artış gösterirken kum içeriğinin arttığı güney kısmında ise en düşük değerleri almıştır.



Şekil 4. Alınabilir K'a ait yersel değişim haritaları



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Sonuç

Sonuçlar, bitki gelişimi için oldukça önemli olan her iki bitki besin elementinin mesafeye bağlı olarak önemli bir değişim gösterdiğini ortaya koymaktadır. Özellikle joistatistiksel yöntemler kullanılarak ve Coğrafi Bilgi sistemleri yardımı ile hazırlanan toprak özelliklerine ait yersel değişim haritaları hassas tarım uygulamalarının adaptasyonunda önemli avantajlar sunmaktadır. Gever Ovası için oluşturulan yersel değişim haritaları ovanın hemen hemen tamamında yarayışlı P ve K içeriklerinin yetersiz olduğunu; bitkisel üretimde istenen verimin elde edilebilmesi için mutlaka P ve K içeren gübrelerin kullanılması gerektiğini ve aynı zamanda bu gübrelerin arazinin tamamında aynı oranda olmaması gerektiğini ortaya koymuştur. Toprak özelliklerine ait yersel değişim haritalarının hazırlanması ve kullanılması arazi kullanıcılarına toprak yönetim sistemlerinde kolaylık sağlaması yanı sıra işgücü, zaman ve maliyette de tasarruf sağlayacaktır.

Teşekkür

Gever ovası topraklarının makro ve mikro besin element düzeylerinin belirlenmesi için bizlere destek sunan Yüksekova Kaymakamlığı ile Hakkâri İl Tarım ve Orman Müdürlüğü'ne teşekkür ederiz.



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Kaynaklar

- Allison, L.E., Moodie, C.D., 1965. Carbonate. In: C.A. Black et al. (Ed.) Methods of soil Analysis, Part 2. Agronomy Series, American Society of Agronomy U.S.A., p: 1379-1400.
- Budak, M. 2012. Tuzlu alkali toprakların oluşumu, sınıflandırılması ve klasik toprak etüd ve jeoistatistik yöntemlerle haritalanması. Doktora tezi, Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü, Tokat.
- Budak, M., Günal, H., Çelik, İ., Acir, N., Sirri, M. 2018. Dicle havzası toprak özelliklerinin yersel değişimlerinin jeoistatistik ve coğrafi bilgi sistemleri ile belirlenmesi ve haritalanması. Türkiye Tarımsal Araştırmalar Dergisi, 5(2), 103-115.
- Brady, N.C, ve Weil R. R., 2002. The Nature and Properties of Soils, 13th Edition. Prentice Hall. Upper Saddle River, New Jersey. 960 p.
- Deutsch, V., Journel, A.G., 1992. Geostatistical Software Library and User's Guide. Oxford University Press, New York.
- Gao, X. S., Yi, X. I. A. O., Deng, L. J., Li, Q. Q., Wang, C.Q., Bing, L.I., Deng, O.P., Min, Z.E. N. G. 2019. Spatial variability of soil total nitrogen, phosphorus and potassium in Renshou County of Sichuan Basin, China. Journal of integrative agriculture, 18(2), 279-289.
- Gee, G.W., Boudier, J.W., 1986. Particle Size Analysis. In: A. Clute (Ed.) Methods of Soil Analysis. Part I Agronomy No: 9 Am Soc. of Agron. Madison, Wisconsin, USA.
- Goovaerts, P. 1998. Geostatistical tools for characterizing the spatial variability of microbiological and physico-chemical soil properties. Biology and Fertility of soils, 27(4), 315-334.
- Lauzon, J. D., O'Halloran, I. P., Fallow, D. J., von Bertoldi, A. P., Aspinall, D. 2005. Spatial variability of soil test phosphorus, potassium, and pH of Ontario soils. Agronomy Journal, 97(2), 524-532.
- Nelson, D.W., Sommers, L., 1983. Total carbon, organic carbon, and organic matter1. Methods of Soil Analysis, Part 2- Chemical and Microbiological Properties (Methods of soil analysis), pp: 539-579.



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- Olsen, S.R., Sommers, L.E., 1982. Phosphorus. In Methods of Soil Analysis Part 2. In: A.L. Page, R.H. Miller and D.R. Keeney (Eds). Chemical and Microbiological Properties of Phosphorus. American Society of Agronomy and Soil Science Society of America Madison, pp. 403-430.
- Rhoades, J., Chandavi, D., Lesch, S. F., 1999. Soil Salinity Assessment Methods and Interpretation of Electrical Conductivity Measurement FAO Irrigation and Drainage Paper 57
- Roger, A., Libohova, Z., Rossier, N., Joost, S., Maltas, A., Frossard, E., Sinaj, S., 2014. Spatial variability of soil phosphorus in the Fribourg canton, Switzerland. *Geoderma*, 217-218: 26-36.
- Tian, H., Qiao, J., Zhu, Y., Jia, X., & Shao, M. A. 2021. Vertical distribution of soil available phosphorus and soil available potassium in the critical zone on the Loess Plateau, China. *Scientific Reports*, 11(1), 1-10.
- Ülgen N, Yurtsever N, 1995. Türkiye Gübre ve Gübreleme Rehberi (4. Baskı). T.C. Başbakanlık Köy Hizmetleri Genel Müdürlüğü Toprak ve Gübre Araştırma Enstitüsü Müdürlüğü Yayınları, Genel Yayın No: 209, Teknik Yayınlar No: T.66, s.230, Ankara.
- Wang, Y.Q., Shao, M.A., 2013. Spatial variability of soil physical properties in a region of the Loess Plateau of PR China subject to wind and water erosion. *Land Degradation and Development*, 24(3): 296-304.
- Webster, R., Oliver, M. A. 2007. *Geostatistics for environmental scientists*. John Wiley & Sons.
- Wilding, L.P., Bouma, J., Goss, D.W., 1994. Impact of Spatial Variability on Interpretative Modelling. 65-75, In: *Quantitative Modelling of Soil Forming Processes*. R.B. Bryant and Arnold R.W. (eds) Soil Sci. Soc. Am. J Special Publication Number 39, Madison Wisconsin, USA.
- Vasu, D., Singh, S.K., Sahu, N., Tiwary, P., Chandran, P., Duraisami, V.P., Ramamurthy, V., Lalitha, M., Kalaiselvi, B., 2017. Assessment of spatial variability of soil properties using geospatial techniques for farm level nutrient management. *Soil and Tillage Research*, 169: 25-34.



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-
- Yao, L. X., Zhou, X. C., Cai, Y. F., & Chen, W. Z. 2004. Spatial variability of soil properties at different sampling intensities and accuracy of their estimation. *Soils*, 36(5), 538-542.
- Yang, F., Zhang, G., Yin, X., Liu, Z., 2011. Field-scale spatial variation of saline-sodic soil and its relation with environmental factors in Western Songnen Plain of China. *International Journal of Environmental Research and Public Health*, 8(2): 374-387.



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ÖZET

Türkiye ortalama 650.000 ton fındık üretimi ve 735.000 ha üretim alanı ile dünyanın en büyük fındık üreticisidir. Yıllık ortalama 500.000-550.000 ton fındık ihraç ederek 1.500.000-2.000.000 dolar gelir elde etmektedir. Fakat üretimden kaynaklanan bu üstünlüğünü avantaja dönüştürememiştir. 1999 ve 2000 yıllarında Avrupa Birliği uyum yasaları çerçevesinde kooperatif ve üretici birlikleri ile ilgili çıkarılan kanunlarla FİSKOBİRLİK devre dışı bırakılmıştır. Böylece serbest rekabet koşullarının tam olarak oluşmadığı ülkemizde üreticiler aleyhine fiili bir durum oluşmuştur. Bazı yıllar arz fazlası oluşmaktadır. Fındık piyasasında arz talep dengesini sağlayacak bir mekanizmanın etkin bir şekilde işletilmemesi fındık piyasasının istikrarını bozmuştur. Bu durum üretici gelirlerinde azalmaya neden olmuştur. Fındık piyasasında arz talep dengesinin bozulması ve lisanslı depoculuk sistemini hayata geçirilememesi sonucu stoklarda belirsizliklere sebebiyet vermiştir. Oluşan arz fazlası kayıtsız ve kontrolsüz bir şekilde halk tarafından stoklanmaktadır. Geçmiş yıllarda fındıkta oluşan rekor fazlasını stoklamak ve fındık piyasasını düzenleme görevini FİSKOBİRLİK’e verilmiştir. Bu nedenle yıl içerisinde fındık piyasadaki fiyat dalgalanmaları nispeten makul seviyelerde idi. Fındık ülkemiz için önemli bir ihraç ürünü olup uluslararası piyasalarda dolar bazında fiyatlanmaktadır. Ekonomik krizlerin sebep olduğu dalgalanmalar sonucu bazı yıllar fındık fiyatları döviz bazında taban seviyelere düşerek uluslararası sorun haline gelmiştir. Son yıllarda fındık üretim alanlarının kontrolsüz bir şekilde artmasının önüne geçilerek mevcut bahçelerin yenilenmesi ve rehabilitasyonu yoluna gidilmelidir. Verimlilik ve kalitenin artırılması yönünde yapılacak çalışmalara önem verilmesi üretim maliyetlerini düşürerek üretici gelirlerinde artış sağlayacaktır. Son bir yıl içerisinde döviz kurlarının istikrarsız bir şekilde yükselmesi ile birlikte ilaç, gübre vb. tarımsal girdilerde %200’den fazla artışlar kaydedilmiştir. Buna rağmen fındık fiyatları serbest piyasa koşullarında ilan edilen resmi fiyatın altında kalmıştır. Fındık piyasasının istikrara kavuşturulabilmesi için, FİSKOBİRLİK tüzüğüne günümüzün gereklerine uygun değişiklikler yapılarak üretimden pazarlamaya kadar zincirin her halkasına sahip olacak şekilde fındık alımında bir aktör olarak devreye girmelidir.

Anahtar kelimeler: Fındık, politika, FİSKOBİRLİK, değer analizi



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1. GİRİŞ

Fındık Kuzey yarım kürede (36°-41° kuzey enlemleri arasında) ılıman iklim kuşağında kendine özgü iklim koşullarında, İç kesimlerde Bolu'nun Mudurnu ve Göynük ilçeleri ile Tokat'ın Erbaa ilçesi dahil olmak üzere Karadeniz'e kıyısı olan 16 il ve 123 ilçede çeşitlere bağlı olarak deniz seviyesinden 1.400 m rakıma kadar olan yerlerde kaliteli olarak yetiştirilmektedir. Fındık, Ceviz, badem ve kestaneden sonra dünya üzerinde en fazla yetiştirilen ve tüketilen sert kabuklu meyve türüdür. Fındığın çerezlik olarak tüketimi sınırlıdır. Fındık özellikle çikolata ve şekerleme gibi sektörlerde gıda sanayinin temel hammaddelerinden biridir. Dünyada yoğun olarak kuzey yarım kürede uygun iklim koşullarında kaliteli bir şekilde yetiştirilen fındığın kültür çeşitleri Çin, İran, Türkiye, İtalya, İspanya, ABD, Yunanistan, Fransa, Portekiz, Azerbaycan, Gürcistan, Rusya, Tacikistan, Kırgızistan, Beyaz Rusya, Moldova, Ukrayna, Tunus, Macaristan, Kıbrıs ve Kamerun'a kadar geniş bir coğrafyada yetiştirilmektedir (Anonim 2020). Bununla birlikte, ekonomik açıdan üretimleri henüz bir değer oluşturmamayan FAO istatistiklerinde üretici olarak henüz yer verilmeyen Arjantin, Avusturya, Avustralya, Estonya, Yeni Zelanda, Romanya, Slovenya, Suriye, Ukrayna, İngiltere, Makedonya, Sırbistan ve Hırvatistan gibi ülkelerde de fındık üretimi yapılmaktadır. Bu ülkelerde fındık üretimini arttırmaya yönelik önemli çalışmalar yapılmaktadır. 1960'lı yıllarda dünya fındık üretimi, 250 bin ton civarında iken; 2019 yılı FAO istatistiklerine göre 1.125.000 tona ulaşmıştır. Dünya fındık üretiminin yaklaşık %69'unu Türkiye gerçekleştirmektedir diğer önemli üretici ülkeler İtalya, Azerbaycan, ABD, Şili ve Gürcistan'dır. Türkiye dünya fındık üretim alanlarının 73.45'ine sahiptir. Üretim alanları bakımından Türkiye'yi sırasıyla İtalya, Azerbaycan, Şili ve ABD izlemektedir.

Ülkeler	Ü. Alanı/(ha) 2000	Ü. miktarı/(Ton) 2000	Veri m Kg/da	Ü. Alanı/(ha) 2019	Üretim (Ton) 2019	Veri m Kg/da	Üretim alanlarındak i (%) payı	Ü. miktarındak i (%) payı
Türkiye	541.000	470.000	87	734.709	776.046	106	73.45	68.97
İtalya	68.868	98.540	143	79.350	98.530	124	7.93	8.76
Azerbaycan	16.721	13.334	80	43.381	53.793	124	4.34	4.78
ABD	11.470	20.410	179	20.230	39.920	197	2.02	3.55
Gürcistan	7.797	14.420	185	13.422	24.000	179	1.34	2.13
Şili	1.702	183	11	24.437	35.000	143	2.44	3.11
İran	10.452	10.290	98	18.472	16.121	87	1.85	1.43
Çin	6.000	9.000	150	13.824	29.318	212	1.38	2.60
İspanya	23.750	25.188	106	13.020	12.370	95	1.30	1.22
Diğer	10.536	14.450	137	39.386	40.080	102	3.94	3.56



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Dünya	500.283	675.815	135	1.000.231	1.125.17	112	100.00	100.00
8								

Çizelge 1. Önemli fındık üreticisi ülkelerin fındık üretim alanları ve üretim miktarı (FAO,2019)

2. MATERYAL ve YÖNTEM

Çalışmanın ana materyalini Uluslararası Gıda ve Tarım Örgütü (Food and Agriculture Organization of The United Nations), Türkiye İstatistik Kurumu (TÜİK), Fındık Tarım ve ticaretiyle ilgili kurum ve kuruluşlardan sağlanan ikincil veriler oluşturmaktadır.

Fındığın Ülkemiz açısından Önemi

Fındık mono kültür bir tarımsal yapıya sahip olan Doğu Karadeniz Bölgesinde özellikle Trabzon, Giresun ve Ordu ekonomisinde önemli bir yere sahip olan ve sosyolojik olarak ele alınması gereken bir üründür. Fındık kırsal yaşamın sürdürülmesi ve kırsal nüfusun yerinde istihdamı için ülkemiz açısından son derece önemlidir. Fındığa alternatif bir üretim imkânı bulunmayan, topografik yapısının hayat şartlarını zorlaştırdığı Karadeniz bölgesinde, kırsal yaşamın sürdürülebilirliği ve göçün önlenmesinde fındık önemli bir faktör olarak kendini göstermektedir. Bu nedenle bölge üreticilerini düzenli bir gelire kavuşturmak, eğimli arazilerde erozyonu önlenmek, fındığın kalitesini artırmak iç ve dış piyasalarda istikrarı sağlanmak amacıyla fındık stratejik bir ürün olarak uzun zaman devlet tarafından desteklenmiştir. Devlet tarafından 1964 yılından itibaren başlatılan destekleme alımları ile Pazar ve fiyat güvencesinin sağlanması fındık yetiştiriciliğini özendirmiştir. 1983 yılında çıkartılan 2844 sayılı fındık üretiminin planlanması ve dikim alanlarının belirlenmesi hakkındaki kanuna rağmen fındık üretim alanları Karadeniz’e kıyısı olan illerin tamamının yanı sıra iç kısımlarda Gümüşhane’nin Kürtün, Tokat’ın Erbaa ve Bolu’nun Mudurnu ve Göynük ilçelerine de yayılarak iki katına çıkmıştır. Bu bölgelerin topraklarının tarıma daha elverişli olması ve bahçelerin genç olması verimliliğinde yüksek olmasını sağlamıştır. Zamanla gübreleme, ilaçlama gibi kültürel ve teknik işlemlerin de devreye girmesi ile verimlilik daha da artmıştır.

Türkiye’de 50’ye yakın ilde doğal florada fındık bulunmakta ve birçoğunda yetiştiriciliği yapılmaktadır. Türkiye’de fındık alanları üç kategoriye ayrılmaktadır.

1. Standart Bölge: Artvin, Rize, Trabzon, Giresun ve Ordu illerini kapsamakta olup; Türkiye’de fındık üretiminin ilk başladığı Bölgedir. Bu Bölgedeki bahçeler genellikle yaşlı ve ekonomik ömrünü tamamlamış oldukça eğimli alanlardır. Türkiye’de fındık üretiminin diğer bölgelere yayılması büyük ölçüde bu illerden o bölgelere olan göçler yoluyla olmuştur.



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2. Standart Bölge: Bu bölgede dağlar denize dik olduğundan yetiştirme alanı vadiler boyunca iç bölgelere kadar ilerlemiştir. Bu bölgede fındık üretimi birinci standart bölgeye göre çok sonra başlamıştır. Bu bölgenin fındık üretiminde 50-60 yıllık bir geçmişi vardır. Fındık üretimine sonradan başlamanın avantajı ile bahçeler daha düzgün kurulmuş, toprak derinliği daha çok ve eğimi daha az dolayısı ile verim daha yüksek olduğundan karlılıkta yüksektir. Bu durum üretim alanlarının genişlemesini özendirilmektedir. Genellikle orta ve batı Karadeniz illeri olan Samsun, Sinop, Kastamonu, Bartın, Zonguldak, Düzce, Sakarya, Kocaeli, Bolu ve Tokat illerini kapsamaktadır.

3. Standart Bölge: Bu Bölgede Bitlis'in Hizan ve Kahramanmaraş'ın Göksun ilçesi haricinde fındığın çerezlik olarak yetiştirildiği illerdir ki bunlara her yıl yenileri eklenmekte ve fındık yakın gelecekte birkaç il haricinde bütün Türkiye coğrafyasına yayılacak gibi görünmektedir. Türkiye İstatistik Kurumu verilerine göre, Ülkemizde 33 ilimizde fındık üretimi gerçekleştirilmekte olup, 2020 yılı istatistiklerine göre fındık dikim alanları 734.538 ha alana ulaşmıştır. Fındık dikim alanları bakımından 227.219 ha ve %31'lik pay ile Ordu ilk sırada yer almaktadır. Bu ilimizi sırasıyla 117.802 ha üretim alanı ve %16'luk pay ile Giresun, 116.574 ha üretim alanı ve %15,9'luk pay ile Samsun, 75.099 ha üretim alanı ve %10'luk pay ile Sakarya, 65.597 ha üretim alanı ve %8,9'luk pay ile Trabzon ve 63.220 ha üretim alanı ve %8,6'luk pay ile Düzce illerimiz izlemektedir. Fındık üretim alanlarının son beş yıllık verilerini değerlendirdiğimizde asıl üretim alanı olan birinci standart bölgede bulunan Trabzon, Giresun ve Ordu illerimizde fındık üretim alanları maksimum değerine ulaşmış olduğu görülmektedir. Üretim alanları ikinci standart bölgede bulunan Samsun, Sakarya, Düzce ve Zonguldak gibi illerde artış eğilimi hız kesmeden devam ettirmekte olup, mevcut ruhsatlı alanlara sürekli olarak yeni il ve ilçeler ilave edilmektedir.



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Çizelge 2. Türkiye’de fındık üretimi yapılan iller ve üretim alanları miktarı (ha) (TÜİK, 2021)

İller	İl Bazında Yıllara Göre Fındık Üretim Alanları (ha)					Ü. Alanında % Payı
	2016	2017	2018	2019	2020	
Ordu	227.092	227.092	227.108	227.311	227.219	31
Giresun	117.087	117.102	117.191	117.778	117.802	16
Samsun	93.609	93.618	114.525	116.438	116.574	15.9
Adapazarı	72.798	73.084	73.443	74.349	75.099	10
Trabzon	65.552	65.552	65.508	65.535	65.597	8.9
Düzce	62.685	63.144	63.165	63.165	63.220	8.6
Zonguldak	23.618	23.834	23.995	25.769	25.906	3.5
Kastamonu	8.227	8.382	8.388	8.244	8.258	1.1
Kocaeli	7.981	7.981	7.980	8.180	8.250	1.1
Artvin	8.694	8.805	8.807	8.979	8.211	1.1
Bartın	5.937	5.937	6.181	6.200	6.243	0.8
Tokat	2.812	2.822	2.822	2.822	2.902	0.4
Rize	2.539	2.439	2.339	2.369	1.837	0.2
Sinop	1.701	1.721	1.721	1.721	1.722	0.2
Bolu	1.202	1.233	1.284	1.358	1.380	0.2
Gümüşhane	800	810	810	810	805	0.1
Diğer İller	3.111	3.111	3.114	3.381	3.513	0.5
TÜRKİYE	705.445	706.667	728.381	734.409	734.538	100

Türkiye’nin fındık üretiminde 197.230 ton üretim ve %29,6’lık pay ile Ordu ilk sırada yer almaktadır. Bu ilimizi 123.555 ton üretim ve 18.6’lık pay ile Samsun, 91.397 ton üretim ve 13.7’lik payı ile Sakarya, 84.167 ton üretim ve %12,6’lık payı ile Giresun, 57.330 ton üretim ve %8.6 pay ile Düzce, 40.315 ton üretim ve %6.1’lik payı ile Trabzon takip etmektedir. İllerin fındık üretimi verim açısından incelendiğinde; 171 kg/da ile Kocaeli ilk sırada yer almaktadır. Bu ilimizi 122 kg/da üretim ile Sakarya, 117 kg/da üretim ile Kastamonu, 113 kg/da üretim ile Tokat ve 106 kg/da üretim ile Samsun takip etmektedir. Burada dikkat edilmesi gereken nokta fındık ne kadar az eğimli tabak arazilerde yetiştiriliyorsa verim o kadar yüksek olmaktadır. Dikkat çeken bir diğer nokta ise verimin yüksek olduğu illerin tamamı ikinci Standart bölge dediğimiz fındığın sonradan yaygınlaştığı bölgede bulunmaktadır.



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Çizelge 3. Türkiye Fındık Üretimi yapılan illerin Üretim Miktarını (Ton) (TÜİK, 2021)

İller	Yıllara Göre Üretim Miktarı (Ton)					Ü. mik. %	Verim kg/da
	2016	2017	2018	2019	2020		
Ordu	93.030	213.572	180.397	217.226	197.230	29.6	87
Giresun	37.591	93.339	46.395	84.766	84.167	12.6	71
Samsun	67.855	96.240	66.363	137.841	123.555	18.6	106
Adapazarı	77.279	88.840	78.300	102.123	91.397	13.7	122
Trabzon	28.978	41.594	34.271	53.946	40.315	6.1	61
Düzce	54.493	74.350	52.686	85.688	57.330	8.6	91
Zonguldak	28.428	30.932	18.533	45.025	23.113	3.6	89
Kastamonu	5.769	6.210	6.226	7.918	9.658	1.4	117
Kocaeli	7.033	11.898	12.509	13.395	14.113	2.1	171
Artvin	5.022	4.149	5.789	5.297	3.744	0.6	45
Bartın	7.153	5.972	3.072	6.046	5.868	0.9	94
Tokat	1.921	1.869	2.342	2.627	3.293	0.5	113
Rize	881	1.331	1.710	2.910	1.404	0.2	76
Sinop	1.080	1.118	808	2.125	1.463	0.2	85
Bolu	228	225	1.108	1.333	1.245	0.2	90
Gümüşhane	483	500	697	861	1.231	0.2	153
Diğer İller	2.776	2.861	3.794	6.919	5.874	8.9	167
TÜRKİYE	420.000	675.000	515.000	776.046	665.000	100.00	90.5

Çizelge 4. Fındığın tarımsal ihracatımız içerisindeki payı (TÜİK, 2021)

Yıl	Fındık İhracatı \$	Türkiye İhracatı \$	% Oran
2000	319.416.550	9.417.450.000	3.392
2005	1.928.378.805	73.476.402.000	2.624
2010	1.516.671.866	113.725.206.000	1.334
2015	2.824.552.282	134.154.581.000	2.105
2016	1.976.198.428	131.979.405.000	1.497
2017	1.871.840.433	147.825.158.000	1.266
2018	1.634.210.764	163.968.689.000	0.997
2019	2.028.338.753	166.360.425.000	1.219
2020	1.951.344.772	156.766.930.000	1.245
2021<*)	2.011.485.771	186.447.530.000	1.079

Türkiye 1980’li yıllara kadar tarımsal ağırlıklı ihracat yapan bir ülke olması nedeni ile ülkemiz ihracatında tarım ürünlerinin payı yüksekti. Tarım ürünleri içerisinde en büyük paya sahip olan fındığın ülkemiz ihracatı içerisindeki payı da %10’lar civarında idi. 1980’den sonra



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sanayileşme yönünde yapılan dönüşümlerle ülkemiz ihracatı içerisinde tarım ürünlerinin payı giderek azalmıştır. Buna bağlı olarak Türkiye'nin toplam ihracatı içerisinde fındık ihracatının payı azalma göstermiştir. Son yirmi yılda ülkemizde hızlı bir ihracat artışı nedeni ile fındık ihracatı 319 Milyon \$'dan 2 Milyar \$ civarına çıkmış olmasına rağmen ülkemiz ihracatı içerisindeki payı %3,4'den %1'e düşmüştür. Bu da ülkemizin kabuk değiştirerek bir tarım ülkesi olmaktan çıkarak bir sanayi ülkesi haline geldiğini göstermektedir.

Ülkemiz fındık İhracatıyla ilgili en çarpıcı olanı ise, Türkiye'nin fındık ihracatı ve getirisi yıllara göre dalgalanmalar göstermektedir. Son yıllarda fındık piyasasını düzenleyici ve rekolte fazlasını regüle eden bir kurumun olmaması rekolteye bağlı olarak fiyatlarda dalgalanmalara neden olmaktadır. Bazı yıllar daha çok fındık ihraç edip daha az gelir elde ediyoruz. Bu da aslında fındık üretimi ve ihracatı ile ilgili Türkiye'nin sağlıklı bir politikasının olmadığını, en büyük üretici olmamıza rağmen fındık piyasasını başkalarının yönlendirdiğini ortaya koymaktadır. Fındığın fiyatı, alım politikası, üretim maliyeti, ihracat fiyatı, döviz kurlarındaki dalgalanma ve rekolteye göre belirleniyor. Bu nedenle rekolte tahmininin doğru yapılması, fındıkta birçok uygulamanın doğru olmasını sağlar. Türkiye'nin en önemli ürünü olan fındıkta rekolte tartışması yaşanırken, fındık ihracat rakamları istikrarsız ve kararsız bir seyir izlemektedir.

Çizelge 5. Türkiye fındık ihracat miktarı ve elde edilen gelir (TUIK, 2021)

Ürün Yılı	Miktar (ton iç)	Tutar Dolar(\$)	Ort.Fiyat (\$/kental)
2021	114.778	733.534.630	639
2020	292.433	2.010.787.689	688
2019	343.557	2.312.045.738	673
2018	269.393	1.592.437.091	591
2017	287.047	1.792.226.728	624
2016	235.798	1.882.254.562	798
2015	249.682	2.280.112.658	913
2014	217.427	2.799.529.619	1.288
2013	267.642	1.981.441.719	740
2012	301.193	1.750.439.804	581
2011	229.628	1.819.725.808	792
2010	281.333	1.783.567.587	634
2009	213.141	1.343.910.079	631
2008	244.630	1.178.101.490	482
2007	207.289	1.589.547.748	767



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Fındık ihrac fiyatları incelendiğinde fiyatların oluşmasında rekoltenin önemli bir rol oynadığı açıkça görülmektedir. Ortalama fındık ihrac fiyatının tavan yaparak en yüksek değer olan 1.288 \$/kental değere ulaştığı 2014 yılında meydana gelen zirai dondan dolayı fındık rekoltesi çok önemli derecede düşük miktarda gerçekleşmiştir. Bunun gibi ekstrem yıllar haricinde fındık fiyatları ortalama 650 \$/kental civarında oluşmuştur.

Türkiye’de Uygulanan Politikalar

Uzun yıllardır uygulanan destekleme politikaları, fındık üretimini ve ihracatını artırmış ancak fındık üreticisinin sorunlarını tam anlamıyla çözmemiştir. Küreselleşme sürecinde ihracatımızda sağlanan artışın yanında ihracatın yapısı da değişmiş, Cumhuriyet’in ilk yıllarından 1980’li yıllara kadar ihracatımızın %80’ini tarımsal ihracat oluştururken 1980 sonrasında sanayi ürünleri ağırlıklı bir ihracat yapısına dönüşmüştür. Türkiye dünya fındık üretiminin yaklaşık %69’unu karşılayan en büyük üretici olmasına rağmen dünya fındık piyasasında belirleyici rol oynayamamakta ve bu üründen gerektiği kadar gelir elde edememektedir. Türkiye dışındaki üretici ülkelerin üretimlerini artırmaları ve büyük fındık alıcısı ülkelerin de desteği ile Gürcistan, Azerbaycan gibi yeni üretici ülkelerin pazara girmesi ile pazar riskimiz giderek artmaktadır. Özellikle AB fındık ticaretinde Gürcistan’a özel bir statü tanıyarak koruma altına aldığı görülmektedir (Anonim, 2021). Fındık sanayi ürünü haline dönüştürülemediği, ihracatın çok büyük bir kısmı işlenmemiş olarak gerçekleşmektedir. Bu da hem katma değerden kaynaklanacak gelir artışının olmasını engellemekte hem de rekabet gücünü azaltmaktadır. Oysa, fındık işleme sanayiine yapılacak olan yatırımlar ihracat gelirlerini arttırmanın yanı sıra işsizliğin önemli bir sorun olduğu ülkemizde yeni istihdam alanlarının oluşturulmasına da yardımcı olacaktır. Fındık ’ta uygulanacak doğru üretim, fiyat ve destekleme politikaları hem ihracat gelirimizin yükselmesini sağlayacak hem de bu üründen geçimini sağlayan yaklaşık 2 milyon kişinin refah düzeyini artıracaktır.

Tarım sektöründeki destekleme politikalarının amacı genel olarak, ürün fiyatlarında ve üretici gelirlerinde istikrar sağlamak, ürün fiyatları arasında bir denge oluşturmak, tarım kesiminde çalışanların gelir düzeyini yükseltmek, adil bir gelir dağılımı sağlamak, tüketicilerin tarımsal ürün taleplerini en uygun şekilde karşılamak ve tarım sektörünün dünyanın diğer ülkeleri ile maliyet, teknoloji ve kalite açısından rekabet edebilir bir düzeye getirmektir

Tarım sektöründe uygulanan politikaları üç ana gruba ayırabiliriz. Bunlar:

- Üretimi artırmaya dönük politikalar
- Fiyat istikrarına yönelik politikalar



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- Kişi başına düşen geliri artırmaya yönelik politikalardır.

Üretimi Artırmaya Yönelik Politikalar:

Fındık üretimini talepteki gelişmelere göre düzenlemeyi ve en uygun alanlarda üretilmesini sağlamak amacıyla, 16.06.1983 tarihinde 2844 sayılı Fındık Üretiminin Planlanması ve Dikim Alanlarının Belirlenmesi Hakkında Kanun hükmündeki kararname çıkarılmıştır. Bu kanunla, fındık üretimi yapılacak alanların, arazi kullanma kabiliyet sınırları ve kalite özellikleri dikkate alınarak, fındık dikim alanlarının altı ay içinde Bakanlar Kurulu'nca belirlenecek alanlarla sınırlandırılacağı yeni fındık dikim alanlarının tespit ve ilanı ile yeni fındık bahçesi tesisine veya yenilenmesine izin verilme usul ve esaslarının çıkarılacak yönetmelikle düzenleneceği hüküm altına alınmıştır.

Bu Kanun ile Devlet düzenli bir fındık politikası için gerekli hukuki altyapının temelini oluşturmuştur. Ancak, bu kanun uyarınca “Fındık Üretiminin Planlanması ve Dikim Alanlarının Belirlenmesine Dair Usul ve Esaslar Hakkındaki Yönetmelik”, 6 yıl sonra, 06.07.1989 tarih ve 89/14313 sayılı Bakanlar Kurulu Kararı ile yürürlüğe girmiştir. Fındık üretimine izin verilecek sahalara ise, 07.01.1993 tarih ve 93/3985 sayılı Bakanlar Kurulu Kararı ile belirlenmiştir. 2001/3267 23/12/1994 Tarihli ve 94/6519 Sayılı Kararnamenin eki k a r a r Madde 1 — 7/1/1993 tarihli ve 93/3985 sayılı Kararname ile fındık üretimine izin verilen alanların dışında kalan fındık bahçelerinin tümü ile, fındık üretimine izin verilen il ve ilçelerdeki 1 ve 2'nci sınıf arazilerle %6'dan daha az eğimli 3. sınıf arazilerde kurulu fındık bahçelerinin ekonomik ömürlerini doldurmadan sahipleri tarafından sökülmesi karşılığında tazminat ödenmesi kararlaştırılmıştır. Bu amaçla tarım sektöründe yapısal uyum çalışmaları bünyesinde Dünya Bankası ile 12.07.2001 tarihinde imzalanan Tarım Reformu Uygulama Projesi İkraz Anlaşması gereği, Proje kapsamına, alternatif ürüne geçiş yaparak fındık üretiminden vazgeçen üreticiler için kaynak sağlanmıştır. Bu proje kapsamında yaklaşık 400 ha alanda söküm yapılması için 340 üretici başvuru yapmıştır. Daha sonra kaynak sıkıntısı nedeniyle bu uygulama yürürlükten kaldırılmıştır.

Daha sonra çıkartılan 2009/15531 Sayılı Bakanlar Kurulu Kararı ile fındık dikim alanları yeniden belirlenerek 14 il ve 105 ilçeye çıkarılmıştır. Bu il ve ilçeler dışındaki il ve ilçelerin tamamı ile yukarıdaki il ve ilçelerde 1 inci ve 2'nci sınıf tarım arazilerinde, %6'dan daha az eğimli 3'üncü sınıf tarım arazilerinde, fındık bahçesi tesis edilmesine ve yenilenmesine izin verilmeyeceği hüküm altına alınmıştır. Değişiklik ile, 750 metre rakımın üzerindeki tarım arazileri için getirilen sınırlandırma kaldırılmış, 2011/1424 sayılı Bakanlar Kurulu Kararı ile,



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findık dikimine izin verilen alanlar yeniden belirlenmiş, Artvin'in Hopa ve Murgul, Sakarya'nın Kaynarca, Bartın'ın Ulus, Kastamonu'nun Doğanyurt ve Samsun'un Alaçam, Asarcık, Atakum, Bafra, Canik, İlkadım, Ondokuzmayıs, Tekkeköy ve Yakakent İlçeleri de bu alanlara dahil edilmiştir. Fındık dikimine izin verilen alanlar Son olarak, 07.02.2015 tarihinde Resmî Gazetede yayınlanan 2014/7253 sayılı Bakanlar Kurulu Kararı ile fındık dikim alanlarına Bolu'nun Göynük ve Mudurnu, Tokat'ın Erbaa, Sakarya'nın Adapazarı, Arifiye, Erenler, Geyve, Pamukova, Sapanca, Serdivan, Söğütlü, Taraklı, Zonguldak'ın bütün İlçeleri fındık üretimine izin verilen alanlara dahil edilmiştir. Böylece fındık üretimine izin verilen il sayısı 16 ya, ilçe sayısı 123'e çıkmış oldu.

Fiyat istikrarına yönelik politikalar (Müdahale Alımları):

1938 yılında kurulan Fiskobirlik (Fındık Tarım Satış Kooperatifleri Birliği) 1964 yılına kadar kendi imkanları ile fındık alımı yaparak fındık üreticisini desteklemiştir. 1964 yılından itibaren Trabzon, Giresun ve Ordu illerinde fındık üretimini teşvik etmek, ihraç gelirlerini arttırmak ve fındık tarımıyla uğraşan çiftçilerin hayat standardını yükseltmek amacıyla Fiskobirlik destekleme alımları için görevlendirilmiştir. Fiskobirlik yapılan bu görevlendirme sonucu 1984 yılına kadar fındık ihracatımızın büyük bir bölümünü gerçekleştirmiştir. 1980 sonrası dönemde rekoltenin yüksek olduğu yıllarda ürünün çoğu Fiskobirlik tarafından alınmıştır. Ancak ihraç edilemeyen üretim fazlası miktarın elinde kalması nedeniyle Fiskobirlik arz fazlası ürünleri stoklayan bir kurum haline gelmiş ve destekleme alımlarından kaynaklanan görev zararları ortaya çıkmıştır. 1994 yılında uygulamaya konulan ekonomik istikrar tedbirleri nedeni ile destekleme alımlarına son verilmiştir. Bu tarihten sonra Fiskobirlik, Destekleme ve Fiyat İstikrar Fonundan sağlanan düşük faizli kredilerle alımlarını gerçekleştirmiştir. Fiskobirlik 1995-2001 ürün alım dönemlerinde 1.730.983.105 dolar karşılığında alım yapılmış ve toplam 1.550.809.883 dolar tutarında DFİF kaynaklı kredi kullanmıştır. Bu faaliyet sonucunda 533 bin ton fındık yağlığa ayrılmıştır. Bu dönemde Fiskobirlik 1 milyar \$ zarar etmiştir. Fiskobirlik'in yağlığa ayrılan fındıklardan elde edilen geliri DFİF hesabından kullanılan kredilere mahsup edilerek özel bankalara olan borçları silinmiştir., Son olarak 2002 yılında Fiskobirlik devlet tarafından hazine adına fındık alımı ile görevlendirilmiştir. Tarım satış kooperatif ve birliklerinin yeniden yapılandırılması için yasal bir çerçeve oluşturarak, etkin ve sürdürülebilir bir şekilde özerk ve malî yönden bağımsız kılmak amacıyla, 4572 sayılı "Tarım Satış Kooperatifleri ve Birlikleri Hakkında" Kanun gereği özerkleştirilmiştir. Bu kapsamda alım



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faaliyetlerine devam etmektedir. Fakat ekonomik yetersizlik nedeni ile piyasada etkin bir oynayamamaktadır.

Fiskobirlik'in 2006 yılında yaşadığı mali sıkıntılar nedeniyle 2006 sezonunda, fındık üreticisinin istikrarsız fiyat hareketlerinden korunarak mağduriyetinin giderilmesi amacıyla, 2006/10865 sayılı Bakanlar Kurulu Kararı ile Toprak Mahsulleri Ofisi (TMO) fındık alımı ile görevlendirilmiştir. 2009'da açıklanan Yeni Fındık Stratejisi doğrultusunda, TMO'nun fındık alım görevi sona ermiştir. Bu tarihten itibaren fındık fiyatları başta fındık borsaları olmak üzere serbest piyasa koşullarında belirlenmesi hedeflenmiştir. Fındık rekoltesinin düşük olduğu ve stokların oluşmadığı dönemlerde fındık fiyatının serbest piyasa koşullarında oluşması ciddi bir sorun oluşturmamıştır. Ancak rekoltenin yüksek olduğu 2017 yılına gelindiğinde Bakanlar Kurulu 2017/10211 sayılı Kararı ile TMO'yu piyasalarda oluşan düşük fiyatlara karşı fiyat istikrarının sağlanması ve piyasaların düzenlenmesi amacıyla fındık alımı yapmakla ikinci defa görevlendirildi. Bu görevlendirme her yıl uzatılarak 2021 yılı itibarı ile devam etmektedir.

Gelir Artırmaya yönelik politikalar

Fındık üreticilerinin gelir kayıplarının telafi edilmesi amacıyla 2003/5203 sayılı Kararname ile fındık üreticilerine 2002 yılı için o günün para birimi ile 2.000.000 TL/Kg seviyesinde ilave doğrudan gelir desteği uygulanmıştır (Türk lirasında atı sıfır atıldığından bu rakam bugün ki para birimi ile 2 TL/kg dır). 2009/15201 sayılı Bakanlar Kurulu Kararı ile ortaya konulan Yeni Fındık Stratejisinde yasal üretim alanlarında Üretim yapan üreticilere "Alan Bazlı Gelir Desteği", kanuna aykırı alanlarda üretim yapan üreticilere ise alternatif ürünlere geçmeleri halinde "Telafi Edici Ödeme" yapılması kararlaştırılmıştır. 28/1/2013 tarihli ve 2013/4245 sayılı Bakanlar Kurulu Kararı ile yürürlüğe konulan Fındık Üreticilerine Alan Bazlı Gelir Desteği ve Alternatif Ürüne Geçen Üreticilere Telafi Edici Ödeme Yapılmasına Dair Karar kapsamında;

1- Fındık Alanlarının Tespitine Dair Kararın 1 inci maddesinde belirtilen il ve ilçelerdeki (14 il,105 ilçe), 2012-2014 yılları arasında sonbahar ve ilkbahar ekim/dikim dönemlerinde; bu il ve ilçelerdeki birinci, ikinci ve %6'dan daha az eğimli üçüncü sınıf tarım arazilerinde ve rakımı 750 metrenin üzerindeki ruhsatsız fındık bahçelerini sökerek yerine alternatif ürün ya da ürünlere geçen kamu kurum ve kuruluşları hariç gerçek ve tüzel kişilere telafi edici ödeme desteği yapılmıştır. Bu desteklemeler için, birinci yıl başvurularında; ilk yıl 300 TL/da ikinci ve üçüncü yıllar için 150 TL/da olarak 3 yıl için 150 TL olmak üzere toplam 600 TL/da ikinci yıl başvurularında; ilk yıl 300 TL/da ikinci yıl için 150 TL/da olmak üzere 2 yıl için toplam 450



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TL/da üçüncü yıl başvurularında; tek yıl 300 TL/da Alternatif ürüne geçiş desteği ödemesi yapılmıştır.

2- 22/11/2001 tarihli ve 2001/3267 sayılı Bakanlar Kurulu Kararı ile yürürlüğe konulan Fındık Alanlarının Tespitine Dair Kararname ile belirlenen ve izin verilen alanlarda fındık yetiştiriciliği yapan ve fındık üretici belgesine sahip, gerçek ve tüzel kişilere 2005 yılı ürünü için 150 TL/da olarak başlatılan alan bazlı gelir desteği ödemesine daha sonra mazot ve gübre desteği de ilave edilerek her yıl güncellenmiştir. Fındıkta 2021 yılı için 170 TL/da alan bazlı destekle birlikte, mazot (17 TL/da) ve gübre desteği (4 TL/da) olmak üzere, toplamda 191 TL/da destek verilmesi karara bağlanmıştır. Fındıkta gelir artırıcı girdiler içerisinde en önemli yeri tutan gübrenin yıllık fiyat değişimleri incelendiğinde üretim maliyetlerinin artışında önemli derecede etkili olduğu görülmektedir. Hammadde olarak dışa bağımlı olan gübre sektöründeki fiyat artışlarının önemli bir ihraç ürünümüz olan fındık fiyatlarına da yansması üreticilerin gelir olarak rahatlamasını sağlayacaktır. Ürün desteklemelerinde uygulanan gübre desteğinin revize edilerek günün şartlarına uygun hale getirilmesi gerekir.



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Yıllar	%21 Amonyum Sülfat (ton/TL)	%26 CAN (ton/TL)	%33 Amonyum Nitrat (ton/TL)	Üre %45 Azot (ton/TL)	DAP (ton/TL)	20.20.0 (ton/TL)
2002	178	194	212	261	389	279
2003	214	253	276	340	427	314
2004	295	301	332	381	550	394
2005	276	323	343	463	553	411
2006	283	328	381	512	608	439
2007	362	385	451	662	798	542
2008	620	561	644	836	1839	1221
2009	358	480	527	693	758	572
2010	382	483	584	694	1011	679
2011	585	617	746	982	1498	1060
2012	641	761	880	1178	1465	1054
2013	623	813	920	1120	1330	960
2014	620	879	980	1159	1568	1062
2015	681	853	982	1176	1825	1260
2016	644	789	928	1035	1471	1062
2017	708	855	1220	1156	1538	1096
2018	1011	977	1250	1664	2383	1587
2019	1219	1222	1850	2018	2654	1892
2020	1700	1380	3000	3600	4000	2800
2021	1800	1480	3000	3800	3700	3600
2021/11	9.796	11.200	10.250	12.178	14.600	8.320

Çizelge 6. Yıllara Göre Gübre Fiyatları (Ton/TL) 2002-2021 yılları arası (Anonim, 2021b)

Fındıkta gelir artırıcı girdiler içerisinde en önemli yeri tutan gübrenin yıllık fiyat değişimleri incelendiğinde üretim maliyetlerinin artışında önemli derecede etkili olduğu görülmektedir. Hammadde olarak dışa bağımlı olan gübre sektöründeki fiyat artışlarının önemli bir ihracat ürünümüz olan fındık fiyatlarına da yansımaları üreticilerin gelir olarak rahatlamasını sağlayacaktır. Ürün desteklemelerinde uygulanan gübre desteğinin revize edilerek günün şartlarına uygun hale getirilmesi gerekir.

Avrupa Birliğinde Uygulanan Fındık Politikaları

AB’de üreticiler kooperatifler aracılığı ile pazar paylarını arttırmaktadırlar. Bu bağlamda Tarımsal Piyasalar Görev Gücü (Agricultural Markets Task Force) kurulmuş olup tarımsal üründe fiyat istikrarını sağlanmaya yönelik çalışmalar yapılmaktadır. AB’nin ortak piyasa



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düzenlemeleri ve fındık desteğinde 2012 yılında tekli ödeme uygulamasına (single payment scheme) geçilmiştir. AB tarafından finanse edilen ve kuru yemiş sektöründe fındık–badem gibi ürünlere verilen 33 €/ha üretim desteği ödemesi yapılmaktadır. Avrupa Birliği ülkelerinde fındığa verilen destekleme miktarı ülkeden ülkeye hatta ülke içinde farklılık arz etmektedir. Her ülke istediği ürüne farklı destek verebildiği “volunteered coupled support” fındık için sadece İspanya’da hektar başına 8 Avro ek destek uygulanmaktadır. 2019 yılı itibariyle İspanya’da doğrudan destek sistemi kapsamında çiftçinin çevresel uygulamalar yapmasına bağlı olarak 86 €/ha ek ödeme de verilebilmektedir. Böylece İspanyol fındık üreticilerine toplam destek miktarının 293 €/ha ulaştığı ifade edilmiştir. İtalya ve Fransa gibi diğer AB ülkelerinde ise Avrupa birliği fonlarından genel tarım desteği programları kapsamında hektar başına 150 Avro destek verilmektedir. İtalya’da yerel hükümetin verdiği desteklerle toplam destek miktarı 300 €/ha bulmaktadır. Ayrıca Avrupa Birliği birlik dışı ülke olmasına rağmen fındık üretiminin artırılması için Gürcistan’a da fon sağladığı bilinmektedir (Anonim, 2020).

Üretici Birliği (Fiskobirlik)’in Önemi:

Tarımsal ürünlerin değerlendirilmesinde ve ticaretinde üretici birlikleri çok önemli rol oynamaktadır. Fiskobirlik fındık üreticilerini fındık tacirlerinin spekülatif hareketlerinden korumak, üreticilerin örgütlenmesini sağlayarak fındığın piyasa arzını düzenlemek, değer fiyatından satışını sağlayarak üreticilerin menfaatlerini korumak amacıyla kurulmuş bir birliktir. Üreticilerin örgütlü bir şekilde hareket etmeleri, kredi dahil ilaç gübre gibi tarımsal girdi ihtiyaçlarının daha ucuz ve ekonomik bir şekilde anlaşmalı kurum ve kuruluşlardan sağlamada geçmiş dönemlerde önemli roller üstlenmiştir. Ayrıca fındık üreticilerine üretim faaliyetleri ile ilgili teknik destek ve hizmet alımı yapmakta idi. Fiskobirlik kurduğu entegre tesislerle fındığı çikolata dahil mamul maddelere işleyip istihdam ve katma değer yaratarak ülkemize daha çok gelir sağlamayı başarmıştır. Doğrudan yaptığı ihracatla elde ettiği gelirin bir kısmını üreticilere dağıtarak alın terinin karşılığını tam olarak vermiştir. Fındık üreticilerinin Fiskobirlik çatısı altında toplanmasını sağlamak amacıyla devlet tarafından fındık için verilen tarımsal destek ve teşviklerin Fiskobirlik aracılığı ile verilmesi sağlanmalıdır. Fındık depolamada kullanılacak lisanslı depoların işletme ve kontrolü de Fiskobirlik tarafından yapılmalıdır. İstikrarlı, spekülasyonlardan arındırılmış bir piyasayı sağlamak için, güçlü bir yerli sermayenin bulunması ulusal menfaatimiz için bir zorunluluktur. Fındık piyasasının istikrara kavuşturulabilmesi için, FİSKOBİRLİK tüzüğünde günümüzün gereklerine uygun değişiklikler yapılarak üretimden pazarlamaya kadar zincirin her halkasına sahip olarak fındık piyasasını



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düzenleme konusunda inisiyatif kullanabilen güçlü ve operasyonel bir yapıya kavuşturulmalıdır.

SONUÇ VE ÖNERİLER

Fındık Doğu Karadeniz bölgesinde yaşayan nüfusun büyük bir çoğunluğunun tek geçim kaynağı ve Dünya üretiminin %69'unu gerçekleştirdiğimiz en önemli tarımsal ihraç ürünlerimizden birisidir. Bu nedenle fındık politikaları Cumhuriyetin ilk yıllarından beri ülkemiz gündeminde önemli bir yer tutmuştur. Fındık politikalarının amacı fındık üreticilerinin gelir düzeyini yükseltmek, üreticilere yeterli, istikrarlı bir gelir sağlanmak ve fındık ihracatından elde edilecek döviz gelirini artırmaktır. Bu amaçla 1964 yılında başlatılan fiyat desteği ve alım garantisi uygulamaları, bazen politik kaygıların etkisi ile fındık piyasasında sorunlara sebep olmuştur. Destekleme alımları sonucu fındık karlı bir ürün haline gelmiş ve üretim alanları hızla genişlemiştir. Üretim Alanlarının hızla genişlemesi fındık piyasasında birçok sorunuda beraberinde getirmiştir. Üretim artışına paralel olarak ihracat ve iç tüketim artırılamadığından arz fazlası sorunu ortaya çıkmıştır. Fındıkta oluşan arz fazlasının kaynağını yüksek verimlilik değil üretim alanlarının aşırı ve kontrolsüz bir şekilde artması oluşturmaktadır. Üretim alanlarının genişlemesi fındık üretiminin doğal fındık alanlarının dışına yayılmasına, alternatif tarım ürünlerinin yetiştirildiği düz ve verimli arazilere kaymasına neden olmuştur. Fındıktaki arz fazlası sorununu çözmek amacı ile Fındık Üretiminin Planlanması ve Dikim Alanlarının Belirlenmesi ve Alternatif ürüne geçişle ilgili teşvik edici kanunlar çıkarılmış olsa bile fındık üretim alanları sürekli olarak artış göstermiştir. Bu durum asıl üretim bölgesi olarak kabul edilen Artvin, Rize, Trabzon, Giresun ve Ordu illerindeki fındık üreticilerinin üretimden aldıkları payı azaltmıştır. Fındıkta Özellikle 1. Üretim Bölgesindeki Bahçelerimizin çoğu Ekonomik ömürlerini tamamlamış olup, verimleri çok düşüktür.

Bu üretim bölgesindeki bahçelerin çoğunu yüksek eğimli alanlarda kurulmuş yaşlı, ekonomik ömrünü tamamlamış verimsiz bahçeler oluşturmaktadır. Ayrıca bu bölgede arazi darlığı ve miras hukukundan kaynaklanan bölünmeler sonucunda üretim alanları çok parçalı ve ekonomik işletme büyüklüğünün altında olduğundan yeni teknolojileri benimsemeye duyarsız kalmalarına, girdi maliyetlerinin artmasına, karlılığın azalmasına ve üretim faaliyetinin ekonomik olmaktan çıkmasına neden olmaktadır. Verim artışı ve sürdürülebilir bir üretim için bu bölgedeki bahçelerin kaliteli çeşitler ve modern dikim sistemleri ile acilen yenilenerek ekonomik işletme büyüklüklerinin korunması sağlanmalıdır. Yeni bahçelerin tesisinde ülkemizi yakından



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İlgilendiren küresel ısınma, kuraklık ve abiyotik stres şartlarına dayanıklı, periyodisite eğilimi olmayan çerezlik ve sanayiye uygun verimli ve kaliteli çeşitlerin geliştirilmesine ihtiyaç vardır. Fındıkta özellikle birinci üretim bölgesinde topografik yapıdan kaynaklanan mekanizasyonun kullanılamaması nedeniyle üretim maliyetlerimiz, rakip konumunda bulunan ülkelere göre oldukça yüksektir. Üretim maliyetlerini azaltıcı tedbirlerin alınması rekabet gücümüzü koruma açısından büyük önem taşımaktadır. Fındıkta fiyat istikrarı sağlamak ve piyasayı regüle etmek için zaman zaman devreye sokulan ve fındıkta arz fazlası ürünü stoklama ve fiyat belirleme haricinde başka bir işlevi olmayan TMO' un yerine, fındık alımından işleme ve ihracatına kadar her kademesinde görev alacak şekilde piyasa düzenleyici ve temel politika belirleyici olarak Fiskobirlik sağlam bir finansal yapıya kavuşturularak yeniden devreye sokulmalıdır. Fiskobirlik'in yeniden güçlü bir şekilde devreye sokulması ile piyasada tekel konumunda olan firmaların yarattığı istikrarsızlığı ortadan kalkacak, üreticilerimizi zor durumda bırakan fiyat dalgalanmalarının önüne geçilerek piyasa istikrarı sağlanmış olacaktır. Fındık sanayini geliştirerek fındığı hammadde olarak değil, katma değeri yüksek ürünler halinde işleyerek ihraç etmeliyiz. Böylece hem daha fazla ihracat geliri sağlanacak hem de istihdam imkânı yaratacağından bölgenin refah düzeyinin iyileşmesine önemli derecede katkı sağlayacaktır. Ülkemiz Fındık üretimindeki artışa paralel olarak dünya fındık üretimi de artmaktadır. Yakın coğrafyamızdaki Gürcistan, İran ve Azerbaycan fındık üretiminde ciddi anlamda rakip olma yolundaki çabaları da göz ardı edilmemelidir. Ayrıca en önemli dış pazarımız olan Avrupa Birliği'nin kendine yeterlilik politikaları yakından takip edilerek stratejiler geliştirilmelidir. Türkiye'nin dünya fındık üretimindeki konumunun sürdürülebilirliği açısından dünya üretim ve ticaretinde gelişmelerin yakından izlenmesi gerekir. Gelişmiş ülkelerde olduğu gibi benzer üretici birliklerinin oluşturulması, markalaşma, entegre mücadele yöntemlerinin uygulanması ve sürdürülebilirlik açısından önem taşımaktadır.

Fındığın insan beslenmesi ve sağlığındaki rolü giderek daha iyi anlaşıldığı için ekonomik refah seviyesi arttıkça talep hızla artacaktır. Fındığın insan sağlığı ve beslenmesindeki rolüne yönelik yoğun tanıtım faaliyetleri ve promosyonlarla özellikle yakın doğu ülkelerinin yeni Pazar haline getirilmesi pazarlama sorunlarımızın çözülmesinde etkili olabilir. Yakın coğrafyamızdaki Gürcistan, İran ve Azerbaycan fındık üretiminde ciddi anlamda rakip olma yolundaki çabaları da göz ardı edilmemelidir. Ayrıca en önemli dış pazarımız olan Avrupa Birliği'nin kendine yeterlilik politikaları yakından takip edilerek stratejiler geliştirilmelidir.



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Fındık piyasasındaki etkinliğimizi artırmak için Türkiye’de bir fındık borsası ve vadeli işlemler piyasasının kurulması fındık piyasasını olumlu etkileyecek, fiyat hareketlerinde istikrar sağlayarak piyasa koşullarına uygun fiyatların belirlenmesine, iç ve dış piyasalar arasında denge sağlanmasında ve ürün planlamasında önemli yararlar sağlayacaktır (Albayrak Vural, 2008)



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KAYNAKLAR

Albayrak Vural, M. M., 2008. Fındıkta Destek Politikalarındaki Değişimin Üretici Üzerindeki Etkisi (yüksek lisans tezi, basılmamış). İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul.

Anonim, 2020. 2019 Yılı Fındık Raporu. T.C. Ticaret Bakanlığı Esnaf, Sanatkarlar ve Kooperatifçilik Genel Müdürlüğü .

Anonim, 2021. Fındık Sektör Araştırması Raporu Rekabet Kurumu III. Denetim ve Uygulama Dairesi Başkanlığı.

Anonim, 2021a. Toprak Mahsulleri Ofisi Genel Müdürlüğü 2019 Yılı Fındık Sektör Raporu
Ankara 2020
<https://www.tmo.gov.tr/Upload/Document/sektorraporlari/findik2019.pdf>. Erişim tarihi: 23.12.2021.

Anonim, 2021b. <https://ziraatodasi.gen.tr/haberler/tarim-ekonomisi/yillara-gore-gubre-ve-mazot-fiyatlari/>.

FAO, 2019. Uluslararası Gıda ve Tarım Örgütü (Food and Agriculture Organization of The United Nations) www.fao.org. Erişim tarihi: 15.12.2021.

TÜİK, 2021. Türkiye İstatistik Kurumu. www.tuik.gov.tr. Erişim tarihi:15.12.2021.



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**ANTIOXIDANT ENZYMES OF 2,4-D (DICHLOROPHENOXYACETIC ACID) IN
CAPOETA UMBLA BRAIN TISSUE AND DETERMINATION OF EFFECT ON LIPID
PEROXIDATION LEVEL**

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ABSTRACT

The aim of this study was to determine the effects of 2,4-dichlorophenoxyacetic acid (2,4-D), a widely used herbicide around the world, on antioxidant enzyme activities (superoxide dismutase (SOD) and glutathione reductase (GR)) and lipid peroxidation in *Capoeta umbla* brain tissue. effects were studied. Changes in malondialdehyde (MDA) level, GR and SOD activities were determined by spectrophotometric methods by applying different doses of 2,4-D to *Capoeta umbla* fish for 72 hours. As a result of the study, it was determined that while MDA level and SOD activity increased in the brain tissue of fish exposed to sublethal doses of 2,4-D, GR activity decreased significantly ($p<0.05$). In conclusion, it is seen that 2,4-D has a toxic effect on *Capoeta umbla* brain tissue and causes stress.

Keywords: *Capoeta umbla*, 2,4-Dichlorophenoxyacetic acid, herbicide, oxidative stress, brain



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**2,4-D (DİKLOROFENOKSİASETİK ASİT)'İN *CAPOETA UMBLA* BEYİN
DOKUSUNDA ANTİOKSİDAN ENZİMLER VE
LİPİD PEROKSİDASYON SEVİYESİ ÜZERİNE ETKİSİNİN BELİRLENMESİ**

ÖZET

Bu çalışmanın amacı, 2,4-diklorofenoksiasetik asitin (2,4-D) *Capoeta umbla* beyin dokusunda antioksidan enzim aktiviteleri (süperoksit dismutaz (SOD) ve glutatyon redüktaz (GR)) ve lipid peroksidasyon üzerindeki etkileri incelendi. *Capoeta umbla* balıklarına 72 saat 2,4-D'nin farklı dozları uygulanarak, malondialdehit (MDA) seviyesi, GR ve SOD aktivitelerindeki değişimler spektrofotometrik yöntemlerle tespit edilmiştir. Çalışma sonucunda, 2,4-D'nin sublethal dozlarına maruz bırakılan balıkların beyin dokusunda MDA seviyesi ve SOD aktivitesi artarken GR aktivitesinin önemli ölçüde azaldığı tespit edildi ($p<0,05$). Sonuç olarak, 2,4-D' nin *Capoeta umbla* beyin dokusunda toksik bir etkiye sahip olduğu ve strese neden olduğu görülmektedir.

Anahtar Kelime: *Capoeta umbla*, 2,4-Diklorofenoksiasetik asit, herbisit, oksidatif stres, beyin



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INTRODUCTION

When fish are exposed to substances that cause environmental pollution (pesticides, heavy metals, industrial wastes, artificial and natural agricultural fertilizers, etc.), they become harmful to health. As a result of excessive and unconscious use of pesticides, which are among these pollutants, significant pollution occurs in the environment and water resources. Aquatic life is directly affected by these pollutions, and human life is indirectly affected (Hill, 1989). Pesticides form the basis of the science of toxicology. These chemicals, whether natural or synthetic, are known to have toxic effects on both humans and other organisms. Pesticides, which can remain in the environment for a long time, can be mutagens, teratogens and more importantly, carcinogens. The fact that the usage areas are very wide causes the harm of pesticides to the environment and living things to increase. Pesticides are kept in a class that is chemically and socially separate from other toxic materials. Because their toxic effects do not directly affect a certain organism (Güven, 2005). Pesticide contamination causes oxygen scarcity in waters and mass deaths in fish and other aquatic organisms (Çelikel, 2011). As a result of lipid peroxidation, which is one of the toxication mechanisms of pesticides, MDA and SOD levels increase, so these parameters are used as markers of oxidative stress (Kehrer, 1993). Lipid peroxidation is an event that causes cellular damage by affecting antioxidant enzyme systems in cells (Kehrer, 1993). 2,4-dichlorophenoxyacetic acid (2,4-D) is a widely used herbicide worldwide and one of the best-studied agrochemicals (Gupta 2011). However, as a result of its intensive agricultural use, 2,4-D is recognized as one of the main pollutants of aquatic ecosystems.

The aim of this study is to examine the changes in SOD and GR activities and MDA level caused by 2,4-D herbicide in the brain tissue of a freshwater fish, *Capoeta umbla*.

MATERIAL AND METHODS

The fish used in the study were caught from Murat River and brought to Bingöl University, Faculty of Agriculture, Fisheries Department, Aquaculture Laboratory and rested in 600 L tanks for 14 days. The fish were then divided into three groups, one control group and two treatment groups. The study was carried out in 60 L aquariums. A total of 21 fish, 7 fish in each group, were used. 72 hour LC50 value at application doses, Gül et al. (2005) determined (72 hour LC50 value, 82,2759 ppm/L) was used. In the study, 25% and 50% of the LC50 value (41.14 and 20.57 ppm/L) were applied to the fish for 72 hours. Chemical properties of the water used,



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dissolved oxygen value, pH value, temperature, alkalinity and total hardness (CaCO_3) values are respectively 7.26 ± 2.11 mg/L, 7 ± 5.6 , 17 ± 6 °C, 128 ± 7 mg /L and 147 ± 07 mg/L.

Fish were anesthetized with benzocaine and blood was removed by removing brain tissues and washing with physiological saline (0.9% NaCl). The preparation of the homogenate was done by rearranging Beutler's (1971) method (Kırıcı et al., 2017). MDA determination of tissue samples Ohkawa et al. (1979) method and GR activity according to Carlberg and Mannervik (1975) method. SOD activity at 560 nm and 20 °C by Sun et al. (1988) method.

While one-way ANOVA was used in the analysis of the data, the significant differences between the control and experimental groups were determined with the Duncan Test. SPSS 17.0 program was used for statistical operations. $p < 0.05$ was chosen as the required level for statistical significance.

RESULTS AND DISCUSSION

In this study, MDA level and SOD activity in *Capoeta umbla* brain tissue increased in a dose-dependent manner, while GR activity decreased significantly. (Table 1, $p < 0.05$). There are many studies in the literature that are similar to our results. For example, azinphos methyl pesticide caused an increase in SOD activity in *Cyprinus carpio* (Oruç et al., 2004), diazinon pesticide caused an increase in SOD activity in *Oncorhynchus mykiss* (Işık and Çelik, 2008), and atrazine pesticide caused a significant increase in liver SOD level in *Lepomis macrochirus*. (Elia et al., 2002). The common point of this and many similar studies is that most pesticides cause oxidative stress in fish. Sayeed et al., (2003) investigated the antioxidant enzyme activities in liver and kidney tissues by applying a single dose of deltamethrin ($0.75 \mu\text{g/L}$) for 48 hours in their study with green snakehead (*Channa punctatus*). They reported that deltametry increased MDA levels in all study tissues. Dorval and Hontela (2003) investigated the enzyme activities of *O. mykiss* at different levels of application doses of endosulfan, an organochlorine pesticide, and reported that this pesticide increased the MDA level. In another study in which diazinon was applied, *O. niloticus* was exposed to the aforementioned chemical for different periods (1, 7, 15 and 30 days), and it was reported that SOD activity and MDA levels increased at the end of the trial period (Durmaz et al. 2005). In a study conducted with European eel (*Anguilla anguilla*), the fish were exposed to a sublethal dose of DDVP (2,2-dichlorovinyl dimethyl phosphate) for 96 hours and reported a decrease in GR activity at the end of the trial period (Pena-Llopis et al. 2003). Figueiredo-Fernandes et al. (2006), in their study with nil



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tilapia (*O. niloticus*), looked at the effect of paraquat (PQ) applied in a single dose (0.5 mg L⁻¹) at different temperatures (17 and 27°C) on antioxidant enzymes and the SOD and GR of the mentioned herbicide. reported an increase in their activity.

Table 1. Effect of 2,4-Dichlorophenoxyacetic acid on MDA, GR and SOD activity (U/mg protein) in *Capoeta umbla* brain tissue.

	Control	20,57 ppm/L	41,14 ppm/L
MDA	3,47±0,75a	4,21±1,03a	6,73±1,45b
GR	1,18±0,12a	0,70±0,09b	0,22±0,02c
SOD	6,47±1,94a	8,93±2,43b	9,11±2,75b

Values are expressed as mean ± standard error (n = 7). The mean values in the same row with different superscripts (a, b, c) are significantly different (p < 0.05).

As a result of the literature review; It is seen that pesticides cause some changes in the antioxidant defense system of aquatic organisms and as a result, damage at the cellular level. The basic enzyme (SOD, GR, MDA) groups (Keramet et al. 2010) contained in the antioxidant systems in aquatic organisms have ROS-destroying effects and can protect the cellular system against the harmful effects of free radicals originating from pesticides (Banerjee et al. 2001), and that these enzymes can protect against pollution. It was concluded that they can be used as appropriate and safe indicators in studies and ecotoxicological risk assessments.



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REFERENCES

- Banerjee, B.D., Seth, V., Ahmed, R.S., 2001. Pesticide-Induced Oxidative Stress: Perspectives and Trends. *Rev Environ Health*, 16(1):1-40.
- Carlberg I, Mannervik B (1975). Purification and characterization of the flavoenzyme glutathione reductase from rat liver, *J. Biol. Chem.*, 250, 5475-5480.
- Çelikel, Y., 2011. Alpha-Cypermethrin'in *Daphnia magna* (Straus 1820) (Cladocera, Crustacea) üzerine akut toksik etkisinin araştırılması. Yüksek Lisans Tezi, Ankara Üniversitesi Fen Bilimleri Enstitüsü. Ankara, 57s.
- Dorval, J., Hontela, A., 2003. Role of Glutathione Redox Cycle and Catalase in Defense Against Oxidative Stress Induced by Endosulfan in Adrenocortical Cells Of Rainbow Trout (*Oncorhynchus mykiss*). *Toxicology And Applied Pharmacology*, 192:191–200.
- Durmaz, H., Sevgiler, Y., Uner, N., 2005. Tissue-specific antioxidative and neurotoxic responses to diazinon in *Oreochromis niloticus*. *Pesticide Biochemistry and Physiology*, 84: 215-226
- E. Beutler, *Red Cell Metabolism Manual of Biochemical Methods*, Academic Press, London, 1971.
- Elia, A.C., Waller W.T. ve Norton, S.J., Biochemical responses of Bluegill sunfish (*Lepomis macrochirus*, Rafinesque) to atrazine induced oxidative stres, *Bulletin of Environmental Contamination and Toxicology*, 68, 809–816, (2002).
- Figueiredo-Fernandes, A., Fontai'nhas-Fernandes, A., Peixoto, F., Rocha, E., Reis-Henriques, M.A.2006. Effects of gender and temperature on oxidative stress enzymes in Nile tilapia (*Oreochromis niloticus*) exposed to paraquat. *Pesticide Biochemistry and Physiology* 85: 97–103
- Gupta PK (2011) Herbicides and fungicides. In: Gupta RC (ed) *Reproductive and environmental toxicology*. Academic Press, London, pp 503–521
- Güven, K.C., *Deniz kirliliği, Türk Deniz Araştırma Vakfı, İstanbul*, (2005)
- Hill, J.R., 1989. Aquatic organisms and pyrethroids, *Pesticide Science*, 27 (4): 429–465
- Işık, I. ve Çelik, I., Acute effects of methyl parathion and diazinon as inducers for oxidative stress on certain biomarkers in various tissues of rainbow trout (*Oncorhynchus mykiss*), *Pesticide Biochemical Physiology*, 92, 1, 38–42, (2008).
- Kehrer, J.P., 1993. Free radicals as mediators of tissue injury and disease, *Critical Reviews in Toxicology*, 23 (1): 21– 48.



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Keramati, V., Shahla, J., Ramin, M. 2010. Effect of diazinon on catalase antioxidant enzyme activity in liver tissue of *Rutilus rutilus*. *Journal of fisheries and aquatic science*. 5(5): 368- 376

M. Kirici, C. Turk, C. Çağlayan, M. Kirici, Toxic effects of copper sulphate pentahydrate on antioxidant enzyme activities and lipid peroxidation of freshwater fish *Capoeta umbla* tissue, *Appl. Ecol. Environ. Res.*, 5, 1685-1696 (2017). DOI: http://dx.doi.org/10.15666/aer/1503_16851696

Ohkawa H, Ohishi N, Yagi K. 1979. Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. *Analytical Biochemistry* 95: 351-358.

Oruç, E.Ö., Sevgiler Y. ve Uner, N., Tissue-specific oxidative stress responses in fish exposed to 2,4-D and azinphosmethyl, *Comparative Biochemical Physiology*, 137, 1, 43–51 (2004).

Peña-Llopis, S., Dolores, F.M, Peña, J.B. 2003. Increased recovery of brain acetylcholinesterase activity in dichlorvosintoxicated European eels *Anguilla anguilla* by bath treatment with N-acetylcysteine. *Diseases of Aquatic Organisms*. 55: 237–245.

Sayeed, I., Parvez, S., Pandey, S., Bin-Hafeez, B., Haque, R., Raisuddin, S., 2003. Oxidative stress biomarkers of exposure to deltamethrin in freshwater fish, *Channa punctatus* Bloch. *Ecotoxicology and Environmental Safety* 56: 295–301.

Sun, Y., Oberley, L. W., Li, Y. (1988): A simple method for clinical assay of superoxide dismutase. *Clinical Chemistry* 34: 497–500.



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**ORIENTAL TÜTÜN TOHUMLARINA UYGULANAN
FARKLI PRIMİNG SÜRELERİNİN FİDE GELİŞİMİNE ETKİSİ**

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ÖZET

Tütün Solanaceae familyasına ait bir bitkidir. Birçok varyetesi bulunan bu bitkinin bugün dünyada önemli iki türü mevcuttur. *Nicotiana tabacum* L. tütün endüstrisinin hammadde olarak kullandığı bir diğeri ise daha sert içerikli *Nicotiana rustica* L.'dir. Araştırmamızda *Nicotiana tabacum* L. cv Birlik-128 tütün çeşidi deneme materyali olarak kullanılmıştır. Bu çalışma, 2021 yılında Ege Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü laboratuvar ve serasında saksı denemesi olarak tütün tohumuna uygulanan bazı iyileştirici ön uygulamaların fide kalitesine etkilerini belirlemek amacıyla gerçekleştirilmiştir. Tesadüf Parselleri Deneme Desenine göre dört tekerrürlü olarak yürütülmüştür. Tütün tohumlarına laboratuvar koşullarında priming olarak kontrol, 3, 6, 9, 12 ve 15 gün sürelerinde geleneksel adıyla “tohum çatlatma” uygulamasına tabi tutulmuş ve daha sonra saksılara ekim işlemi gerçekleştirilmiştir. Çalışmada, fide boyu (cm), yaprak sayısı (adet/bitki), gövde çapı (mm), kök uzunluğu (cm), yaş gövde ağırlığı (g/bitki), kuru gövde ağırlığı (g/bitki) gibi özellikler incelenmiştir. Araştırma sonuçlarına göre, fide boyu 13.1-19.4 cm, yaprak sayısı 6.4-10.3 adet/bitki ve gövde çapı 3.9-5.2 mm arasında değiştiği belirlenmiştir. Fide boyu, yaprak sayısı, gövde çapı, yaş ve kuru gövde ağırlığı özelliklerine ait en yüksek sonuçlar 6 gün priming uygulamasından; kök uzunluğu özelliğine ait en yüksek sonuç ise 3 günlük priming uygulamasından elde edilmiştir.

Anahtar Kelimeler: Tütün, Priming, Fide, Tohum Çatlatma, Fide Kalitesi



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**THE EFFECT OF DIFFERENT PRIMING TIMES APPLIED TO ORIENTAL
TOBACCO SEEDS ON SEEDLING DEVELOPMENT**

ABSTRACT

Tobacco is a plant in the Solanaceae family. There are many varieties of tobacco but today only two are prominently used. *Nicotiana tabacum* L. is the species that dominates the tobacco industry. The other *Nicotiana rustica* L. is much stronger variety. *Nicotiana tabacum* L. cv Birlik-128 variety was used research material. This study was carried out under controlled conditions at Ege University, Faculty of Agriculture, Department of Field Crops in 2021. The aim of the study was to examine the effects of different priming times applied to oriental tobacco seeds on seedling quality. The experiment was designed in a randomized parcel design with four replications. As priming to tobacco seeds in laboratory conditions; control, 3, 6, 9, 12 and 15 days, traditionally called "seed cracking", and then planted in pots. Some parameters were evaluated in the experiments such as length of the seedling (cm), number of the leaf (per/plant), stem diameter (mm), length of the root (cm), fresh stem weight (g/plant), dry stem weight (g/plant). According to the results of the research, it was determined that length of the seedling varied between 13.1-19.4 cm, the number of leaves 6.4-10.3 per plant, and the stem diameter between 3.9-5.2 mm. The highest results in terms of the length of the seedling, number of leaves, stem diameter, fresh and dry stem weight were obtained after 6 days of priming whereas the highest result of length of the root feature was obtained from the 3-day priming application.

Key Words: Tobacco, Priming, Seedling, Seed Cracking, Seedling Quality



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INTRODUCTION

Tobacco is an industrial plant with its own characteristics such as seedling, cropping and processing, compared to other arable crops. Therefore, it is very important its quality criteria besides the high yield. To obtain a high-quality tobacco, each stage must be well known from seedling to harvest and from harvest to processing.

According to 2020 statistics, 82.791 kg tobacco which is more than that of 50% of total production of Turkey, has been obtained from Aegean Region of Anatolia. In addition, oriental tobaccos is grown in six regions in Turkey. Considering the tobacco production properties in these regions, approximately Aegean (57.1%), Black Sea (11.4%), South East Anatolia (26.3%), Marmara (1.9%), Mediterrean (0.9%), East Anatolia (2.3%). In addition to this, Aegean Region has an important place in terms of foreign sales and 79.6% of the total tobacco exported was covered by the Aegean Region. Furthermore the region has sufficient agricultural land to meet requirement of the World's total oriental tobacco (Anonymous, 2020).

Tobacco production in Turkey has been decreasing sharply in the recent years. Just like tobacco production, tobacco yield also followed decreasing. There are many factors causing the decline in production. Such as reduction in the number of families producing tobacco, farmers usually be over the age of us 45 years and older consists of farmers, price policy, anti-smoking policy and the challenges of the agricultural practices. As well as, to grow tobacco in the same field every year and to use low purity seed are among the main factors in the decrease of the yield (Ekren and İlker, 2017).

Aegean tobaccos are grown in the region with the local name of Aegean Region tobaccos. The type has been cultivated in this region for more than 150 year (Wolf, 1962). Small leaf oriental or aromatic tobaccos and very small amounts of large leaf tobaccos has grown in our country because of suitable for soil type and climatic conditions. The harvested tobacco leaves are sun-cured and chracteristics golden yellow leaves have a high aroma and low total alcaloid (nicotine) content. (Gumus Guler, 2008).

The material of the research subject includes increasing the seed germination and seedling quality with some preliminary applications to be applied to the seeds of the tobacco plant, which has been produced in various regions of Turkey for many years and has a very important contribution to the country's economy, and the transfer of the results of these applications to the producer size in the future. In this study, it was aimed to investigate the effect of priming times



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applied to Birlik-128 tobacco seed, which is an important commercial variety in tobacco production in the Aegean Region, on seedling quality.

MATERIAL and METHODS

Location of experimental site

Experiment was conducted in the 2021 seedling growing seasons at the pot experiment of Agricultural Faculty at Ege University, in the province Bornova, in the city İzmir

The research carried out in two stages;

1. Stage: Priming application to seeds in the tobacco laboratory of the Field Crops Department
2. Stage: Seed sowing and seedling growing at pot experiment in the greenhouse

Plant material

Nicotiana tabacum L. cv Birlik-128 was used as the research material in this study.

METHOD

The study was carried out in 2 stages, laboratory and pot. The laboratory and pot experiments were carried out according to randomized completely parcel design (RCPD) with four replications.

1. Priming Application

Tobacco seeds in a total of 24 (6 Factors x 4 Replicates) petri dishes were subjected to priming application at laboratory conditions on 26th February 2021. Priming times were determined as the trial factor and control was carried out for 3 days, 6 days, 9 days, 12 days and 15 days. In the application, blotting papers were placed in petri dishes and 100 seeds were placed in 1 petri dish. Then, pure water was added to these petri dishes and allowed to germinate.

2. Pot Stage

Tobacco seeds that have completed the laboratory stage were sown in a total of 24 pots prepared with 1/3 sand + 1/3 soil + 1/3 farm manure in the greenhouse of Ege University Faculty of Agriculture Field Crops Department in 2021. 10-20 seeds were sown in each pot (Table 1).



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Table 1. Seed Sowing Dates According to Priming Times

<i>Priming Times</i>	<i>Seed Sowing</i>
Control	26 th February 2021
3 day	1 th March 2021
6 day	3 rd March 2021
9 day	5 th March 2021
12 day	8 th March 2021
15 day	10 th March 2021

After sowing, 2-3 mm of cover fertilizer was added to each pot, and irrigation was continued until germination and emergence appeared, so that the soil moisture was not lost. These processes continued until the beginning of the analysis of the seedlings.

First germination dates of seeds; control and 6 day priming 12th March 2021; 3 and 9 day priming 15th March 2021; 12 and 15 day priming 19th March 2021. Weeding and irrigation in pots continued at regular intervals. Thinning was done in seedling pots on April 16th, 2021. Tobacco seedlings were pull out when they reached 15-20 cm lenght and the following features were examined.

In this study some features were determined such as lenght of the seedling (cm), number of the leaf (per/plant), stem diameter (mm, lenght of the root (cm), fresh stem and root weight (g/plant), dry stem and root weight (g/plant) (Ekren and İlker, 2017).

Statistical analysis: The data for all traits were analyzed by the analysis of variance by Acikgoz et al. (2004).

RESEARCH RESULTS and DISCUSSION

The effect of priming applied to tobacco seeds on the number of leaves is given in Figure 1. Significant differences were found among the priming times. It is seen that the number of leaves varies between 6.4-10.3 per/plant. It was determined that the highest number of leaves was 10.3 per/plant for 6 days and the lowest number of leaves was 6.4 per/plant from seeds exposed to seed cracking pre-treatment for 15 days (Figure 1). Our results showed a similarity to the results given by Ekren and Yalman, 2019 and Ekren and Gungor, 2020.

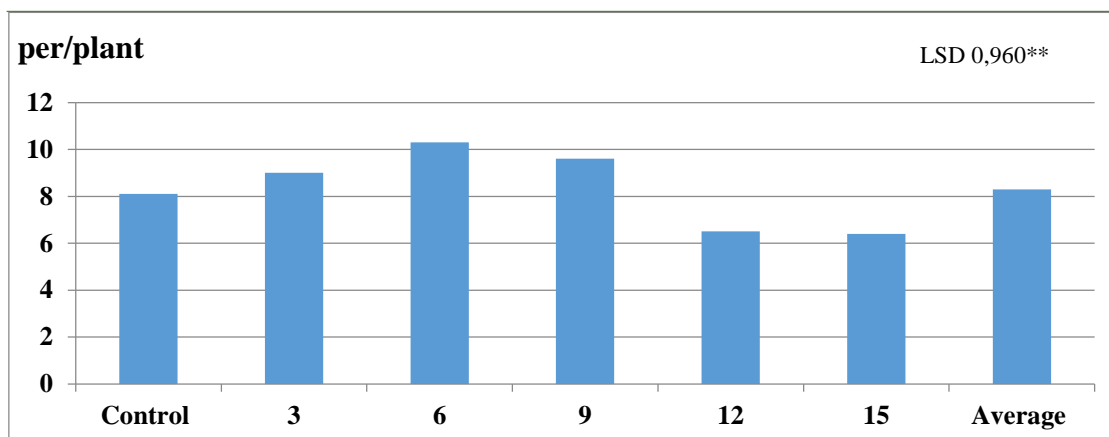


Figure 1. The Effect of Priming Application on Tobacco Seeds on the Number of Leaves
It is seen that the seedling length varies between 13.1-19.4 cm. The longest length of the seedling of 19.4 cm was obtained from seeds exposed to priming for 6 days (Figure 2). Length of the seedling mostly depends on living space for development of the plant, number of the plants per m², agro-technological measures as well as technology of seedlings production (Pearce et al., 2005). Kabranova et al. (2014) indicates that the length of stem is appropriate as well as number of leaves and if phosphate level kept lower, top and root growth present a better balance. In other studies, length of the seedling was found to be change from 6 cm to 21 cm (Turi et al., 2004; Ayan and Caliskan, 2006; Hou-Long et al., 2014). The results were consistent with these scientists.

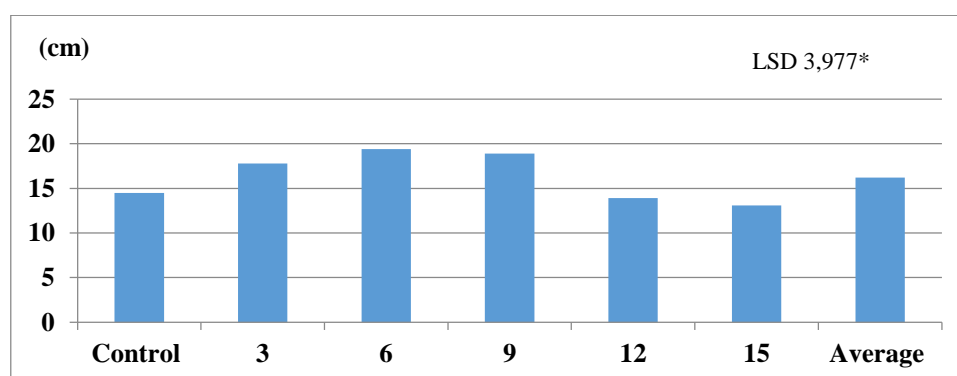


Figure 2. The Effect of Priming Application on Tobacco Seeds on the Length of the Seedling
Stem diameter was affected by the priming times. The lowest stem diameter was observed with 3.9 mm in the seeds primed for 15 days. Stem diameters were found in in control and 12-day seeds as 4.2 mm and 4.3 mm; and in seeds primed for 3 days and 9 days as 4.9 mm and 5.0 mm, respectively. The highest stem diameter value of 5.2 mm was determined in the seeds that were primed for 6 days (Figure 3). According to the Kabranova et al. (2014) great stem diameter



is a great potential for further plant development. Stem diameter was obtained between 4.1 mm and 5.7 mm in Prilep NS72 and Yaka 125/3 tobacco varieties. Turi et al. (2004) was found that stem diameter changed from 2.6 mm to 4.1 mm. Our results were lower than these scientists because the stem diameter has been affected by the tobacco variety which was used. However, The results were consistent with Ekren and Yalman (2019) and Ekren and Gungor (2020).

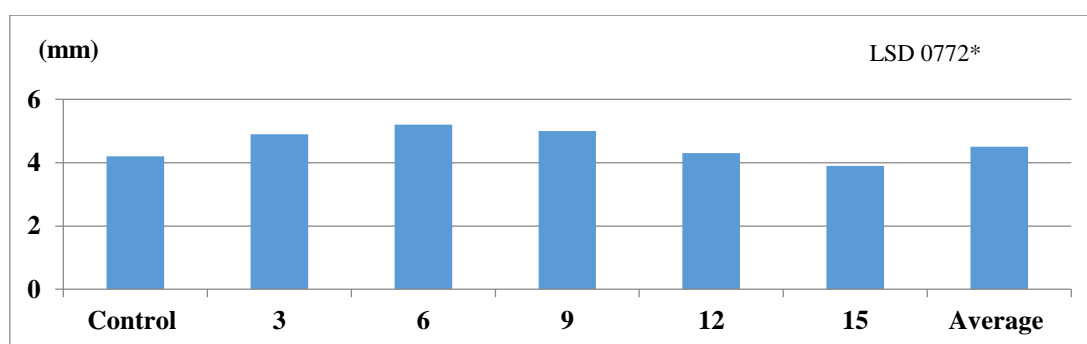


Figure 3. The Effect of Priming Application on Tobacco Seeds on the Stem Diameter. The results of length of the root, the fresh and dry stem weight were shown that Table 2. According to the results, priming effect was not statistically significant on these parameters. Length of the root was found to be higher in 3 days of priming compared to other priming times. When root lengths were examined, it was determined that it was 4.8 mm in 15 days, 5.0 mm in 12 days, 5.2 mm in control planted, 5.3 mm in 9-days, 5.5 mm in 6-days and 6.3 mm in 3-days (Table 2). The results of the length of the root we found in our study were higher than the results of Ekren and Yalman (2019) and Ekren and Gungor (2020) because it can be said that it is due to the different seed sowing times.

It is seen that the highest fresh stem weight is 9.9 g/plant in 6-day priming application. The lowest dry stem weight was obtained from Control and 15-day priming applications as 6.1 g/plant. Considering the average dry stem weight values during priming periods, it is observed that it varies between 0.34-0.93 g/plant. While priming period with the lowest stem weight is 0.34 g/plant, 15 days, 6 days with 0.93 g/plant has the highest dry stem weight (Table 2). The results of the length of the root we found in our study were higher than the results of Ekren and Yalman (2019) because it can be said that it is due to the different seed sowing times.



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Table 2. The Effect of Priming Application on Tobacco Seeds on the Length of the Root, Fresh Stem Weight and Dry Stem Weight

<i>Priming Times</i>	<i>Length of the Root (cm)</i>	<i>Fresh Stem Weight (g/plant)</i>	<i>Dry Stem Weight (g/plant)</i>
Control	5.2	6.1	0.41
3	6.3	7.9	0.57
6	5.5	9.9	0.93
9	5.3	8.0	0.63
12	5.0	7.5	0.46
15	4.8	6.1	0.34
Average	5.3	7.5	0.55
LSD	ns	ns	ns

CONCLUSIONS

This study was carried out to improve the germination performance of tobacco seeds before planting, to improve seedling quality and development, and to emergence rapid and homogeneous germination in a short time. The "seed cracking" germination improvement pre-treatment to tobacco seeds at different times, it was determined that this priming application made before planting for tobacco seeds could be used successfully. When the results obtained in this respect are examined, it is noteworthy that the number of leaves, length of the seedling, stem diameter, fresh stem weight, dry stem weight values, which are formed at a high rate by the application of seeds for 6 days before sowing. However, this study was carried out in pot conditions and it is thought that it would be appropriate to evaluate the findings obtained from the field by growing the study in nursery conditions and transplanting the existing seedlings to the field.



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LITERATURE

Acikgoz, N., E. Ilker and A. Gokcol. 2004. Assessment of Biological Research on the Computer. ISBN: 973-483-607-8 Ege University Seed Technology Center, Publication No: 2 Bornova-Izmir, Turkey (in Turkish).

Anonim, 2020. www.tarimorman.gov.tr (Accessed date: 4th October 2021)

Ayan, A.K. and O. Caliskan. 2006. Seedling quality of flue-cured tobaccos as affected by different types of peat. Communications in Biometry and Crop science. Vol. 1, No. 1, pp. 56-62.

Ekren, S., E. İlker, 2017. The Influence of Clipping Application on Yield and Some Yield Parameters of Aegean Types Tobaccos. Turkish Journal of Field Crops 22(2), 218-226.

Ekren, S., H. B. Yalman, 2019. Effects of Some Plants Nutrients Applied to Seedbed Compost on Seedling Quality. Avrupa Bilim ve Teknoloji Dergisi. Sayı: 16. ss.515-521

Gumus Guler, S. 2008. Economic analysis of oriental tobacco in Turkey. Bulgarian Journal of Agricultural Science, 14 (No 5), 470-475.

Hou-Long, J., I. Na-Jia, X. An-ding, Y. Chao, W. Hong-Feng, C. Hai-Tao, S. Pei-Xiang, D. Wei. 2014. Development of closed-type transplant production system and discussion of its application mode for flue-cure tobacco. Australian Journal of Crop Science. AJCS 8(11): 1566-1570. ISSN:1835-2707.

Kabranavo, R., Z. Arsov, Z. Dimov and M. Spirkovska. 2014. Impact of float tray technology on quality of oriental tobacco seedling. 49th Croatian&9th International symposium on Agriculture. P.362-366. Dubrovnik/Croatia.

Pearce, B., G. Palmer, W. Nesmith, L. Townsend. 2005. Guide management of tobacco float systems, Cooperative Extension Service-University of Kentucky-Clooege of Agriculture. ID-132; pp.8.

Turi, I., D. Hamel, H. Mesi, R. Sanz, V. Radulovi. 2004. Phase out of methyl bromide in production of tobacco seedlings in Croatia. Tütün/Tobacco. Vol:54, No:11-12, 252-256. ISSN: 0494-3244.

Wolf, F.A., 1962. *Aromatic or Oriental Tobaccos*. Duke University Press. Durham. N.C.



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**THE CURRENT STATUS AND THE FUTURE OF THE LIVESTOCK SECTOR IN
TURKEY**

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ABSTRACT

The study aims to reveal the current livestock sector structure of Turkey, to make predictions about the general economic situation and future. In the study, statistical data, reports, and legislation related to the number of animals in the livestock sector, animal production, export, and import quantities were used. It is foreseen that cattle breeding and sheep and goat breeding in Turkey will increase gradually until 2030 and the total number of animals will reach 74,766. When the SWOT analysis of the livestock sector is examined, the most striking element of the opportunities is the high labor productivity, the continuous increase in the market growth rate, and the increasing trend of meat and milk consumption. The biggest threats to come are wrong or untimely policies and insufficient support. The imbalance in milk and feed prices is one of the biggest problems of producers. Structural problems in the sector must be eliminated for the livestock sector to contribute to the development and development of Turkey and to be able to compete with the world.

Key Words: Livestock industry, Animal production, Trend analysis, SWOT analysis, Turkey



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1.INTRODUCTION

Agriculture: It is explained as multi-faceted production activities that include animal husbandry, forestry, and aquafarming as well as crop production (Nigar, 2018). In other words, to provide food and raw materials to society, it is defined as the planned and directed use of biological production capabilities of plant and animal assets (Olalı and Duymaz, 1987; Gürler, 2010). The agricultural sector is a sector that produces various nutrients, diversifies the nutrients by processing these substances, meets the needs of consumers for these substances, and therefore has a significant impact on the health and development of societies (Doğan et al., 2015).

The increasing population and changing consumption habits have led to many countries' intensification and expansion of plant and animal production activities. Due to increased agricultural activities, biodiversity is being damaged globally and agricultural sustainability is under threat (et al., 2017). Changing production patterns, increased crop production, soil pressure, and overgrazing on pastures have jeopardized food production and lead to soil degradation. In particular, the livestock sector is shown as the most important sector which is effective in soil degradation (Durning and Brough, 1991). Animal production accounts for 26% of the world's terrestrial surface and represents approximately 3.38 billion hectares of permanent meadows and pastures worldwide (Foley et al., 2011).

The population has surpassed livestock and wildland mammals in the world (Bar-On et al., 2018). Therefore, increased demand for meat and dairy products has resulted in an increase of approximately 150-450% in the number of animals produced globally. Livestock is an alternative risk reduction strategy in plant production enterprises and an important food source for small enterprises (Thornton, 2010). Animal products contribute 33% to protein consumption globally. However, this rate varies according to the level of development of the countries. In particular, there are large differences between richer and poorer countries (Fonseca et al., 2012). In developed and developing country economies, while the share of industry and service sectors in production increases, the share of the agricultural sector, which consists of livestock, fisheries, and plant production under the name of food production, decreases. In the Turkish economy, approximately 76.3% of agricultural production is plant-based, while 23.7% is animal-based production (Peşmen and Yardımcı, 2008). Another trend in the sector is that as the development level of countries increases, it is known that they turn from plant production to animal-based production in the composition of agricultural production. Livestock is the



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locomotive of the agricultural economy in developed countries (Nigar, 2018). The reason behind this trend; low-cost employment of livestock. It is of great importance in terms of converting poor quality feed resources that are not suitable for human nutrition into quality human food. In this context, livestock is considered as one of the sectors that creates the highest added value for unit investment (Ünlüsoy et al., 2010). The first three countries with the lowest share of the agricultural sector, consisting of crops, livestock, and fisheries, in GDP in the European Union member countries and Turkey, are respectively Luxembourg with 0.22%, Malta with 0.65%, and Germany with 0.6 (FAO, 2021a).

This study, it is aimed to reveal the current livestock sector structure of Turkey and to make predictions about the general economic situation and future. In addition, the number of animals in Turkey, the developments in animal product production and trade, and the possible number of animals in the future, the production, and business of animal products have been tried to be analyzed.

MATERIAL and METHOD

With this study, predictions will be made about the current situation and future of the livestock sector structure in Turkey. For this purpose, the number of animals whose meat can be eaten, the number of bovine and ovine animals, the production and consumption of red meat obtained from bovine and ovine animals, and the trade volumes of animal products were used as indicators. These indicators were obtained from the databases on the official website of the Turkish Statistical Institute (TUIK) and the Food and Agriculture Organization (FAO).

In the research, The SWOT analysis was carried out to determine the current situation of the livestock sector in Turkey. The SWOT analysis is a technique that includes the analysis of the internal and external situation of a country or region, and the investigation of the factors that are the subject of the analysis (Aktan, 2006; Tapkı, 2015). SWOT Analysis; It is a method in which the current structure of the institution, country, region, its competitors, and the market are researched extensively, the competitiveness is measured and strategies are determined according to the emerging situation (Emeksiz, 1999). In this analysis technique, a table is created in which strengths and weaknesses, opportunities and threats are given as items, and these items are examined under separate headings. Evaluations are made according to the results (Tapkı, 2015; Seçer and Emeksiz, 2019). In this study, the necessary data to perform SWOT analysis were presented by using the information obtained from the literature and statistical



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institutions. It is possible to find many studies in the literature using SWOT analysis (Ommami, 2011; Durmuş, 2016; Arun and Ghimire, 2018; Farzana et al., 2018; Bahtera and Hayati, 2020; Kurmanalina et al., 2020; Küçük and Tapki, 2020; Vineer et al., 2020; Mohan, 2021).

In addition, trend analysis was carried out to determine the future of the livestock sector in the study. Trend analysis, which is one of the time series methods, shows the development of the series in a certain direction in the long run (Yüzer et al., 2003). In the analysis, the series is freed from the effects of irregular, seasonal and cyclical movements, and the values under the influence of a long period are obtained. Then, by determining the shape of the trend with these data, it is aimed to find the parameters in the function that can represent it. Thus, it becomes possible to make predictions for the future period with the equation found. In the analyzes made, linear (linear), quadratic (quadratic), exponential, and s-curve (s-curve) trend models in Minitab 17.1.0 program were tested. As the accuracy criteria of the results obtained; MAPE-mean absolute percentage error, MAD-mean absolute deviation, and MSD-mean squared deviation were used. In these models, the mathematical model with the lowest calculated values according to the MAPE, MAD, and MSD accuracy criteria was preferred (Minitab, 2013).

RESEARCH FINDINGS

The presence of cattle and sheep and goats in Turkey by years is given in Table 1. There has been no significant change in the presence of animals over the years. From 2001 to 2019, there was an increase of 68% in the number of cows, 38% in the number of sheep, and 60% in the number of goats. In 2030, the number of cows is expected to be 20,944 thousand, the number of sheep is 39,801 thousand, and the number of goats is 14,021 thousand. In other words, it has been determined that the number of cows will increase by 25%, the number of sheep by 18%, and the number of goats by 27% compared to 2019. Considering the population of Turkey in 2020, it is 83,614,362 people. In 2030, it has been determined that the population will increase by 5.76% and will reach 88,427,604 (TÜİK, 2021). Depending on the increase in the world population, nutrition and food problems are also increasing. Balanced nutrition and adequate animal protein intake have become the priority issue of developed and developing countries, therefore the livestock sector has maintained its strategic importance despite developing technology and industrialization policies (TEPGE, 2020a). The level of consumption of animal products is considered as an indicator of the development and welfare level of the countries. The reason is that the importance of animal protein foods such as meat, milk, eggs in human



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nutrition. The egg is one of the largest products of poultry production, one of the nutritious and complete foods for humans (Gokdogan and Baran, 2019). The increase in the demand for animal foods and the use of developing technology have made the livestock sector one of the fastest-growing sectors in the world, which constitutes the livelihood of approximately 1.5 billion people (TEPGE, 2020a).

Table 1. Number of cattle, sheep and goats in Turkey (thousand units, head)

Years**	Cattle	Sheep	Goat	Total
2001	10,548	26,972	7,022	44,542
...
2010	11,370	23,090	6,293	40,753
2011	12,386	25,032	7,278	44,696
2012	13,915	27,425	8,357	49,697
2013	14,415	29,284	9,226	52,925
2014	14,223	31,140	10,345	55,708
2015	13,994	31,508	10,416	55,918
2016	14,080	30,984	10,345	55,409
2017	15,944	33,678	10,635	60,256
2018	17,043	35,195	10,922	63,160
2019	17,688	37,276	11,205	66,170
2020*	16,769	33,835	11,020	61,624
2021*	17,187	34,431	11,320	62,938
2022*	17,604	35,028	11,621	64,253
2023*	18,022	35,625	11,921	65,567
2024*	18,439	36,221	12,221	66,881
2025*	18,857	36,818	12,521	68,195
2026*	19,274	37,415	12,821	69,509
2027*	19,692	38,011	13,121	70,824
2028*	20,109	38,608	13,421	72,138
2029*	20,527	39,205	13,721	73,452
2030*	20,944	39,801	14,021	74,766

**Data for trend analysis were taken from 2001.

Source: TSI, 2021

In the agricultural sector, poultry farming has an important place in addition to cattle and sheep farming. Poultry farming is very important in the livestock sector due to its easy and less costly production, white meat being an important protein source for human health, and its price being more affordable than red meat (Keskin and Demirbaş, 2012; Cebeci, 2019; Saçlı, 2020). Table 2 shows the changes in the number of poultry in Turkey. In 2019, meat chicken constitutes 63.6%, laying chickens 34.6%, and others 1.8% of poultry in Turkey. From 2001 to 2019, there was an increase of approximately 144.07% in the number of laying hens, 159.68% in the number of broiler chickens, and 29.07% in the number of turkeys. There was a -32.48% decrease in the number of geese and a decrease of -52.08% in the number of ducks. This shows



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that the demand for chicken meat has increased. Broiler stock, which reached its highest level of 229.5 million in 2018, decreased by 3.3% in 2019.

Table 2. Number of poultry in Turkey (Head)

Years**	Laying hen	Broiler hen	Turkey	Goose	Duck
2001	55,675,750	161,899,442	3,254,018	1,397,560	913,748
...
2010	70,933,660	163,984,725	2,942,170	715,555	396,851
2011	78,956,861	158,916,608	2,563,330	679,516	382,223
2012	84,677,290	169,034,283	2,760,859	676,179	356,730
2013	88,720,709	177,432,745	2,925,473	755,286	367,821
2014	93,751,470	199,976,150	2,990,305	911,990	399,820
2015	98,597,340	213,658,294	2,827,731	850,694	398,387
2016	108,689,236	220,322,081	3,182,751	933,353	413,841
2017	121,556,027	221,245,322	3,872,460	978,384	491,561
2018	124,054,810	229,506,689	4,043,332	1,080,190	532,841
2019	120,725,299	221,841,860	4,541,102	1,157,049	519,575
2020*	120,725,299	221,841,860	4,541,102	1,157,049	519,575
2021*	111,114,792	242,173,857	3,386,660	685,097	202,941
2022*	113,427,938	246,307,985	3,384,294	649,703	166,243
2023*	115,741,084	250,442,113	3,381,928	614,310	129,546
2024*	118,054,230	254,576,241	3,379,562	578,917	92,848
2025*	120,367,376	258,710,369	3,377,196	543,524	56,150
2026*	122,680,522	262,844,497	3,374,830	508,130	19,452
2027*	124,993,668	266,978,625	3,372,464	472,737	-17,246
2028*	127,306,814	271,112,753	3,370,098	437,344	-53,943
2029*	129,619,960	275,246,881	3,367,732	401,950	-90,641
2030*	131,933,106	279,381,009	3,365,366	366,557	-127,339

**Data for trend analysis were taken from 2001.

Source: TSI, 2021

According to the World Health Organization (WHO) data, a healthy person should consume 1 gram of protein per kilogram of body weight per day, of which 42% should be of animal origin (TİGEM, 2018). Meat farming can be done based on extensive and beef breeds on large pastures or large lands with cheap feed raw material production (Saygın and Demirbaş, 2017). In Turkey, a significant portion of red meat is obtained from dairy or combined productive breeds. Livestock is carried out in small-scale enterprises and with plant production activities (Saçlı, 2020). Turkey's red meat production increased by 175% in 2019 compared to 2001.

In Turkey, the number of milked animals and the increase in yield have increased in the amount of milk production over the years. Depending on the increase in the amount of milk production, the number of dairy products has also increased (TEPGE, 2020b). Compared to 2001, milk production increased by 141.8% in 2019.

Chicken meat production increased by 141.8% compared to 2001. More than half (56.4%) of meat chickens are concentrated in 5 provinces. While Manisa is the province with the highest



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share of meat chickens with a share of 12.6%, Sakarya 12.6%, Balıkesir 11.6%, Bolu 10.8%, and Mersin 8.7% are other important provinces.

The amount of chicken egg production in Turkey increased by 1.3% compared to the previous year and reached its highest level in 2019. The production amount of chicken eggs in 2019 was 1.2 million tons and 19.9 billion pieces on a piece basis (TEPGE, 2020c). Protein amounts in animal foods are 15-20% in meat, 19-24% in fish, 12% in eggs, 3-4% in milk, and 15-25% in cheese. For a healthy diet, animal products such as red meat, white meat, milk, eggs should be consumed regularly (TİGEM, 2018). Compared to 2001, the production of chicken eggs increased by 88.16% in 2019.

Table 3. Amount of Animal Production in Turkey (Tone)

Years**	Red meat (Tone)	Milk (Tone)	Chicken Meat (Tone)	Chicken Egg (Thousand Pieces)	Honey (Tone)	Wet Silk Cocoon (Tone)	Fleece (Tone)	Hair (Tone)	Mohair (Tone)
2001	435,778	9,495,550	614,745	10,575,046	60,190	47	40,909	2,684	400
...
2010	780,718	13,543,674	1,444,059	11,840,396	81,115	126	42,823	2,607	200
2011	776,915	15,056,211	1,613,309	12,954,686	94,245	151	46,586	3,062	194
2012	915,844	17,401,262	1,723,919	14,910,774	89,162	134	51,180	3,570	200
2013	996,125	18,223,713	1,758,363	16,496,751	94,694	121	54,784	4,902	260
2014	1,008,272	18,630,859	1,894,669	17,145,389	103,525	80	58,402	5,460	280
2015	1,149,262	18,654,682	1,909,276	16,727,510	108,128	115	59,196	5,569	325
2016	1,173,042	18,489,161	1,879,018	18,097,605	105,727	103	58,168	5,518	340
2017	1,126,403	20,699,893	2,136,734	19,281,196	114,471	102	63,315	5,797	356
2018	1,118,695	22,120,716	2,156,671	19,643,711	107,920	94	66,428	5,999	371
2019	1,201,469	22,960,379	2,138,451	19,898,126	109,330	90	70,588	6,162	380
2020*	1,286,418	22,785,491	2,346,479	19,740,691	115,480	105	65,638	6,100	302
2021*	1,340,134	23,563,250	2,438,925	20,260,114	118,133	104	67,112	6,334	303
2022*	1,393,850	24,341,009	2,531,370	20,779,537	120,786	102	68,585	6,567	305
2023*	1,447,566	25,118,768	2,623,816	21,298,960	123,439	101	70,058	6,801	306
2024*	1,501,282	25,896,527	2,716,262	21,818,383	126,092	100	71,532	7,034	308
2025*	1,554,999	26,674,286	2,808,708	22,337,806	128,745	98	73,005	7,268	309
2026*	1,608,715	27,452,045	2,901,153	22,857,229	131,398	97	74,479	7,501	311
2027*	1,662,431	28,229,804	2,993,599	23,376,652	134,052	96	75,952	7,735	312
2028*	1,716,147	29,007,563	3,086,045	23,896,075	136,705	95	77,425	7,968	314
2029*	1,769,863	29,785,322	3,178,490	24,415,498	139,358	93	78,899	8,202	315
2030*	1,823,579	30,563,081	3,270,936	24,934,921	142,011	92	80,372	8,436	317

**Data for trend analysis were taken from 2001.

Source: TSI, 2021

Export values of cattle, chickens, goats, and sheep are given in Table 4. The import status for 2019 is cattle 3,805 head, chickens 23,358 thousand head, goat 1,964 head, and sheep 244,326 head. In 2030, it is estimated that chicken will be 149,113 heads and sheep will be 1,038,686 heads.



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Table 4. Turkey Exports Cattle, Sheep, Goat, Chickens

Years**	Cattle (head)	Chickens (Thousand head)	Goats (Head)	Sheep (Head)
2001	18,041	2,809	38623	433044
...
2010	7	6,336	0	0
2011	0	4,573	0	0
2012	84	3,807	0	1,096
2013	379	13,778	898	0
2014	667	28,224	376	8,107
2015	9	40,589	13	4,500
2016	0	31,589	123	0
2017	0	52,078	0	0
2018	350	62,335	177	16,130
2019	3,805	23,358	1,964	244,326
2020*	-21,301	57,376	-5,522	199,435
2021*	-23,163	64,579	-6,421	255,869
2022*	-25,025	72,220	-7,319	318,412
2023*	-26,887	80,299	-8,217	387,064
2024*	-28,748	88,816	-9,115	461,825
2025*	-30,610	97,771	-10,014	542,696
2026*	-32,472	107,164	-10,912	629,676
2027*	-34,333	116,994	-11,810	722,765
2028*	-36,195	127,262	-12,708	821,963
2029*	-38,057	137,969	-13,607	927,270
2030*	-39,919	149,113	-14,505	1,038,686

**Data for trend analysis were taken from 2001.

Source: TSI, 2021

Cattle, chickens, goat, and sheep import values are given in Table 5. The import status for 2019 is cattle 547,950 head, chickens 41 thousand head, goat 1.614 head, and sheep 137,495 head. In 2030, it is estimated that cattle will be 2,952,769 heads, chicken 1,960,000, goats 2,508 and sheep 1,038,686.



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Table 5. Turkey Import of Cattle, Sheep, Goats, Chickens

Years	Cattle (head)	Chickens (Thousand head)	Goats (Head)	Sheep (Head)
2001	290	2,945	0	200
...
2010	140,045	3,343	155	234,819
2011	470,796	4,517	268	1,447,496
2012	471,571	5,755	440	405,186
2013	193,807	3,430	2,935	92,835
2014	50,072	3,023	1,175	14,476
2015	203,077	3,174	690	2,387
2016	494,194	1,341	610	4,689
2017	895,810	1,370	0	280,669
2018	1,460,793	1,245	0	425,507
2019	547,950	41	1,614	137,495
2020*	1,086,074	2,182	1,563	322,386
2021*	1,232,011	2,160	1,657	338,594
2022*	1,386,999	2,137	1,752	354,803
2023*	1,551,039	2,115	1,846	371,011
2024*	1,724,131	2,093	1,941	387,219
2025*	1,906,275	2,071	2,035	403,427
2026*	2,097,470	2,049	2,130	419,636
2027*	2,297,717	2,027	2,224	435,844
2028*	2,507,016	2,004	2,319	452,052
2029*	2,725,367	1,982	2,414	468,261
2030*	2,952,769	1,960	2,508	484,469

**Data for trend analysis were taken from 2001.

Source: TSI, 2021

Cattle meat export in 2019 is 1,642 tons. In 2030, it will decrease by 8.03% to 4,295. Sheep and goat meat export is 533 tons and in 2030 it will decrease by 86.63%. Chicken meat exports, which reached a record level of 4,670 tons in 2018, decreased by 6.08% in 2019 compared to the previous year. More than half of chicken meat exports have been made to Iraq for the last 10 years, and Iraq's export share is 53.8% in 2019. Iraq is followed by Hong Kong with 8.4%, Libya with 4.7%, and Congo with 4.2% (TEPGE, 2020c).

The export amount of chicken eggs, which reached its highest level with 360,298 tons in 2018, decreased in 2019. Egg exports, which decreased by 23.78% compared to the previous year, decreased to 275,170 tons. Chicken eggs constitute almost all of the shell eggs exported in Turkey. While 91.8% of these eggs are table (fresh) eggs, 8.2% are hatching and breeding eggs (TEPGE, 2020c).



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Table 6. Turkey Red Meat, Milk, Chicken Meat, Egg Export (Tonnes)

Years**	Cattle Meat	Sheep and Goat Meat	Chicken Meat	Turkey, Goose, Duck Meat	Egg
2001	93	658	21,256	333	18,533
....
2010	704	5	235,037	1,971	206,282
2011	1,390	14	302,175	3,750	244,095
2012	2,257	11	364,305	5,575	281,370
2013	2,709	3	403,962	7,507	289,551
2014	1,736	18	340,151	3,712	217,936
2015	1,063	65	320,191	4,347	289,365
2016	1,170	58	421,370	7,217	348,232
2017	1,642	48	479,618	9,756	360,928
2018	4,670	533	508,778	13,362	275,107
2019	2,665	76	506,208	9,009	373,663
2020*	2,828	76	536,112	9,567	395,663
2021*	2,991	75	566,017	10,125	417,663
2022*	3,154	75	595,922	10,683	439,663
2023*	3,317	74	625,826	11,241	461,664
2024*	3,480	74	655,731	11,799	483,664
2025*	3,643	73	685,635	12,357	505,664
2026*	3,806	73	715,540	12,915	527,664
2027*	3,969	72	745,445	13,473	549,664
2028*	4,132	72	775,349	14,031	571,664
2029*	4,295	71	805,254	14,589	593,664

Source: FAO, 2021b

Cattle meat import in 2019 is 6,665 tons and it is estimated to be 49,074 tons in 2030. Sheep and goat meat import are 420 tons and in 2030 it will decrease by 75.87%.

Although the Turkish poultry sector is self-sufficient and exporter in terms of chicken meat production, it is dependent on foreign sources in terms of breeding materials. All broiler breeders are imported. In addition to this, crossing studies were started by bringing 5 pure broiler lines from abroad, and the first domestic broiler line called Anadolu-T was obtained (TEPGE, 2020c). Chicken meat imports are 44,150 tons and will decrease by 55.92% in 2030. In Turkey, which is foreign-dependent in terms of breeding eggs, all of the egg imports consist of hatching/breeding eggs. Egg import status in 2019 is 4,170 tons. The most important country where egg imports are made is the United Kingdom; 72.9% of egg imports in 2019 was made



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from this country. Hungary is the other important country that accounts for 9.5% and the USA 8.7% (TEPGE, 2020c).

Table 7. Turkey Red Meat, Milk, Chicken Meat, Egg Import

Years**	Cattle Meat	Sheep and Goat Meat	Chicken Meat	Turkey, Goose, Duck Meat	Egg
2001	0	202	108	0	1,398
...
2010	50,689	0	463	35	1,006
2011	110,771	0	539	44	1,106
2012	25,541	0	414	40	581
2013	6,289	0	361	68	1,326
2014	901	0	322	95	2,073
2015	18,094	0	927	30	1,863
2016	6,074	0	85	18	1,914
2017	18,881	0	2,755	69	1,774
2018	55,774	0	5,899	109	2,897
2019	6,665	420	44,150	333	4,170
2020*	32,427	67	11,267	137	2,229
2021*	34,091	71	12,086	145	2,285
2022*	35,756	74	12,905	154	2,340
2023*	37,421	77	13,725	162	2,395
2024*	39,086	81	14,544	171	2,451
2025*	40,750	84	15,363	180	2,506
2026*	42,415	88	16,183	188	2,561
2027*	44,080	91	17,002	197	2,617
2028*	45,745	94	17,821	205	2,672
2029*	47,410	98	18,641	214	2,728
2030*	49,074	101	19,460	223	2,783

Source: FAO, 2021b

Looking at the import figures for 2019, milk is 456 tons, milk powder is 1.017 tons, butter is 32,307 tons and cheese is 10,863 tons. In 2030, it has been estimated as 6,746 tons of milk, 32,490 tons of butter, and 15,180 tons of cheese.



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Table 8. Turkey's milk and dairy products import situation

Years**	Milk	Milk Powder	Butter	Chesee
2001	22	2,628	1,683	3,716
...
2010	269	12,462	11,749	5,177
2011	114	2,683	10,666	5,937
2012	167	73	15,139	6,796
2013	154	43	19,616	7,821
2014	497	81	22,157	9,798
2015	207	106	19,165	11,512
2016	67	180	13,521	10,766
2017	279	118	9,572	9,735
2018	976	138	10,068	8,219
2019	456	1,017	32,207	10,863
2020*	3,642	-775	21,940	10,949
2021*	3,953	-1,507	22,987	11,372
2022*	4,263	-2,239	24,034	11,795
2023*	4,574	-2,972	25,081	12,218
2024*	4,884	-3,704	26,128	12,641
2025*	5,194	-4,436	27,175	13,064
2026*	5,505	-5,169	28,221	13,487
2027*	5,815	-5,901	29,268	13,910
2028*	6,125	-6,633	30,315	14,334
2029*	6,436	-7,366	31,362	14,757
2030*	6,746	-8,098	32,409	15,180

Source: FAO, 2021b

Milk export (milk and cream subject to foreign trade) in Turkey increased by 21% in 2019 compared to the previous year and was calculated as 30.490 thousand tons. As of 2019, 45.9% of Turkey's milk exports were to Libya (30.4%), Iraq (12.6%), and Qatar (2.9%) (TEPGE, 2020b). In 2019, imports of powdered milk are 42,640 tons, butter is 27,394 tons and cheese is 34,964 tons. In 2030, it was estimated to be 55,663 tons of milk powder, 10,922 tons of butter, and 54,417 tons of cheese.



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Tablo 8. Turkey's milk and dairy products export situation

Years**	Milk	Milk Powder	Butter	Chesee
2001	342	168	116	4,730
...
2010	2,770	1,018	268	14,496
2011	10,311	10,415	637	18,736
2012	11,008	1,538	372	23,133
2013	11,029	4,824	491	25,691
2014	12,542	14,230	415	25,890
2015	9,983	8,496	368	23,301
2016	15,237	56,706	322	28,220
2017	37,457	33,311	1,108	31,112
2018	42,922	26,665	511	33,148
2019	30,409	42,640	27,394	34,964
2020*	13,667	33,230	6,332	35,346
2021*	14,378	35,473	6,791	37,253
2022*	15,088	37,716	7,250	39,160
2023*	15,799	39,960	7,709	41,067
2024*	16,510	42,203	8,168	42,974
2025*	17,221	44,446	8,627	44,881
2026*	17,932	46,690	9,086	46,788
2027*	18,643	48,933	9,545	48,695
2028*	19,353	51,176	10,004	50,602
2029*	20,064	53,419	10,463	52,509
2030*	20,775	55,663	10,922	54,417

Source: FAO, 2021b

The SWOT analysis in terms of strengths, weaknesses, opportunities, and threats of the aviation sector in Turkey is given in the Table 9. The future of the sector needs to carry out studies for the maintenance and development of strengths in livestock enterprises (Seki and Biler, 2016). Turkey is a country that can grow different types of products in many regions as a result of its geographical conditions and different climatic possibilities. Although this situation is not as much as plant production, it is also valid in most regions in terms of animal husbandry (Küçük and Tapki, 2020). Weaknesses in the sector are the biggest obstacles to the growth of the sector. In this respect, strengthening the weaknesses is of great importance for the sector (Seki and Biler, 2016). Opportunities are environmental factors that a business can turn into an advantage to become competitive. The most striking element of the opportunities in the high labor productivity, the continuous increase in the market growth rate, and the increasing trend of meat and milk consumption. Threats are the negative aspects that develop in favor of the sector.



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Taking measures to minimize these harmful aspects, developing policies and strategies are important for the sustainability of the sector. The biggest threat that stands out is the wrong or untimely policies and insufficient support. The imbalance in milk and feed prices is one of the biggest problems for the producer.

Table 9. SWOT Analyses

Strengths	Weakness
<ul style="list-style-type: none"> • Profitability and efficiency rate of the organization • Marketing facilities and possibilities • Human resources potential • Land Assets • The climate is ideal for livestock • Presence of meadow and pasture areas • Implementation of total quality management • Effect of irrigated agriculture on livestock • Increase in the number of animals 	<ul style="list-style-type: none"> • Unqualified labor • R&D disadvantage • Ineffective management • Science and technology disadvantage • Brand disadvantage • Bad organizational image • Frequent personnel changes • Education deficiency • Lack of technical knowledge
Opportunities	Threats
<ul style="list-style-type: none"> • Ability to develop new products • New market opportunities • High labor productivity • Continuous increase of market growth rate • Reduced number of competitors • Owning quality products • Meat and milk consumption and prices tend to increase • Having grants and subsidies • Quickly converting animals into cash • Presence of areas to produce roughage 	<ul style="list-style-type: none"> • Increased competition in the domestic market • Increased competition in a foreign market • Rapid change in preferences and demands of customers • Increased labor costs • Erosion of money and inflation • High input costs • Import of Livestock and Meat • The young population moving away from livestock. • Only paving the way for large enterprises • Inability to find a caregiver • Rapid changes in livestock policies • Migration of young population to big cities • Inadequate animal husbandry policies • Late intervention in animal diseases

CONCLUSION and RECOMMENDATION

Turkey, which was the leading country in the field of agriculture and livestock in the 1970s, has become a foreign-dependent country in recent years for carcass meat, cattle, calf, sheep, goats, and even feed and straw products. Livestock in Turkey; It has become unable to compete with the world, as livestock enterprises are small and scattered, the support given to livestock is insufficient, mechanization in agriculture has become expensive and fuel prices have increased due to the increase in costs, low productivity in the agricultural field, inadequate quality, and standards of animal products. Structural problems in the sector must be eliminated for the livestock sector to contribute to the development and development of Turkey and to be able to compete with the world. The agriculture and livestock profession should be encouraged,



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and the number of people engaged in this business should be increased. The pastures where the animals are raised should be protected and expanded. The needs of the farmer such as roughage should be supported. Apart from these, all necessary training should be given to the farmer dealing with livestock to be able to do better quality and healthy livestock.



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REFERENCES

- Aktan C.C. 2006. Stratejik Yönetim ve SWOT analizi, web, <http://www.canaktan.org/yonetim/stratejik-yonetim/swot.htm>: [12.07.2019].
- Arun G., Ghimire K. 2018. A SWOT analysis of Nepalese agricultural policy, *International Journal of Agriculture Environment and Food Sciences*, 2 (4), 119-123.
- Bahtera N., Hayati L. 2020. An alternative policy of livestock farmers' empowerment towards the environmental vision, *IOP Conference Series: Earth and Environmental Science*, 012076.
- Bar-On Y. M., Phillips R., Milo R. 2018. The biomass distribution on Earth, *Proceedings of the national academy of sciences*, 115 (25), 6506-6511.
- Ceballos G., Ehrlich P.R., Dirzo R. 2017. Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines, *Proceedings of the national academy of sciences*, 114 (30), E6089-E6096.
- Cebeci İ. 2019. Kümes hayvanları kesimhane atıklarının yönetim planının oluşturulması, *Sakarya Üniversitesi*.
- Doğan Z., Arslan S., Berkman A, 2015. Türkiye’de tarım sektörünün İktisadi gelişimi ve sorunları: Tarihsel bir bakış, *Niğde Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 8 (1), 29-41.
- Durmuş S. 2016. A SWOT analysis of livestock economy in Kars, Turkey, *Karadeniz Uluslararası Bilimsel Dergi*, 1 (29), 46-59.
- Durning A.B., Brough H.B. 1991. Taking stock: animal farming and the environment, p.
- Emeksiz, F., 1999, Orta toroslarda kiraz üretim ve ihracatını geliştirme olanakları, *Çukurova Üniversitesi Ziraat Fakültesi Dergisi*, 14, 37-46.
- FAO, 2021a. Sustainable agriculture for biodiversity, biodiversity for sustainable agriculture, web (Food and Agriculture Organization of the United Nations), [12.10.2021].
- FAO, 2021b. <https://www.fao.org/faostat/en/#data/TCL> [15.10.2021].
- Farzana C., Khandi S., Bafanda R., Fahad S. 2018. SWOT analysis of sheep and goat rearing practices of Bakarwal tribe in Jammu district of Jammu and Kashmir, *Journal of Experimental Biology and Agricultural Sciences*, 6 (5), 898-902.



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Foley J.A., Ramankutty N., Brauman K.A., Cassidy E.S., Gerber J.S., Johnston M., Mueller N.D., O'Connell C., Ray D.K., West P. C. 2011. Solutions for a cultivated planet, *Nature*, 478 (7369), 337-342.

Fonseca J., Narrod C., Rosegrant M.W., Fernandez M., Sinha A., Alder J., Ahammad H., De Fraiture C., Eickhout B., Fonseca J. 2012. Looking into the future for agriculture and AKST.

Godfray H.C.J., Beddington J.R., Crute I.R., Haddad L., Lawrence D., Muir J.F., Pretty J., Robinson S., Thomas S.M., Toulmin C. 2010. Food security: the challenge of feeding 9 billion people, *science*, 327 (5967), 812-818.

Gokdogan O., Baran M.F. 2019. Determination of the energy usage efficiency in egg chicken reared, *Fresenius Environmental Bulletin*, 28 (11A), 8460-8465.

Gürler A.Z. 2010. Analitik tarım ekonomisi, Nobel Yayınları, p.

Keskin B., Demirbaş N. 2012. Türkiye'de Kanatlı Eti Sektöründe Ortaya Çıkan Gelişmeler: Sorunlar ve Öneriler, *Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 26 (1), 117-130.

Kurmanalina A., Bimbetova B., Omarova A., Kaiyrgaliyeva M., Bekbusinova G., Saimova S., Saparaliyev D. 2020. A swot analysis of factors influencing the development of agriculture sector and agribusiness entrepreneurship, *Academy of Entrepreneurship Journal*, 26 (1), 1-8.

Küçük R., Tapki N. 2020. Hatay İlinde süt ve süt ürünleri üreten İşletmelerin GZFT analizi İle değerlendirilmesi, *Hayvan Bilimi ve Ürünleri Dergisi*, 3 (2), 134-142.

Minitab L. 2013. Minitab, web, <https://www.minitab.com/content/dam/www/en/uploadedfiles/documents/pricing/GSACONT RACTPRICELIST.pdf>: [09.09.2021].

Mohan S. K. 2021. Swot analysis and strategies to optimise the buffalo rearing system of the Kole lands of Trissur district, Kerala.

Nigar A. 2018. Avrupa birliği ve Türkiye'de hayvancılık sektörünün genel ekonomik durumu, *GÜ İslahiye İİBF Uluslararası E-Dergi*, 2 (2), 57-76.

Olalı H., Duymaz İ. 1987. Tarımın Türk ekonomisindeki yeri ve ekonomik gelişmeye katkısı, İzmir Ticaret Borsası, p.



**ISPEC 8th INTERNATIONAL CONFERENCE
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Ommani A.R. 2011. Strengths, weaknesses, opportunities and threats (SWOT) analysis for farming system businesses management: Case of wheat farmers of Shadervan District, Shoushtar Township, Iran, *African journal of business management*, 5 (22), 9448-9454.

Peşmen G., Yardımcı M. 2008. Avrupa Birliği'ne adaylık sürecinde Türkiye hayvancılığının genel durumu, *Veteriner Hekimler Derneği Dergisi*, 79 (3), 51-56.

Saçlı Y. 2020. The factors affecting the beef producer price formation in Turkey, *Turkish Journal of Agriculture-Food Science and Technology*, 8 (3), 759-767.

Saygın Ö., Demirbaş N. 2017. Türkiye'de kırmızı et sektörünün mevcut durumu ve çözüm önerileri, *Hayvansal Üretim*, 58 (1), 74-80.

Seçer A., Emeksiz F. 2019. Doğu Akdeniz Bölgesinde zeytin ve zeytinyağı pazarlama organizasyonunun etkinliğinin değerlendirilmesi, *Anadolu Tarım Bilimleri Dergisi*, 34 (1), 47-56.

Seki İ., Biler T. 2016. Büyük baş hayvan işletmelerine yönelik SWOT analizi: Biga örneği, *ÇOMÜ Ziraat Fakültesi Dergisi*, 4 (1), 51-59.

Tapkı N. 2015. Hatay ilinde meyve fidancılığı yapan işletmelerin ekonomik analizi, *Çukurova Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, Adana*.

TEPGE, 2020a. Tarım Ürünleri Piyasaları, web (Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü Müdürlüğü), <https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tarim%20Urunleri%20Piyasaları/2020-Temmuz%20Tarim%20Urunleri%20Raporu/Dana%20Eti,%20Temmuz-2020,%20Tarim%20Urunleri%20Piyasa%20Raporu.pdf>: [10.08.2021].

TEPGE, 2020b. Süt ve süt ürünleri durum ve tahmin raporları, web (Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü Müdürlüğü), <https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Durum-Tahmin%20Raporları/2020%20Durum-Tahmin%20Raporları/Süt%20ve%20Süt%20Urunleri%20Durum%20Tahmin%20Raporu%202020-321%20TEPGE.pdf>: [09.09.2021].

TEPGE, 2020c. Kümes hayvancılığı durum ve tahmin, web (Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü Müdürlüğü), <https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Durum-Tahmin%20Raporları/2020%20Durum-Tahmin%20Raporları/Kümes%20Hayvancılığı%20Durum%20Tahmin%20Raporu%202020-315%20TEPGE.pdf>: [09.09.2021].



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Thornton P.K. 2010. Livestock production: recent trends, future prospects, *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365 (1554), 2853-2867.

TİGEM, 2018. Hayvancılık sektörü raporu, web (Tarım İşletmeleri Genel Müdürlüğü), <https://www.tigem.gov.tr/WebUserFile/DosyaGaleri/2018/2/a374cc25-acc1-44e8-a546-63b4c8bce146/dosya/2018%20YILI%20HAYVANCILIK%20SEKTOR%20RAPORU.pdf>: [10.10.2020].

TÜİK, 2021. Hayvancılık istatistikleri, web (Türkiye İstatistik Kurumu), <https://data.tuik.gov.tr/Kategori/GetKategori?p=tarim-111&dil=1>: [09.09.2021].

Ünlüsoy K., İnce E., Güler F. 2010. Türkiye’de kırmızı et sektörü ve rekabet politikası, *Rekabet Kurumu*, 3.

Vineer H.R., Morgan E.R., Hertzberg H., Bartley D.J., Bosco A., Charlier J., Chartier C., Claerebout E., De Waal, T., Hendrickx G. 2020. Increasing importance of anthelmintic resistance in European livestock: creation and meta-analysis of an open database, *Parasite*, 27.

Yüzer A., Ağaoğlu E., Tatlıdil H., Özmen A., Şıklar E. 2003. İstatistik, TC Anadolu Üniversitesi Yayını, no: 1448, Eskişehir.



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**THE EFFECT OF ALTERNATIVE POULTRY SECTOR ON RURAL
DEVELOPMENT IN KONYA**

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ABSTRACT

The study was conducted to investigate the effect of the alternative poultry sector on rural development in Konya. The study was created using secondary data. In addition, a SWOT analysis was conducted to identify the strengths, weaknesses, opportunities, and threats of the poultry sector for Turkey and Konya province. As a result, feed crops constitute a significant part of the input costs of the poultry sector in Konya. Feed plants should be encouraged to be grown in Konya and the feed industry should be given importance. In this way, it should be ensured that feed prices decrease. With the decrease in input costs, farmers will stop looking for alternative livelihoods and focus on poultry production in rural areas. An increase in meat and egg supply will occur with increased poultry production. In parallel with this increase, consumers should be made aware of the consumption of poultry meat and eggs in Konya, and the occurrence of a supply deficit of the products produced should be prevented.

Keywords: Poultry Industry, Rural Development, Konya



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INTRODUCTION

The world population is 7.5 billion and it is predicted to be 9.73 billion in 2050. In order to meet the food needs of the increasing population, 3 times more production will be needed (Kleyn and Ciacciariello, 2021). The agriculture sector is important for the nutrition of the growing population and especially for the provision of a balanced diet. 2019 World GDP is 87.76 trillion dollars; 3.49 trillion dollars of this was the agricultural sector (Word Bank, 2021). Turkey's GNP value is 761.4 billion dollars and the agricultural sector is 48.90 billion dollars. Animal protein deficit, which is necessary for a healthy and balanced diet of the increasing population in the coming years, must be met. Animal production has come to the fore in people's ability to lead a healthy life and at the same time to achieve this at a very affordable price. The livestock sector has an important place in ensuring rural development with its economic and social functions. The livestock sector has strategic importance in Turkey in terms of economic and social aspects such as adequate and balanced nutrition of the population, the realization of rural development, prevention of migration from village to city by reducing agricultural unemployment (Bayraç ve Çemrek, 2011). Animal husbandry is a branch of production with high added value in agricultural production. Within animal production, poultry plays an important role in providing jobs in both rural and urban areas. Poultry industry is one of the world's largest food industry (Chowdhury and Morey, 2019). Poultry business has been integrated with people's livelihoods for thousands of years and has increased the nutrition, income and food and nutritional security of the rural poor (Alders and Pym, 2009). The poultry sector has great potential to provide employment opportunities to unemployed youth, rural women, small and marginal farmers, and people in small industries such as laying poultry. This potential affects many industries such as feed formulation, cage manufacturing, poultry medicines, poultry meat and egg processing, hatchery management, poultry equipment, poultry agriculture.

Increasing global population and changes in food consumption patterns, means that it is important to find other sources of protein. Regardless of whether they are animal or vegetable origin, must be able to meet the demand in a way applicable and sustainable food (Ruviaro et al., 2012; Gandhi and Zhou, 2014). There is a global increase in meat consumption as a result of increasing income and changes in food models, especially in developing countries. (Allegretti et al., 2018). Consumers are becoming more sensitive to a healthy and balanced diet with each passing day, and food purchasing patterns are changing (Magkos et al., 2006; Bray



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and Ankeny, 2018). As an alternative to red meat, consumers turned to less fat and less expensive poultry. Poultry provides high quality animal protein (eggs and meat) at the source of production (Copland and Alders 2009; Copland and Alders 2005). For the last 20 years, poultry meat production and consumption have been continuously increasing in Turkey, as in the rest of the world (Anonymous, 2017). The poultry sector for Turkey has strategic importance due to its young population structure. Approximately 80% of the white meat produced in Turkey today is carried out in highly modern facilities, and most of the facilities are 20 years younger than their counterparts in developed countries. The latest developments in the sector in the world are closely monitored and the reflection of this on production is very rapid (Anonymous, 2019). However, the most important condition for successful businesses is the establishment of a development strategy that should take into account the state and dynamics of changes in the competitive market environment (Sharopatova et al., 2020). The poultry sector, which started as a small family business in the 1970s and gained momentum with the "contracted production" method since the 1980s, has become a sector that can perform professional production, meet the needs of the country, and export its products (TEPGE, 2014). The poultry industry is regarded as an important socio-economic development tool among the vulnerable segment of rural society because of its triple benefits. It has contributed significantly to providing people with lucrative employment and additional income. It can also play an important role in meeting the animal protein demand of the rural population.

MATERIAL and METHOD

The study was made by using secondary data. Tables were created from the Turkish Statistical Institute (TSI) data and the Agricultural Economics and Policy Development Institute (TEPGE) as secondary data. The data are given and interpreted as simple and percentage calculations. In addition, the study has been developed using literature studies. SWOT analysis has been made for the poultry sector in the study (Sharopatova et al., 2020; Heise et al., 2015; Lucian 2015). Strengths and Weaknesses, supporting organizations to achieve their missions and obstacles, respectively internal (controllable) are factors. Opportunities and Threats disable and enable them to fulfill their duties outside the organization (uncontrollable) are the factor (Phadermrod et al., 2019; Sayın ve ark., 2010; Leigh 2009; Samejima et al., 2006; Dyson, 2004). There are two main benefits of doing SWOT Analysis. First, the current structure of the poultry sector is determined by performing a SWOT analysis. In this framework, it is tried to put forward the



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strengths and weaknesses of the poultry sector, as well as the opportunities and threats that it faces. In this sense, SWOT is a "current situation" analysis. Second, SWOT analysis is an analysis technique used to determine and predict the poultry industry's future state (Aktan, 1999).

RESEARCH FINDINGS

The population of Turkey is 83,614,362 people and 7.20% of this population lives in rural areas. The rate of employment reserved for the agricultural sector in Turkey is 18.20%. Konya province has the largest land area in Turkey with its surface area and agriculture is carried out on an area of 1.876.344 hectares. Konya's surface area constitutes 5.24% of Turkey and its agricultural area constitutes 8.12% of Turkey's total agricultural area (TSI, 2021). In 2019, 45.9% of Konya's total area is cultivated agricultural land. 19.9% of the current area of the province consists of meadow pasture, 12% forest, 21.9% non-agricultural land (Table 1).

Table 1. Land Asset (ha)

	Area	Agricultural Land	Forest	Meadow Pasture	Non- Agricultural Land
Konya	4.083.800	1.876.344	492.857	816.444	898.155
Turkey	78.004.300	23.094.924	21.678.134	14.617.000	18.614.242
Ratio (%)	5,24	8,12	2,27	5,59	4,83

Source: TSI, (2021)

According to Table 2, cereals and other field crops are produced in an area of 1,460,354 hectares, vegetables in 28,226 hectares, fruit in 56,073 hectares, and ornamental plants in 83 hectares of land in Konya. The fallow area is 331.608 hectares (TSI, 2021).

Table 2. Tarımsal Alan Kullanımı (2019, ha)

	Total Agricultural Area	Cultivated Area of Cereals and Other Crops	Fallow Area	Vegetable Area	Fruits, Beverage and Spice Crops Area	Ornamental Plants Area
Konya	1.876.344	1.460.354	331.608	28.226	56.073	83
Turkey	23.094.924	15.387.323	3.387.382	789.906	3.525.070	5.243
Ratio (%)	8,12	9,49	9,79	3,57	1,59	1,58
TR Sırası	1.	1.	1.	9.	24.	10.

Source: TSI, (2021)

When considered agriculturally, Konya offers important resources and opportunities to farmers. The region has suitable soil, climatic and ecological conditions for the cultivation of many agricultural products. There are mostly medium and large-scale agricultural enterprises in



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Konya, and the average land size per farm is above the Turkey average of 67 decares. According to the data of the Turkish Statistical Institute, Konya province ranks first in the number of cattle in Turkey. Konya province has an important place in sheep and goat breeding as well as in cattle breeding. Konya province ranks second in Turkey with its presence of 2,191,228 sheep (TSI, 2021).

Table 3. Agricultural Production Value of Turkey by Selected Provinces (TL) (2019)

	Total Agricultural Production Value	Crop Production Value	Live Animal Value	Animal Products Value
1. Konya	24.213.214	12.192.031	8.994.979	3.026.204
2. Antalya	17.106.898	13.987.128	2.371.703	748.067
3. İzmir	15.351.104	6.323.972	6.791.462	2.235.670
4. Mersin	14.327.422	11.277.113	2.444.038	606.271
5. Şanlıurfa	11.693.665	6.810.341	4.108.696	774.628
TURKEY	455.067.310	195.831.757	165.318.008	93.917.545
Konya/TR (%)	5,32	6,23	5,44	3,22

Source: TSI, (2021)

Table 3 shows the agricultural production values in terms of the selected provinces. As of 2019, the total agricultural production value of Turkey is 455,067,310 TL and 5.32% (24,213,214 TL) belongs to Konya province. Approximately half of the total agricultural production value in both Turkey and Konya is obtained from the crop production value and has a share of 5.44% in the value of livestock and 3.22% in the value of animal products (TSI, 2021).

Animal products are indispensable and cannot be substituted with another nutrient due to their biological properties. It meets the needs of people, including meat, milk, and eggs. The average protein consumption per person worldwide is 82 grams, 32 grams of which is obtained from animal products (TİGEM, 2018). In the livestock sector, the poultry sector is very important. Poultry farming in the poultry industry began in the 1930s with the establishment of the Central Poultry Institute in Ankara. Studies have been carried out to develop backyard poultry in the 1950s. In the 1970s and 1980s, production and research institutions were established for the development of modern poultry; Thanks to the Resource Utilization Support Fund and feed support, the establishment of modern production facilities has been encouraged. In this period, with the increase in integrated facilities and the start of contracted production; An important structural change has been made. With the investments made in the sector in the 1990s, the number and production capacity of modern production facilities increased rapidly and high standard production became widespread. Continuing investments in the 2000s, production at European standards has become widespread. Today, the poultry sector is an important production branch that can make its own production planning and meet a large part of the animal protein requirement of the country. Poultry farming has a distinct and important place among



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other animal production branches in Turkey, as it meets animal protein in a cheap, healthy, and high-quality way, facilitates R & D studies in the field of breeding and nutrition, and contributes to rural development. The sector also contributes to the development of the feed industry, the production of tools and equipment such as cages, drinkers, and feeders, the vaccine and pharmaceutical industry, and the food industry (TAGEM, 2018). Meat chickens, laying hens, ducks, geese, and guinea fowl are raised as poultry.

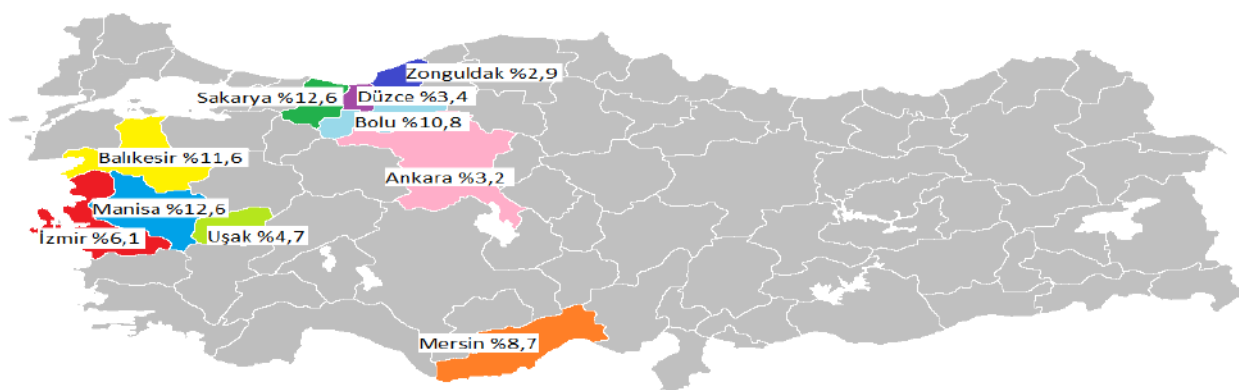
The number of broiler chickens in Turkey in 2020 is 258,046,340 and the number of laying hens is 121,302,869. Konya province constitutes 0.12% of the number of broiler chickens in Turkey and 8.94% of the number of laying hens (TSI, 2021).

Table 4. Number of Broiler and Laying Chickens in Turkey

	Number of Broiler Chicken				Number of Laying Hens			
	2017	2018	2019	2020	2017	2018	2019	2020
Turkey	221,245,322	229,506,689	221,841,860	258,046,340	121,556,027	124,054,810	120,725,299	121,302,869
Konya	348,000	307,800	582,000	318,250	15,215,625	13,090,022	12,565,621	10,847,916
Konya/TR (%)	0.16	0.13	0.26	0.12	12.52	10.55	10.41	8.94

When the number of broiler chickens is analyzed on the basis of regions, it is seen that the Eastern Marmara and Aegean Regions have a total share of 59.8% in 2019. While East Marmara is in the leading position in terms of the number of broilers with 33.5%, Aegean Region has a share of 26.3% and West Marmara has a share of 14.3%. In 2019, more than half of the broiler chickens (56.4%) were collected in five provinces. Konya is ranked 27th in terms of broiler chicken production (582,000), and the production is mostly carried out in Akşehir and Ereğli districts. Chicken meat consumption per capita in 2019 is 21.3 kg (TEPGE, 2020; TSI, 2021).

Figure 1. Number of Broiler Chicken by City in Turkey (%)



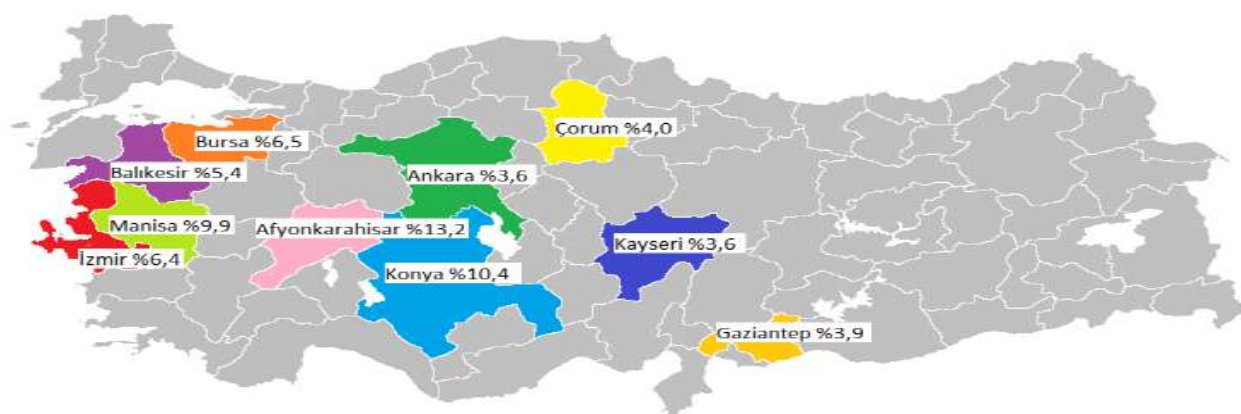


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Although the enterprises in egg poultry are generally concentrated near big cities, they are spread all over Turkey. When the regional distribution is examined in terms of the number of chicken eggs; In 2019, it is seen that the Aegean Region is in the leading position with 33.3%. Western Anatolia Region has 15.0%, East Marmara Region 13.2%, and Western Black Sea Region 7.9%. In 2019, 40% of the current laying hen assets were collected in 4 provinces. (TEPGE, 2020; TSI, 2021).

Figure 2. Number of Laying Chicken by City in Turkey (%)



In poultry breeding in Konya, most egg farming is done. Egg poultry in the province is carried out in all districts, but it is more common in the districts of Karatay, Meram, and Selçuklu, which form the central district. Konya province ranks 2nd in terms of laying hens (12.565.621). (TSI, 2021). Chicken egg consumption; In 2019, per capita, egg consumption in Turkey is 191. Foreign trade difficulties experienced in 2019 led to excess supply, which led to a decline in egg prices. It can be said that this decrease in egg prices caused an increase in egg consumption (TEPGE, 2020; TSI, 2021).



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Table 5. Number of Broiler and Laying Chickens by Cities

	Broiler Chicken		Laying Chicken	
1	Manisa-45	27,946,401	Afyonkarahisar-3	15,975,022
2	Sakarya-54	27,943,738	Konya-42	12,565,621
3	Balıkesir-10	25,761,143	Manisa-45	11,937,402
4	Bolu-14	23,972,931	Bursa-16	7,825,840
5	Mersin-33	19,408,453	İzmir-35	7,707,068
6	İzmir-35	13,574,089	Balıkesir-10	6,573,494
7	Uşak-64	10,441,524	Çorum-19	4,793,822
8	Düzce-81	7,481,348	Gaziantep-27	4,688,338
9	Ankara-6	6,996,247	Ankara-6	4,404,361
10	Zonguldak-67	6,442,339	Kayseri-38	4,360,133
11	Adana-1	6,006,135	Bolu-14	3,679,895
12	Çanakkale-17	5,995,592	Sakarya-54	1,868,031
13	Kocaeli-41	5,441,244	Denizli-20	1,826,606
14	Bilecik-11	4,456,339	Mersin-33	1,809,413
15	Elazığ-23	3,772,688	Amasya-5	1,650,529
16	Denizli-20	3,762,340	Eskişehir-26	1,598,471
17	Malatya-44	2,724,172	Mardin-47	1,502,780
18	Eskişehir-26	2,651,363	Samsun-55	1,495,990
19	Çankırı-18	2,434,520	Kahramanmaraş-46	1,343,801
20	Bursa-16	2,362,476	Elazığ-23	1,332,810
21	Aydın-9	1,907,158	Karaman-70	1,115,922
22	Samsun-55	1,587,900	Kütahya-43	1,109,782
23	Erzincan-24	1,182,435	İstanbul-34	1,080,411
24	Bartın-74	1,043,800	Aydın-9	1,061,598
25	Karabük-78	990,210	Malatya-44	1,025,840
26	İstanbul-34	683,400	Nevşehir-50	943,650
27	Konya-42	582,000	Kırşehir-40	860,670
Türkiye-TR		221,841,860		120,725,299

In Turkey, feed expense constitutes the biggest part of the production cost of the poultry sector with a rate of 66%. The amount of poultry feed produced in 2019 is 10 million tons, 53.4% of which is broiler feed. The main inputs of these feeds are corn and soybeans. Turkey imported 3.6 million tons of corn in 2019 and soybean production was 150 thousand tons. The amount of soybeans imported in 2019 is 2.6 million tons (TEPGE, 2020; TSI, 2021).

Other poultry (duck, turkey, goose) breeding is very low in Konya. Turkey has 4,797,793 turkeys, 1,373,960 geese, and 559,620 chickens in Turkey in 2019. Turkey meat production in 2019 is 60 thousand tons in Turkey. The province of Konya, on the other hand, constitutes 0.85% of the number of turkeys, 1.59% of the number of geese, and 1.28% of the number of duck-guinea fowls (TSI, 2021).



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Table 6. Number of Turkey, Goose, Duck and Beç Chicken in Turkey

	Number of Turkey				Number of Goose				Number of Duck and Beç Chicken			
	2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
Turkey	3,872,460	4,043,332	4,541,102	4,797,793	978,384	1,080,190	1,157,049	1,373,960	491,561	532,841	519,575	559,620
Konya	46,180	44,907	43,571	40,594	19,305	18,335	18,401	20,200	9,184	9,678	9,401	7,147
Konya/TR (%)	1.19	1.11	0.96	0.85	1.97	1.70	1.59	1.47	1.87	1.82	1.81	1.28

The province of Konya ranks 14th in terms of turkey numbers, 11th in terms of geese, and 12th in terms of duck-five chickens. When the regional distribution of live goose in Turkey is examined, it is seen that it is mostly bred in the Northeastern Anatolia Region with a rate of 40.7% in 2019. Middle East Anatolia with 10.7%, West Black Sea with 10.1%, and Aegean with 9.1% are the regions with the highest amount of geese. It ranks 14th for turkey production (43.571), 11th for goose production (18.401), and 12th for duck and guinea fowl (9.401). In 2019, per capita consumption was 600 grams (TEPGE 2018; TSI, 2021). Increasing turkey meat consumption is very important for Turkey.

Table 7. The Number of Turkey, Goose and Duck and Beç Chick by Provinces of Turkey

		Tukey		Goose		Duck and Beç Chicken
1	Manisa-45	1,159,340	Kars-36	315,375	Bahkesir-10	115,734
2	Bolu-14	963,925	Ardahan-75	100,429	Muş-49	35,310
3	İzmir-35	613,018	Muş-49	94,036	Bolu-14	29,142
4	Sakarya-54	264,871	Kütahya-43	42,321	Samsun-55	23,755
5	Balıkesir-10	152,698	Samsun-55	34,869	Diyarbakır-21	19,605
6	Kocaeli-41	100,576	Afyonkarahisar-3	34,835	Sakarya-54	15,578
7	Kütahya-43	83,233	Yozgat-66	28,375	Edirne-22	13,035
8	Şanlıurfa-63	82,027	Çorum-19	28,264	Kars-36	11,398
9	Muş-49	72,615	Şanlıurfa-63	22,967	Ankara-6	10,341
10	Diyarbakır-21	72,071	Diyarbakır-21	21,732	Bursa-16	10,048
11	Muğla-48	67,019	Konya-42	18,401	Afyonkarahisar-3	9,526
12	Afyonkarahisar-3	62,206	Erzurum-25	17,755	Konya-42	9,401
13	Ağrı-4	47,315	Adana-1	17,629	Ağrı-4	8,698
14	Konya-42	43,571	Ankara-6	17,475	Şanlıurfa-63	8,082
	Türkiye-TR	4,541,102		1,157,049		519,575

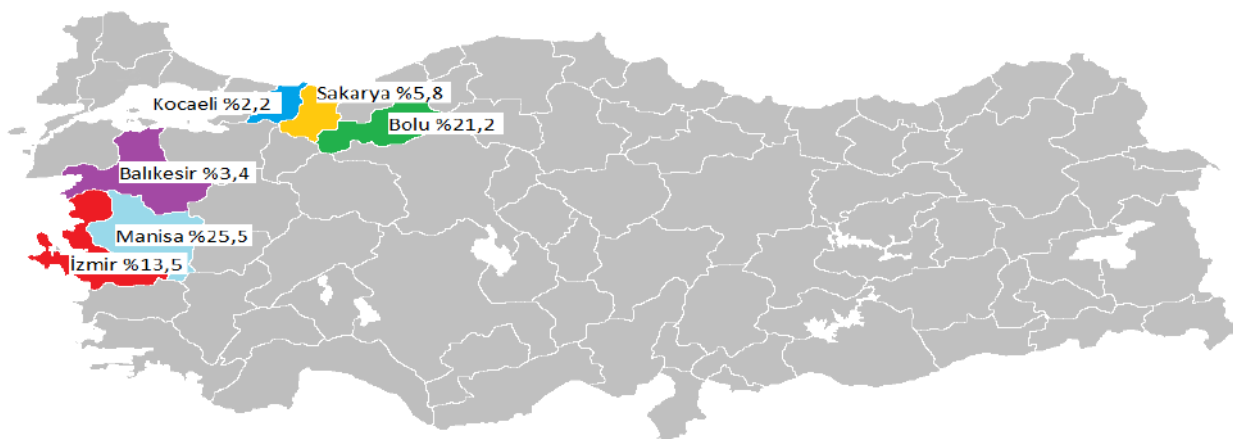
When the regional distribution of live turkeys in Turkey is examined; In 2019, it is seen that the Aegean Region is the most important region with a share of 44.6%. East Marmara is the 2nd region where the most turkey is grown, with a share of 30.7%. When the presence of turkeys is examined in terms of provinces, it is seen that 60.2% of them are gathered in 3 provinces. These provinces are Manisa with a share of 25.5%, Bolu with a share of 21.2%, and İzmir with a share of 13.5% (TEPGE 2018; TSI, 2021).



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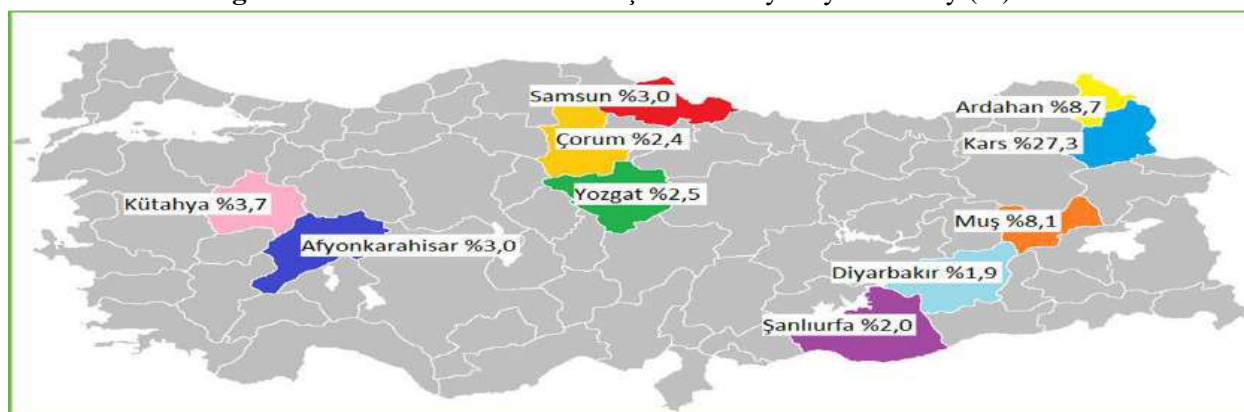


Figure 3. Number of Turkey by Provinces in Turkey (%)



When the regional distribution of live goose in Turkey is examined, it is seen that it is mostly bred in the Northeastern Anatolia Region with a rate of 40.7% in 2019. Middle East Anatolia with 10.7%, West Black Sea with 10.1%, and Aegean with 9.1% are the regions with the highest amount of geese (TEPGE 2018; TSI, 2021).

Figure 4. Number of Goose and Beç Chicken by City in Turkey (%)



Feed costs account for 70% of the costs in turkey breeding. Turkey's feed-in 2019 is 207 thousand tons, and turkey feed constitutes 2.1% of the feed. In Turkey, it is consumed as a part of local culture only in certain regions and is not sufficiently known throughout the country. The Beç chicken, whose intensive breeding is not common in Turkey, attracts only a certain consumer group in terms of providing diversity in poultry meat. In Turkey, it is produced for export rather than domestic consumption. Goose breeding in Turkey is generally carried out as a family business. The shelters are not suitable for modern breeding and are mostly barns, barns, etc. are places. The grazing skills of geese have improved and for this reason, pasture is of great



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importance in goose breeding. Chickens can be reared using the same equipment in areas similar to rearing houses used for turkeys and chickens. White chickens are usually fed with feeds similar to turkeys (TEPGE 2018; TUIK 2021). When the effect of alternative poultry farming in Konya is examined, the poultry sector is very important in terms of being a cheap protein source, high feed conversion rate, short production cycle, capital turnover 7 times a year, and reducing unemployment. Poultry products are the cheapest source of protein, where white meat (poultry meat) is cheaper than red meat (cow meat) (Alexandratos and Bruinsma, 2012). The price of one kg of red meat is equal to the price of 3-4 kg of white meat. In poultry, the conversion rate of feed into meat is higher compared to other animals (Vaarst et al., 2015; Fry et al., 2018; Godfray et al., 2018). One kg of white meat requires 2-2.5 kg of feed, while one kg of red meat requires 7 kg or more (Anonyms 2017b). The poultry production cycle takes 7-8 weeks. It has a high economic return due to the short production cycle (Fry et al., 2018). In poultry production, the capital cycle can be repeated 7 times a year (Anonymous, 2016). Poultry production requires a smaller area compared to other animals (Sakhatskiy, 2013). Poultry production contributes to the solution of the unemployment problem in rural areas. Feed industries, cutting industry, food freezing and packaging industry, meat protection industries, for machine manufacturing industries and poultry production through the development of industry associated with poultry products as appropriate technical means indirectly may lead to new jobs (Mehta and Nambiar, 2007; Wahyono and Utami, 2018).

Support for the Poultry Sector

Chicken Meat Support Policies in Turkey According to the Money-Credit and Coordination Board Decision of 2018, export return assistance is determined as 430 TL per ton for poultry meat and 550 TL per ton for processed and canned products. In 2020, within the scope of IPARD, 50-70% of grants are awarded for investments in the physical assets of agricultural enterprises producing poultry meat and 40-50% for the processing and marketing of products. With the EMRA's decision numbered 8468 of 2019, broiler chicken coop, breeder coop, and hatchery enterprises were included in the industrial group, and the benefit from discounted electricity was provided. Chicken Egg Support Policies in Turkey According to the 2018 Money-Credit and Coordination Board Decision, export return assistance has been determined as 40 TL / 1000 pieces for eggs. Within the scope of IPARD in 2020, grants of 50-70% are given for investments in the physical assets of egg-producing agricultural enterprises. With the decision numbered 8468 of the Energy Market Regulatory Authority, broiler chicken coop,



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laying chicken coop, breeding house, and hatchery enterprises were included in the industrial group, and benefit from discounted electricity was provided. In addition, with the decision dated 02.01.2020 and numbered 30996, the VAT rate applied as 8% in the wholesale delivery of chicken eggs was reduced to 1%. Support Policies Goose Breeding has been included in the scope of support in the IPARD-II Program. Within the scope of the IPARD Program (2014-2020), which is one of the investment support tools of the Ministry of Agriculture and Forestry, 40-50% of the investments with a limit of 30,000-3,000,000 Euros for the slaughterhouse with 100-1,000 goose slaughtering capacity are given as grants. Investments in the physical assets of enterprises such as new poultry construction and purchase of tools and equipment in enterprises with a capacity of at least 350 and at most 3,000 geese are supported up to 70%. An additional 10% grant is given to the applicants who invest in waste management. Ziraat Bank and Agricultural Credit Cooperatives provide investment and operating loans to producers who have established a business with a minimum capacity of 1,000 or more for goose or breeding goose breeding, or who have increased their established operating capacity to these minimum capacities, within the scope of poultry breeding. Within the scope of ARDSI, Processing and Marketing of Poultry Meat and Meat Products is supported under the title of investments for physical assets related to the processing and marketing of agriculture and fishery products. The Konya region is supported by the SOGEP support program.



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Poultry Sector SWOT Analysis

Strengths	Weakness
<p>Poultry has the best feed conversion rate.</p> <p>The integration and contracted production model of the poultry meat sector in Turkey are good.</p> <p>The yield per unit area in production is high.</p> <p>Farmers producing broilers are engaged in contract production.</p> <p>There is no marketing problem in egg poultry.</p> <p>The technologies of the poultry and slaughterhouses in the integration are very good.</p> <p>Poultry houses and slaughterhouses operate with appropriate capacity and hygiene conditions.</p> <p>Compared to red meat, it is preferred by consumers at every income level as it has a lower price.</p> <p>It is a low-priced source of protein.</p> <p>Capital turnover is 7 times a year.</p> <p>There are forage crop production supports.</p> <p>There is support for establishing a business belonging to the poultry industry.</p> <p>There is support for waste management.</p> <p>The logistic structure of Konya province is an advantage for the poultry sector.</p>	<p>Investment and production costs are high in the poultry industry.</p> <p>It is not possible to take an active role in animal waste and chicken waste management.</p> <p>There are seasonal fluctuations in the demand for poultry products (meat, eggs).</p> <p>Imports are intensely made for breeding, vaccines, medicines, and feedstuffs.</p> <p>Exports are limited to only a few countries.</p> <p>Poultry meat and egg consumption per person is low.</p> <p>Its competitive power is low due to high costs and foreign dependency.</p> <p>There are many alternative products in terms of rural development.</p>
Opportunities	Threats
<p>Bilateral relations between Turkey and countries importing poultry products are good.</p> <p>The demand spectrum is quite wide. It appeals to all income levels.</p> <p>It has tools that encourage investment, protect domestic production and support R&D projects.</p> <p>Demonstration of white meat as a substitute for red meat in meat demand.</p> <p>To be able to use poultry litter and droppings as fertilizer.</p> <p>If the feed input is reduced, it helps rural development and prevents migration from the village to the city.</p> <p>Konya is located in the center of Turkey.</p> <p>Konya province's land assets are higher than other provinces.</p> <p>The agricultural industry of Konya province is developed.</p> <p>It will reduce unemployment in Konya, both in production and in industry, with regard to the need for labor.</p> <p>Having ARDSI, IPARD, SOGEB and KOSGEB supports in Konya province.</p>	<p>Being always at risk against poultry diseases.</p> <p>Foreign dependency in breeding material and feed raw materials.</p>

CONCLUSION AND RECOMMENDATIONS

The poultry sector in Turkey has developed with the emergence of new technologies in sector every year. As in Turkey, the majority of the poultry sector in Konya is broiler and egg poultry. Feed problem arises at the beginning of the problems in the sector. Insufficient feed production leads to dependence on imports, thus causing an increase in costs. In addition, the cost of breeding material production, animal diseases, new market needs in exports are other problems.



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Logistics infrastructure, which plays an important role in increasing exports, should be developed. Incentives and support programs should be established for the production of feed raw materials and additives. Despite the increasing population in Turkey, poultry consumption is very low. This situation arises from product marketing problems and consumers' lack of information. In order to increase consumption, the importance and advantages of chicken meat and eggs for human health should be explained to consumers. Public spots should be created, advertisements should be given and conferences should be organized by bringing experts on the subject for the consumption of poultry animal products.

In Konya province, feed prices are high due to the inadequate cultivation of feed plants, which constitute an important part of the input costs of the poultry sector. Feed plants should be encouraged to be grown in Konya and the feed industry should be given importance. In this way, it should be ensured that feed prices decrease. With the decrease in input costs, farmers will stop looking for alternative livelihoods and focus on poultry production in rural areas. An increase in meat and egg supply will occur with increased poultry production. In parallel with this increase, consumers should be made aware of poultry meat and egg consumption in Konya and the occurrence of a supply deficit of the products produced should be prevented. Although Konya has ideal lands for agriculture, there are also a considerable number of poultry breeders in the province.



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REFERENCES

- Aktan C. 1999. 2000'li Yıllarda Yeni Yönetim Teknikleri (2) Stratejik Yönetim. TÜGİAD Yayını, İstanbul.
- Alders R.G., Pym R.A.E. 2009. Village poultry: still important to millions, eight thousand years after domestication. *World's Poultry Science Journal*, 65(2), 181-190.
- Alexandratos N., Bruinsma J. 2012. World Agriculture Towards 2030/2050: The 2012 Revision. Rome: Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/fileadmin/templates/esa/Global/Global/world_ag_2030_50_2012_rev.pdf
- Allegretti G., Talamini E., Schmidt V., Bogorni P.C., Ortega, E. 2018. Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry. *Journal of cleaner production*, 171, 403-412.
- Anonymous, 2016. Latest Poultry, Egg Markets, Forecast available in 2016. WATT executive guide to World Poultry Trends. www.poultrytrends.com/2016.
- Anonymous, 2017. https://ticaret.gov.tr/data/5b8700a513b8761450e18d81/Kanatli_Eti.pdf
- Anonymous, 2019. https://samsun.tarimorman.gov.tr/Belgeler/Yayinlar/Tarimsal_strateji/kanatli_eti_sektor_raporu_sorunlari_ve_cozum_onerileri.pdf
- Bayraç H.N., Çemrek F. 2011. AB uyum sürecinde Türkiye’de hayvancılık sektörünün yapısal analizi ve geliştirmeye yönelik politikalar. *Ekonomik Yaklaşım Kongreler Dizisi*, 7, 1-20.
- Bray H.J., Ankeny R.A. 2018. “Happy Chickens Lay Tastier Eggs: Motivations for Buying Free-range Eggs in Australia.” Australian Poultry Science Symposium, Sydney, Sydney Australia, February 4-7, 29.
- Chowdhury E.U., Morey A. 2019. Intelligent packaging for poultry industry. *Journal of Applied Poultry Research*, 28(4), 791-800.
- Copland J.W., Alders R.G. 2009. The comparative advantages of village or smallholder poultry in rural development. *Village chickens, poverty alleviation and the sustainable control of newcastle disease*, 11.
- Copland J.W., Alders, R.G. 2005. The Australian village poultry development programme in Asia and Africa. *World's Poultry Science Journal*, 61(1), 31-38.



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Dyson R.G. 2004. Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational Research*, 152, 631–640.

Fry J.P., Mailloux N.A., Love D.C., Mill M.C., Cao L. 2018. “Feed Conversion Efficiency in Aquaculture: Do We Measure It Correctly?” *Environmental Research Letters* 13: 024017. doi:10.1088/1748-9326/aaa273.

Gandhi V.P., Zhou Z. 2014. Food demand and the food security challenge with rapid economic growth in the emerging economies of India and China. *Food Res. Int.* 63, 108e124. <https://doi.org/10.1016/j.foodres.2014.03.015>.

Godfray H.C.J., Aveyard P., Garnett T., Hall J.W., Key T.J., Lorimer J., Pierrehumbert R.T., Scarborough P., Springmann M., Jebb S.A. 2018. “Meat Consumption, Health, and the Environment.” *Science* 361: 243. doi:10.1126/science.aam5324.

Heise H., Crisan A., Theuvsen L. 2015. The poultry market in Nigeria: Market structures and potential for investment in the market. *International Food and Agribusiness Management Review*, 18(1030-2016-83098), 197-222.

Kleyn F.J., Ciacciariello M. 2021. Future demands of the poultry industry: will we meet our commitments sustainably in developed and developing economies?. *World's Poultry Science Journal*, 1-12.

Leigh D. 2009. SWOT analysis. *Handbook of Improving Performance in the Workplace: Volumes 1-3*, 115-140.

Lucian L.U.C.A. 2015. SWOT analysis of poultry meat chain in Romania. *Romanian Journal of Economics*, 41(2 (50)), 238-246.

Magkos F., Arvaniti F., Zampelas A. 2006. “Organic Food: Buying More Safety or Just Peace of Mind? A Critical Review of the Literature.” *Critical Reviews in Food Science and Nutrition* 46: 22–56.

Mehta R., Nambiar R.G. 2007. The poultry industry in India. In *Paper delivered at the FAO Conference on 'Poultry in the 21st Century* (pp. 5-7).

Phadermrod B., Crowder R.M., Wills G.B. 2019. Importance-performance analysis based SWOT analysis. *International Journal of Information Management*, 44, 194-203.

Ruviaro C.F., Gianezini M., Brand~ ao F.S., Winck C.A., Dewes H. 2012. Life cycle assessment in Brazilian agriculture facing worldwide trends. *J. Clean. Prod.* 28, 9e24. <https://doi.org/10.1016/j.jclepro.2011.10.015>.



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Sakhatskiy M.I. 2013. Broiler meat production in the world.
<http://texha.com/en/presscenter/articles/broiler-meat-production-in-the-world.html>

Samejima M., Shimizu Y., Akiyoshi M., Komoda N. 2006. SWOT analysis support tool for verification of business strategy. In IEEE international conference on computational cybernetics (pp. 1–4).

Sayın C., Mencet N., Taşcıoğlu Y. 2010. Bölgesel Kalkınmada Etkisi Olan Unsurların Katılımcı GZFT Analizi ile Belirlenmesi: Antalya ili Döşemealtı İlçesi Örneği. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 23(31-39).

Sharopatova A.V., Pyzhikova N.I., Olentsova J.A. 2020. The current situation of the poultry industry and the formation of a strategy for its sustainable development in the region. In *IOP Conference Series: Earth and Environmental Science* (Vol. 421, No. 2, p. 022061). IOP Publishing.

TAGEM, 2018.
<https://www.tarimorman.gov.tr/TAGEM/Belgeler/yayin/Kanatli%C4%B1%20Hayvanc%C4%B1%C4%B1k%20Sekt%C3%B6r%20Politika%20Belgesi%202018-2022.pdf>

TEPGE, 2014.
https://arastirma.tarimorman.gov.tr/tepge/Lists/Haber/Attachments/18/KANATLI_URUN_RAPORU_2014.pdf

TİGEM 2018. 2018 Yılı Hayvancılık Sektör Raporu.
<https://www.tigem.gov.tr/WebUserFile/DosyaGaleri/2018/2/a374cc25-acc1-44e8-a546-63b4c8bce146/dosya/2018%20YILI%20HAYVANCILIK%20SEKTOR%20RAPORU.pdf>

TSI, 2021. <https://tuikweb.tuik.gov.tr/PreTabloArama.do?metod=search&araType=vt> (Accessed Date: 21/10/2021).

Vaarst M., Steinfeldt S., Horsted K. 2015. “Sustainable Development Perspectives in Poultry Production.” *World’s Poultry Science Journal* 71: 609–620. doi:10.1017/S0043933915002433.

Wahyono N.D., Utami M.M.D. 2018. A review of the poultry meat production industry for food safety in Indonesia. In *Journal of Physics: conference series* (Vol. 953, No. 1, p. 012125). IOP Publishing.

Word Bank, 2021. <https://www.worldbank.org/en/home> (Accessed Date: 11/10/2021)



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**TÜRKİYE’NİN YILLARA GÖRE SIĞIR VARLIĞI VE ÜRETİLEN SIĞIR SÜTÜ
MİKTARI**

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ÖZET

Bu çalışmanın amacı; son yıllarda artış gösteren büyükbaş hayvanlardan sağılan sığır sayısı ve üretilen süt miktarının yıllara göre değişimini ortaya koymak olmuştur. Ülkemize kültür ırkı sığırların üretilmeye başlandığı Cumhuriyet’in ilk yıllarından bu güne kadar kültür ırkı ve melez sığır ırkı sayısı gün geçtikçe artış göstermiştir. Özellikle 2005 yılından sonra kültür ırk sığır sayısında büyük bir artış görülmüştür. Bu artış sığır başına yıllık süt verimini de artırmıştır. Kültür, Melez ve Yerli ırklar dikkate alındığında 1991 yılında sığır başına yıllık süt verimi 1408.14 litre iken bu verim 2019 yılı itibarıyla sığır başına 3158.05 litreye yükselmiştir. 1991 yılında üretilen sığır sütü miktarı 8.616.412 ton, 2019 yılında ise 20.782.374 ton olmuştur. TÜİK verilerine göre 1991 yılında toplam sağılan sığır varlığımız 6.118.997 baş idi. Sağılan bu sığırların 650.739 baş kültür, 2.087.014 melez ve 3.381.244 başta yerli ırklardan oluşmaktaydı. Oran olarak 1991 yılında sağılan sığırların %10.63 kültür, %34.11 melez ve %55.26’sı yerli ırklardan oluşmuştur. TÜİK 2019 yılı verilerine göre sağılan sığır sayısı 1991 yılı verilerine nazaran 430.000 kadar artmış ve toplamda 6.580.753 sayısına ulaşmıştır. 2019 yılında sağılan sığır sayısının 1991 sayılarına yakın olmasına rağmen kültür ve yerli sığırların yüzdelik oranları büyük oranda değişiklik göstermiştir. 2019 yılında ırklara göre sağılan sığır sayısı; kültür 3.249.002 baş, melez 2.745.243 baş ve 586.508 baş yerli ırklardan oluşmuştur. Oran olarak 2019 yılında sağılan sığırların %49.37 kültür, %41.72 melez ve %8.91’i yerli ırklardan oluşmuştur. Sonuç olarak yıllar içerisinde yerli sığır varlığımız çok hızlı bir şekilde azalırken kültür ırkı sığır varlığı hızlı bir şekilde artış göstermiştir. Yerli sığır ırklarımız o derece hızlı azalmıştır ki artık koruma ve ıslah programları uygulanmaya başlanmıştır.

Anahtar sözcükler: Türkiye, Sığır, Süt



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**CATTLE PRESENCE AND THE AMOUNT OF CATTLE MILK PRODUCED IN
TURKEY BY YEARS**

ABSTRACT

The aim of this study; The aim of this study is to reveal the change in the number of cattle milked from cattle, which has increased in recent years, and the amount of milk produced over the years. Since the first years of the Republic, when culture breed cattle were started to be produced in our country, the number of culture breeds and cross breed cattle breeds has increased day by day. Especially after 2005, a great increase has been seen in the number of culture breed cattle. This increase also increased the annual milk yield per cattle. Considering the Culture, Crossbreed and Native breeds, while the annual milk yield per cattle was 1408.14 liters in 1991, this yield increased to 3158.05 liters per cattle as of 2019. The amount of bovine milk produced in 1991 was 8.616.412 tons, and in 2019 it was 20.782.374 tons. According to TUIK data, our total milked cattle in 1991 was 6,118,997 heads. These milked cattle consisted of 650,739 heads of culture, 2,087,014 crosses and 3,381,244 mainly native breeds. As a ratio, 10.63% of the cattle milked in 1991 were cultured, 34.11% crossbred and 55.26% local breeds. According to TUIK 2019 data, the number of milked cattle increased by 430,000 compared to 1991 data and reached a total number of 6,580,753. Although the number of cattle milked in 2019 was close to 1991, the percentages of cultured and domestic cattle have varied greatly. Number of cattle milked by breed in 2019; culture consisted of 3.249.002 heads, crossbred 2.745.243 heads and 586,508 native breeds. As a ratio, 49.37% of the cattle milked in 2019 were cultured, 41.72% crossbred and 8.91% domestic breeds. As a result, over the years, while the presence of domestic cattle has decreased very rapidly, the presence of cultural breed cattle has increased rapidly. Our domestic cattle breeds have decreased so rapidly that protection and breeding programs have begun to be implemented.

Keywords: Turkey, Bovine, Milk



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GİRİŞ

Ülkemizin sahip olduğu coğrafi koşullar hayvancılık için son derece elverişli imkânlar sunmaktadır (Esen, 2017). Hayvancılık sektörü milli gelir ve istihdama katkıda bulunmanın yanı sıra, et, süt, tekstil, deri, kozmetik, ilaç gibi sanayi kollarına hammadde sağlayarak katkıda bulunmaktadır (Tapkı ve ark., 2018). Türkiye'nin milli ekonomisi açısından tarım ve hayvancılık sektörü önemli bir potansiyele sahiptir (Köseman ve Şeker, 2015). Ülkemizin sığır varlığı Cumhuriyetin ilk yıllarında neredeyse tamamen yerli sığır ırklarından oluşmaktaydı. Cihan harbinden yeni çıkmış bir millet olarak sadece çok kıymetli insan hazinesini savaşlarda şehit vermesinin yanında genetik açıdan iyi durumda olan boğalar bile savaşlarda kullanılmak zorunda kalmıştır. Bu durum sonraki sığır neslini etkilemiş ve verim düzeyleri daha düşük seviyelere gerilemiştir. Ülkemize ilk getirilen kültür sığır ırkı 1925 yılında İsviçre Esmeri ve Simental ırklar olmuştur (Macit, 2017). Sığırlardan daha fazla verim almak amacıyla özellikle 1950'lili yıllardan itibaren kültür sığır ırkları Türkiye'ye getirilmeye başlanmıştır. Getirilen bu sığırlar hem saf olarak yetiştirilmiş hem de boğalar ve sonraki yıllarda spermaları kullanılarak yerli sığırların melezlenmesinde kullanılmıştır. Özellikle suni tohumlamanın ülke sathında yaygınlaşmasıyla 1990 yıllardan itibaren yerli sığır ırklarımız hızlı bir şekilde azalma eğilimine girmiştir. 1991 yılında Türkiye sığır varlığının 3.381.244 baş sayısı ile %55.26'sını yerli sığırlar oluşturmakta idi. 2019 yılına gelindiğinde Yerli sığırların sayısı hızlı bir düşüşle 586.508 başa ve %8.91 gibi çok düşük bir orana gerilemiştir. Bu hızlı düşüş hayvanlardan elde edilen verim özelliklerini arttırsa da bazı önemli olumsuz sonuçları da beraberinde getirmiştir. Bunlardan en önemlisi bazı yerli sığır ırklarımızın sayısı o kadar azaldı ki yok olma tehlikesi ile karşı karşıya kalındı. Bu yerli sığır ırklarımızın yerli koyun ve keçi ırklarımızda olduğu gibi 1995 yılından itibaren hem koruma sürüleri oluşturuldu hem de halk elinde ıslah projeleri başlatıldı (TAGEM, 2015).

Ülkelerin gelişmişlik düzeylerini gösteren önemli kriterlerden birisi de yıllık kişi başı hayvansal kaynaklı protein tüketim miktarıdır (Köseman ve Şeker 2015). Sığır sütü, günümüzde dünyada en çok tüketilen hayvansal gıdalardan birisidir. Son yıllarda Covid-19 salgını gibi bazı durumlar gıdaya olan talebi artırmıştır. Süt ve süt ürünlerine olan talepte son yıllarda hızlı bir artış şekillenmiş bu pandemi dönemi de bu durumu tetiklemiştir. Hayvansal veya bitkisel gıdalar çok kıymetli bir hale gelmiştir. Pandemi dönemi gıda fiyatlarında olduğu gibi süt ve süt ürünleri fiyatlarını da etkilemiştir. Devletlerin kendi insanını beslemesi konusunun ne derece önemli bir konu olduğu bir kez daha anlaşıldı. Bundan dolayı ülkemizi kendine yetecek hatta daha fazlasını



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üretecek kapasiteye ulaşması için sığır ırklarımızın verimlerinin artırılması gerekmektedir. Gelişmiş ülkelerde hayvancılığın iyileştirilmesi için uygulanan sistemler, yüksek süt ve süt ürünleri talebini karşılayacak şekilde uyarlanmıştır. Bu ülkelerde ileri üreme teknikleri de yaygın olarak kullanılmaktadır. Yıllardır, süt ineklerinin üretimini geliştirmeye odaklanan genetik seleksiyon uygulanmaktadır. Günümüzde birçok ırk süt üreticisi, çift yönlü bir üretim ya da et üretimine bir yönelme söz konusu olmaktadır.

Yıllara göre sağılabilir sığır varlığı

Türkiye’de 1991 yılından 2019 yılına kadar sağılabilir sığır sayısında baş olarak çok önemli bir değişiklik olmamıştır. Ancak üretilen ırklar bakımından çok önemli ve kayda değer değişimler olmuştur. Bu yıllar arasında kültür ırkı sağılan sığırların sayısı büyük bir artış göstermiş ve ülke sığır varlığının büyük çoğunluğunu oluşturmuştur.

1991 yılında 8.616.412 ton sığır sütü üretilirken, üretilen süt miktarı 2019 yılında ise 20.782.374 tona ulaşmıştır. TÜİK verilerine göre 1991 yılında toplam sağılan sığır varlığımız 6.118.997 baş idi. Sağılan bu sığırların 650.739 baş kültür, 2.087.014 melez ve 3.381.244 başta yerli ırklardan oluşmaktaydı. Oran olarak 1991 yılında sağılan sığırların %10.63 kültür, %34.11 melez ve %55.26’sı yerli ırklardan oluşmuştur. TÜİK 2019 yılı verilerine göre sağılan sığır sayısı toplamda 6.580.753 sayısına ulaşmıştır. 2019 yılında sağılan sığır sayısının 1991 sayılarına yakın olmasına rağmen kültür ve yerli sığırların yüzdelik oranları büyük oranda değişiklik göstermiştir. 2019 yılında ırklara göre sağılan sığır sayısı; kültür 3.249.002 baş, melez 2.745.243 baş ve 586.508 baş yerli ırklardan oluşmuştur. Oran olarak 2019 yılında sağılan sığırların %49.37 kültür, %41.72 melez ve %8.91’i yerli ırklardan oluşmuştur.

Tablo 1. Tür ve ırklarına göre sağılan sığır sayısı (Kaynak TÜİK).

Yıllar	Sağılan hayvan sayısı				İrklara göre % değerleri		
	Kültür	Melez	Yerli	Toplam	Kültür	Melez	Yerli
1991	650.739	2.087.014	3.381.244	6.118.997	10.63	34.11	55.26
1994	779.690	2.308.308	2.994.180	6.082.178	12.82	37.95	49.23
1997	879.779	2.355.541	2.358.974	5.594.294	15.73	42.11	42.17
2000	904.849	2.335.119	2.039.601	5.279.569	17.14	44.23	38.63
2003	1.034.817	2.236.680	1.768.865	5.040.362	20.53	44.38	35.09
2006	1.106.679	1.799.409	1.281.843	4.187.931	26.43	42.97	30.61
2009	1.470.886	1.686.064	976.198	4.133.148	35.59	40.79	23.62
2012	2.211.242	2.263.400	956.758	5.431.400	40.71	41.67	17.62
2015	2.500.880	2.314.061	720.883	5.535.774	45.18	41.80	13.02
2019	3.249.002	2.745.243	586.508	6.580.753	49.37	41.72	8.91

Ülkede uygulanan ıslah çalışmaları sonucunda hem sığır başına üretilen süt miktarı artmış hem de ırklar bazında verim yükselmiştir. 1991 yılında sığır başına 1408.14 kg süt elde edilirken



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2019 yılında bu rakam 3.158.05 kg olarak belirlenmiştir. Kültür ırkı sığırlardan 1991 yılında sığır başına 2.940.41 kg, melez ırklardan 2.006.89 kg, yerli ırklardan 743.68 kg süt alınmaktaydı. 2019 yılına gelindiğinde ise, kültür, melez ve yerli ırklardan sığır başına sırasıyla; 3.861.03, 2.722.47, 1.302.68 kg süt elde edilmiştir.

Tablo 2. Tür ve ırklarına göre sığır başına yıllık süt üretim miktarı kg. (Kaynak TÜİK).

Yıllar	İrklar			İrklara göre % değerleri		
	Kültür	Melez	Yerli	Kültür	Melez	Yerli
1991	2940.41	2006.89	743.68	22.21	48.61	29.18
1994	2962.39	1986.23	746.21	25.30	50.22	24.48
1997	2947.50	1947.28	735.12	29.09	51.46	19.45
2000	2916.63	1966.44	735.96	30.22	52.59	17.19
2003	3107.66	2042.43	978.04	33.80	48.02	18.18
2006	3881.31	2714.55	1316.34	39.53	44.95	15.53
2009	3884.06	2719.86	1315.77	49.32	39.59	11.09
2012	3868.60	2724.56	1313.47	53.54	38.60	7.87
2015	3867.67	2729.13	1311.79	57.12	37.30	5.58
2019	3861.03	2722.47	1302.68	60.36	35.96	3.68

SONUÇ VE ÖNERİLER

Sonuç olarak yıllar içerisinde yerli sığır varlığımız çok hızlı bir şekilde azalırken kültür ırkı sığır varlığı hızlı bir şekilde artış göstermiştir. Yerli sığır ırklarımız o derece hızlı azalmıştır ki artık koruma ve ıslah programları uygulanmaya başlanmıştır. Dünya iklimi son yıllarda çok büyük değişiklikler göstermektedir. Yerli ırklarımız Anadolu'nun zor iklim şartlarına adapte olmuş hayvanlardır. Yerli ırklarımızın üstün yaşama kabiliyeti özelliklerinden yeterince ve iş işten geçmeden faydalanmamız gerekmektedir.



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KAYNAKLAR

Esen F (2017). Bingöl ili'nde büyükbaş ve küçükbaş hayvancılık faaliyetleri. Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi (BUSBED), 7(13), 83-100.

Tapkı, N., Aybüke, K. A. Y. A., Tapkı, İ., Dağıstan, E., Çimrin, T., & Selvi, M. H. (2018). Türkiye'de büyükbaş hayvancılığın durumu ve yıllara göre değişimi. Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi, 23(2), 324-339.

Köseman, A., Şeker, İ. (2015). Malatya ili sığır, koyun ve keçi yetiştiriciliğinin mevcut durumu. FÜ Sağ. Bil. Vet. Derg, 29(2), 137-143.

Macit İ (2017). Türkiye'de yetiştirilen bazı sığır ırklarında sığır lökosit bağlanma yetmezliğinin (BLAD) restriksiyon parçacık uzunluk polimorfizmi (RFLP) ile belirlenmesi. Doktora tezi.

TAGEM. (2015). Hayvan genetik kaynakları araştırmaları ve yönetim faaliyetleri. <https://docplayer.biz.tr/10304252-Hayvan-genetik-kaynaklari-arastirmalari-ve-yonetim-faaliyetleri.html> (Ulaşım tarihi: 11.11.2021).

TÜİK. hayvancılık istatistikleri. (2021). Ankara
<https://data.tuik.gov.tr/Kategori/GetKategori?p=Tarim-111>



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**ERKEK ARI LARVASININ (APILARNIL) ABTS RADİKALİ GİDERME
AKTİVİTESİ**

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ÖZET

Günümüz dünyasında sağlık ile ilgili problemlerinin giderilmesinde organik ürünlere yönelme hızla artmaktadır. Özellikle biyolojik aktiviteleri yüksek ve yan etkileri düşük ürünler rağbet görmektedir. Bu amaçla arı ve arı ürünleri çoklukla bilimsel araştırmalara konu olmaktadır. Erkek arı larvası (Apilarnil) genel olarak üç-yedi günlük erkek arı larvalarından elde edilir. Bu ürün zengin aminoasit ve protein içeriğine sahiptir. Yapılan çalışmalarda erkek arı larvasının biyolojik olarak aktif olduğu belirtilmiştir. Kraliçe arı ve işçi arı larvalarının araştırmalar sonucunda apilarnil kadar aktif olmadığı belirtilmiştir. Bu nedenle çalışmalar erkek arı larvaları üzerine yoğunlaşmıştır. Antioksidan aktivite ise en çok çalışılan biyolojik aktivitelerin başında gelmektedir. Antioksidanlar, gıda ve farmasötik ürünlerde oksidatif bozulmayı engelledikleri ve vücuttaki koruyucu rolleri nedeni ile yoğun bir şekilde araştırılmaktadır. Gıdaların korunmasında ve insan sağlığında farklı yöntemler kullanılarak araştırma konusu olan farklı örneklerin antioksidan aktivitelerini belirleyen birçok çalışma yapılmıştır. Bu araştırmaların sayısı her geçen gün artmaktadır. Bu çalışmada erkek arı larvalarının bozulmamaları için hızlıca soğuk zincire alınmıştır. Önemli bir antioksidan aktivite tayin metodu olan ABTS radikal giderme metoduna göre erkek arı larvasının biyolojik aktivitesi belirlenmiştir. Standart birer antioksidan olan BHA, BHT, Trolox, α -Tokoferol ve Askorbik asit ile kıyaslandığında, erkek arı larvalarının iyi bir ABTS radikal gidericisi olduğu belirlenmiştir. Sonuç olarak, ABTS radikal giderme aktivitelerine ait erkek arı larvalarının IC_{50} değeri 38.5 $\mu\text{g/mL}$ olarak bulunmuştur. Standart antioksidanların ise IC_{50} değerleri ise BHA 4.2 $\mu\text{g/mL}$, BHT için 5.29 $\mu\text{g/mL}$, Trolox için 6.132 $\mu\text{g/mL}$, α -Tokoferol için 8.25 $\mu\text{g/mL}$ ve Askorbik asit için 21.0 $\mu\text{g/mL}$ olarak bulunmuştur. Bu sonuçlara göre erkek arı larvasının sentetik antioksidanlardan çok daha iyi bir şekilde ABTS radikallerini giderdiği ve ilaç potansiyeline sahip olabileceği belirlenmiştir.

Anahtar Kelimeler: Apilarnil, ABTS, Antioksidan, Arı ürünleri



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ABTS RADICAL SCAVENGING ACTIVITY OF DRONE LARVAE (APILARNIL)

ABSTRACT

In today's world, the tendency towards organic products is increasing rapidly in the elimination of health-related problems. In particular, products with high biological activities and low side effects are in demand. For this purpose, bee and bee products are often the subject of scientific research. Drone larva (Apilarnil) is generally obtained from three to seven days old drone larvae. This product has rich amino acid and protein content. Studies have shown that drone larvae are biologically active. Queen bee larvae and worker bee larvae were found not to be as active as apilarnil. For this reason, studies focused on drone larvae. Antioxidant activity is one of the most studied biological activities. Antioxidants are intensively researched because they prevent oxidative deterioration in food and pharmaceutical products and because of their protective role in the body. Many studies have been conducted to determine the antioxidant activities of different samples, which are the subject of research, using different methods in food preservation and human health. The number of these studies is increasing day by day. In this study, drone larvae were quickly transferred to the cold chain so that they do not deteriorate. Biological activity of drone larvae was determined according to ABTS radical scavenging method, which is an important antioxidant activity determination method. It was determined that drone larvae were good ABTS radical scavengers when compared with standard antioxidants such as BHA, BHT, Trolox, α -Tocopherol and Ascorbic acid. As a result, IC_{50} value of drone larvae belonging to ABTS radical scavenging activities was found as 38.5 $\mu\text{g/mL}$. The IC_{50} values of standard antioxidants were found to be 4.2 $\mu\text{g/mL}$ for BHA, 5.29 $\mu\text{g/mL}$ for BHT, 6.132 $\mu\text{g/mL}$ for Trolox, 8.25 $\mu\text{g/mL}$ for α -Tocopherol and 21.0 $\mu\text{g/mL}$ for Ascorbic acid.. According to these results, it was determined that drone larvae scavenge ABTS radicals much better than synthetic antioxidants and may have drug potential.

Keywords: Apilarnil, ABTS, Antioxidant, Bee products



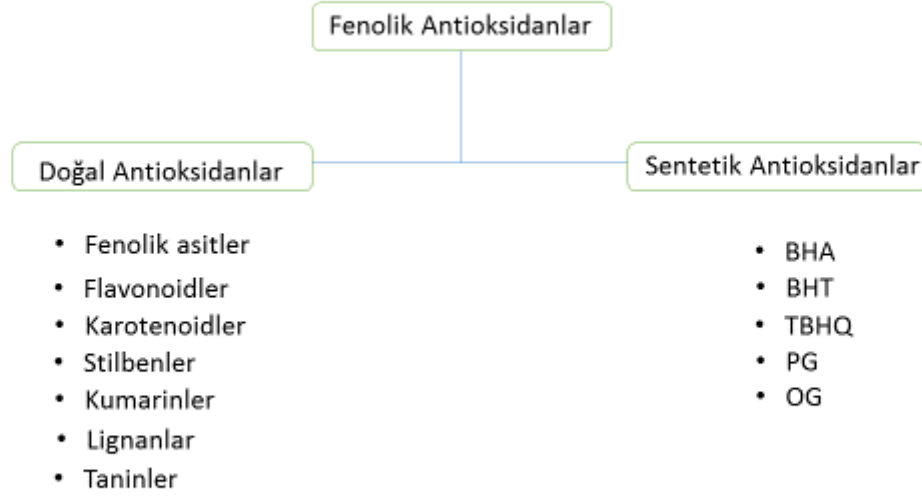
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1. GİRİŞ

Arı ürünleri içeriklerindeki kimyasal bileşikler nedeni ile birçok bilimsel çalışmalara konu olmaktadır. Bu bileşenlerin biyolojik aktivite göstermesi ise ayrı bir önem katmakta ve bu konuda çalışan bilim insanlarının ilgisini çekmektedir. Özellikle antioksidan aktiviteye sahip bileşenleri barındıran arı ürünleri ise daha çok tercih edilmektedir. Arı larvaları da özellikle erkek arı larvası (apilarnil) ilgi ile araştırılan arı ürünlerindendir (İnci ve ark. 2021). Apilarnilin birçok biyolojik aktiviteye sahip olduğu belirlendiği için, sağlığın korunması ve bazı hastalıklara karşı destek ürünü olarak kullanılabileceği belirlenmiştir. Bu nedenle erkek arı larvaları apiterapik uygulamalarda kullanılmaktadır (Mateescu 2011; İzol 2021a).

Antioksidanlar birçok hastalığa karşı kullanılmaktadır. Antioksidanların savunma mekanizmaları farklı şekillerde etki göstermektedir. Bu etkiler temel olarak oksidasyon ve radikal etkileri olarak sınıflandırılmaktadır. Antioksidanlar, oksidasyon olayını biyolojik sistemde ilk oluşum veya gelişim evrelerinde önlemekte veya geciktirmektedirler, radikal etkileri ise, radikalik bileşik oluşumunu önlemekte ve oluşan radikalleri gidermektedir. Bu etkileri sebebi ile biyolojik sistemlerde antioksidan bileşiklere çok fazla ihtiyaç duyulmaktadır. Antioksidanların eksikliğinde kanser, AIDS, kalp ve damar hastalıkları, şeker hastalığı, Parkinson gibi hastalıklar oluşmaktadır. Antioksidanlar doğal ve sentetik olarak ikiye ayrılmaktadır. Doğal antioksidanlar, bitkisel ve hayvansal besinlerde bulunan ve ekstre edilebilen veya gıda işlenmesi sürecinde oluşan bileşiklerdir. Başlıca doğal antioksidanlar şunlardır: flavonoidler, tokoferoller, fenolik asitler, karotenoidler, askorbik asit, polifenoller ve selenyumdur. Doğal antioksidanların vücut sisteminde olması hayati önem arz etmektedir. Bu nedenle dengeli beslenmeli ve antioksidan içeriği fazla olan gıdalar tüketilmelidir. Sentetik antioksidanlar ise inorganik olarak laboratuvar ortamında üretilmektedir. Gıdaların bozulmasını önlemek, besinlerdeki oksidasyonu azaltmak, hastalıkların tedavisinde ilaç olarak ve kozmetik ürünlerde kullanılmaktadır. Başlıca sentetik antioksidanlar şunlardır ise Troloks, askorbik asit, BHA (Bütillenmişhidroksianisol), BHT (bütillenmişhidroksitolüen), α -tokoferol, t-bütillhidrokinon (TBHQ)'dur. Fenolik antioksidanların sınıflandırılması Şekil 1.'de verilmiştir. Sentetik antioksidanlar ve oluşturduğu yan ürünler çeşitli hastalıklara neden olabilecekleri ifade edilmiştir. Bu nedenle doğal ürünlere yönelim artmakta ve özellikle doğal ürünlerden antioksidan özelliği olanlar tercih edilmektedir. Yapılan birçok bilimsel çalışma doğal antioksidanlar üzerine yoğunlaşmıştır (Gulcin 2020).



Şekil 1. Fenolik antioksidanların sınıflandırılması (Gulcin 2020).

ABTS (2,2'-azinobis(3-etilbenzotiazolin-6-sülfonat)) bileşiği oksidatif bir ajan olarak bilinmektedir. ABTS, özellikle $K_2S_2O_8$, MnO_2 ve H_2O_2 molekülleri ile etkileşerek koyu yeşil ya da mavi renkli $ABTS^{*+}$ radikal şekline dönüşmektedir.

ABTS radikal katyonunun üretilmesi, gıda maddelerinin, saf maddelerin, sulu karışımların ve içeceklerin toplam antioksidan aktivitesini ölçmek için uygulanan spektrofotometrik yöntemlerden birinin temelini oluşturmaktadır. Miller ve arkadaşları tarafından bulunmuştur (Miller ve ark. 1993). ABTS antioksidan etki gösteren bir örnek ile reaksiyon verdiğinde radikal katyonunu indirgeyerek oksitlenir ve renksiz bir durum oluşturmaktadır. Antioksidan kapasitesi ise rengi azaltma özelliği olarak belirlenmektedir. Bu özellik sayesinde antioksidan aktivite spektrofotometrik yöntem ile tespit edilebilmekte ve reaksiyon sonucunda $ABTS^{*+}$ radikalinin absorbans sonucunun düşmesi ile antioksidan aktif olduğu belirlenmektedir. $ABTS^{*+}$, sulu çözeltilerde 414, 734 ve 815 nm ve etanolik çözeltilerde 414, 730 ve 873 nm maksimum absorpsiyon gösterdiği bildirilmiştir. Sonuç ise antioksidan aktivitesi belli olan sentetik antioksidanlar ile kıyaslanarak belirlenmektedir. $ABTS^{*+}$ iyonik yapılardan etkilenmemekte ve hem organik hem de sulu çözücülerde çözünmektedir. Bu özelliklerinden dolayı, organik numunelerin ve vücut sıvılarının hem hidrofilik hem de lipofilik antioksidan aktivitelerini



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bulmada farklı çözücü kullanılan numunelerde kullanılabilir. Ayrıca ABTS^{•+} radikali pH'ın antioksidan üzerindeki aktivitelerini belirlemek için geniş bir pH aralığında kullanılmaktadır (Awika ve ark. 2003).

2. MATERYAL METOT

2,2-Azino-bis (3-etilbenzo-tiyazolin-6-sülfonik asit) (ABTS^{•+}) Giderme Aktivitesi

Azino-bis 3-etilbenzo-tiyazolin-6-sülfonik asit ABTS^{•+} radikal giderme aktivitesini belirlemek için ilk olarak ABTS radikal çözeltisi hazırlanmıştır. Bunun için ABTS (2 mM) çözeltisi ile K₂S₂O₈ (2.45 mM) çözeltisi reaksiyona sokulmuştur. Kontrol solüsyonunu hazırlamak için fosfat tamponu (0.1 M, pH:7.4) ile absorbansı 734 nm'de ölçülerek 0.9 ± 0.1'e ayarlanmıştır. Sonra numuneler farklı konsantrasyonlarda (10-30 mg/mL) hazırlanmış ve hazırlanan standart çözeltilere ABTS radikal çözeltisi ilave edilmiştir. Deney tüpleri vorteksenerek oda sıcaklığında 30 dk. karanlıkta inkübe edilmiştir. Son olarak 734 nm'de etanole karşı absorbans değerleri ölçülmüştür ve radikal giderme aktivitesi absorbans düşüşü ölçülerek bulunmuştur (Bursal ve ark. 2021; İzol ve ark. 2021b).

3.SONUÇ VE TARTIŞMA

Hesaplamalar yapıldıktan sonra grafik çizilmiş ve erkek arı larvası numunesini ve sentetik antioksidanlar için IC₅₀ değerleri hesaplanmıştır. Sonuçlar Tablo 1.'de verilmiştir.

Antioksidanlar	ABTS ^{•+} Giderme (IC ₅₀ , µg/mL)	R ²
BHA	4.200	0.9805
BHT	5.290	0.9545
Troloks	6.132	0.9800
α-Tokoferol	8.250	0.9490
Askorbik asit	21.000	0.9805
Erkek arı larvası	38.500	0.9869

Erkek arı larvasının ABTS^{•+} radikal giderme aktivitesi sentetik antioksidanlardan daha yüksek olduğu belirlenmiştir. Sonuçlara göre IC₅₀ değerleri erkek arı larvası için 38.5 µg/mL olduğu bulunmuştur. Sentetik antioksidanların değerleri ise BHA için 4.2 µg/mL, BHT için 5.29 µg/mL, Troloks için 6.132 µg/mL, α-Tokoferol için 8.25 µg/mL ve Askorbik asit için ise 21.0 µg/mL olarak bulunmuştur. Sentetik antioksidanların ve erkek arı larvasının ABTS katyon



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radikal giderme aktivitesi sıralaması ise Erkek arı larvası > Askorbik asit > α -Tokoferol > Troloks > BHT > BHA şeklinde olduğu belirlenmiştir. Bu sonuçlara göre erkek arı larvasının sentetik antioksidanlardan daha aktif olarak ABTS katyon radikalini giderdiği bulunmuştur.



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KAYNAKÇA

Awika JM, Rooney LW, Wu X, Prior RL, Cisneros-Zevallos L. 2003. Screening methods to measure antioxidant activity of sorghum (*Sorghum bicolor*) and sorghum products. *J Agric Food Chem.* 51:6657–6662

Bursal E, Yılmaz MA, İzol E, Türkan F, Atalar MN, Murahari M. 2021. Enzyme inhibitory function and phytochemical profile of *Inula discoidea* using in vitro and in silico methods. *Biophys Chem* [Internet]. Oct;277:106629. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0301462221001113>

İzol E. 2021a. “Yenilikçi Arı Ürünleri Ve Biyolojik Önemleri.” In *Tarım Uygulamalarında Yenilikçi Yaklaşımlar*, ed. İnci, H., Kökten K., Iksad Publications, 77–116. <https://iksadyayinevi.com/wp-content/uploads/2021/10/TARIM-UYGULAMALARINDA-YENILIKCI-YAKLASIMLAR.pdf>.

Gulcin İ. 2020. Antioxidants and Antioxidant Methods: An Updated Overview. *Archives of Toxicology* 94

İzol E , Temel H, Yılmaz MA, Yener İ, Olmez OT, Kaplaner E. 2021b. A Detailed Chemical and Biological Investigation of Twelve *Allium* Species from Eastern Anatolia with Chemometric Studies. *Chem Biodivers.* 18(1)

İnci H, İlkaya M, İzol E. 2021. Apilarnil (Drone larvae) Chemical Content , Bioactive Properties and Supporting Potential in Medical Treatment of Some Diseases in Terms of Human Health. *International Journal of Food , Agriculture and Animal Sciences (IJFAA)* 1(1): 1–7.

Mateescu, C. 2011. *Apiterapia sau Cum Sa Folosim Produsele Stupului Pentru Sanatate*. ISBN 978-973-9250-90-0.

Miller NJ, Rice-Evans CA, Davies MJ, Gopinathan V, Milner A. 1993. A novel method for measuring antioxidant capacity and its application to monitoring the antioxidant status in premature neonates. *Clin Sci* 84:407–412.



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**TÜRKİYE’DE ORGANİK HAYVANCILIĞIN DURUMU VE GELİŞMESİNE
YÖNELİK ÖNERİLER**

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ÖZET

Türkiye’de organik tarım faaliyeti Avrupa’daki gelişmelerin uzağında, ithalatçı firmaların talebi doğrultusunda 1984 yılında başlamıştır. Başlangıçta kuru incir ve üzümle başlayan organik tarım faaliyeti zamanla bitkisel ürünlerde ürün yelpazesini genişletmiş ve ihracata dayalı bir gelişme göstermiştir. Fakat aynı gelişmeyi hayvansal ürünlere yansıtamamıştır. Türkiye’de hayvansal ürünlerin ihracat şansının düşük olması ve iç pazarda alım gücünün yetersizliği organik hayvansal ürünlerin üretim ve tüketimini olumsuz etkilemiştir. Türkiye’de organik hayvancılık uygulamaları daha çok arıcılık ve kanatlı sektöründe yoğunlaşmıştır. 2020 yılı verilerine göre organik bal yetiştiriciliğinde 387, organik kanatlı hayvan yetiştiriciliğinde 91, organik büyükbaş hayvancılığında 12 ve organik küçükbaş hayvanlığında ise 6 adet çiftçi üretim faaliyetinde bulunmaktadır. Organik arıcı sayısının en yoğun olduğu iller sırasıyla Bayburt, Van, Elazığ ve Gümüşhane’dir. Kovan sayısı açısından ise Van, Bayburt, Mersin, Trabzon Ordu, Sivas ve Artvin ön sıralarda yer almaktadır. Organik arı ürünleri bazında Van, Bayburt ve Mersin ilk üç sırayı almaktadır. Organik kanatlı hayvan yetiştiriciliği sırasıyla Ordu, Uşak ve Sakarya illerinde yoğun olarak yapılmaktadır. Organik yumurta açısından ise Sakarya, İzmir ve Manisa ilk üç sırayı almaktadır. Organik büyükbaş hayvancılık, Çanakkale, Samsun, Niğde, Manisa ve Aydın illerinde, küçükbaş hayvancılık ise Çanakkale, Kocaeli ve tokat illerinde yapılmaktadır. Elde edilen bulgulardan hareketle büyükbaş ve küçükbaş hayvan yetiştiriciliğinde üretimin yoğunlaştığı bir havza ya da bölge bulunmamaktadır. Türkiye sahip olduğu sığır gen kaynakları, bozulmamış toprak yapısı ve ekstansif ağırlıklı hayvancılık işletmeleri ile organik hayvancılık için son derece uygun bir konuma sahip olmasına rağmen bu imkânları yeterince kullanamamaktadır. Sonuç olarak; devlet tarafından çiftçilere sağlanacak birtakım destek, bilgilendirme ve teşviklerle birlikte organik hayvancılığa büyük bir ivme kazandırılabilir.

Anahtar Kelimeler: Organik Üretim, Hayvancılık, Türkiye, Organik Bal



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**RECOMMENDATIONS ABOUT THE STATUS AND DEVELOPMENT OF
ORGANIC LIVESTOCK IN TURKEY**

ABSTRACT

In Turkey, organic farming started in 1984, far from the developments in Europe, due to the demand of importing companies. Organic farming started with dried figs and grapes at the beginning, the product range expanded over time to cover herbal products and had an export-oriented development. However, the same development was not seen in animal products. The low export chances for animal products in Turkey and low purchasing power in the domestic market negatively affected the production and consumption of organic animal products. Organic livestock activities in Turkey mostly consist of beekeeping and poultry. According to data for the year 2020, there are 387 farmers doing organic honey farming, 91 farmers doing organic poultry farming, 12 farmers doing organic cattle farming, and 6 farmers doing organic small cattle farming. The provinces with the highest number of organic beekeepers are Bayburt, Van, Elazığ, and Gümüşhane, respectively. In terms of the number of hives, Van, Bayburt, Mersin, Trabzon Ordu, Sivas, and Artvin have the highest numbers. Van, Bayburt, and Mersin are in the first three rankings in terms of organic bee products. Organic poultry farming is carried out most intensively in Ordu, Uşak, and Sakarya provinces, respectively. In terms of organic eggs, Sakarya, İzmir, and Manisa are in the first three rankings. Organic cattle breeding is carried out in the provinces of Çanakkale, Samsun, Niğde, Manisa, and Aydın, while small cattle breeding is carried out in the provinces of Çanakkale, Kocaeli, and Tokat. Based on the findings, there is no specific catchment area or region with intense production in cattle and small cattle breeding. Although Turkey has a very suitable geographic location for organic livestock breeding with its cattle genetic resources, undisturbed soil structure, and extensive livestock farms, these resources are not utilized at a sufficient level. As a result, with some support, information, and incentives to be provided to farmers by the government, organic livestock farming can be highly improved.

Keywords: Organic Production, Livestock, Turkey, Organic Honey



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1. GİRİŞ

Artan nüfusa bağlı olarak tarımsal üretimden daha fazla verim elde etmek için uygulanan kimyasal ilaç, gübre, hormon ve değişik sentetik preparatların kullanımı doğal dengenin bozulmasına, ürünlerde kalıntı oluşmasına ve ürünün kalitesinin bozulmasına neden olmuştur. Aşırı kimyasal gübre, hormon ve ilaç kullanılarak üretilen gıdaların insanlarda sağlık problemlerine yol açtığı kaygısını ortaya çıkarmıştır (Dellal ve ark., 2015) Ortaya çıkan bu olumsuzluklar, uzmanları yeni sistem arayışına itmiştir. Çevre sağlığını, gıda güvenliğini ve hayvan refahını hedefleyen tarım teknolojileri gündeme gelmiştir. Bu anlayış organik tarım ve hayvancılığın çıkış noktasını oluşturmuştur (Tölü vd., 2020: 74).

Yoğun hayvansal üretimin insan, çevre ve hayvan sağlığı üzerinde olumsuz etkileri tüketicilerin bakış açılarında önemli değişikliğe neden olmuştur. Toplumsal bilinç düzeyi ve gelirin artmasıyla birlikte insanlar çevreye ve doğal kaynaklara en az zararı olan, hayvan haklarının esas alındığı ve hayvanlara daha iyi yaşam standartlarının sunulduğu organik hayvansal ürünlere yönelmişlerdir.

Organik hayvancılık; hayvanların doğal davranış göstermesine olanak tanıyan, hayvanların organik yemle beslenmesini sağlayan, verimi artırmak amacıyla antibiyotik, hormon vb kalıntıların kullanılmasına izin vermeyen, tüketicilere daha sağlıklı ürünler sunan, kontrol ve sertifikasyon kuruluşları tarafından denetlenen, çevre dostu bir üretim şeklidir. Son yıllarda organik hayvancılık AB ülkeleri başta olmak üzere ABD’de de alternatif bir model olarak önem kazanmaya başlamıştır (Rosati and Aumaitre, 2004).

Bu çalışmada organik hayvanlığa geçiş süreci, uygulama şartları ve Türkiye’de organik hayvancılığın durumu ve gelişmesine yönelik stratejiler üzerinde durulmaktadır. Bu çalışmayla birlikte Türkiye’nin organik hayvancılığın birçok dalında yetersiz kaldığı ve sahip olduğu potansiyeli yeterince kullanamadığı vurgulanmaktadır. Çalışmanın kapsamını organik hayvancılıkla ilgili bazı temel sorunlar ve bu sorunlara yönelik birtakım çözüm önerileri oluşturmaktadır.

2. ORGANİK HAYVANCILIK GEÇİŞ SÜRECİ İLE İLGİLİ İŞLEMLER

Organik tarıma geçişte olduğu gibi organik hayvancılığa geçişte de birtakım kurallar bulunmaktadır. Organik hayvancılık faaliyeti resmi organlardan izin alınmak suretiyle yapılmaktadır. Bu noktada organik hayvancılık faaliyetinde bulunmak isteyen yatırımcı çalışma iznini aldıktan sonra herhangi bir kontrol ya da sertifikasyon kuruluşuna dilekçe yoluyla



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başvurur ve gerekli çalışmaların yapılmasını talep eder. Kontrol kuruluşu yapılan başvurunun organik hayvancılığa uygun olup olmadığı kararını verir ve bu durumu resmi organa bildirir. Kontrol kuruluşu üretim yapılmasında kabul ettiği yatırımcıyı geçiş sürecine alır. Geçiş sürecindeki ürünler geçiş ürünü olarak değerlendirilir. Geçiş ürünü, "Organik tarım geçiş süreci ürünüdür" etiketiyle pazarlanabilir fakat organik ürün olarak pazarlanamaz. Bu süreci de olumlu tamamlayan yatırımcıya organik ürün etiketi kullanım izni verilir.

Organik hayvancılığa geçişte mera ve barınaklarla ilgili bazı kriterlerin yerine getirilmesi gerekmektedir. Bu noktada öncelikle organik hayvansal üretim için kullanılacak mera ve araziler iki yıllık geçiş sürecine alınmaktadır. Ot dışında beslenen hayvanlar için ayrılan mera, açık barınaklar ve gezinti alanları için geçiş süresi bir yıla kadar indirilebilmektedir. Organik hayvancılık için ayrılan araziler yönetmelikte izin verilen ürünlerin dışında başka üretim yapılmamışsa geçiş süreci yetkilendirilmiş kuruluşlar tarafından altı aya kadar indirilebilmektedir.

Organik hayvancılığa geçişte diğer bir kriter kullanılan yemdir. Organik ölçütlere göre üretilen bir hayvan organik yem ile beslenmiyorsa, o hayvandan elde edilen ürün organik ürün olarak adlandırılmaz. Organik hayvancılıkta beslenme hayvanın gelişim evrelerine ve ihtiyaçlarına göre yapılır, hayvanların zorlama ile beslenmesine izin verilmez. Yem ihtiyacı karşılanırken öncelikle işletmenin kendi imkânlarıyla ürettiği yem tercih edilir. Eğer işletme kendi yemini üretmiyorsa yönetmeliklere uygun bir üretim gerçekleştiren başka işletmelerden yem temininde bulunulur (<https://avys.omu.edu.tr>).

Organik tarımda doğal dengeyi korumak temel amaç ise hayvansal üretimde de üretim yapılan yöreye ait yerel ırklara yer vermek esas olmalıdır. Fakat bu noktada yerli ırkların verim seviyeleri göz önüne alındığında, uygulamada çok fazla yer bulamamaktadır. Üretimde kullanılacak hayvanlar başka yerden satın alınacaksa satın alınan yerde hayvanların organik şartlara uygun yem ile büyütülmesi ve beslenmesi gerekmektedir. Aynı zamanda genetiği değiştirilmiş hayvanların organik üretimde kullanımı da yasaklanmıştır. Organik üretimde esas olan hayvan refahını ön planda tutmaktır. Bu noktada hayvanların rahat edebilmesi için açık alanlara, gezinti ve mera alanlarına erişim sağlanmalıdır.

3. ORGANİK HAYVANCILIĞIN TEMEL ESASLARI

Organik hayvancılık yetiştiriciliğinde hayvan sağlığını koruyucu tedbirlerin alınması önem arz etmektedir. Bu bağlamda öncelikle üretimde uygun damızlık seçimi yapılmalı, hayvanların



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gezinti alanlarına ve otlaklara ulaşımı kolayca sağlanmalı ve kaliteli yem kullanılmalıdır. Hayvanların rahat edebilmeleri için yerleşim sıklığına dikkat edilmeli, aşırı kalabalıktan kaçınılmalıdır. Alınan tüm tedbirlere rağmen bir hayvanın hastalanması ya da yaralanması durumunda, izole işlemleri için hayvan ayrı bir barınağa alınmakta ve tedavisine başlanılmaktadır. Yetkilendirilmiş kuruluşun izni olmadan antibiyotik ya da ilaç kullanımına izin verilmez. Yetki izni alındıktan sonra ilaç kullanımı veteriner tarafından kontrollü olarak yapılmaktadır. Bir yıl içerisinde hayvanlara uygulanan ilaç tedavisi üçten fazla gerçekleşirse, bu hayvanlardan elde edilen ürünler organik olarak değerlendirilemez ve bu ürünler yeniden geçiş sürecine alınır (<https://akademik.adu.edu.tr>).

Organik büyükbaş ve küçükbaş hayvancılıkta yavruların beslenmesi ana sütüyle sağlanmalıdır. Ana sütünün yetersiz olması durumunda yavrular aynı sürüden elde edilen sütlerle beslenir. Hayvanların beslenmesinde büyümeyi artırıcı hormonlar, hayvansal kökenli maddeler, antibiyotikler, tıbbi ürünler, genetiği değiştirilmiş organizmalar ve üretimi artırıcı maddeler kullanılamaz. Yine bu yemlerin depolanması ve satışı esnasında farklı yerlerde tutulması gerekmektedir. Organik yemler mutlaka etiketlenmeli, bu şekilde yemin organik miktarı, yem materyallerinin yüzdesi ve yetkilendirilmiş kuruluşun ismi kuru madde üzerinden belirtilir. Yavruların süttten kesilmesi büyükbaş hayvanlarda 90 gün, küçükbaş hayvanlarda ise 45 gün olarak uygulanmalıdır. Yetiştirme sistemine göre hayvanlar yılın farklı dönemlerinde meralara çıkabilmektedirler (<https://avys.omu.edu.tr>).

Büyükbaş hayvan yetiştiriciliğinde hayvanların bağlanması yasaktır. Barınak koşulları hayvanların biyolojik ve ırk yapısına göre düzenlenmelidir. Hayvanlar barınak içerisinde doğal hareketlerini ve davranışlarını sergileyebilmelidirler. Hayvan barınaklarının zenini sert ve düz olmalıdır. Altlık olarak saman gibi doğal maddeler kullanılmalıdır.

Kümes hayvanları yetiştiriciliğinde hayvanların kapalı alanlarda yetiştirilmesi yasaktır. Hayvanların mutlaka açık yetiştirme koşullarına sahip olması gerekmektedir. Kümes zemini kum, talaş ve kısa çimli maddelerle kaplı olmalı ve en az üçte biri düz bir yapıya sahip olmalıdır. Gezinti alanına giriş/çıkış delikleri hayvanların büyüklüğüne göre belirlenmeli ve bu delikler kümes barınağının her 100 m² 'si için en az 4 m uzunlukta olmalıdır. Etlik piliç yetiştiriciliğinde yavaş gelişen genotipler kullanılmalı ve kesim süresi en az 81 gün olmalıdır. Kesim işlemi farklı kanat türlerinde de mevzuata uygun şekilde yapılmalıdır. Kesime gönderilecek hayvanların nakli stressiz ve sıra süre içinde gerçekleştirilmelidir. Nakliye öncesi ve sonrasında hayvanlara herhangi bir yatıştırıcı verilmemelidir (<https://avys.omu.edu.tr>).



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Organik arıcılıkta geiş süreci ile ilgili olarak öncelik ırk seçimine verilmektedir. Bu noktada arıların yerel koşullara adapte olabilme kapasitesi, dayanıklılıkları ve hastalıklara karşı dirençleri göz önüne alındığında yerel ırk tercihi daha avantajlı görülmektedir.

Organik arıcılıkta koloni beslenmesi, erken ilkbahar döneminde organik bal ya da organik şeker grubu kullanılarak yapılmaktadır. Ancak iklim şartlarının kötü gitmesinden dolayı koloniler tehlike altında ise, sadece son bal hasadı ile bir sonraki nektar akış döneminden başlayarak 15 gün önceki dönemi kapsayan süre içerisinde arıların beslenmelerine izin verilir. Besleme yapılırken ürünler tamamen organik olmalı, beslemede kullanılan ürün çeşitleri ve miktarları hangi kovana uygulanmışsa tüm bulgular kayıt altına alınmalıdır.

Kolonilerin yerleştirildikleri bölgeler ve kovan bilgileri mutlaka kayıt altına alınmalıdır. Konvansiyonel arıcılıkta olduğu gibi organik arıcılıkta da koloniler yeterli miktarda nektar ve polen kaynağı bulunan yerlerde konaklamalı ve suya erişim imkânı bulmalıdır. Kolonilerin başka bir yere taşınması durumunda yetkilendirilen kuruluşa bilgi verilmeli ve taşıma esnasında arılarda oluşabilecek stres unsurlarına da dikkat edilmelidir. Kolonilerin iç ve dış cephesi doğal malzemeden oluşmalı ve kolonilerin çevresi balmumu, propolis ve bitki yağları gibi doğal ürünlerle kapatılmalıdır. Öte yandan kimyasal boya gibi çevreye ve arıcılık ürünlerine risk getiren malzemelerin kullanımına da izin verilmemelidir (<https://avys.omu.edu.tr>).

Kolonilerin hastalanması durumunda kimyasal ilaçlar yerine homeopatik ya da fitoterapik yöntemler kullanılmalıdır. Fakat bu yöntemlerden istenilen sonuç alınamazsa yetkilendirilmiş sertifika kuruluşlarının onayladığı kimyasal bileşenli ilaçlar kullanılmalıdır.

Elde edilen bulgular organik hayvancılık için belirlenen esasların yetkilendirilmiş sertifika kuruluşlarının onayıyla uygulamaya konulduğunu ortaya koymaktadır. Organik hayvancılık ürünleri yetkilendirilmiş kuruluşun onayından sonra organik ürün sertifikası ile satışa sunulmaktadır.

4. TÜRKİYE’DE ORGANİK HAYVANCILIK

Türkiye’de organik tarım faaliyeti, Avrupa’daki gelişmelerin uzağında, ithalatçı firmaların talebi doğrultusunda 1984 yılında başlamıştır. Başlangıçta kuru üzüm ve kuru incirle başlayan üretim zamanla çeşitlenmiş fakat ihracata dayalı gelişme göstermiştir. Günümüzde ise organik üretim 50’den fazla çeşitte yapılmaktadır.

Türkiye’de organik tarım sadece bitkisel üretime yönelik gelişme göstermiştir. Hayvansal üretimde istenilen başarı sağlanamamıştır. Bunun gerekçesi hayvansal ürünlerin iç pazarda



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ihracat şansının düşük olmasına, alım gücünün yetersiz olmasına ve tüketici bilincine bağlanabilir.

Türkiye’de organik hayvancılık alanında üretim daha çok arıcılık ve kanatlı hayvanlar üzerine yoğunlaşmıştır. İhraç edilen hayvansal ürünler arasında sadece bal yer almakta, kalan kısmı bitkisel ürünler oluşturmaktadır. Organik hayvansal ürünlerden et, süt ve yumurta üretimi de yapılmakta fakat çok düşük oranlarda kalmaktadır. Günümüzde organik arıcılık alanında 387, yumurta tavukçuluğu alanında 91, büyük ve küçükbaş yetiştiriciliğinde 19 adet çiftçi organik hayvansal üretim yapmaktadır.

Tablo 1. Türkiye’de 2020 Yılı Organik Kanatlı Hayvan Yetiştiriciliği Verileri

İller	Çiftçi Sayısı	Hayvan Sayısı	Yumurta Sayısı (Adet)
Adana	1	11.815	2.000.400
Afyonkarahisar	2	9.000	1.105.220
Bilecik	1	36.000	1.000.000
Bolu	8	128.479	24.277.081
Burdur	1	1.800	576.000
Bursa	2	11.759	3.945.290
Elazığ	2	115.118	18.327.800
İstanbul	1	350	-
İzmir	7	126.162	28.527.991
Kırklareli	5	51.240	7.151.531
Kocaeli	4	5.787	1.514.591
Malatya	2	5.225	482.100
Manisa	5	103.150	26.093.020
Mersin	1	2.000	288.000
Ordu	20	14.250	12.000
Sakarya	11	155.600	34.450.132
Samsun	2	187.583	23.411.665
Tekirdağ	3	74.700	1.358.000
Trabzon	1	2.205	341.280
Uşak	12	49.200	8.129.826
Toplam:	91	1.091.423	182.991.927

Kaynak: <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>
2020 yılı verilerine göre Türkiye’de organik kanatlı hayvan yetiştiriciliği 91 adet üretici ile yapılmaktadır. Bu üreticiler toplamda 1091.423 adet hayvana sahip olup yılda 182.991.927 adet organik yumurta elde etmektedirler. Tablo 1’de özetlenen bulgular üretici bazında Ordu ilinin ilk sırada yer aldığını ortaya koymaktadır. Hayvan sayısı açısından ilk sırada Samsun gelmektedir. Organik yumurta sayısı açısından ise ilk sırada Sakarya yer almaktadır (Tablo 1). 2020 yılı verilerine göre organik tavuk eti ise sadece İzmir (31,88 ton) , Sakarya (16,80 ton) ve Samsun (1,10 ton) illerinde üretilmektedir (www.tarimorman.gov.tr).



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Tablo 2. Türkiye’de Organik Büyükbaş Hayvancılık Verileri (2020)

İller	Çiftçi Sayısı	Hayvan Sayısı	Süt (ton)	Et (ton)
Aydın	1	723	3.000,00	-
Çanakkale	2	2.786	1.840,00	701,10
İstanbul	1	7		-
Kastamonu	2	59	81	-
Manisa	2	2.083	8.147,00	-
Niğde	1	1.165	6.069,00	-
Samsun	3	682	1.836,00	-
Yalova	1	128	248,79	-
Toplam:	13	7.633	21.221,79	701,10

Kaynak: <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>

Türkiye’de organik büyükbaş hayvancılık 13 adet üretici ile sınırlı bölgelerde yapılmaktadır. 2020 yılı verilerine göre 7.633 adet büyükbaş hayvandan 21.221,79 ton süt ve 701,10 ton et elde edilmektedir. Organik süt üretimi en fazla Manisa’da yapılmakta, ardından Niğde, Aydın ve Çanakkale gelmektedir. Organik et üretimi ise sadece Çanakkale’de yapılmaktadır (Tablo 2).

Tablo 3. Türkiye’de Organik Küçükbaş Hayvancılık Verileri (2020)

İller	Çiftçi Sayısı	Hayvan Sayısı	Süt(ton)	Et (ton)
Çanakkale	3	1.997	1,00	608,60
İstanbul	1	10		
Kocaeli	1	102	0,22	
Tokat	1	95		4,10
Toplam:	6	2.204	1,22	612,70

Kaynak: <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>

Türkiye’de organik küçükbaş hayvancılık sadece Çanakkale, Kocaeli, Tokat ve İstanbul illerinde yapılmaktadır. Organik küçükbaş hayvancılık en yoğun Çanakkale’de yapılmakta, ardından Kocaeli ve Tokat gelmektedir (Tablo 3). Elde edilen bulgular Türkiye’de organik küçükbaş hayvancılığının yetersiz ve oldukça sınırlı yapıldığını ortaya koymaktadır.



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Tablo 4. (Türkiye’de Organik Arıcılık Verileri 2020)

İL	ÜRÜN	ÇİFTÇİ (İŞLETME) SAYISI	KOVAN SAYISI	ÜRETİM MİKTARI (TON)
ADİYAMAN	BAL	27	2.165	47,75
AFYONKARAHİSAR	BAL	1	220	2,50
ANKARA	BAL	1	30	0,85
ARTVİN	BAL	31	2.653	24,45
AYDIN	BAL	3	1.094	25,30
BALIKESİR	BAL	1	45	0,47
BAYBURT	BAL	71	9.948	156,65
BİNGÖL	BAL	2	1.750	22,20
BİTLİS	BAL	1	995	27,50
ÇANAKKALE	BAL	11	917	9,78
ÇORUM	BAL	1	115	0,80
ELAZIĞ	BAL	33	3.742	29,56
ERZİNCAN	BAL	6	1.571	7,35
ERZURUM	BAL	9	2.214	25,22
GAZİANTEP	BAL	2	642	6,87
GÜMÜŞHANE	BAL	31	2.052	17,61
HAKKARİ	BAL	1	130	0,12
İSTANBUL	BAL	1	110	3,00
İZMİR	BAL	2	455	10,65
KARS	BAL	3	1.190	15,97
KAYSERİ	BAL	1	50	0,30
KONYA	BAL	1	127	3,00
MERSİN	BAL	25	6.935	143,13
MUĞLA	BAL	1	355	3,00
MUŞ	BAL	6	1.854	43,00
ORDU	BAL	4	2.833	55,75
RİZE	BAL	5	625	7,45
SİİRT	BAL	4	1.141	17,56
SİVAS	BAL	9	2.704	39,68
ŞIRNAK	BAL	1	732	4,20
TRABZON	BAL	11	4.238	86,35
TUNCELİ	BAL	13	2.427	10,07
VAN	BAL	35	12.825	175,99
YALOVA	BAL	9	349	1,50
YOZGAT	BAL	1	105	0,82
ZONGULDAK	BAL	23	1.047	2,00
GENEL TOPLAM		387	70.385	1.028,39

Kaynak: <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>



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2020 yılı verilerine göre Türkiye’de organik bal yetiştiriciliğinde 387 adet üretici bulunmaktadır. Organik arıcı sayısının en yoğun olduğu iller sırasıyla Bayburt, Van, Elazığ ve Gümüşhane’dir. Kovan sayısı açısından ise Van, Bayburt, Mersin, Trabzon Ordu, Sivas ve Artvin ön sıralarda yer almaktadır. Organik arı ürünleri bazında Van, Bayburt ve Mersin ilk üç sırayı almaktadır (Tablo 4).

Elde edilen bulgular Türkiye’de organik hayvancılık alanında üretimin daha çok arıcılık ve kanatlı hayvanlar üzerine yoğunlaştığını ortaya koymaktadır. İhraç edilen hayvansal ürünler arasında sadece bal yer almakta, kalan kısmı bitkisel ürünler oluşturmaktadır. Bu bulgulara ek olarak büyükbaş ve küçükbaş hayvancılıkta üretimin yoğunlaştığı bir bölge ya da havza bulunmamaktadır. Oysaki Doğu Anadolu Bölgesi başta olmak üzere, İç Anadolu Bölgesi ve Güneydoğu Anadolu Bölgesi sahip olduğu doğal toprak yapıları, yerli sığır gen kaynakları ve ekstansif ağırlıklı hayvancılık işletmeleri ile organik büyükbaş ve küçükbaş hayvancılık için son derece uygun bir yapı göstermektedir. Bu noktada devletin üreticilere yapacağı desteklemeler ve teşvik uygulamaları organik hayvancılığa büyük bir ivme kazandırabilir.

5. TÜRKİYE’DE ORGANİK HAYVANCILIKLA İLGİLİ SORUNLAR VE ÇÖZÜM ÖNERİLERİ

Türkiye sahip olduğu sığır gen kaynakları, bozulmamış toprak yapısı ve ekstansif ağırlıklı hayvancılık işletmeleri ile organik hayvancılık için son derece uygun bir potansiyele sahiptir. Gerçekte Türkiye bu potansiyelden yeterince faydalanamamaktadır. Bunun nedeni olarak Türkiye’de organik hayvancılığın önünde birtakım engellerin bulunması gösterilebilir. Bu noktada organik hayvancılıkla ilgili bazı sorunlar ve bu sorunlara yönelik bir takım çözüm önerileri üretilebilir. Bunları özetleyecek olursak:

- **Türkiye’de Organik Hayvansal Ürünlerin Üretim Miktarlarının Oldukça Düşük Olması:** Türkiye’de bal dışındaki diğer organik hayvansal ürünlerin ihracatında ve pazarlanmasında bir takım problemler yaşanmaktadır. Burada öncelikle organik hayvansal ürünlerin pazarlanmasında iç pazar hedef olarak alınmalıdır. Ayrıca tüketicilerin organik ürünler konusundaki bilinç düzeyleri de artırılmalıdır.

- **Organik Hayvansal Ürünlerin Fiyatlarının Yüksek Olması:** Dünyada birçok ülkede organik ve konvansiyonel ürünler arasındaki fiyat farkı %25-60 arasında değişirken, Türkiye’de bu oran %150-200’ler düzeyindedir. Organik ürün talebinde bulunan tüketicilerin %90’ına yakını bu ürünlerin fiyatının yüksek olması nedeniyle alım gücüne sahip değildirler. Yem ve



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girdi fiyatlarının yanı sıra kontrol hizmeti ücretlerinin yüksek oluşu organik ürünlerin maliyetlerini de artırmakta bu durum fiyatlara olumsuz yansımaktadır. Bu noktada organik ürünlerin tüm tüketicilere hitap edeceği şekilde pazarlama stratejileri belirlenmelidir. Aynı zamanda üreticilere organik yem desteği sağlanmalı, mera ıslah çalışmalarına ağırlık verilmeli ve özel şahıslara ait mera alanlarının oluşturulmasına imkân tanınmalıdır (<https://avys.omu.edu.tr>).

- **Organik Hayvancılıkla Uğraşan Çiftçilerin Örgütlenme Sorunu:** Organik ürünün pazarlanmasında, doğrudan tüketiciye ulaştırılmasında önemli sorunlar bulunmaktadır. Özellikle kontrol ve sertifikasyon kuruluşlarıyla yapılan anlaşmalar maliyetleri artırmaktadır. Üretici malını doğrudan pazara ulaştıramadığı için aracı sayısı artmaktadır. Bu noktada aracı sayısını en asgariye indirebilmek için bazı büyük şehirlerde organik ürün pazarlarının kurulması önem arz etmektedir.

- **Üreticilere Sağlanan Mali Desteklerin Yetersiz Oluşu:** Organik bitkisel ve hayvansal ürünlerde gelişme gösteren ülkelerde, üreticilere önemli mali destekler sunulmaktadır. Türkiye’de ise bu konuda sağlanan desteklemeler yetersiz kalmaktadır. Organik hayvan türlerinin bölgedeki uygunluğuna göre tüm işletmelere kapsamlı ve kalıcı destekler sağlanmalıdır. Elde edilecek hayvansal ürünlerin işlenmesi ve pazarlanmasına yönelik sanayi desteği de alınmalıdır.

- **Kontrol ve Sertifikasyon Kuruluşlarının Yetersizliği:** Türkiye’de organik bitkisel ve hayvancılık ürünlerinin kontrolü için kalıntı ve katkı analizi yapacak laboratuvar sayısı oldukça azdır. Kontrol ve sertifikasyon kuruluşları ağırlıklı olarak büyük şehirlerde konumlanmıştır. Diğer illerde analiz yapılamadığından bu durum üreticiler için büyük bir maliyet getirmektedir. Bu noktada yapılması gereken kontrol ve sertifikasyon kuruluşlarının tüm bölgelere yayılması sağlanmalıdır.

- **Tüketicilerin Organik Üretim Konusunda Yeterli Bilgiye Sahip Olmaması:** Organik ürünlerle ilgili olarak kamuoyunda ve tüketici nezninde ciddi bilgi yetersizliği ve yanlış algı bulunmaktadır. Özellikle köy ürünleri, doğal ürünler gibi yanlış kullanımların organik üretimle bir ilgisi bulunmamaktadır. Bu bilgi yetersizliğinin ve yanlış algının ortadan kaldırılması hem organik üretim hem de geleneksel üretimin sürdürülebilirliği açısından oldukça önemlidir. (<https://avys.omu.edu.tr>).



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6. SONUÇ VE DEĞERLENDİRME

Dünyada olduğu gibi Türkiye’de de organik hayvansal ürünlere olan talep gün geçtikçe artmaktadır. Bu noktada organik hayvancılıkta el edilen ürünlerin her aşamada kontrollü ve sertifikalı yapılması, beslenme amaçlı kullanılan bitkisel veya hayvansal kökenli yem maddelerinin kimyasal çözücüler kullanılmadan organik üretilmiş veya hazırlanmış olması gerekmektedir.

Türkiye’de organik tarım sadece bitkisel üretime yönelik gelişme göstermiştir. Hayvansal üretimde istenilen başarı sağlanamamıştır. Bunun nedenleri arasında hayvansal ürünlerin iç pazarda ihracat şansının düşük olması, alım gücünün yetersiz olması ve tüketicilerin bilinç düzeylerinin yetersiz oluşu gösterilmektedir.

Bu çalışmada organik hayvanlığa geçiş süreci, uygulama şartları ve Türkiye’de organik hayvancılığın durumu ve gelişmesine yönelik stratejiler üzerinde durulmaktadır. Türkiye sahip olduğu sığır gen kaynakları, bozulmamış toprak yapısı ve ekstansif ağırlıklı hayvancılık işletmeleri ile organik hayvancılık için son derece uygun bir potansiyel oluşturmaktadır. Fakat gerçekte elde edilen bulgular Türkiye’de organik hayvancılık alanında üretimin sadece arıcılık ve kanatlı hayvanlar üzerine yoğunlaştığını ortaya koymaktadır. İhraç edilen hayvansal ürünler arasında sadece bal yer almakta, kalan kısmı bitkisel ürünler oluşturmaktadır. Organik hayvansal ürünlerden et, süt ve yumurta üretimi de yapılmakta fakat çok düşük oranlarda kalmaktadır. Sonuç olarak; Türkiye sahip olunan bu potansiyelden yeterince faydalanamamaktadır. Bu noktada devletin organik yem üretimi desteği sağlaması, mera ıslahı çalışmalarına ağırlık vermesi ve özel şahıslara ait mera alanlarının oluşturulmasına imkân tanınması gerekmektedir.



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KAYNAKLAR

1. Dellal, G., Öztürk, A.K., Aksakal, V., Haşimoğlu, s., Uzunçam, R., Pehlivan, E., Koşum, N., 2015. Türkiye’de Organik Hayvansal Üretim. Türkiye Ziraat Mühendisliği VIII. Teknik Kong., Bildiriler Kitabı-2. s:880-913. 12-16 Ocak 2015 Ankara. ISBN-978-605-01-0676-3.
2. Rosati, A., Aumaitre, A., 2004. Organic dairy farming in Europe. Livestock Production Sci..90: 4151.
3. Tölü, C., Akbağ, H.I., Yurtman, İ.Y., Savaş, T., Organic Animal Farming in Turkey: Philosophy and Practice, J. Anim. Prod., 2020, 61 (1): 73-81.
4. <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>, Erişim Tarihi: 29.11.2021.
5. <https://avys.omu.edu.tr/storage/app/public/msarica/67443/15%20Organik%20Hayvanc%C4%B1%C4%B1k.pdf> , Erişim Tarihi, 28.11.2021.
6. <https://akademik.adu.edu.tr/myo/cine/webfolders/File/ders%20notlari/Organik%20Hayvancilik.pdf>, Erişim Tarihi, 27.11.2021.



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ÖZET

Çiftlik hayvanları yetiştiriciliğinde, hayvanların verim özellikleri kazancı direkt etkileyen en önemli faktörlerdendir. Bu sebeple yetiştirici, hayvanlardan en yüksek verimi almak ve bu verimin devamlılığını sağlamak amacıyla uygun bir sürü yönetim planı takip etmelidir. Gerek sütçü hayvan yetiştiriciliği gerekse etçi ırkların yetiştiriciliğinde hayvanların reproduktif özellikleri en önemli unsurdur. Gebelik sonuçlanmayan her östrus dönemi yetiştirici hanesine zarar olarak eklenmektedir. Bu nedenle reproduktif kontrollerin düzgün yapılması ve hayvan bilgilerinin düzenli tutulması gerekmektedir. Esmer ırkı sığırlar; anavatanı İsviçre olan, koyu kahverengi ya da gri bir renge sahip, olumsuz mevsim ve bakım şartlarına dayanıklı bu sebeple de uzun süre üretimine devam edilebilen bir ırktır. Sütlerindeki yağ ve protein oranı yüksek olan bu kombine verimli ırk ülkemizde hemen her bölgede yetiştiriciliği yapılmaktadır. Sunulan çalışmada bir işletmede aynı bakım ve besleme koşullarına sahip 752 esmer ırkı ineğin reproduktif verileri incelenmiştir. Buna göre esmer ırkı ineklerde ilk tohumlama yaşı 610 gün, gebelik oluşumu için harcanan tohum sayısının 3.2, gebelik oranını % 79 ve buzağılama aralığının 504 gün olduğu belirlenmiştir.

Anahtar kelimeler: Esmer ırkı, inek, reproduksiyon, parametre



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REPRODUCTIVE PARAMETERS IN BROWN COWS

ABSTRACT

In farm animal breeding, the yield characteristics of animals are one of the most important factors that directly affect the earnings. For this reason, the breeder should follow an appropriate herd management plan in order to get the highest yield from the animals and to ensure the continuity of this yield. Reproductive characteristics of animals are the most important factor in both dairy farming and beef breeds. Every estrus period that does not result in pregnancy is added to the farmer's household as a loss. For this reason, reproductive controls should be done properly and animal information should be kept regularly. Brown cattle; It is a breed whose homeland is Switzerland, has a dark brown or gray color, is resistant to adverse seasonal and maintenance conditions, and therefore can be produced for a long time. This combined productive breed, which has a high fat and protein ratio in its milk, is cultivated in almost every region of our country. In the present study, the reproductive data of 752 brown cows with the same care and feeding conditions in a farm were examined. According to this, it was determined that the first insemination age in brown cows was 610 days, the number of seeds spent for pregnancy formation was 3.2, the pregnancy rate was 79% and the calving interval was 504 days.

Keywords: Brown swiss, cow, reproduction, parameter



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GİRİŞ

Sığır yetiştiriciliği ülkemizde süt ve et üretiminin büyük bir kısmının yapıldığı bir hayvancılık alanıdır. Tarım ve Orman Bakanlığı Hayvancılık Genel Müdürlüğü Kasım 2021 verileri incelendiğinde Türkiye de 18.124.106 adet sığırın bulunduğu bunların toplam süt üretiminin 20.782.377 ton; toplam et üretiminin 1.075.479 kg olduğu belirtilmiştir (Haygem 2021).

Döl verimi, hayvan yetiştiriciliği yapılan işletmelerde devamlılığı ve karlılığı etkileyen en önemli parametrelerden biridir. İşletmede devamlılığının sağlanması, ıslah programlarının sağlıklı yürütülmesi ve döl veriminin sağlıklı bir şekilde takibine bağlıdır. Damızlıkta ilk kullanım yaşı, buzağılama aralığı, doğum sonrası ilk tohumlama zamanı ve gebelik oluşumu için kullanılan ortalama tohum sayısı gibi parametreler bu amaçla değerlendirilir (Emsen, 1997; Akbulut ve Tüzemen, 1992) .

Damızlıkta ilk kullanım yaşı ırk özellikleri, bakım ve besleme şartlarına göre değişmekle birlikte genellikle yetişkin canlı ağırlığın 2/3 üne erişildiğinde yeterli görülmektedir (Kaya ve ark, 1998). Erken dönemde oluşturulan gebelikler annenin gelişimini olumsuz etkilerken sonraki süreçte verim düşüklüğüne ve güç doğumlara da sebebiyet vermektedir.

Doğum sonrası dinlenme periyodundan sonra gebelik oluşumunun uzaması buzağılama aralığını uzatmakta buda bir sonraki laktasyon periyodunun başlangıcını geciktirmekte ve maddi zararlara neden olmaktadır. Gebelik oluşumu için kullanılan tohumlama sayısının 2 den fazla olması istenmez. 2 den fazla tohumlama sayısı reproduktif bir sıkıntı bulunabileceği anlamına gelir (ALAÇAM, 1994).

Sunulan çalışmada aynı işletmede bulunan, benzer bakım ve besleme koşullarına sahip esmer ırkı ineklerin reproduktif verileri incelenmiştir. İneklerin ilk tohumlama yaşları, gebelik oluşumu için kullanılan tohum sayısı, gebelik oranı, doğum sonrası ilk gebeliğin oluşum süresi ve buzağılama aralıkları belirlenmiştir.

MATERYAL METOD

Araştırmamız İç Anadolu bölgesinde bulunan bir çiftlikteki esmer ırkı 752 adet ineğin verileri kullanılarak yapılmıştır. İneklerin ilk tohumlama yaşları, gebelik oluşumu için kullanılan tohum sayısı, gebelik oranı, doğum sonrası ilk gebeliğin oluşum süresi ve buzağılama aralıkları kayıt altına alınmış ve incelenmiştir.



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BULGULAR

Tablo 1 de verilen veriler incelendiğinde ilk tohumlama yaşının 610 gün olduğu, gebelik oluşumu için ortalama 3.2 payetin kullanıldığı, gebelik oranının % 79 ve buzağılama aralığının 504 gün olduğu görülmektedir.

Tablo 1: Esmer ırkı ineklerde reprodüktif veriler

Toplam inek sayısı	İlk Tohumlama zamanı (gün)	Kullanılan Payet sayısı	Gebe inek sayısı	Gebelik oranı	Doğum sonrası ilk tohumlama zamanı (gün)	Buzağılama Aralığı (gün)
752	610	3.2	596	%79	72	610

TARTIŞMA VE SONUÇ

Çalışmamızda ilk tohumlama yaşı 610 gün olarak bulunmuştur. Yapılan çalışmalar incelendiğinde; Alpan ve Ada (1977) 456 gün, Gökdere (1981) 738,72 gün, Özbeyaz ve ark. (1996) 556,32 gün, İnal ve ark. (2003) ortalama 632,32 gün, Kopuzlu ve ark. (2008) 796.9 gün, Sabuncuoğlu ve ark. (2014) 728.3 gün olarak belirlemiştir.

Reprodüksiyon için önemli parametrelerden birisi de tohumlama sayısıdır. Bu sayının düşük oluşu yüksek bir başarının göstergesidir. Ülkemiz koşullarında 2.0 değerinin üzerindeki rakamlar problemli, 1.5-2.0 arası orta düzeyde, 1.5'in altındaki değerler ise çok iyi kabul edilmektedir (Alpan, 1993). Gebelik için uygulanan tohumlama sayısı çalışmamızda genel ortalama olarak 3.2 bulunmuştur. Yapılan çalışmalardaki veriler incelendiğinde Alpan ve ark. (1976) yaptıkları araştırmada Alman Esmerlerinde bu rakamı 2.1; Uludağ (1977) İsviçre Esmerlerinde 1.6, Karacabey ve Alman esmerlerinde 1.59; Vaccaro ve Vaccaro (1983) Venezuela Brown Swiss melezi ineklerde 2.66 ve 2.77; Oğan (2000) 2,11; İnal ve ark. (2003) 1.76; Sabuncuoğlu ve ark. (2014) 1,54 adet olarak bildirmiştir. Kullanılan tohum sayısının yüksek olması yanlış beslenme, işletme yönetimi ve tohumlama operatörlerinin uzmanlığı ile ilişkili olabilir.

Buzağılama aralığı çalışmamızda 504 gün bulunmuştur. Yapılan çalışmalar incelendiğinde, esmer ineklerde buzağılama aralıkları; Taiwan da 500 gün (Ma ve Chyr, 1978) Rusya'da 382 gün (Soldatov ve Rusanova, 1979) ve Almanya' da 395 gün (Kassel, 1981) olarak bildirilmiştir. Türkiye' de yapılan çalışmalarda, Alpan ve ark. (1976) ithal Alman esmerlerinde 441 gün; Uludağ (1977) İsviçre ve Karacabey esmerlerinde 384 gün, Venezuela esmerlerinde 381 gün



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ve Alman esmerlerinde ise 360 gün; (2) İnal ve ark. (1989) 5 farklı menşeli esmer ırkında ortalama 324,9 gün; (5) Oğan (2000) 402,7 gün; İnal ve ark. (2003) 382,5 gün; Estrada-Leon ve ark. (2008) 453,9 gün; Kopuzlu ve ark. (2008) ise bu aralığı 394.6 ± 6.0 gün; hesaplamışlardır. Çalışmamızda doğumdan sonra ineğin tekrar tohumlanma zamanı ortalama 72 gün bulunmuştur. Ancak gebelik başına tohum sayısının ortalama 3,2 oluşu servis periyodunu uzatarak yaklaşık 140 güne kadar uzatmaktadır. Yapılan çalışmalar incelendiğinde bu süre; Yanar ve ark. (1997) 144.4 gün; Oğan, (2000) 114,6 gün; İnal ve ark. (2003) 124 gün; gün Estrada-Leon ve ark. (2008) 87,8; Sabuncuoğlu ve ark. (2014) 114.7 gün olarak belirlenmiştir. Çalışmamızdaki veriler ile diğer araştırmacıların verileri arasındaki farkla işletme yönetimi, bakım besleme ve uygulayıcıların profesyonel olup olmamaları, çalışmalarda incelenen hayvanların ortalama süt verimleri gibi nedenlerden kaynaklanmış olabilir.

Çalışmamızdan sonuç olarak esmer ırkı ineklerin ilk tohumlama yaşının 610 gün; gebelik oluşumu için harcanan tohum sayısının 3.2; gebelik oranını % 79 ve buzağılama aralığının 504 gün olduğu belirlenmiştir.



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KAYNAKLAR

- Akbulut Ö, Tüzemen N (1992) Sığırlarda Döl Verimi Ölçüleri. Atatürk Üniv. Zir. Fak. Derg., 23(1) 104-110.
- Alaçam, E. (1994) Büyük Ruminantlarda İnfertilite, Evcil hayvanlarda Reprodüksiyon, Sun'i Tohumlama, Doğum ve İnfertilite. Ed. Alaçam, E., Dizgi Yayınevi, Konya, 265-289, 1994.
- Alpan O., Yosunkaya H., Alıç K. (1976): Türkiye'ye ithal edilen Esmer, Holsteyn ve Simental sığırlar üzerinde karşılaştırmalı bir adaptasyon çalışması. Lalahan Zoot. Aras. Enst. Derg., 16: 3 -17.
- Alpan, O., Ada, H. (1977): Esmer ırk düvelerin erken sığata alınmasının bazı verim özellikleri üzerine etkisi. TÜBTAK, VI. Bilim Kongresi Veteriner ve Hayvancılık Araştırma Grubu Tebliği. 17 -21 Ekim 1987, Ankara, 595 -605.
- Chavaz, J., Hagger, C. (1980) : Effect of Herd Environment and Milk Yield on Various Fertility Traits in swiss Browns. 31 st Annual Meeting, European Association for Animal Production No: GC2.19, 10 pp. (Anim. Breed. Abstr., 49: 1985, 1981).
- Emsen H (1997) Hayvan Yetiştirme İlkeleri. Atatürk Üniv. Ziraat Fakültesi Yayınları No: 720, s. 27-55.
- Estrada- Leon R.J, Magana JG ve Segura- Correa J.C (2008). Genetic Parameters For Reproductive Traits Of Brown Swiss Cows In The Tropics Of Mexico. Journal of Animal and Veterinary Advances 7 (2): 127-129, 2008.
- Gökdere M.A. (1981): Karacabey Harasında, Karacabey Esmeri ırkı sığırlarda bazı dölverimi özellikleri. Uzmanlık Tezi. A. Ü. Vet. Fak. Hayvan Yetiştiriciliği ve Sağlık Bilimleri Yüksek Okulu. Ankara.
- İnal Ş Ve Alpan O (1989). Konya Hayvancılık Merkez Araştırma Enstitüsündeki Esmer Irk Sığırların Dölverimi Performansı. Lalahan Hay. Arast. Enst. Derg. 1989 29 (1-4) 1-20.
- İnal Ş, Tilki M, Çolak M, Ümitli S (2003). Konya Hayvancılık Araştırma Enstitüsündeki Esmer Irk Sığırların Dölverimi Özellikleri. Vet. Bil. Derg. (2003), 19, 1-2: 5- 10.
- Jans F. (1977) : Rearing Experimenths with Simmental and Swiss Brown Cattle. Schweizerische Landwirt Schaftliche Monatshefte. 55 (11) 362-376. (Anim. Breed. Absr., 46: 4267, 1978).
- Kassel K.F. (1981): Study of fertility in dairy cattle within a veterinary practice in the lower Allgau. Anim. Breed. Abstr., 49: 5154.



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Kaya, A., Yaylak, E., Önenç, A. 1998. Süt sığırcılığında düzenli üreme ve önemi. Hayvansal Üretim Dergisi, Sayı:38,8-17.

Koçak S, Tekerli M, Özbeyaz C, Demirhan İ (2008). Lalahan Merkez Hayvancılık Araştırma Enstitüsü'nde Yetiştirilen Holştayn, Esmer ve Simental Sığırlarda Bazı Verim Özellikleri. Lalahan Hay. Araşt. Enst. Derg. 2008, 48 (2) 51 – 57.

Kopuzlu S, Emsen H, Özlütürk A, Küçüközdemir A (2008). Esmer Ve Siyah Alaca Irkı Sığırların Doğu Anadolu Tarımsal Araştırma Enstitüsü Sartlarında Döl Verim Özellikleri. Lalahan Hay. Araşt. Enst. Derg. 2008, 48 (1) 13 – 24.

Ma, R.C.S., Chyr, S.C. (1978): The reproductive performance of a dairy herd in northern Taiwan. Anim. Breed. Abstr 46: 3290.

Oğan M (2000). Esmer Irk ineklerin Dölverimi Özellikleri ve Bu Özelliklere Etki Eden Bazı Çevre Faktörleri. J Fac VetMed 19 (2000) 7-12.

Özbeyaz C, Küçük M, Çolakoğlu N (1996). Malya Tarım İşletmesi Esmer İnekler_Nde Dölverim Performansı. Lalahan Hay. Arast. Enst. Derg. 1996 36 (2) 1-17.

Plakhtii P.D., Zayats A.M. (1977): Reproductive Performance of Cows in the Podolian Region in Relation to age, Postpartum İnsemination İnterval and Season. İn Vosproizvodstvoi Bolezni Krupnogo Rogatogo Skotav Promyshlennykh Kompleksakh. kishinev, USSR, Kishinouskii Sel' Skokhozyaistvennyi İstitut. 9-13 (Anim. Breed. Abstr. 48: 4612, 1980).

Sabuncuoğlu N, Laçın E, Çoban Ö, Yıldız A, Genç M (2014). Erzurum İlinde Yetiştirilen Esmer ve Siyah Alaca İneklerin Bazı Reprodüktif Performansları ve Ayıklama Nedenleri Üzerine Bir Araştırma. Atatürk Üniversitesi Vet. Bil. Derg. 2014; 9(1): 30---38.

Soldatov A.P., Rusanova G.E. (1979): Heritability and repeatability of reproductive traits in cattle. Anim. Breed. Abst. 47: 1734.

Uludağ, N. (1977): Çifteler Harası değişik orijinli Esmer ırk sığırlarında süt ve yavru verimleri. Doçentlik Tezi. Fırat Ü. Veteriner Fakültesi, Elazığ.

Vaccaro R, Vaccaro L. DE (1983): Age at first calving, reproduction and prenatal survival in Holstein Friesian and Brown Swiss crossbred in an intensive tropical milk production system. Anim. Breed. Abstr 51: 3628.



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T.C Tarım ve Orman Bakanlığı Hayvancılık Genel Müdürlüğü Verileri (2021).
<https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf>

Yanar M, Tuzemen N, Akbulut Ö, Aydın R, Uğur F (1997). The Reproductive Performance of Brown Swiss Cattle Raised in the Eastern Turkey Indian J. Dairy Sci. 50, 4, 1997.



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FARKLI ZENCEFİL ESANSİYEL YAĞ DOZLARININ MISIR DANE YEMİNİN *İN VİTRO* GAZ ÜRETİMİ, RUMEN FERMANTASYONU ve METAN ÜRETİMİ ÜZERİNE ETKİSİ

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ÖZET

Bu çalışmada, rumen sıvısına sırasıyla; 0 (kontrol), 0.2, 0.4, 0.8, 1.2, 1.6 ve 2.0 g/L rumen sıvısı (RS) zencefil esansiyel yağı (ZEY) (*Zingiber officinale Roscoe*) ilave edilmiştir. Denemede yem olarak ise mısır dane yemi kullanılmıştır. Rumen sıvısına ilave edilen zencefil esansiyel yağının mısır danesinin *in vitro* gaz üretimi, organik madde sindirimi (OMS), metabolik enerji (ME), rumen fermantasyonu özellikleri ile metan (CH₄) üretimi üzerine olan etkileri saptanmıştır. Rumen sıvısına artan dozlarda ZEY ilavesi, mısır dane yeminin (MDY) *in vitro* gaz üretimini düşürmüştür. Aynı şekilde OMS ve ME içerikleri ile toplam uçucu yağ asitleri (TUYA), asetik asit (AA), propiyonik asit (PA), bütirik asit (BA) ve diğer UYA içeriklerini azaltmıştır (P<0.05). Ancak ZEY dozunun artışına bağlı olarak metan (CH₄) ve amonyak azotu (NH₃-N) üretimi düşerken, rumen pH'sını artmıştır (P<0.05). Sonuç olarak, *in vitro* gaz üretimi, rumen fermantasyonu, besin maddeleri sindirimi ve CH₄ gazı üretimi üzerinde, en fazla olumsuz etkili ZEY dozu 2.0 g/L RS olduğu saptanmıştır. Yüksek ZEY dozlarının rumen fermantasyonunu, yemlerin sindirimini olumsuz etkilemesi nedeniyle düşük dozlarda (0.4 g/L RS) kullanılmasının uygun olacağı kanaatine varılmıştır.

Anahtar Kelimeler: Mısır dane yemi, zencefil esansiyel yağı, rumen parametreleri, *in vitro* gaz üretimi, metan



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EFFECT OF DIFFERENT GINGER ESSENTIAL OIL DOSES ON *IN VITRO* GAS PRODUCTION, RUMEN FERMENTATION AND METHANE PRODUCTION OF CORN GRAIN FEED

ABSTRACT

In this study, rumen fluid, respectively; 0 (control), 0.2, 0.4, 0.8, 1.2, 1.6 and 2.0 g/L rumen fluid (RF) ginger essential oil (GEO) (*Zingiber officinale Roscoe*) was added. Corn grain feed was used as feed in the experiment. The effects of ginger essential oil added to rumen fluid on in vitro gas production, organic matter digestion (OMS), metabolic energy (ME), rumen fermentation properties and methane (CH₄) production of corn grain were determined. The addition of increasing doses of ZEY to rumen fluid reduced the in vitro gas production of corn grain feed (CGF). Likewise, OMS and ME contents and total volatile fatty acids (TVFA), acetic acid (AA), propionic acid (PA), butyric acid (BA) and other VFA contents were decreased (P<0.05). However, depending on the increase in GEO dose, methane (CH₄) and ammonia nitrogen (NH₃-N) production decreased, while rumen pH increased (P<0.05). As a result, *in vitro* gas production, rumen fermentation, nutrient digestion and CH₄ production on the most adverse effect GEO dose was found to be 2.0 g/L RF. It was concluded that it would be appropriate to use low doses (0.4 g/L RF) because of the high GEO doses that affect rumen fermentation and the digestion of feed.

Key words: Corn grain, ginger essential oil, rumen parameters, *in vitro* gas production, methane



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GİRİŞ

Hayvancılıkta yemden yararlanma düzeyimi artırmak, hastalık ve metabolik bozuklukları önlemek için antibiyotikler kullanılmıştır (Jouany ve Morgavi 2007; Hodjatpanah ve ark. 2010). Son yıllarda hayvan beslemede antibiyotik kullanımı insan sağlığı için risk oluşturması nedeniyle, Avrupa Birliği'nin 2003 yılında (EU regulation no.1831/2003 of the European Parliament and of the Council of 22 September 2003) aldığı karar gereği 2006 Ocak ayından sonra gelişmeyi teşvik edici olarak kullanımı yasaklanmıştır (Chesson, 2006). Antibiyotiklerin yasaklanması yeni yem katkı maddelerinin geliştirilmesine yönelik çalışmaları artırmıştır. Bu arayışlar içinde aromatik bitki ve bu bitkilerde izole edilen esansiyel yağlar ön plana çıkmıştır (Chao ve Young, 2000; Jeena ve ark. 2013; Meliani ve ark. 2014; Sharma ve ark. 2016; Mahboubi, 2019; Zaki ve ark. 2021).

Bu esansiyel yağlardan birisini zencefil esansiyel yağı (ZEY) oluşturmaktadır (Kim ve ark. 2012; Tag El-Din ve ark. 2012; Mohammad ve Moeini 2015; Faniyi ve ark. 2016; Faniyi ve ark. 2019). Zencefil bitkisinden elde edilen esansiyel yağların yapısında zingiberen (%10.5-16.6), e-sitral (%7.4-12.0) z-sitral (%5.3-8.8), kamfen (%4.9-7.6), okimendir (% 0.9-6.5), ar-curcumene (% 2.9-9.8), β -farnesen (%5.1-8.4), β -farnesol (%3.9-5.8) ile β -seskiphellandren (%5.8-7.2) gibi çok sayıda aktif metabolit içermektedir (Mollenbeck ve ark. 1997; Raina ve ark. 2005; Ishiguro ve ark. 2007; Bhatt ve ark. 2013; Sharma ve ark. 2016).

Zencefil esansiyel yağında bulunan bu aktif bileşiklerin antiseptik, antimikrobiyal, antioksidant özellikleri yanı sıra soğuk algınlığı, kusmanın kontrolü, kalp hastalıkları, mide ülserini iyileştirme, tümör büyümesine, romatizmaya ve migrene karşı etkili olduğu bildirilmektedir (Shao ve ark. 2003; Raina ve ark. 2005; Bhatt ve ark. 2013; Meliani ve ark. 2014; Mahboubi, 2019). Zencefil esansiyel yağının gram pozitif ve gram negatif bakterilere karşı anti bakterisit özellik gösterdiği de bildirilmektedir (Chao ve Young, 2000; Jeena ve ark 2013; Meliani ve ark.2014; Nanon ve ark. 2015; Faniyi ve ark. 2019).

Yukarıda belirtilen özelliklere sahip olan ZEY'nin rumen fermantasyonu manipüle etmede kullanılacağı bildirilmektedir (Soroor ve Moeini, 2015; Faniyi ve ark. 2016; Al-Azazi ve ark. 2018; Kurniawati ve ark. 2018; Mekuiko Warsop ve ark. 2018; Faniyi ve ark. 2019). Zencefil esansiyel yağının ayrıca yemlerin sindirimi, metabolik enerji ve metan üretimi üzerine de etkisinin olduğu saptanmıştır (Soroor ve Moeini, 2015; Nanon ve ark. 2015; Kurniawati ve ark. 2018; Mekuiko Watsop ve ark. 2018; Faniyi ve ark. 2019). Bu nedenle ZEY'nin rumen



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fermantasyonu, yemlerin sindirimi ile rumende metan (CH₄) üretimi üzerine etkilerinin ortaya konması önem taşımaktadır.

Bu çalışma; ZEY ve farklı dozlarının (0, 0.2, 0.4, 0.8, 1.2, 1.6 ve 2.0 g/L RS) mısır dane yeminin *in vitro* gaz üretimi, sindirim ve rumen fermentasyonu üzerine olan etkilerini saptanmak amacıyla düzenlenmiştir.

MATERYAL ve YÖNTEM

Yem ve hayvan materyali

Araştırmanın yem materyalini mısır (*Zea mays* L.) dane yemi oluşturmuştur. Mısır danesi 1 mm elek çapına sahip değirmende öğütülerek araştırmada kullanılmıştır. Denemede kullanılan ZEY (katalog no: W252204-8007-08-7) saf olarak piyasadan sağlanmıştır (Sigma-Aldrich). Araştırma kullanılan rumen sıvısı ise kesilmiş 3 baş Kıvırcık ırkı tokludan alınmıştır.

***In vitro* gaz üretim tekniğinin uygulanması**

Mısır dane yeminin *in vitro* gaz üretimi, organik madde sindirimi (OMS) ve metabolik enerji (ME) düzeyinin saptanmasında Menke ve Steingass (1988) tarafından geliştirilen “*in vitro* gaz üretim tekniği” kullanılmıştır. *In vitro* gaz üretiminin saptanması için 100 mL hacimli özel cam tüpler (Model Fortuna, Häberle Labortechnik, Lonsee-Ettlenschieß, Germany) kullanılmış ve şırıngalara ZEY’nin her bir dozu (0, 0.2, 0.4, 0.8, 1.2, 1.6 ve 2.0 g/L RS) için üç paralel olacak şekilde yaklaşık 200±10 mg yem örneği konmuştur. Daha sonra tüplerin içine Menke ve ark. (1979)’ı tarafından bildirilen yönteme göre hazırlanmıştır. Bu işlemten sonra tüpler 39°C’de su banyosunda sırasıyla; 3, 6, 12, 24, 48, 72 ve 96. saat aralıklarla *in vitro* gaz üretimleri ölçülmüştür.

İnkübasyonun 96. saatinde şırıngalar içerisindeki rumen sıvısında pH, TUYA ve NH₃-N saptanmıştır. *In vitro* ortamda oluşan karbondioksit (CO₂) ve metan (CH₄) gazları ise rumen sıvılarında saptanan bireysel uçucu yağ asitleri (UYA)’den yararlanarak aşağıdaki eşitliklerle hesaplanmıştır (Blümmel ve ark. 1999).

Karbondioksit, CO₂ = Asetik asit / 2 + Propiyonik asit / 4 + 1.5 x Bütirik asit

Metan, CH₄ = (Asetik asit + 2 x Bütirik asit) - CO₂

(UYA’nin konsantrasyonu mmol olarak alınmıştır).

Yem ham maddelerinin organik madde sindirilebilirliği (OMS) ve metabolik enerji (ME) Menke ve Steingass (1988) tarafından bildirilen aşağıdaki eşitliklerle saptanmıştır.

OMS, % = 9.00 + 0.9991 x GÜ + 0.0595 x HP + 0.0181 x HK



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$ME, MJ/kg\ KM = 1.06 + 0.1570 \times GÜ + 0.0084 \times HP + 0.0220 \times HY - 0.018 \times HK$

(GÜ: 200 mg kuru yem örneğinin 24 saat inkübasyon süresi sonundaki net gaz üretimi, HP: ham protein, HY: ham yağ ve HK: ham kül, g/kg kuru madde (KM)).

Kimyasal analizler

Mısır dane yeminin kuru madde, ham kül, ham protein ve ham yağ analizi AOAC (2000)'da bildirilen yöntemlere göre, hücre duvarı bileşenleri (nötr deterjan lif: NDF, asit deterjan lif: ADF ve asit deterjan lignin: ADL) analizi ise Van Soest ve ark. (1991) tarafından bildirilen yöntemlere göre ANKOM 200 Fiber Analyzer (ANKOM Technology Corp., Fairport, NY, USA, 2008) cihazı ile analiz edilmiştir.

Rumen sıvısı pH'sı dijital pH metreyle saptanmıştır. Amonyak azotu (NH₃-N) Kjeldahl metodundan yararlanarak Blümmel ve ark. (1997)'nin bildirdikleri yöntemle göre, Rumen sıvısı UYA ise Wiedmeier ve ark. (1987)'nin önerdiği yöntemle göre gaz kromatografisi (Agilent Technologies 6890N gaz kromatografisi, Stabilwax-DA, 30 m, 0.25 mm ID, 0.25 µm df. Max. temp: 260°C. Cat. 11023) cihazı ile belirlenmiştir.

İstatistik analizler

Araştırmadan verilerinin istatistiki olarak değerlendirmesinde varyans analizi (Snedecor ve Cochran, 1976), veriler arası görülen farklılıkların önem düzeylerinin saptanması Duncan çoklu karşılaştırma testi ile belirlenmiştir (SAS, 2004).

ARAŞTIRMA BULGULARI ve TARTIŞMA

Mısır dane yeminin kimyasal bileşimleri

Araştırmada kullanılan mısır dane yeminin besin maddeleri bileşimi saptanmış ve Çizelge 1'de verilmiştir.

Çizelge 1. Mısır dane yeminin kimyasal bileşimi, %

Besin maddeleri	%
Organik maddeler	98.13
Ham kül	1.87
Ham protein	10.07
Ham yağ	4.36
Nötr deterjan lif, (NDF)	14.32
Asit deterjan lif, (ADF)	3.12
Asit deterjan lignin, (ADL)	1.05



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Mısır dane yeminin OM, HP, HP, HY, NDF, ADF ve ADL içerikleri sırasıyla; %98.13, 1.87, 10.07, 4.36, 14.32, 3.12 ve 1.05 olarak saptanmıştır. Mısır dane yeminin ham besin maddeleri bileşimi Canbolat (2021) ve NRC (2007)'nin bildirdikleri besin maddeleri bileşimi ile benzer bulunmuştur.

Zencefil esansiyel yağının *in vitro* gaz üretimi üzerine etkisi

Zencefil esansiyel yağı ve farklı dozlarının MDY'nin *in vitro* gaz üretimi üzerine etkisi saptanmış ve Çizelge 2'de verilmiştir.

Çizelge 2. Zencefil esansiyel yağı ve farklı dozlarının MDY'nin *in vitro* gaz üretimi, mL

İnkübasyon süresi, saat	Zencefil esansiyel yağı, g/L RS							
	Kontrol (0)	0.2	0.4	0.8	1.2	1.6	2.0	SH*
3	18.33 ^a	17.93 ^a	16.27 ^b	15.10 _c	14.60 _c	14.40 _c	13.37 _d	0.46 ₀
6	35.53 ^a	35.13 ^a	32.83 ^b	31.00 _c	28.47 _d	27.23 _e	24.00 ^f	0.56 ₀
12	51.70 ^a	50.10 ^a	47.77 ^a _b	45.63 _b	44.43 _b	42.80 _c	38.67 _c	0.68 ₅
24	68.90 ^a	66.43 ^b	64.60 ^c	62.50 _d	60.27 _e	57.47 ^f	54.03 _g	0.63 ₉
48	74.77 ^a	73.77 ^a _b	72.87 ^b	70.23 _c	66.70 _d	63.40 _e	59.00 ^f	0.77 ₈
72	80.40 ^a	78.40 ^b	76.43 ^c	74.70 _d	68.27 _e	66.07 ^f	63.37 _g	0.52 ₁
96	82.13 ^a	79.97 ^b	78.70 ^c	75.90 _d	70.53 _e	66.63 ^f	61.47 _g	0.68 ₇

*: Standart hata. Aynı satırda farklı harfler ile gösterilen ortalamalar arasındaki farklılıklar önemlidir (P<0.05)

In vitro gaz üretimi üzerine farklı dozlarda ZEY ilavesi, *in vitro* gaz üretimini tüm inkübasyon dönemlerinde düşürmüştür (P<0.05). Zencefil esansiyel yağı dozlarına bağlı olarak 96. Saatte gaz üretimi 61.47 ile 82.13 mL/200 mg MDY arasında değişmiştir. En düşük 61.47 mL ile 2.0 g ZEY/L RS ilave edilen grupta, en yüksek ise 82.13 mL ile ZEY ilave edilmeyen kontrol grubunda bulunmuştur. Rumen sıvısına ilave edilen ZEY dozu artışına bağlı olarak *in vitro* gaz üretimindeki azalma, ZEY aktif bileşenlerinden zingiberen, e-sitral, z-sitral, kamfen, okimendir, ar-curcumene, β -farnesen, β -farnesol ve β -seskiphellandren gibi aktif bileşenlerin antimikrobiyal özellik göstermesi ve bunun sonucu olarak rumen mikroorganizmalarını sınırlanmaları ile açıklanabilir (Chao ve Young, 2000; Jeena ve ark 2013; Meliani ve ark. 2014; Soroor ve Moeini, 2015; Nanon ve ark. 2015; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018; Faniyi ve ark. 2019). Yapılan birçok çalışmada ZEY'nin *in vitro* gaz üretimini azalttığı bildirilmektedir (Tag El-Din ve ark. 2012; Jeena ve ark 2013; Meliani ve ark.2014; Soroor ve



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Moeini, 2015; Nanon ve ark. 2015; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018; Faniyi ve ark. 2019). Bu araştırmada saptanan bulgular Tag El-Din ve ark. (2012), Kurniawati ve ark. (2018) ve Mekuiko ve ark. (2018)'nın bildirdikleri sonuçları desteklemektedir. Nanon ve ark. (2015)'nin yapmış oldukları çalışmada ise *in vitro* gaz üretimini ZEY (2.0 mg/kg KM) ilavesi olumsuz etkilememiştir.

Rumen sıvısına ZEY ilavesi yemlerin sindirimi üzerinde etkili olan mikroorganizmalar karşı antimikrobiyal aktivite göstermesi ile açıklanabilir (Tag El-Din ve ark. 2012; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018). Zencefil esansiyel yağında bulunan organik bileşiklerin (zingiberen, e-sitral, z-sitral, kamfen, okimendir, ar-curcumene, β -farnesen, β -farnesol ve β -seskiphellandren gibi aktif bileşenlerin) diğer esansiyel yağlardaki gibi mikroorganizmaların hücre duvarı yapısını bozarak antimikrobiyal etki gösterdiği bildirilmektedir (Sharma ve ark. 2016; Ashraf ve ark. 2017; Mahboubi 2019). Benzer mekanizma ile rumen mikroorganizmalarının gelişiminin de sınırladığı (Tag El-Din ve ark. 2012; Soroor ve Moeini, 2015; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018), buna bağlı olarak *in vitro* gaz üretiminin azaldığı söylenebilir.

Zencefil esansiyel yağının organik madde sindirimi ve ME üzerine etkisi

Zencefil esansiyel yağı ve farklı dozlarının MDY'nin *in vitro* koşullarda besin maddeleri sindirimi ve metabolik enerji (ME) üzerine etkisi saptanmış ve Çizelge 3'de verilmiştir.

Çizelge 3. Zencefil esansiyel yağı ve farklı dozlarının MDY'nin *in vitro* koşullarda organik madde sindirimi ve ME üzerine etkisi

Parametreler	Zencefil esansiyel yağı, g/L RS							
	Kontrol (0)	0.2	0.4	0.8	1.2	1.6	2.0	SH
OMS, %	84.17 ^a	81.70 ^b	79.87 ^c	77.77 ^d	75.54 ^e	72.75 ^f	69.31 ^g	0.639
ME, MJ/kg KM	12.29 ^a	11.90 ^b	11.61 ^c	11.28 ^d	10.93 ^e	10.49 ^f	9.95 ^g	0.099

OMS: Organik madde sindirimi; **ME:** Metabolik enerji; *: Standart hata. Aynı satırda farklı harfler ile gösterilen ortalamalar arasındaki farklılıklar önemlidir (P<0.05)

In vitro koşullarda rumen sıvısına farklı dozlarda ZEY ilavesi, MDY'nin OMS'i %84.17 ile %69.31 arasında değişmiş, rumen sıvısına ZEY ilave dozunun artmasına bağlı olarak önemli düzeyde azalmıştır (P<0.05). Mısır dane yeminin ME düzeyi de ZEY dozu artışına bağlı olarak 12.29 ile 9.95 MJ/kg KM arasında değişmiş ve yüksek dozda ZEY ilavesi ME düzeyini olumsuz etkilemiştir (P<0.05). Rumen sıvısına ZEY ilavesinin artışına bağlı olarak OMS ve ME düzeyindeki azalma OMS ve ME değerlerinin 24. saatte üretilen *in vitro* gaz hacmi temel (mL gaz/24 saat) alınarak hesaplanmasından kaynaklanmaktadır. Rumen sıvısına artan dozlarda



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ZEY ilavesi antimikrobiyal etki göstererek (Tag El-Din ve ark. 2012; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018; Mahboubi, 2019; Camnolat 2020) düşük *in vitro* gaz üretimine neden olması ile açıklanabilir. Ancak Soroor ve Moeini (2015) ise *in vitro* gaz üretimini ZEY'nin artırdığını saptamıştır. Burada *in vitro* gaz üretiminin yüksek çıkması kullanılan rasyon ve ZEY dozunun düşük (60 mg/L RS) olması ile açıklanabilir. Araştırmada saptanan OMS'de ki düşüş farklı yem ve zencefil esansiyel yağı dozu ile çalışan Tag El-Din ve ark. (2012), Mekuiko ve ark. (2018) ve Mahboubi M. (2019)'nın araştırmalarında da olmuştur. Soroor ve Moeini, (2015), Medjekal ve ark. (2017) ve Kurniawati ve ark. (2018)'nin bildirdikleri araştırma bulgularında ise ZEY yemlerin sindirimi olumlu yönde etkilemiştir. Ancak bu araştırmacılar düşük dozlarda (60 mg/RS; 50 mg; 100 mg/L RS) olması ile açıklanabilir. Nanon ve ark. (2015)'nin yapmış oldukları çalışmada ise rasyona ZEY (2.0 g/kg KM) ilavesi kuru madde sindirimini olumsuz etkilemediğini bildirmişlerdir.

Rumen sıvısına farklı dozlarda ZEY ilavesi, MDY'nin ME içeriği 12.29 ile 9.95 MJ/kg KM arasında değişmiştir. Zencefil esansiyel yağı dozun arttıkça ME düzeyi düşmüştür. Benzer düşüş Tag El-Din ve ark. (2012)'nin zencefil ilavesi ile ilgili yapmış oldukları araştırma ile de ortaya konmuştur.

Zencefil esansiyel yağının rumen fermantasyonu üzerine etkisi

Zencefil esansiyel yağı ve farklı dozlarının rumen fermantasyon özellikleri üzerine etkisi saptanmış ve Çizelge 4'de verilmiştir.

Çizelge 4. Zencefil esansiyel yağı ve farklı dozlarının rumen fermantasyonuna etkisi

Rumen sıvısı parametreleri	Zencefil esansiyel yağı, g/L RS							SH*
	Kontrol (0)	0.2	0.4	0.8	1.2	1.6	2.0	
pH	5.83 ^a	6.08 ^{ab}	6.11 ^{bc}	6.29 ^c	6.40 ^d	6.51 ^d	6.58 ^e	0.091
NH ₃ N, mg N/100 mL	31.96 ^a	30.19 ^b	27.99 ^c	26.21 ^d	22.67 ^e	21.66 ^e	19.97 ^f	0.908
TUYA, mmol/L	104.17 ^a	100.69 ^b	98.78 ^c	94.67 ^d	92.64 ^e	81.79 ^e	71.82 ^g	1.070
Asetik asit, mmol/L	49.93 ^a	48.04 ^b	46.99 ^b	45.70 ^c	44.74 ^{cd}	43.65 ^d	37.45 ^e	0.628
Propiyonik asit, mmol/L	27.90 ^a	27.34 ^a	27.36 ^a	26.02 ^b	25.99 ^b	21.30 ^c	19.23 ^d	0.544
Bütirik asit, mmol/L	17.66 ^a	17.37 ^a	17.09 ^{ab}	17.05 ^{ab}	16.36 ^b	12.24 ^c	10.86 ^d	0.466
DUYA, mmol/L	8.67 ^a	7.91 ^b	6.92 ^c	5.89 ^d	5.55 ^e	4.60 ^f	4.19 ^g	0.142
Asetik asit/propiyonik asit	1.79 ^c	1.75 ^{cd}	1.69 ^d	1.76 ^{cd}	1.72 ^{cd}	2.05 ^a	1.94 ^b	0.047

NH₃N: Amonyak azotu; TUYA: Toplan uçucu yağ asidi; DUYA: Diğer uçucu yağ asitleri; AA/PP: asetik asit/propiyonik asit; *: Standart hata. Aynı satırda farklı harfler ile gösterilen ortalamalar arasındaki farklılıklar önemlidir (P<0.05)

Farklı dozlarda ZEY ilavesi TUYA ile asetik, propiyonik ve bütirik asitler önemli düzeyde düşürmüştür (P<0.05). Zencefil esansiyel yağı dozlarına bağlı olarak rumen sıvısı TUYA'leri 104.17 ile 71.82 mmol/L arasında saptanmış ve en düşük TUYA 2.0 g ZEY/RS ilave edilen



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deneme grubunda saptanmıştır. Rumen sıvısı asetik, propiyonik ve bütirik asit düzeyi ise sırasıyla; 49.93-37.45 mmol/L, 27.90-19.23 mmol/L ve 17.66-10.86 mmol/L arasında değişmiştir. Toplam ve asetik, propiyonik, bütirik asitler üzerinde en etkili olan ZEY dozunun 2.0 g ZEY/L RS olduğu saptanmıştır ($P<0.05$). Rumen sıvısına ZEY ilavesi rumen parametrelerine etkisi rumen mikroorganizmaları üzerine antibakteriyel (Tag El-Din ve ark. 2012; Kurniawati ve ark. 2018; Mekuiko ve ark. 2018; Mahboubi, 2019; Canbolat 2020; Zaki ve ark. 2021) etki yapması ile açıklanabilir. Özellikle ZEY dozunun artışı TUYA'leri ile bireysel uçucu yağ asitleri üretimini azaltmıştır.

Soroor ve Moeini, (2015)'nin yapmış oldukları çalışmada rumen sıvısına 30 ve 60 mg ZEY ilave etmişler ve araştırma sonucunda ZEY dozları artışına bağlı olarak propiyonik asit oranını artırdığı, TUYA'leri ile asetik asit oranını ise düşüğünü bildirmişlerdir. Benzer bulgular Tag El-Din ve ark. (2012)'nin TUYA için bildirdikleri çalışmayla da ortaya konmuştur. Bu araştırmalardan elde edilen sonuçlarda, araştırmacıların bulguları ile uyumlu bulunmuştur. Ancak Nanon ve ark. (2015)'nin yapmış oldukları çalışmada ise ZEY'nin TUYA, asetik asit, propiyonik asit içeriğini etkilemediğini bildirmişlerdir.

Araştırmada saptanan AA/PA oranı ZEY dozu artışına bağlı olarak 1.69 ile 2.05 arasında değişmiş ve ZEY dozları arası farklılıklar önemli bulunmuştur ($P<0.05$). En yüksek AA/PA oranı ZEY içermeyen kontrol grubunda bulunmuştur. Araştırmada saptanan AA/PA oranı ZEY ile çalışan Nanon ve ark. (2015) (3.33-3.34) ile Soroor ve Moeini, (2015)'nin saptadıkları (2.3-2.6) değerlerden düşük, farklı esansiyel yağ (sarımsak esansiyel yağı) ile çalışan Chaves ve ark. (2008)'nin bildirdikleri değerlerden (1.8-1.7) daha yüksek saptanmıştır.

Zencefil esansiyel yağı dozu artışına bağlı olarak rumen sıvısı pH düzeyi 5.83-6.58 arasında değişmiş ve ZEY dozları arası farklılıklar önemli bulunmuştur ($P<0.05$). En yüksek rumen pH'sı 2.0 g ZEY/L RS'nin olduğu grupta saptanmıştır. Zencefil esansiyel yağı dozu artışına bağlı olarak pH'nın artması, ZEY'nin rumen sıvısını asit karaktere çeviren uçucu yağ asitlerinin azalması ile açıklanabilir (Çizelge 4). Araştırmada saptanan rumen pH'sı ZEY ile çalışan Kurniawati ve ark. (2018) ile Zaki ve ark. (2021)'nin bulgularından düşük bulunmuştur. Busquet ve ark. (2006)'nin bildirdikleri sonuçlarla benzer saptanmış ve ZEY rumen pH'sını artırmıştır.

Rumen sıvısı amonyak azotu (NH_3N) düzeyi ise ZEY dozu artışına bağlı olarak 31.96 ile 19.97 mg N/100 mL arasında değişmiştir. En yüksek NH_3N 31.96 mg N/100 mL ile ZEY bulunmayan kontrol grubunda, en düşük ise 19.97 mg N/100 mL ile 2.0 g ZEY/L RS bulunan grupta



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saptanmıştır ($P<0.05$). Rumen sıvısı NH_3N düzeyindeki azalma başta rumen sıvısı mikroorganizmalarının etkinliğinin azalması yanında, esansiyel yağların amino asitlerin deaminasyonunu önlemesinden de kaynaklanacağı bildirilmektedir (Roy ve ark. 2014; Nanon ve ark. 2015; Soroor ve Moeini, 2015). Rumende amonyak (NH_3) şeklinde azot kaybının azalması hayvan besleme açısından yarar sağlayacağı, yemin enerji ve azotundan yararlanmayı artıracığı bildirilmektedir (Anassori ve ark. 2011; Nanon ve ark. 2015; Soroor ve Moeini, 2015; Blanch ve ark. 2016; Bakr 2019). Araştırmada saptanan rumen sıvısı NH_3N düzeyi ZEY ile çalışan Nanon ve ark. (2015)'nin bildirdikleri sonuçlardan düşük, Soroor ve Moeini, (2015)'nin bulguları ile benzer saptanmıştır. Mekuiko ve ark. (2018) ile Zaki ve ark. (2021)'nin yapmış oldukları çalışmada da ZEY ilavesi rumen NH_3N 'nu azalttığını bildirmişlerdir. Busquet ve ark. (2006)'ı ise rumen sıvısına ZEY ilavesinin rumen NH_3N 'nu etkilemediğini bildirmişlerdir.

Zencefil esansiyel yağının karbondioksit (CO_2) ve metan (CH_4) gazı üretimine etkisi

Rumen sıvısına ZEY ve farklı dozları ilavesinin CO_2 ve CH_4 gazı üretimi üzerine etkisi saptanmış ve Çizelge 5'de verilmiştir.

Araştırmada rumen sıvısına ilave edilen ZEY dozunun artışına bağlı olarak *in vitro* CO_2 gazı üretimi azalmıştır ($P<0.05$). En yüksek 58.44 mmol/L ile kontrol grubunda, en düşük ise 39.85 mmol/L ile 2.0 g ZEY/L RS bulunan grupta saptanmıştır ($P<0.05$). *In vitro* CH_4 gazı üretimi ise ZEY dozu artışına bağlı olarak azalmış ve 26.82 ile 19.33 mmol/L arasında değişmiş ve aralarındaki farklılıklar önemli bulunmuştur ($P<0.05$). Ruminantlarda CO_2 ve CH_4 üretimi rumende bulunan metajenik bakteriler UYA ile hidrojen iyonlarını (H^+) kullanılarak üretilmektedir (Demeyer ve ark. 1996; Nanon ve ark. 2015; Blanch ve ark. 2016). Zencefil esansiyel yağı diğer rumen bakterileri gibi metajenik bakteriler üzerine antimikrobiyal etki göstererek CH_4 gazı oluşumu düşmektedir.

Çizelge 5. Zencefil esansiyel yağı ve farklı dozlarının karbondioksit (CO_2) ve metan (CH_4) üretimi

Parametreleri	Zencefil esansiyel yağı, g/L RS							SH*
	Kontrol (0)	0.2	0.4	0.8	1.2	1.6	2.0	
CO_2 , mol/L	58.44 ^a	56.92 ^b	56.07 ^{bc}	54.94 ^c	53.41 ^d	45.51 ^e	39.85 ^f	0.837
CH_4 , mol/L	26.82 ^a	25.87 ^b	25.09 ^c	24.87 ^c	24.05 ^d	22.62 ^e	19.33 ^f	0.430

*: Standart hata. Aynı satırda farklı harfler ile gösterilen ortalamalar arasındaki farklılıklar önemlidir ($P<0.05$)

Rumende yemlerin fermentasyonu ile yem enerjisinin %2-15'i metan şeklinde kayba uğradığı bildirilmektedir (Boadi ve ark., 2004; Kim ve ark. 2012). Metan gazı yoluyla enerji kaybı azaltma ve sera gazı emisyonunu düşürmede esansiyel yağların bir potansiyel olduğu



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bildirilmektedir (Benchaa ve Greathead. 2011; Nanon ve ark. 2015; Ozkan ve ark. 2015; Ratika ve James Singh 2018). Zencefil esansiyel yağda rumende metan üreten bakterilerin sayısını sınırlayarak, metan üretiminin azalmasına yol açtığı birçok çalışma tarafından ortaya konmuştur (Tag El-Din ve ark. 2012; Nanon ve ark. 2015). Araştırmada rumen sıvısına farklı dozlarda ZEY ilavesi *in vitro* metan gazı üretimini önemli düzeyde azaltmıştır ($P<0.05$). Aynı bulgular zencefil esansiyel yağı ve bitkisi ile çalışan Tag El-Din ve ark. (2012) ile Kurniawati ve ark. (2018)'nın bulguları bezer yönde bulunmuştur.

SONUÇ

Sonuç olarak, *in vitro* koşullarda rumen sıvısına farklı dozlarda ZEY ilavesi *in vitro* gaz üretimi, OMS ile ME düzeyini önemli düzeyde etkileyerek düşürmüştür ($P<0.05$). Aynı şekilde rumen sıvısına ilave edilen ZEY dozu artışı rumen metabolitlerinden TUYA ve bireysel uçucu yağ asitleri ile NH_3N , CO_2 ve CH_4 gazı üretimini düşürmüş, pH'yı artırmıştır. Araştırmadan elde edilen veriler ve bu alanda yapılan diğer araştırmalar birlikte değerlendirildiğinde kullanım dozların düşük tutulması gerektiği (>0.4 g ZEY/L RS) söylenebilir. Konunun daha iyi aydınlatılması için daha fazla *in vitro* ve *in vivo* çalışma yapmaya gerek olduğu sonucuna varılmıştır.



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KAYNAKLAR

Al-Azazi AS., Tayeb FA., Baraka TA., Khalaf AM, 2018. Effect of ginger powder (*Zingiber Officinale*) on selected rumen and blood serum constituents in sheep. Indian Journal of Applied Research 8: 27-30.

Anassori E., Dalir-Naghadeh B., Pirmohammadi R., Taghizadeh A., Asri-Rezaei S., Maham M., Farahmand-Azar S., Farhoomand P. 2011. Garlic: A potential alternative for monensin as a rumen modifier. Livestock Science 142. 276-287.

AOAC 2000. Official Methods of Analysis. 17th ed. 5th rev. Association of Official Analytical Chemists. Arlington, VA, USA. 930-954.

Ashraf SA., Al-Shammari E., Hussain T., Tajuddin S., Panda BP. 2017. In-vitro antimicrobial activity and identification of bioactive components using GC-MS of commercially available essential oils in Saudi Arabia. Journal of Food Science and Technology, 54(12): 3948-3958.

Bakr SA. 2019. Effect of adding ginger powder or ginger oil on productive performance of ewes during lactation period. Egyptian J. Nutrition and Feeds. 22(1): 63-78.

Benchaar C., Greathead H. 2011. Essential oils and opportunities to mitigate enteric methane emissions from ruminants. Anim. Feed Sci. Technol. 166: 338-355.

Bhatt N, Waly MI, Essa MM, Ali A, 2013. Ginger: A functional herb. Food as Medicine. Nova Science Publishers, Inc., New York, USA, pp: 51-71.

Blanch M., Carro MD., Ranilla MJ., Viso A., Vázquez-Añón M., Bach A. 2016. Influence of a mixture of cinnamaldehyde and garlic oil on rumen fermentation, feeding behavior and performance of lactating dairy cow, Anim Feed Sci Technol, 219. 313-323.

Blümmel M., Aiple KP., Steingass H., Becker K. 1999. A note on the stoichiometrical relationship of short chain fatty acid production and gas evolution in vitro in feedstuffs of widely differing quality, J Anim Physiol Anim Nutr, 81, 157-167.

Blümmel M., Steingass H., Becker K. 1997. The relationship between in vitro gas production, in vitro microbial biomass yield and 15N incorporation and its implications for the prediction of voluntary feed intake of roughages. Br. J. Nutr, 77, 911-921.

Boadi D., Benchaar C., Chiquette J., Massé D. 2004. Mitigation strategies to reduce enteric methane emissions from dairy cows: Update review. Can. J. Anim. Sci. 84:319-33.

Busquet M., Calsamiglia S., Ferret A., Kamel C. 2006. Plant extracts affect in vitro rumen microbial fermentation. J Dairy Sci. 89(2):761-71.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
and RURAL DEVELOPMENT
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BINGOL, TURKEY**



- Canbolat 2021. Buzağların bakım ve beslenmesi. ISBN: 978-605-247-323-8. s563.
- DORA Basım-Yayın Dağıtım Ltd. Şti. Bursa
- Canbolat Ö. 2020. Farklı Zencefil esansiyel yağ dozlarının arpa dane yeminin in vitro sindirim ve rumen fermantasyonu üzerine etkisi. 7. Ulusal Tarım Kongresi. (Özet metin sözlü bildirisi). s17. İstanbul.18.10.2020.
- Chao SC., Young DG. 2000. Screening for inhibitory activity of essential oils on selected bacteria, fungi and viruses. J. Essent. Oil Res. 12:639-649.
- Chesson A. 2006. Phasing out antibiotic feed additives in the EU: worldwide relevance for animal food production. Antimicrobial Growth Promoters-Where do We Go from Here? Wageningen Academic Publishers, The Netherlands, pp. 69-81.
- Demeyer DI., Fiedler D., De Graeve KG. 1996. Attempted induction of reductive acetogenesis into the rumen fermentation in vitro. Reprod Nutr Dev 36: 233-240, 1996.
- Faniyi TO., Adewumi MK., Prates ER., Ayangbenro AS. 2016. Effect of herbs and spices (plant extracts) on rumen microbial activities: a review. Public Med Vet Zootec PUBVET 10:465-474.
- Faniyi TO., Prates ÊR., Adegbeye MJ., Adewumi MK., Elghandour MMY., Salem AZM., Ritt LA., Zubieta AS., Stella L., Ticiani E., Jack AA. 2019. Prediction of biogas and pressure from rumen fermentation using plant extracts to enhance biodigestibility and mitigate biogases. Environ Sci Pollut Res Int. 26(26): 27043-27051.
- Hodjatpanah AA., Danesh Msegaran M., Vakili AR. 2010. Effects of diets containing monensin, garlic oil or turmeric powder on ruminal and blood metabolite responses of sheep, J Anim Vet Adv, 9 (24): 3104-3108.
- Ishiguro K., Ando T., Maeda O., Ohmiya N., Niwa Y., Kadomatsu K., Goto H. 2007. Ginger ingredients reduce viability of gastric cancer cells via distinct mechanisms. Biochem Biophys Res Commun 362: 218-223.
- Jeena K., Liju VB., Kuttan R. 2013. Antioxidant, anti-inflammatory and antinociceptive activities of essential oil from ginger. Indian J Physiol Pharmacol. 57(1): 51-62.
- Jouany JP., Morgavi DP. 2007. Use of “natural” products as alternatives to antibiotic feed additives in ruminant production. Animal, 1, 1443-66.
- Kim ET., Kim, C., H., Min, K.-S., Lee, SS. 2012. Effects of plant extracts on microbial population, methane emission and ruminal fermentation characteristics in in vitro. Asian-Australas. J. Anim. Sci. 25, 806-811.



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on AGRICULTURE, ANIMAL SCIENCES
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BINGOL, TURKEY**



Kurniawati A., Widodo, W., Artama T., Yusiati LM. 2018. Study of Local Herb Potency as Rumen Modifier: The Effect of Red Ginger (*Zingiber officinale* Var. *Rubrum*) on Parameters of Ruminal Fermentation In Vitro. *Earth and Environmental Science* 119: 1-8.

Mahboubi M. 2019. *Zingiber officinale* Rosc. essential oil, a review on its composition and bioactivity. *Clinical Phytoscience*. 5:6.

Medjekal S., Bodas R., Bousseboua H., López S. 2017. Evaluation of three medicinal plants for methane production potential, fiber digestion and rumen fermentation in vitro. *Energy Procedia*. 119; 632-641.

Mekuiko Watsop H., Tendonkeng F., Ngoula F., Miégoué E., Lemoufouet J., Fogang Zogang B., Chounna A., Mouchili M, Pamo Tedonkeng E. 2018. Effect of the essential oil of rhizomes of *zingiber officinale* on the in vitro digestibility of pennisetum clandestinum hay in small ruminants. *International Journal of Current Innovation Research*. 4(1A); 984-989.

Meliani A., Nair S., Bensoltane A. 2014. Cyto-biochemical and antimicrobial investigations on essential oil of *Zingiber officinale* Roscoe. *J Essent Oil Bear Plants*. 17(6): 1120-1129.

Menke KH., Raab L, Salewski A., Steingass H., Fritz D., Schneider W. 1979. The estimation of the digestibility and metabolizable energy content of ruminant feedingstuffs from the gas production when they are incubated with rumen liquor in vitro, *J Agric Sci*, 93, 217-222.

Menke KH., Steingass H. 1988. Estimation of the energetic feed value obtained from chemical analysis and in vitro gas production using rumen fluid, *Anim Res Dev*, 28. 9-55.

Mohammad ENS., Moeini MM. 2015. The influence of ginger (*Zingiber Officinale*) on in vitro rumen fermentation patterns. *Annual Research and Review in Biology*, 5, 54-63.

Mollenbeck S., Konig T., Schreir P., Schwab W., Rajaonarivony J., Ranarivelo L. 1997. Chemical composition and analysis of enantiomers of essentials from Madagascar. *Flavour Fragrance Journal*. 12(2):63-69.

Nanon A., Suksombat W., Wen Z. Y. 2015. Use of Essential Oils for Manipulation of Rumen Microbial Fermentation Using Batch Culture. *The Thai Journal of Veterinary Medicine*, 45(2); 167-180.

NRC (National Research Council), 2007. *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids*. Washington, DC: The National Academies Press.



**ISPEC 8th INTERNATIONAL CONFERENCE
on AGRICULTURE, ANIMAL SCIENCES
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- Ozkan, CO., Kamalak, A., Atalay, A.-I., Tatliyer A., Kaya E. 2015. Effect of peppermint (*Mentha piperita*) essential oil on rumen microbial fermentation of barley grain, *Journal of Applied Animal Research*, 43:3, 287-290, DOI: 10.1080/09712119.2014.963101.
- Raina VK., Kumar A., Aggarwal KK. 2005. Essential oil composition of ginger (*Zingiber officinale Roscoe*) rhizomes from different place in india. *J Essent Oil Bear Plants*. 8(2):187-91.
- Ratika K., James Singh RK. 2018. Plant derived essential oil in ruminant nutrition - A review. *Int. J. Curr. Microbiol. App. Sci.* 7(5): 1747-1753.
- Roy D., Tomar SK., Sirohi SK., Kumar V., Kumar M. 2014. Efficacy of different essential oils in modulating rumen fermentation in vitro using buffalo rumen liquor, *Veterinary World* 7(4): 213-218.
- SAS (Statistical Analysis Systems), 2004. SAS procedures guide. Release 9.1. (SAS Institute Inc.: Cary, NC).
- Shao Y., Marriott P., Shellie R., Hugel H. 2003. Solid-Phase Micro-Extraction Comprehensive two-dimensional Gas Chromatography of Ginger (*Zingiber officinale*) volatiles. *Flavour and Fragrance Journal*. 18: 5-12.
- Sharma PK., Singh V., Ali M. 2016. Chemical Composition and Antimicrobial Activity of Fresh Rhizome Essential Oil of *Zingiber Officinale Roscoe*. *Pharmacognosy* 8 (3); 185-190. doi:10.5530/pj.2016.3.3.
- Snedecor GW., Cochran WG. 1967. *Statistical Methots*, 7th Edition, Iowa State University Press, Ames.
- Soroor M., Moeini M. 2015. The Influence of Ginger (*Zingiber Officinale*) on *In vitro* Rumen Fermentation Patterns. *Annual Research and Review in Biology*, 5(1); 54-63.
- Tag El-Din AE., Moharam MS., Nour AA., Nasser ME. 2012. Effect of some herbs on the rumen fermentation: 1- Effect of ginger (*zingiber officinale*) and garlic (*allium sativum*) on gas production, energy values, organic matter digestibility and methane emission, in vitro. *Journal of Agricultural and Environnementa Science*, 11, 33-53.
- Van Soest PJJ., Robertson JB., Lewis BA. 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition, *J. Dairy Sci*, 74, 3583-3597.



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and RURAL DEVELOPMENT
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Wiedmeier RD., Arambell MJ., Walters JL. 1987. Effect of orally administered pilocarpine on ruminal characteristics and nutrient digestibility in cattle, J. Dairy Sci, 70, 284-289.

Zaki MG, Barka TA and Tayeb FAEF, 2021. Effect of ginger powder (*Zingiber officinale*) on acid-base balance, rumen and blood constituents in healthy Egyptian sheep. International Journal of Veterinary Science 10(1): 55-58.



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**TÜRKİYE’DE ÖRTÜALTI
YETİŞTİRİCİLİĞİ ve YENİ GELİŞMELER**

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ÖZET

Dünya nüfusunun hızla artması, tüketicinin alışkanlıklarının değişmesi, sağlıklı ve güvenilir gıda talepleri, iklim değişiklikleri ve tarım alanlarının çeşitli faktörlere bağlı olarak tehdit altında olması insanları yeni arayışlara girmiştir. Seracılık da bu arayışlardan biri olmuştur. Seracılık birim alandan maksimum verimin alınmasına yönelik arayışlar sonunda gelişmiştir. Üretim kontrol altında tutulurken sağlıklı, güvenilir, izlenebilir ve standart ürünler elde edilmektedir. Üretici kazancı açısından bakıldığında da ürünlerin açık alanda yetiştirildiği dönemler dışında yetiştirilmesi oldukça kârlı bir faaliyet olarak karşımıza çıkmaktadır. Ülkemiz örtüaltı yetiştiriciliği açısından son derece elverişli bir konumda yer almaktadır. Bu durum özellikle dış pazar rekabetimizi ülkemiz lehine çevirmektedir. Örtüaltı tarımı, birim alandan yüksek verim alınmasını sağlayan bir üretim sistemidir ve ülkemizde örtüaltı tarımı alçak plastik tüneller ve seralardaki üretimi kapsamaktadır. Toplam örtüaltı alanımız 2019 yılı itibarı ile 427.675 da’a ulaşmıştır. Bu alanın %30’sı (126.367 da) alçak plastik tünel, geriye kalan % 69’u (292.238 da) ise sera (yüksek tünel, cam ve plastik sera) alanlarından oluşmaktadır. Örtüaltı yetiştiriciliği iklimin uygun olduğu yerlerde yaygınlaşmış olup, üretim genelde diğer Akdeniz ülkelerinde olduğu gibi sadece anti-don amaçlı ısıtma ve/veya korumanın olduğu, basit yapılar altında gerçekleştirilmektedir. Bununla birlikte ülkemizde ileri teknoloji kullanan iklim kontrollü büyük ölçekli modern sera işletmeleri de kurulmakta olup, bu işletmeler için jeotermal alanlar tercih edilmektedir. Ülkemiz modern sera varlığı ise yaklaşık 13 bin dekadır. Bu seralarda topraksız tarım yöntemi ile ihracata yönelik üretim yapılmaktadır. Bu makalede ülkemiz örtüaltı yetiştiriciliğinin zaman içerisindeki gelişimi ve mevcut durumu, yetiştiriciliği yapılan türler, örtüaltı kurulumu, sera ve üretim teknolojileri ile konularında bilgi verilmiştir.

Anahtar Kelimeler: Örtüaltı, Sera Teknolojisi, Topraksız Tarım.



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**INVESTIGATION OF POST DISASTER SPATIAL CHANGE BY IMAGE
EVALUATION AND SEMANTIC DIFFERENTIATION METHODS**

ABSTRACT

The rapid increase in the world population, the change in consumer habits, healthy and safe food demands, climate changes and the fact that agricultural areas are under threat due to various factors have started to search for new people. Greenhouse cultivation has also been one of these pursuits. Greenhouse cultivation has developed as a result of the search for maximum efficiency from the unit area. While the production is kept under control, healthy, reliable, traceable and standard products are obtained. From the point of view of the producer's income, it is a very profitable activity to grow the products outside the periods when they are grown in the open field. Our country is located in an extremely favorable position in terms of greenhouse cultivation. This situation especially turns our foreign market competition in favor of our country. Greenhouse agriculture is a production system that ensures high efficiency from the unit area, and greenhouse agriculture in our country includes production in low plastic tunnels and greenhouses. Our total greenhouse area has reached 427,675 da as of 2019. 30% of this area (126.367 decares) consists of low plastic tunnels and the remaining 69% (292.238 decares) consists of greenhouse (high tunnel, glass and plastic greenhouse) areas. Greenhouse cultivation has become widespread in places where the climate is suitable, and production is generally carried out under simple structures with heating and/or protection for anti-frost purposes, as in other Mediterranean countries. In addition, climate-controlled large-scale modern greenhouse enterprises using advanced technology are also being established in our country, and geothermal areas are preferred for these enterprises. Our country's modern greenhouse assets are approximately 13 thousand decares. In these greenhouses, production is carried out for export with soilless farming method. In this article, information is given on the development and current status of greenhouse cultivation in our country, the species cultivated, the support given to the inputs used in greenhouse setup and cultivation, greenhouse and production technologies, and marketing opportunities.

Keywords: Greenhouse, Greenhouse Technology, Soilless Agriculture, Marketing.



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1. GİRİŞ

Örtüaltı tarımı, bitkilerin mevsimleri dışına kaydırılarak ya da mevsimleri dışında yetiştirilmesine olanak sağlayan bir yetiştiricilik şeklidir. Ülkemizde örtüaltı tarımı, alçak plastik tüneller, yüksek tüneller ve cam ve plastik örtü materyali ile örtülmüş seralardaki üretimi kapsamaktadır. Alçak plastik tünellerde bitkiler mevsimleri dışına kaydırılarak yetiştirilmekte ve üretimde erkencilik hedeflenmektedir. Yüksek tünellerde ve seralarda yapılan üretimde bitkiler mevsimleri dışında yetiştirilmektedir. Ülkemizde örtüaltı tarımı, plastiğin tarımda kullanımının başlamasıyla ticari önem kazanmıştır. 1970’li ve 1980’li yıllarda ekolojik koşulların uygun olduğu bölgelerde yayılmaya başlamıştır. 1990’lı yıllarda sera yatırımlarına ve serada yetiştiriciliğe uygulanan kaynak kullanımı ve destekleme fonu teşviki de alan artışında önemli katkı sağlamıştır. Bu yıllarda yüksek teknolojinin kullanıldığı modern seralar kurulmaya başlamış ve topraksız tarım kullanım alanı bulmuştur. 2000’li yıllarda sürdürülebilir üretim tekniklerinin ve sertifikalı üretimin yaygınlaşmaya başladığı görülmektedir (Tüzel ve ark., 2015). Günümüzde bahçe bitkileri türlerinin sağlık üzerindeki etkilerinin anlaşılması ile değişen tüketici talepleri yönlendirici olmaktadır. Kentlerdeki alanların değerlendirilmesine yönelik uygulamalar ve küçük alanların hacim olarak etkin kullanımını sağlayan ve kontrollü koşullarda yapılan dikey tarım uygulamaları son yıllardaki önemli gelişmelerdir.

2. TÜRKİYE’DE ÖRTÜALTI YETİŞTİRİCİLİĞİ

2.1. Alan

Türkiye, örtüaltı yetiştiriciliği bakımından dünyada ilk dört ülke arasında, Avrupa’da ise İspanya’nın ardından ikinci sırada yer almaktadır (TUIK, 2019). Toplam örtüaltı alanımız 2018 yılı itibarı ile 772 bin 91 dekara ulaşmıştır. Bu alanın 126.367 da alçak plastik tünel, yüksek tünel 18.995 da, cam 26.353 da ve plastik 246.890 da sera alanlarından oluşmaktadır (Çizelge 1), (TUIK 2019). Toplam örtüaltı alanı 2008 ve 2018 yılları arasında %42.4 oranında artmıştır. Plastik sera, yüksek ve alçak tünel alanlarındaki artış oranları sırasıyla %74.1, %70.6 ve %16.5 olmuştur. Cam sera alanları ise ürün fiyatlarındaki dalgalanmalardan etkilenerek %5’lik bir azalma göstermiştir (TUIK, 2019).



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Çizelge 1. 2019 Yılına Ait Örtüaltı Kayıt Sistemi Verileri

Örtüaltı Tipi	İşletme Sayısı	Örtüaltı Sayısı	Alan (da)
Cam Sera	10.060	19.720	26.353
Cam ve Plastik Sera	2.744	3.875	9.070
Plastik Sera	40.409	81.106	246.890
Toplam Sera	53.213	104.701	282.313
Yüksek Tünel	2.179	6.936	18.995
Alçak Tünel	1.668	5.201	126.367
GENEL TOPLAM	57.060	116.838	427.675

Örtüaltı yetiştiriciliği özellikle iklim koşullarının uygun olduğu Akdeniz sahil kuşağında gelişmiştir. Örtüaltı alanımızın %84'ü Akdeniz bölgesinde yer almaktadır. Antalya 286.52 da ile en önemli merkezdir ve bu ilimizi sırasıyla Mersin (201.06 da) ve Adana (160.49 da) izlemektedir. Adana ve Hatay (1109.6 da) özellikle alçak plastik tünel alanlarının yoğunlaştığı merkezlerdir. Bu illeri Akdeniz ve Ege Bölgesi arasında geçit olan Muğla (39.048 da) izlemektedir. İzmir ve Aydın'da sırasıyla 14.016 ve 12.717 da'lık örtüaltı varlığına sahiptir (TUIK 2020). Türkiye'de seraların yüzde 46'sı plastik seradan oluşuyor. Geri kalanların yüzde 24'ü alçak tünel, 17'si yüksek tünel, yüzde 13'ü ise cam sera olmuştur.

Ülkemiz örtüaltı üretim miktarı bakımından 2002 yılında 4.271 000 ton üretim alınırken; 2019 yılından itibaren 8.437.000 ton üretim olmuştur (Çizelge 2), (TUIK 2020).

Çizelge 2. Ülkemiz Örtüaltı Üretim Miktarları (Bin Ton)

Yıllar	Cam sera	Plastik sera	Yüksek	Alçak tünel	Toplam
2002	999	1.980	369	923	4.271
2003	1.188	2.134	404	801	4.528
2004	1.218	2.041	383	713	4.354
2005	1.182	2.129	412	743	4.465
2010	1.345	2.895	601	910	5.750
2014	1.259	3.554	744	919	6.482
2015	1.276	3.676	805	963	6.720
2016	1.289	4.011	838	1.028	7.165
2017	1.319	4.168	792	1.104	7.383
2018	1.316	4.615	891	1.249	8.071
2019	1.311	4.902	875	1.349	8.437



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2.2. Yetiştiriciliği Yapılan Türler

Seralarda yetiştirilen ana ürün grubu sebzelerdir (%94), bunu meyve türleri (%5) ve kesme çiçek ve iç mekan bitkileri izlemektedir. Örtüaltındaki bitkisel üretim değerinin yaklaşık olarak 10 milyar TL olduğu tahmin edilmektedir (TUIK 2019). Ülkemizde 2018 yılındaki 30 milyon ton sebze üretiminin yaklaşık 8 milyon tonu örtüaltında gerçekleştirilmiştir. Üretimde de Antalya %49'luk payla (48.938.739 ton) birinci sıradadır ve bu ilimizi sırasıyla, Mersin %18 (17.609.868 ton), Adana %11.35 (11.148.797 ton) ve Muğla %8.23(8.084.515 ton) illeri takip etmektedir. Bu 4 ildeki toplam örtü altı üretimimiz yaklaşık 98.243.938 ton ile ülkemiz toplam örtüaltı üretiminin yaklaşık %86'sını oluşturmaktadır (Çizelge 3), (TUIK 2019).

Çizelge 3. İllere Göre Sera Üretim Değerleri

İller	Sera Üretimi (Ton)	Yüzdelik Oran (%)
Antalya	48.938.739	49.81
Mersin	17.609.868	17.92
Adana	11.148.797	11.35
Muğla	8.084.515	8.23
İzmir	2.703.743	2.75
Samsun	1.766.864	1.80
Hatay	795.211	0.81
Aydın	761.853	0.78
Diğer 73 İl	6.434.348	6.55
TÜRKİYE	98.243.938	100.0

Sebze üretiminde domates ve hıyar üretimi sırasıyla % 48 ve %14'lik oran ile ilk iki sırada yer almaktadır. Solanaceae grubu sebzelerin payı %65, Cucurbitaceae familyası sebzelerinininki ise %32'dir. Cucurbitaceae sebzeleri içinde karpuz özellikle alçak plastik tünel altında çok yüksek miktarlarda üretilmektedir. Bu iki familya üyesi sebzelerin dışında da çok çeşitli sebze türlerinin örtüaltında yetiştirildiği görülmektedir. Seralarda meyve türlerinin üretimi de giderek önem kazanmıştır. Son 20 yılda toplam örtüaltı meyve üretimimiz 5.7 kat artış göstermiş ve 2018 yılı itibarı ile örtüaltında 535 515 ton meyve üretilmiştir. 2000'li yılların başında seralarda sadece çilek ve muz yetiştiriciliği yapılırken, günümüzde bu iki meyve türüne asma ve sert çekirdekli meyve türlerinin (şeftali, kayısı, erik, nektarin) yetiştiriciliği eklenmiştir (Çizelge 4), (TUIK 2020)



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Çizelge 4. Örtüaltında Yetiştirilen Ürünler

Ürünler	Üretim (Ton)	Oran (%)	Ürünler	Üretim	Oran (%)
Domates	4.083.681	48	Patlıcan	323.009	4
Hıyar	1.156.997	14	Kabak	211.953	3
Karpuz	877.505	10	Kavun	205.340	2
Biber	749.769	9	Çilek	195.206	2
Muz	424.837	5	Diğer	200.702	2
TOPLAM		8.436.616			

3. SERA TEKNOLOJİSİ

3.1. İşletme Özellikleri

Ülkemizdeki sera işletmeleri, büyüklükleri, yapısal özellikleri, üretim maliyetleri, iklimlendirme koşulları, teknoloji kullanımları gibi çeşitli özellikleri bakımından farklılık göstermektedir. İşletmeler düşük teknoloji kullananlar, orta ölçekli teknoloji kullananlar ve yüksek teknoloji kullananlar olmak üzere gruplanabilmektedir. Düşük teknoloji kullanan seralar basit yapılardır ve ısıtma yoktur. Açıkta yapılan yetiştiriciliğe benzer uygulamalar görülür. Orta ölçekli olanlarda ısıtma sistemi düşük teknoloji kullananlara göre daha etkin olduğundan, sera içindeki iklim koşulları dış hava koşullarından nispeten farklılık gösterir. Topraksız tarım dahil olmak üzere daha ileri teknoloji kullanılabilir ve uygulamalar kısmen yada tam otomatik olabilir. Yüksek teknoloji kullanan seralarda yatırım maliyeti yüksektir. Isıtma, havalandırma, evaporatif soğutma, aydınlatma, karbondioksit gübrelemesi gibi uygulamalarla iklim kontrolü yapılır ve sera içerisinde dış hava koşullarından tamamen bağımsız bir ortam yaratılır. Üretimde sera hacminden azami düzeyde yararlanan üretim sistemleri kullanılır (Pardossi ve ark., 2004). Ülkemizde ileri teknoloji kullanan sera varlığı yaklaşık olarak 1200 ha'dır ve işletmelerin ortalama büyüklükleri 27 da civarındadır. Ülkemizde son 10 yılda ortalama örtüaltı işletme büyüklüğü 2 da'dan 4 dekara yükselmiştir (TÜİK, 2019).

3.2. Örtü Malzemesi ve Konstrüksiyon

Türkiye'de 1995 yılında 363.042 dekar alanda seracılık yapılırken 2014 yılında 649.118 dekara çıkararak ikiye katlanmıştır. Söz konusu yaklaşık toplam alanın 80.975,71 dekarı cam,



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298.651,01 dekarı plastik, 112.771,37 dekarı yüksek tünel ve 156.720,03 dekarı alçak tünel seralardır. Türkiye seracılığında gelişimi incelendiğinde yıllık ortalama artış hızı % 15 dolayındadır. Aşağıdaki tabloda da görüleceği üzere yıllar itibarıyla seracılık alanları katlanarak artarken sera niteliklerinde farklılar oluşmuştur. Niteliklerine göre dağılımda plastik sera alanı artışını sürdürürken alçak tünel alanı düşüşe geçmiştir (Çizelge 5), (TUIK 2020).

Çizelge 5. Ülkemiz Örtüaltı alanlarının son 12 yıldaki değişimi (1000 da)

Yıllar	Cam sera	Plastik sera	Yüksek tünel	Alçak tünel	Toplam
1995	34	109	21	199	363
2002	64	180	61	230	536
2003	70	167	61	185	483
2004	72	169	66	171	478
2005	65	171	67	164	468
2010	81	231	82	171	564
2014	81	299	113	157	649
2015	80	309	113	162	664
2016	80	329	113	170	692
2017	86	355	120	191	752
2018	78	369	114	211	772
2019	75	379	111	224	790

Yukarıdaki grafikte de görüldüğü üzere yıllar itibarıyla seracılık alanları katlanarak artmıştır. Niteliklerine göre dağılımda plastik sera alanı diğer türlere göre daha yüksek artış göstermiştir. Cam seralar ise maliyetler göz önüne alındığında daha az tercih edilmektedir. Yüksel tünel seralar düzenli artış göstermekle beraber alçak tünel seralar dönem dönem artış ve azalışlar göstermiştir.

2018 yılı itibarı ile toplam sera alanı içerisinde cam seralar 7811 ha ile %13.92, plastik seralar ve yüksek tüneller ise %86.07'lik bir paya sahiptir. 2000'li yıllardan itibaren plastik sera ve özellikle yüksek tüneller artış göstermiştir. Plastik örtü materyalinin ucuz olması ve yüksek tünel ve/veya basit yapıların plastik ile örtülme kolaylığı, bu örtü materyalinin kullanımını yaygınlaştırmıştır. Ülkemizde cam sera varlığı son 5 yıl içerisinde azalma gösterse de, diğer Akdeniz ülkeleriyle karşılaştırıldığında alan fazladır. Bunun da başlıca nedenleri düz cam fiyatlarının daha düşük olması, yapım işçiliğinin ucuz olması, diğer Akdeniz ülkelerine göre yağışlı dolayısıyla bulutlu günlerin fazla olması nedeniyle yüksek ışık geçirgenliği ve kış aylarında sera içindeki aşırı nemin daha az buğulanmaya yol açmasıdır (Titiz 2004). İleri teknoloji kullanan seralarda galvanize edilmiş konstrüksiyon materyali hatta bazı işletmelerde



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alüminyum kullanılırken, küçük işletmelerde halen demir kullanılabilmektedir. 3.3. İklimlendirme Seralar bitkilerin mevsimleri dışında yetiştirilmesine olanak sağlayan yapılar olduğundan, seracılığın yapılacağı lokasyondaki iklim koşulları ve sera içinde bitki gelişimini etkileyen sıcaklık, CO₂, ışık, nem gibi faktörlerin bitki gereksinimini karşılayacak şekilde düzenlenmesi, diğer bir ifade ile sera içinde iklimlendirme kontrolünün olması verim üzerine doğrudan etkilidir. Türkiye'nin en büyük şansı ve avantajı ısıtmada kullanabileceği -jeotermal enerji gibi• yenilenebilir enerji kaynaklarının bulunmasıdır. Ülkemiz jeotermal enerji kaynakları bakımından, dünyada 7'nci, Avrupa da ise 1'inci sırada yer almaktadır. Jeotermal enerji kullanım alanları arasında sera ısıtması %25.6'lık bir oran ile kaplıca ve merkezi ısıtmadan sonra üçüncü sırada yer almaktadır (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015). Ülkemizde 2018 yılı sonundaki jeotermal enerji kullanım kapasitesinin 5000 MWt'a yükseldiği, toplam jeotermal ısı kapasitesinin de 35500 MWt'a ulaştığı bildirilmektedir. Jeotermal enerji varlığı açısından potansiyel oluşturan alanların %78'i Batı Anadolu'da, %9'u İç Anadolu'da, %7'si Marmara Bölgesi'nde, %5'i Doğu Anadolu'da ve %1'i diğer bölgelerde yer almaktadır (Enerji ve Tabii Kaynaklar Bakanlığı 2019). Isıtma yapılan sera varlığı toplam sera alanı içinde %3'lük bir paya sahiptir ve sera ısıtmasında kullanılan enerji kaynakları arasında kömürden sonra jeotermal enerji %30'luk bir oran ile 2. sırada yer almaktadır (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015). Ülkemizde, jeotermal enerji ile ısıtılan sera varlığının 4.344 dekar olduğu rapor edilmektedir (TÜİK, 2019). Jeotermal sera alanlarının %76'sında üretimde "iyi tarım" uygulamaları esas alınmakta ve %90'nında "topraksız tarım" üretim sistemi kullanılmaktadır. Yetiştirilen ürün türleri arasında domates en yüksek orana (%97) sahiptir (Ulusal Jeotermal Seracılık Stratejisi Raporu 2015).

3.3. Örtüaltı Bitki Yetiştiriciliği Çeşitleri ve Teknolojileri

Seralar, gerek üretimin mümkün olmadığı kış periyodunda üretime olanak tanınması ve gerekse doğanın öngörülemeyen olumsuz etkilerinin minimize edilmesi amacıyla, çevre şartları kontrol edilebilen veya düzenlenebilen cam, plastik, fiberglas gibi ışığı geçiren materyallerle yapılan bitkisel üretimdir. Örtüaltı ve turfanda sebzeciliği birbirinden farklıdır. Turfanda sebzecilik, iklime bağlı kalınarak veya kısmen kontrol altına alınarak özellikle mikro klimaya sahip bölgelerden yararlanarak pazara erken veya geç dönemde ürün çıkarıldığı yetiştiriciliktir. Örtüaltı yetiştiriciliğinde ise ortamdaki klima özellikleri kısmen veya tamamen kontrol altına alınarak pazara ürün çıkarmak dönemini ayarlayabilmektir. Sera, çevre koşullarının olumsuz etkisini kısmen veya tamamen ortadan kaldırarak bitkisel üretim yapmaya yarayan seralar alçak



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veya yüksek sistemler olarak tanımlanmaktadır. Her bir tarımsal ürünün en verimli yetiştigi koşullar üründen ürüne farklılık göstermektedir.

3.3.1. Örtüaltı Bitki Yetiştiriciliğinde Geleneksel Teknikler

Seralarda sağlanan yapay koşullar; ısıtma, havalandırma, sulama ve gübreleme, ilaçlama olup bütün bunlar teknoloji kullanımı ile gerçekleştirilir. Söz konusu yapay ortam, sera ve alçak plastik tüneller altındaki üretimi kapsamaktadır. Alçak plastik tüneller; bitki sıraları üzerine yaklaşık 60 cm yarıçaplı ve yarım daire kesitli yerleştirilmiş iskeletlerin üzerinin yumuşak plastik örtülerle örtülmesi sonucu elde edilen yapılardır. Alçak plastik tünel altında yapılan bitkisel üretimde erkencilik amaçlanır. Bu nedenle, seracılık tekniklerini; yetiştiriciliği yapılan ülkeleri farklı enlem derecelerinin sonucu olan iklim ve farklı sera teknolojileri göz önüne alınarak şöyle sınıflandırmamız mümkündür.

Yüzeysel Örtüler: Örtüaltı yetiştiriciliğinde malçlama, yüzeysel örtüler, yastıklar şeklinde yapılan ve kısa veya uzun süre bitkilerin üzerini kapatan, ayrıca tüm tarımsal işlemlerin dışardan yapıldığı sistemler olarak sınıflandırılmaktadır.

Alçak tüneller: Turfanda amacıyla cam, plastik v.b. ışık geçirebilen malzeme ile kaplanarak değişik şekillerde yapılan, yüksek sistemli bir örtüaltı yetiştiriciliği yapısıdır.

Yüksek tüneller: Örtüaltı yetiştiriciliğinde insanın içerisine rahatça girebileceği, tarımsal mekanizasyona olanak sağlayan, ancak ısıtma, havalandırma sistemleri genellikle olmayan, dar ve yarım daire kesitli yapılardır. Bu örtü tiplerinin hepsi plastik örtülerdir

Seralar: Tüm iklim elemanlarının denetimine olanak sağlayabilecek örtülü yapılardır. Seracılık, iklimle ilgili çevre koşullarına, tümüyle veya kısmen bağlı kalmadan gerektiğinde sıcaklık, ışık, nem ve hava gibi etmenler denetim altında tutularak bütün yıl boyunca çeşitli kültür bitkileriyle bunların tohum, fide ve fidanlarını üretmek, bitkileri korumak, sergilemek amacıyla cam, plastik v.b. ışık geçirebilen malzeme ile kaplanarak değişik şekillerde yapılan, yüksek sistemli bir örtüaltı yetiştiriciliği yapısıdır.

3.3.3. Örtü Altı Yetiştiriciliğinde Yeni Teknikler

Modern seracılık geçmişi ise 18. yüzyıl sanayi devrimi ve sonrasında geliştirilen malzemeler kullanılarak yapılmıştır. Daha sonra ABD ve Avrupa'da sera yapımı, endüstri ile birlikte birinci dünya savaşından sonra hızlı bir şekilde gelişmeye başlamıştır. Günümüzde uluslararası seracılığa bakacak olursak, seraların dünya üzerinde geniş bir yayılma alanı olduğunu görürüz. Bu geniş yayılma alanı üzerinde ekolojik etmenler ve sera teknolojisinin oldukça farklı olduğu görülmektedir. Ülkemiz dünya üzerinde seracılık açısından uygun bir konumdadır. Birçok



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ülkede olmayan iklim avantajımız vardır. Halen gelişmekte olan seracılığımız da bunun göstergesidir. Bu bölgelerde ilkbahar ve sonbahar devrelerinde güneş enerjisinin pasif sistemlerle kullanılarak kısa devrelerde daha ekonomik ve pratik seralarda ürün yetiştirilmesi planlanırsa, hormon kullanmaya gerek kalmadan ve uygun yeterli ilaçlama ile turfanda ürün elde edilmesi mümkündür. Bugün örtü altı yetiştiriciliği, Ekim-Temmuz ayları arasındaki dönemde 8 aylık sebze ihtiyacını karşılayan bir kısmını ihraç eden ve yüzbinlerce kişinin geçimini sağlayan önemli bir sektör haline gelmiştir. Ülkemiz seracılığı Marmara, Ege ve Akdeniz kıyı şeridinde dağılma ve gelişme göstermektedir. Bu dağılım içerisinde yer yer yoğun üretim alanları doğmuştur. En kuzeyde Yalova çevresindeki mikro klimada görülen seracılık, batıda İzmir ve Muğla çevresinde, güneyde Antalya ve Mersin dolaylarında yoğunlaşmakta ve oradan Hatay'a uzanmaktadır. Türkiye'de örtüaltı bitki yetiştiriciliği TÜİK verileri paralelinde 4 ana başlık altında inceleyebiliriz. Bu sınıflandırmalar, sera alanlarının niteliklerine göre dağılımı, bu alan üzerinde yetiştirilen sebze, meyve ve süs bitkileri yetiştiriciliği şeklindedir.

3.3.4. Örtüaltı Topraksız Tarım

Günümüzde, pek çok ülkede, seralarda üretimin büyük bir kısmı topraksız tarım ile gerçekleştirilmektedir. Aslında topraksız yetiştiricilik 17.yy'dan günümüze bitki beslenme konusundaki bilgilerimizin çoğu su ve kum kültürü denemelerinden elde edilmiştir. Topraksız tarımın, seralarda ticari anlamda yaygın kullanımı ise 1970'li yıllara rastlamaktadır. Bunun nedeni ise bu yıllarda ortaya çıkan enerji krizi sonucu buhar ile toprak dezenfeksiyonunun çok pahalı bir uygulama haline gelmesidir. Bu şekilde kullanılmaya başlanan topraksız tarım günümüze kadar artan bir hızla yaygınlaşmıştır, hatta bazı ülkelerde sera üretimi tamamen topraksız tarım ile yapılmaktadır. Topraksız tarımın geleneksel yetiştiriciliğe göre üstün yanları şu şekilde özetlenebilir; Toprağın bulunmadığı veya kalitesinin üretim için yeterli olmadığı yerlerde yetiştiricilik yapılabilir. Toprak yorgunluğu ortadan kalkar, aynı yerde arka arkaya aynı ürünler yetiştirilebilir. Toprak kaynaklı hastalık ve zararlılar ile yabancı otlar sorun olmaktan çıkar, toprak dezenfeksiyonuna gerek kalmaz. Ürünlerde dezenfektan kalıntısı sorunu ile karşılaşılmaz. Su ve besin maddeleri etkin bir şekilde kullanılır, su ve gübre kullanımı azalır. Seraların jeotermal ile ısıtılmasının getirdiği çok önemli avantajlar;4 Bitkinin ihtiyaç duyduğu sıcaklığı sağlayacak yeterli bir ısıtma verimi % 50-60 oranında artırabilmektedir. Bu nedenle jeotermal kaynak kullanılarak ısıtılan seralarda, bitki gelişimi ve dölleme için gereken sıcaklık daha ekonomik şartlarda sağlanmakta, bu sayede gerekli havalandırma yapılarak sera içi rutubet kontrol edilmekte ve bundan kaynaklanabilecek hastalıklar oluşmayarak, verim



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yükselmektedir. Sera atmosferine jeotermal karbondioksitin verilmesi verimi % 40 artırmaktadır. Sera içi sıcaklık döllenme için gereken sıcaklığın üstünde olmakta bu da verimi artırmaktadır. Bu sayede gerekli havalandırma yapılabilen ve sera içi rutubet yükselmemekte ve bundan kaynaklanabilecek hastalıklar oluşmamaktadır. Bu, Avrupa Birliği'nin ve Uluslararası Gıda/Sağlık örgütlerinin istediği bir koşuldur. İdeal iç sıcaklık nedeniyle hormonsuz üretim mümkün olmaktadır. Seraların teknik, ekonomik, ticari işletmesi için büyüklüğünün en az 25.000 m² olması, ısıtma hesaplarına esas olan dış dizayn sıcaklığının -15°C'den daha soğuk olmaması ve kış ayları dış hava ortalama sıcaklığının + 5°C'den daha düşük olmaması gerekmektedir. Jeotermal enerji günümüzde, özellikle gıda tedariki amaçlı seracılık tarımsal üretim açısından son derece önemli bir noktaya gelmiştir. Jeotermal enerji, hem düşük karbondioksit emisyon oranı ile hava kirliliği yaratmaması hem de yenilenebilir olması nedeniyle en önemli alternatif enerji kaynağıdır. Bunun yanında güneş ve rüzgâr gibi diğer yenilenebilir enerji kaynakları ile kıyaslandığında kesintisiz olması nedeniyle önemli bir üstünlüğe sahiptir. Jeotermal enerji politikası oluşturulmalı ve jeotermal kullanım teşvik edilmelidir. Yapılacak yatırımlar, mümkün olduğunca jeotermal enerjinin kullanılacağı entegre tesisler şeklinde planlanmalıdır. Ülkemiz jeotermal enerji kaynakları potansiyeli açısından; Avrupa'da 1 inci, Dünyada 7'nci sırada yer almaktadır. Ülkemizde, jeotermal enerji ile ısıtılan sera varlığı 4.344 dekadır. Örtüaltı sebze üretimi 7.814.543 ton, örtüaltı meyve üretimi 622.073 ton ve örtüaltı süs bitkileri üretimi 1.238.975.594 adettir. (TÜİK, 2020) Ülkemiz modern sera varlığı yaklaşık 13 bin dekadır. Bu seralarda topraksız tarım metodu ile ihracata yönelik üretim yapılmaktadır.

4. SONUÇ

Örtüaltı tarımı, tünel ve/veya seraların kuruluşundan başlayarak, bitkisel üretimi ve pazarlamasını içine alan uzun bir zincirden oluşur. Özellikle seracılıkta pek çok yeni teknoloji bu zincir içerisinde bir veya birden fazla yerde kullanılmaktadır. Isıtmada ülkemiz jeotermal enerji varlığı açısından önemli bir avantaja sahiptir ve yatırımlar bu nedenle bu kaynakların olduğu bölgelere kaymaktadır. Jeotermal enerji kullanımının yaygınlaştırılmasına yönelik çalışmalara hız verilmelidir. Ancak jeotermal kaynakların sürdürülebilir kullanımı sağlanmalıdır. Örtüaltı tarımının, özellikle seracılığın, arazilerin ekonomik kullanımına olanak sağlaması nedeniyle ülkemiz genelinde artışının önümüzdeki yıllarda da hızla devam etmesi beklenmektedir. Ülkemiz, uygun iklimsel ve coğrafi koşullar, pazar ülkelere yakınlık, ucuz



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iřgücü, sulama suyu miktarı ve kalitesi, alternatif yenilenebilir enerji kaynaklarının varlığı gibi nedenlerle seracılık açısından önemli avantajlara sahiptir. Ancak alan artışına paralel olarak üretimin de sürdürülebilir bir şekilde artması gerekir. İnsan ve çevre sağlığının ön plana çıktığı günümüzde örtüaltı tarımında da yeni arayışların ve yeniliklerin “ekonomik” ve “çevre dostu” olması şartı aranmaktadır.



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KAYNAKÇA

1. Enerji ve Tabii Kaynaklar Bakanlığı, 2019. <https://www.enerji.gov.tr/tr-TR/Sayfalar/Jeotermal> (Erişim tarihi:13.11.2019).
2. Pardossi, A., Tognoni, F., Incrocci, L., 2004. Mediterranean Greenhouse Technology. *Chronica Horticulture* 44(2):28-34.
3. Titiz, S., 2004. Modern Seracılık: Yatırımcıya Yol Haritası. Ansiad, Antalya, 124 s.
4. TUIK, 2019. www.tuik.gov.tr (Erişim tarihi:13.11.2019)
5. TUIK, 2020 <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Tarla-Ve-Bahce-Bitkileri/Ortu-Alti-Yetistiricilik>.
6. Tüzel, Y., Gül, A. 2008. Seralarda İyi Tarım Uygulamaları. Tıbyan Yayıncılık. ISBN:978-9944-172-07-3, 172 s, İzmir.
7. Ulusal Jeotermal Seracılık Stratejisi Raporu, 2015. Gıda, Tarım ve Hayvancılık Bakanlığı Jeotermal Seracılık Stratejilerinin Geliştirilmesi Faaliyeti Ulusal Jeotermal Seracılık Stratejisi Raporu.. [https://www. Tarım ve Orman Bakanlığı](https://www.Tarım ve Orman Bakanlığı), 2019.
8. [https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/ BUGEM. pdf](https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/BUGEM.pdf) (Erişim tarihi: 16.12.2021).



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BALIN ANTİMİKROBİYEL ÖZELLİĞİ

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ÖZET

Bitkilerin çiçeklerinde bulunan nektarların veya bitkilerin canlı kısımlarından yararlanarak bazı eş kanatlı böceklerin salgıladığı tatlı maddelerin bal arıları tarafından toplanması, vücutlarında bileşimlerinin değiştirilip petek gözlerine depo edilmesi ve buralarda olgunlaşması sonucunda meydana gelen tatlı bir üründür. Eski Mısır ve Yunanlılar ölümlerini mumyalamak için bal kullanmışlardır. 12. yüzyılda Mısır piramitlerinde bal içerisinde muhafaza edilmiş bir çocuk cesedi bulunmuştur. Romalılar eti, tat ve kokusunu bozmadan bal içerisinde muhafaza etmişlerdir. Balın bakteri engelleyici özelliğine "inhibin" adı verilir. İnhibin ısı ve ışığa karşı çok duyarlı katalaz enzimi tarafından tahrip olmakta ve düşük pH'dan etkilenmektedir. Balın bu özelliğinin, arının yutaküstü bezlerinden salgılanan glukoz oksidaz enziminin glukozu glukolakton ve hidrojen peroksit ayrıştırması sonucunda 1 g balda 1 saatte biriken hidrojen peroksit miktarından kaynaklandığı bildirilmiştir. Doğal bal, muhtelif bakterilere karşı etkili olup, üremelerine imkân vermemektedir. Yüksek yayla (1.000 m ve üzeri rakımlarda) ballarının diğerlerinden 2 kat daha fazla inhibe etkiye sahip oldukları belirlenmiştir. Balın bakterilere karşı inhibe edici özelliği, daha çok bağışıklık sisteminin zayıfladığı ve yetersiz olduğu durumlarda daha yüksektir. Hastalık ve enfeksiyonlara neden olan birçok mikroorganizmanın gelişimi bal tarafından inhibe edilmektedir. Yapılan laboratuvar araştırmaları balın *Escherichia coli*, *Staphylococcus aureus*, ve *Salmonella enterica*, *Ser. typhimurium* gibi yaralarda bulunan bakterilere karşı etkili olduğunu göstermektedir. Doğal olarak bazı balların; patojen ve gıdaları bozucu mikroorganizmaların gelişimini yavaşlatıcı ve/veya durdurucu etkiye sahip olduğu çeşitli araştırmalarla tespit edilmiştir. Bu nedenle balın antimikrobiyel ve antioksidant özelliklerinin balın çeşitli gıdalarla birlikte kullanıldığındaki etkisinin araştırılmasına ihtiyaç bulunmaktadır.

Anahtar Kelimeler: Antimikrobiyel, Enfeksiyon, Bal



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ANTIMICROBIAL PROPERTIES OF HONEY

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ABSTRACT

It is a sweet product that occurs as a result of honey bees collecting the nectar found in the flowers of plants or the sweet substances secreted by some iso-winged insects by making use of the living parts of the plants, changing their composition in their bodies and storing them in the honeycomb cells and maturing there. Ancient Egypt and Greeks used honey to embalm their dead. A child's body preserved in honey was found in the 12th century Egyptian pyramids. The Romans preserved the meat in honey without spoiling its taste and smell. The antibacterial property of honey is called "inhibin". Inhibin is destroyed by the enzyme catalase, which is very sensitive to heat and light, and is affected by low pH. It has been reported that this property of honey is due to the amount of hydrogen peroxide accumulated in 1 g of honey in 1 hour as a result of the glucose oxidase enzyme secreted from the bee's pharyngeal glands, which decomposes glucose into glucolactone and hydrogen peroxide. Natural honey is effective against various bacteria and does not allow them to reproduce. It has been determined that high plateau (1,000 m and above) honeys have 2 times more inhibitory effect than the others. The inhibitory property of honey against bacteria is higher in cases where the immune system is weakened and insufficient. The growth of many microorganisms that cause diseases and infections is inhibited by honey. Laboratory studies conducted on honey *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella enterica*, Ser. It shows that it is effective against bacteria found in wounds such as typhimurium. Naturally, some honeys; It has been determined by various studies that it has a slowing and/or stopping effect on the development of pathogenic and food spoilage microorganisms. For this reason, there is a need to investigate the effect of the antimicrobial and antioxidant properties of honey when used with various foods.

Keywords: Antimicrobial, Infection, Honey



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GİRİŞ

Bal insanoğlu tarafından MÖ 4000 yıllarından beri üretilip tüketilen bir besin maddesidir. Binlerce yıldır değerini koruyarak günümüze gelen bal temel besin maddesi ve enerji kaynağı olarak kullanılmasının yanı sıra insan sağlığı bakımından da önem taşımakta ve çeşitli hastalıkların tedavisinde kullanılmaktadır. Balın koruyucu etkisi antioksidan ve antibakteriyel özelliğinden kaynaklanmaktadır. Balın antioksidan aktivitesinden sorumlu temel bileşikler flavanoidler (krisin, pinosembrin, kuersetin, galangin, kampferol, hesperetin, mirsetin), fenolik asitler (kafeik, kumarik, ellagik, ferulik, klorojenik), askorbik asit, katalaz, peroksidaz, karetenoidler ve Maillard'dır. Balın antibakteriyel etkisi balın yüksek osmomolaritesine ilaveten düşük pH'ya sahip olması, içerdiği hidrojen peroksit, glukoz oksidaz enzimi, bal arılarının hipofarengial salgıları, çiçek polenlerinden kaynaklanan katalaz aktivitesi, nektardan kaynaklanan katalaz aktivitesi ve propolis ile onun fenolik derivatlarından kaynaklanmaktadır. Mevcut bu derleme bu konuda günümüze kadar yapılan yayınlar dikkate alınarak balın antioksidan ve antibakteriyel özellikleri detaylı olarak ortaya konmuştur.

1.BALIN ANTIOKSIDAN AKTİVİTESİ

Antioksidanlar, düşük konsantrasyonlarda çeşitli organik bileşiklerin serbest radikal mekanizmalı oksidasyonunu engelleyen veya önleyen bileşiklerdir. Son yıllarda sentetik antioksidanların kanserojenik olarak düşünülmesi sebebiyle bitkisel kaynaklı doğal antioksidanlara olan ilgi artmıştır. Bitkilerden toplanan özütlerden elde bir besin maddesi olan bal, potansiyel antioksidan olarak dikkat çekmektedir (Rice-Evans, 1997). Yaklaşık 200 bileşikten oluşan bal, ortalama % 20 nem, % 76 şeker, % 0.18 kül, % 1 toplam polifenol, protein gibi bileşenlerin yanı sıra koruyucu olarak α - tokoferol, askorbik asit, flavonoidler (krisin, pinosembrin, kuersetin, galangin, kampferol, hesperetin, mirsetin) ve diğer fenolik asitler (kafeik, kumarik, ellagik, ferulik, klorojenik), glukoz oksidaz, katalaz ve peroksidaz gibi enzimleri içerir (White, 1979; Bertonecelj *et al.*, 2007).

Balın antioksidan aktivitesi ve toplam fenolik içeriği arasında pozitif bir ilişki bulunmakta ve antioksidan aktivite esas olarak fenolik bileşiklerden kaynaklanmaktadır. Koyu renkli ballarda bol miktarda bulunan fenolik bileşiklerin, askorbik asit ya da E vitaminine göre daha güçlü antioksidan aktivite gösterdiği bilinmektedir (Sarıkaya, 2009). Balda en çok bulunan fenolik bileşiklerden flavonoidler ve fenolik asitlerin; antibakteriyel, anti-enflamatuar, anti-alerjik ve anti-trombotik etki göstermelerinin yanında epidemiyolojik çalışmalar ile kardiyovasküler



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hastalıklar ve kanser tedavilerinde önemli rol oynadıkları belirlenmiştir (Al-Habori *et al.*, 2002; Pyrzyńska and Biesaga, 2009; Miotto, 2010).

2.BALIN ANTİMİKROBİYEL ÖZELLİĞİ

Balın antibakteriyel etkisi önemli oranda, balda yaklaşık %76 oranında bulunan şekerin oluşturduğu osmotik basınç ve balın içerdiği glukonik, bütirik, asetik, formik, laktik, süksinik, malik, sitrik ve okzalik asitler gibi organik asitlerin sebep olduğu düşük pH (ort. 3,9)'ya bağlıdır (Özmen ve Alkın, 2006; Anonim, 2003). Arıların hipofarınjial bezlerinde üretilen glikoz oksidaz enziminin baldaki glukozu okside etmesi sonucu oluşan ve inhibitör olarak tanımlanan hidrojen peroksit de baldaki antibakteriyel bileşiklerden biri olarak ön plana çıkmaktadır (Gauhe, 1941). Baldaki bitkilerden kaynaklanan katalaz aktivitesine bağlı olarak, hidrojen peroksit seviyesi değişmektedir. Hidrojen peroksit baldaki glikoz oksit veya onun fraksiyonları tarafından üretilirken ortamdaki katalaz enzimi hidrojen peroksiti parçalamaktadır. Böylece hidrojen peroksitten kaynaklanan antibakteriyel etkinin azalmasına neden olmaktadır (Snow and Manley-Harris, 2004). Polifenoller, fenolik asitler (kafeik asit, ferulik asit, kumarik asit, ellagik asit vb.) ve onların türevleri (metil syringate), aromatik asitler, flavonoidler ve son zamanlarda Maillard reaksiyonu ürünlerinin de balın antibakteriyel aktivitesinde etkili olduğu belirtilmiştir (Gauhe, 1941; White *et al.*, 1962; Dustman, 1971; Molan, 1995; Bogdanow, 1997; Erdoğan ve Erbilir, 2007; Kwakman and Zaat, 2012). Bu durum yüksek oranda fenolik bileşen içeren koyu renkli balların açık renkli ballara göre daha yüksek antibakteriyel aktiviteye sahip olmasını açıklamaktadır (Sarıkaya, 2009). Balın, *Escherichia coli*, *Staphylococcus aureus*, *Salmonella enterica*, *Ser. typhimurium*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Enterobacter cloaca*, *Micrococcus luteus*, *Klebsiella pneumoniae* bakterileri üzerine inhibe edici özellik gösterdiği yapılan çalışmalarla ortaya konmuştur (Tomoi and Miyata, 2000). Balın antibakteriyel aktivitesinin insan sağlığı üzerine etkisi gıda patojeni ve bozulma yapan bu mikroorganizmaların gelişmesine izin vermemesi ve enfeksiyonların iyileşmesine yardımcı olmasından ileri gelmektedir (Özmen ve Alkın, 2006). Bu özelliği ile bal, yara, yanık ve çeşitli ülser tedavilerinde kullanılmakta; ağız, boğaz ve bronş enfeksiyonlarının iyileşmesine yardımcı olmaktadır (Krell, 1996).

Bal; bileşiminde bulunan çeşitli vitaminler, mineraller, organik asitler ve enzimler nedeniyle sindirimi kolay, besleyici ve pek çok hastalığa karşı koruyucu ve tedavi edici özellik gösteren fonksiyonel bir gıdadır. Balın bileşimi arının nektarını aldığı çiçeklerin türüne, iklim koşullarına, arının cinsi ve yaşına bağlı olarak değişir (Hışıl ve Börekçioglu 1986, Güneş 2001).



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Balın %17.10'unu su, kalanını katı madde oluşturmaktadır. Katı madde içinde fruktoz, glukoz, maltoz ve sakkaroz olmak üzere şekerler önemli bir paya sahiptir. Ayrıca az miktarda protein, bazı B grubu vitaminler, C vitamini ve çeşitli mineraller de bulunmaktadır (Anonim2003a). Bal, içerdiği başta glukonik asit olmak üzere bütirik asit, asetik asit, formik asit, laktik asit, süksinik asit, malik asit, sitrik asit ve okzalik asit gibi organik asitler nedeniyle asidik bir gıdadır. Ortalama olarak asitliği %0.57 (%0.017–1.17) olup, pH'sı 3,9 (3.4–6.1)'dur(Anonim 2003). Baldaki başlıca maddeler sekerdir ve bu da antibakteriyel etkili osmotik basınca sebep olmaktadır. Balda ayrıca lizozim enzimi de antibakteriyel etkiye sahiptir. Balda antibakteriyel flovonoidlerden pinocembrin de bulunmaktadır. Fakat baldaki içeriği oldukça düşüktür. Yeni Zelanda ballarında, özellikle de Manuka ve Viper's Bugloss ballarında antibakteriyel aktiviteye sahip birkaç aromatik asit izole edilmiştir. Balın yüksek osmomolaritesine ilaveten düşük pH'ya sahip olması antibakteriyel aktiviteden sorumlu tutulmaktadır. Bazı araştırmacılar antibakteriyel aktiviteye sahip uçucu bileşenler izole etmişlerdir. Fakat balın antimikrobiyel özellikleri tam olarak bilinmemektedir. (Bogdanow 1997).

2.1.Farklı Kaynaklardan Elde Edilen Balların Antimikrobiyel Özellikleri

Baldaki antibakteriyel aktivite ilk olarak 1982 yılında bildirilmiştir. Baldaki inhibitör bileşen, ısı ve ışığa duyarlı ve glukozoksidaz tarafından üretilen hidrojen peroksittir. Bazı araştırmacılar baldaki esas antibakteriyel bileşenin hidrojen peroksit olduğuna inanmaktadırlar. Fakat bazı ballarda glukozoksidaz inaktiftir ve bu ballarda bakterilerin gelişimini inhibe etmeye yetmeyecek kadar az hidrojen peroksit bulunmaktadır. Bu ballar ısı ve ışığa duyarlı değildirler ve uzun süre bozulmadan kalabilmektedirler (Bogdanow 1997). Hastalık ve enfeksiyonlara neden olan birçok mikroorganizmanın gelişimi bal tarafından inhibe edilmektedir. Yapılan laboratuvar araştırmaları balın *Escherichia coli*, *Staphylococcus aureus*, ve *Salmonella enterica*, *Ser. typhimurium* gibi yaralarda bulunan bakterilere karşı etkili olduğunu göstermektedir (Mundo ve ark. 2004). Yapılan araştırmalarda, küf, maya ve bakteri sporlarının düşük seviyede balda bulunabileceği, ancak vejetatif bakterilerin genellikle bulunmadığı tespit edilmiştir. Bununla birlikte bal genel olarak düşük mikrobiyel yük ve uzun raf ömrüne sahiptir. Antimikrobiyel özelliklerinden dolayı bal, doğal gıda koruyucu olarak görülür (Mundo ve ark 2004). Balın antimikrobiyel aktivitesi onun asitliğine, pH'sına, osmotik basıncına, glukoz oksidaz aracılığı ile enzimatik olarak hidrojen peroksit üretimine bağlıdır. Ek bal bileşenleri olarak, aromatik asitler veya fenolik bileşenler, antimikrobiyel aktiviteye bütün olarak katkıda bulunabilirler. Çeşitli bal örneklerinde gözlenen antibakteriyel aktivite nedeni, dört etmen



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sekinde sınıflandırılmıştır. Bunlar; yüksek seker konsantrasyonuna (düşük su aktivitesi) bağı inbibisyon, hidrojen peroksit oluşumu, proteinli antimikrobiyel bileşenlerin varlığı ve tanımlanamayan bileşenlerdir (Mundo ve ark 2004). Balın içerdiği glukozoksidaz enzimi su ve oksijen varlığında, glukozu glukonik asit ve hidrojen perokside parçalamaktadır. Oluşan hidrojen peroksit ve asidik ortam, olgunlaşma sırasında balı korumakta ve antimikrobiyel özellik kazandırmaktadır. Daha sonra düşük pH nedeniyle enzim inaktif olurken, hidrojen peroksit askorbik asit ve bazı iyonlar tarafından su ve oksijene parçalanmaktadır ve bu durumda balın sulanmasına neden olmaktadır. Ayrıca glukozoksidaz ısı ve ışık ile hasar görmektedir. Yapılan bir çalışmada, balın 10 dakika ışıktaki tutulması ile hidrojen peroksit üretiminde kayıp gözlenmiştir. Bu nedenle de tedavi amaçlı kullanılacak ballar ısıtılma uğratılmazlar. Bu ballarda bulunabilecek bakteri sporları gamma ısınlarıyla sterilize edilerek biyolojik aktivitelerinin korunması sağlanmaktadır. Balın peroksit haricindeki diğer özellikleri ise ısı ve ışığa karşı stabildir ve oda sıcaklığında 6 ay boyunca aktivitelerini korumuştur. Bu yüzden yüksek miktarda fenolik içeriğe sahip ballar antimikrobiyel aktivite açısından daha stabildirler. Ayrıca balda bulunan katalaz enzimi hidrojen peroksidi parçalayarak balın antimikrobiyel özelliğini azaltmaktadır (Lusby ve ark. 2002, Mundo ve ark. 2004, Snow ve Manley–Harris 2004). Baldaki hidrojen peroksit seviyesi; başlıca baldaki bitkilerden kaynaklanan katalaz seviyesine bağı olarak değişmektedir. Hidrojen peroksit baldaki glukoz oksit veya onun fraksiyonları tarafından üretilir ve ortamdaki katalaz hidrojen peroksidi parçalayarak antimikrobikrobiyel özelliğini azalttığı yapılan laboratuvar çalışmalarıyla tespit edilmiştir (Snow ve Manley–Harris 2004). Mundo ve ark (2004) değişik floradan ve coğrafi bölgelerden 27 bal örneği üzerine yaptıkları mikrobiyolojik analizlerde; balın 7 gıda bozucu mikroorganizma (*Alcaligenes faecalis*, *Aspergillus niger*, *Bacillus stearothermophilus*, *Geotrichum candidum*, *Lactobacillus acidophilus*, *Penicillium expansum*, *Pseudomonas fluorescens*) ve gıda zehirlenmesine neden olan 5 patojen (*Bacillus cereus*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella enterica*, *Ser. typhimurium*, ve *Staphylococcus aureus*) üzerine inhide edici özellik gösterdiklerini tespit etmişlerdir. *Staph. aureus* üzerine örneklerde inbibisyon etkisi gözlenmiştir. Örneklerin hiçbirisi küf gelişimini inhide etmemiştir. Balın bu inhide edici etkisi yüksek şeker konsantrasyonu (düşük su aktivitesi), hidrojen peroksit üretimi ve balda bulunan proteinli bileşenlere bağlanmaktadır. Bazı antibakteriyel aktiviteler ise diğer tespit edilemeyen bileşenlere bağlanmıştır. Balın mikroorganizmaların gelişmelerini inhide edici etkisi oldukça değişkenlik göstermektedir. Yapılan çalışmada balın bu özelliğinin özel bir



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floraya veya bölgeye bağlı olmadığı da tespit edilmiştir. Bakteriler üzerine balın antimikrobiyel etkisi tekdüze olmayıp değişiklik göstermektedir. Bu araştırmada en çok inhibisyona neden olan etmen hidrojen peroksit olarak bulunmuştur. Daha sonraki aktif maddeler proteinli bileşenler olabileceği düşünülmüştür. Mundo ve ark. (2004)'ün yapmış oldukları araştırmada; antimikrobiyel aktiviteye en duyarlı mikroorganizma *B. stearothermophilus*, en az etkilenen mikroorganizmalar ise *S. aureus*, *P. expansum*, *A. niger*, *G. candidum* olarak saptanmıştır. Isıya dayanıklı sporlu bir bakteri olan *B. stearothermophilus*, balın hem yüzeyinde hem de iç kısmında oldukça duyarlılık göstermiştir. Diğer duyarlı bakteriler *A. faecalis* and *L. Acidophilus* olarak tespit edilmiştir. *A. faecalis*, *L. acidophilus*, ve *S. aureus* ATCC 25923, 8095 ve 9144 balın antimikrobiyel aktivitesine karşı duyarlıdır. *E. coli*, *S. typhimurium* ve *S. aureus* ATCC 8095 balın yüksek osmotik basıncından dolayı gelişimleri azalmaktadır. Çünkü *E. coli* (0.96), *Salmonella* spp. (0.96), *Pseudomonas* spp. (0.97), ve *Bacillus subtilis* (0.95) su aktivitelerinde gelişebilirler. Baldaki su aktivitesi ise 0.920–0.945 arasında bulunmuştur. Fakat *P. fluorescens*, *B. stearothermophilus* ve *B. cereus* bu su aktivitesinde gelişmelerini azaltmazlar. Ayrıca, *S. aureus*'un minimum su aktivite ihtiyacı 0.86 olup, bu değerden oldukça düşüktür. Bu nedenle, su aktivitesi yanında diğer faktörlerin de bu bakterilerin gelişmesi üzerine rol oynadığı düşünülmektedir. Allen ve ark. (2000), yaptıkları bir çalışmada, klinik olarak çok önemli olan Methicillin'e dayanıklı *Staphylococcus aureus* ve Vancomycin'e dayanıklı *Escherichia coli*.16 üzerine antibakteriyel özellik gösterdiğini tespit etmişlerdir. Ayrıca içeriğinde benzilalkol, 1,4-dihidroksibenzen, terpenler ve 2-hidroksibenzoikasit gibi maddelerin varlığı, düşük protein içeriği ve düşük redoks potansiyeline sahip olması da balın antimikrobiyal özelliğine katkıda bulunmaktadır (Anonim 2003a). Balın antimikrobiyal özelliğinin bileşimindeki benzilalkol, 1,4-dihidroksibenzen, terpenler ve 2- hidroksibenzoikasit gibi maddelerin varlığından kaynaklandığının bilinmesine rağmen, bazı bilim adamları antimikrobiyal özelliğin arıdan mı yoksa nektardan mı bala geçtiğinin henüz bilinmediğini ifade etmektedirler (Anonim 2003b). Bal, genellikle (*Apis mellifera*) bal arısı tarafından üretilir. Tropikal ve yarı tropikal bölgelerde *Meliponinae* alt familyasına ait *Melipona* ve *Trigona* cinsi iğnesiz bal arılarının üretmiş oldukları balların da iyileştirici özelliklere sahip oldukları tespit edilmiştir. *Trigona* spp. ait iğnesiz bal arılarının üretmiş oldukları ballar genellikle yüksek derecede apiterapik ürünler olarak değerlendirilmekte ve Etiyopya'da onlarca hastalığa karşı ilaç olarak kullanılmaktadır. Bu arıların balları; mide rahatsızlıklarının tedavisinde, bademcik iltihabında, öksürük, boğaz ağrısı, mide ve bağırsak ülserlerinde, üşütmede, ağız hastalıklarında, sümüksü yapılarda ve yara



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pansumanlarında yaygın olarak kullanılmaktadır (Garedew ve ark. 2004). Günümüzde dünyada ticari açıdan yaygın olarak tedavi maksadıyla kullanılan iki bal çeşidi bulunmaktadır. Bunlar; *Leptospermum polygalifolium* cinsi ağaçlardan elde edilen Medihoney (Capiliano, Australia¹³) ve *Leptospermum scoparium* cinsi ağaçlardan elde edilen Active Manuka Honey (Yeni Zelanda) ballarıdır. Bu ballar tipik olarak yüksek viskoziteye sahiptir ve bir ısıl işleme uğratılmaksızın ham olarak kullanılırlar (Lusby ve ark. 2002). Manuka balı; Yeni Zelanda’da yetişen (*Leptospermum scoparium*) isimli ağaçtan arılar tarafından elde edilen baldır. Manuka Balı; yapısında peroksit bulunmadığı halde antimikrobiyel özellik gösteren özel bir baldır (Snow ve Manley–Harris 2004). Hidrojen peroksit içermeyen balların özellikle *Staphylococcus aureus* ve *Micrococcus luteus* bakteri cinslerine karşı antimikrobiyel etkisi tespit edilmiştir. Antibakteriyel aktivite, balın asitliği ile önemli derecede ilişkili olduğu halde pH’sına bağımlı değildir. Balın antibakteriyel aktivitesi arının cinsinden ziyade üretildiği bitkilere bağlı olarak değişmektedir (Bogdanow 1997). Manuka balının ülser neden olan *Helicobacter pylori*’ye karşı da antibakteriyel etkili olduğu tespit edilmiştir. (Weston ve Brocklebank 1999). Cooper ve ark. (2000), Manuka balının dirençli ve yaralarda enfeksiyonlara neden olan *Burkholderia cepacia*’ya karşı etkili, *Pseudomonas aeruginosa*’ya karşı ise etkisiz olduğunu bildirmektedirler.

2.2.Baldaki Antimikrobiyel Özelliğin Sağlık Açısından Önemi

Birçok medeniyetin yazıtlarında ve kutsal din kitaplarında kutsal veya şifalı bir gıda olduğu belirtilen balın, bileşiminde insan sağlığı için önemli birçok besin maddesinin bulunduğu bilimsel olarak kanıtlanmıştır (Günes 2001). Balın ülser ve diğer mide hastalıkları, kalp yetmezlikleri, çarpıntı, kemik hastalıkları, öksürük, allerji, bronşit, kansızlık, boğaz ağrısı, sinir hastalıkları, bazı cilt ve sinir sistemi hastalıkları gibi 500’e yakın hastalığın tedavisinde olumlu etkileri saptanmıştır. Ayrıca kabızlığı giderdiği, vücuttaki kanı temizlediği, damarları genişlettiği ve kan dolaşımını kolaylaştırdığı, kalbi güçlendirdiği, yağ hazmını kolaylaştırdığı, yara ve yanıkları iyileştirdiği de bilinmektedir (Molan 2000). Bal binlerce yıldır güncel bakteriyel enfeksiyonlara ve gastrointestinal hastalıklara karşı tıbbi olarak kullanılmaktadır (Mundo ve ark. 2004). Günümüzde ise bunun yerini antibiyotikler almıştır. Fakat antibiyotiklerin devamlı olarak kullanımı antibiyotiğe dayanıklı etmenlerin oluşmasına neden olmaktadır. Farmasötik ürünlerin yanında, bakterilerin antibiyotiklere karşı direnci giderek arttığı ve sentetik ilaç ve antibiyotiklerin sonradan meydana getirdikleri olumsuz etkilerden dolayı kullanılmaması yönündeki görüşler giderek artmaktadır. Bu tür problemleri çözmek için



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araştırmacılar, sürekli araştırma yapmakta ve yeni ilaçlar sentezlemektedirler. Ne yazık ki, bu tür ilaçların fiyatı çok yüksek ve üretilme oranı düşük olmaktadır. Bu karışıklık; apiterapi (arı ürünleri ile tedavi) gibi alternatif tedavi yöntemlerine yeniden aktiflik kazandırmaktadır. Günümüzde doğaya dönüşün artması da bu durumu olumlu yönde etkilemektedir. Arıların ürettikleri ürünler, yaygın olarak gıda/sağlık katkısı, balın tıbbi kullanımını yeniden canlandırmaktadır (Garedew ve ark. 2004). Bu nedenle son yıllardaki araştırmaların çoğu bitkiler ve aromaterapik ürünler üzerine yoğunlaşmıştır (Lusby ve ark. 2002). Balın antimikrobiyal özellik göstermesinin insan sağlığı açısından önemi; gıda patojeni ve bozulma yapan mikroorganizmalarının gelişmesine izin vermemesi ve enfeksiyonların iyileşmesine yardımcı olmasından ileri gelmektedir. Balın antimikrobiyal ve antioksidan aktiviteleri, yüksek viskozitesi, bağışıklık sistemini uyarması, anti-enflamatuar gibi olumlu etkilerinin yanı sıra organizmaya dıştan uygulanması durumunda hava almayı engellemesiyle de; yara ve yanıkların iyileşmesini hızlandırmaktadır (Lusby ve ark. 2002). Yanıklarda ve enfeksiyonlu yaralarda bal kullanılması yaraların temiz ve steril hale gelmesini sağlamakta, böylece yaraların daha çabuk kapanmasına sebep olmaktadır. Yaraların balla temizlenmesi aynı zamanda yara içinin daha net görülmesini ve ameliyat, dikiş vb. tıbbi müdahale durumunda kolaylık sağlamaktadır (Molan 2000). Enfeksiyon kapmış yaralarda ve yanıklarda balın tıbbi etkisi Mısır, Yunanistan ve Hindistan'da geniş bir şekilde tıbbi amaçla kullanıldığı literatürlerde bildirilmektedir. Yanıklarda bal, gres yağ veya hayvansal yağlarla, 1/3 bal, 2/3 yağ olacak şekilde karıştırılır ve yaranın üzerine sürülür. Yunanlılar yağdan başka sirke, bal, bitki sapı, sodyum karbonat ve az miktarda safra da ilave ederek merhem haline getirmekte ve bu şekilde yaranın iltihap yapmasını da önlemektedirler. Enhemes olarak adlandırılan bu karışım, içeriğindeki balın osmotik basıncı, sodyum karbonat ve safradan dolayı da alkali pH nedeniyle antiseptik özelliğe sahiptir (Lusby ve ark. 2002). Yaralar bal uygulayarak tedavi edildiğinde ölü hücreler kolayca yaradan ayrılmaktadır. Ayrıca yanıklarda oluşan ve kuru olmayan kabuklara da bal sürülebilmektedir. Bunların yanı sıra bir yaraya bandajla bal uygulandığında, bandaj sökülürken kirlerin de bandajla birlikte çıktığı, dolayısıyla yaranın temizlendiği belirtilmektedir. Enfeksiyonlu yaralar, özellikle anaerobik bakteriler nedeniyle kötü kokabilmektedirler. Böyle durumlarda balın koku giderici özelliğinden yararlanılmaktadır (Molan2000). Son zamanlarda yapılan bir araştırmadan elde edilen bulgular tüm dikkatlerin bir anda balın üzerinde yoğunlaşmasına neden olmuştur. Laparoskopi aletiyle karından girilerek yapılan kolon kanseri tedavisi sırasında, aletin kullanıldığı karın bölgesinde meydana gelen



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ensizyon çevresinde genellikle tümörler oluşmaktadır. Hamzaoglu ve ark.(2000). Bu bölgeye bal uygulanmasının etkisini incelemek üzere 60 fareye tümör hücreleri enjekte etmişlerdir. Bunlardan 30'unun ensizyon bölgesine bal uygulanmış, diğer 30'una uygulanmamıştır. Sonuçta ameliyat için açılan ensizyon kanalı çevresine bal sürülmeyen 30 farede tümörler olduğu halde ensizyon kanalı çevresine bal sürülen 30 fareden sadece 8'inde tümör oluşmuştur. Kolon kanseri üzerinde çalışan bilim adamları balın içinde bulunan bir maddenin kanser hücrelerinin yok olmasına neden olabileceğini belirtmişlerdir (Anonim 2004a). Swellam ve ark. (2003), mesane kanserinde balın antitümör ve antimetastatik özellik gösterdiğini bildirmektedirler. Amerikan Dental Araştırmalar Birliği tarafından Chicago'da (Illinois) düzenlenen "Oral Sağlık için Yararlı Yiyecekler" konulu sempozyumunda, balın dis çürümesini önlediği açıklanmıştır. Yeni Zelanda Waikata Üniversitesi Bal Araştırma Ünitesinde çalışan Dr. Molan tarafından diş çürüğünden sorumlu bakterilerden *Streptococcus mitis*, *Streptococcus sabrinus* ve *Lactobacillus casii*'nin ürettikleri asit miktarını balın önemli ölçüde azalttığını belirtilmiştir. Bu durumun balın dental plaktaki dekstran üretimini engellemesinden ve antibakteriyel etkisinden kaynaklandığı, dişetin enflamatuvar enfeksiyonlarının tedavisinde balın bu etkisinden faydalanılabileceği bildirilmiştir. Balın anti-enflamatuvar bileşenleri sayesinde şişlik ve ağrı da azalmaktadır (Anonim 2004b).

3. SONUÇ

Ülkemiz nektarlı bitkilerce zengin bir floraya sahip olması nedeniyle arıcılığa çok uygun bir ülkedir. Ayrıca, arıcılığın maliyeti düşük, işgücü ve arazi kullanımı azdır. Bal son derece özel, besleyici ve sağlıklı bir gıda maddesidir. Balın yararları nedeniyle her gün düzenli olarak tüketilmesi, yalnız alerji, diyabet, obezite gibi özel durumlarda balın tüketiminin dikkatli ve kontrollü yapılması önerilmektedir. Özet olarak; günümüzde balın gıdaları bozucu mikroorganizmaları inhibe etme yeteneği hakkında bilinenler azdır. Doğal olarak bazı balların; patojen ve gıdaları bozucu mikroorganizmaların gelişimini yavaşlatıcı ve durdurucu etkiye sahip olduğu çeşitli araştırmalarla tespit edilmiştir. Bu özelliklerin araştırılması ve balın gıdalara koruyucu amaçla katılması özellikle günümüzdeki doğal gıda tüketme isteği göz önüne alınacak olursa araştırılması insanoğluna büyük fayda sağlayacaktır. Bu nedenle de balın antimikrobiyel ve antioksidant özelliklerinin balın çeşitli gıdalarla birlikte kullanıldığında etkisinin araştırılmasına ihtiyaç bulunmaktadır.



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KAYNAKLAR

- Al-Habori, M., Al-Meer, A., Al-Mamary, M., 2002. Antioxidant activities and total phenolics of different types of honey. *Nutrition Research*, 22: 1041-1047.
- Allen K. L., G. Huthinson, P. C. Molan 2000. The Potential for using Honey to Treat Wounds Infected with MRSA and VRE. Melbourne (Australia): First World Healing Congress;
- Anonim 2000. Honey User Health Concept Study Report. National Honey Board. <http://www.nhb.org/download/industry/HoneyUserConcept.pdf>
- Anonim 2003a. Honey-Health and Therapeutic Qualities. National Honey Board.
- Anonim 2003b. Bal Yaraları _yilestiriyor. <http://www.hekimce.com/konu.php?konu=1833>.
- Anonim 2004a. Bal Mucizesi. <http://www.saglikvakfi.org.tr/Default.asp?id=42>
- Anonim 2004b. Balın Faydaları. <http://www.ardabal.com/balin faydaları.htm>
- Bertoncelj, J., Dobersek, U., Jamnik, M. and Golob, T., 2007. Evaluation of The Phenolic Content, Antioxidant Activity and Colour of Slovenian Honey. *Food Chemistry*. 2007, 105, 822-828.
- Bogdanow, S. 1997. Nature and Origin of the Antibacterial Substances in Honey. *Lebensm.-Wiss. u.-Technol.*, 30: S.748-753.
- Cooper R, P. WIGLEY, N. F. BURTON 2000. Susceptibility of Multi-resistant Strains of *Burkholderia Cepacia* to Honey. *Lett Appl Microbiol.* 31: S.20-24.
- Dustman, J.H., 1971. Über die Katalaseaktivität in Bienenhonig aus der Tracht der Heidekrautgewächse (Ericaceae). *Zeitschrift für Lebensmittel- Untersuchung und Forschung*, 145: 292-295.
- Çakıcı N., Yassıhüyük N. 2013. Balın Antioksidan Aktivitesi Ve Antibakteriyel Özelliği Arıcılık Araştırma İstasyonu Müdürlüğü, Ordu, Türkiye sayı: 9. 2013
- Erdoğan, Ö. ve Erbilir, F., 2007. Kahramanmaraş'ta Üretilen Bal Örneklerinin Mikrobiyel Kalitesi ve Antibakteriyel Etkilerinin Araştırılması. *KSÜ Fen ve Mühendislik Dergisi*, 10(1), 2007.
- Gauhe, A., 1941. Über ein glucoseoxydierendes Enzym in der Pharynxdrüse der Honigbiene. *Zeitschrift für Vergleichende Physiologie*, 28(3): 211-253.



**ISPEC 8th INTERNATIONAL CONFERENCE
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Garadew, A. E. Schmolz, I. Lamprecht 2004. Microcalorimetric Investigation on The Antimicrobial Activity of Honey of The Stingless Bee *Trigona* spp. and Comparison of Some Parameters with Those Obtained with Standard Methods. *Thermochimica Acta* 41(5): S.99–106.

Günes M.E., 2001. Balın Sağlığımız için Önemi. *Uludağ Arıcılık Dergisi*, 2: S.19–20.

Hamzaoglu _H. ve ark. 2000. Bal Mucizesi. <http://www.topuykackarbal.com/arastirmalar.htm>

Hısıl, Y., N. Börekçioğlu 1986. Balın Bilesimi ve Bala Yapılan Hileler. *Gıda, Gıda Teknolojisi Derneği Yayın Organı*, 2:S.79–82.

Krell, R., 1996. Value-Added Products from Beekeeping. *FAO Agricultural Services Bulletin No.124* Food and Agriculture Organization of the United Nations Rome.

Kwakman, P. H. S. and Zaat, S. A. J., 2012. Critical Review: Antibacterial Components of Honey. *Life*, 64(1): 48–55, January 2012.

Lusby P. E., A. Coombes, J. M. Wilkinson 2002. Honey: A Potent Agent for Wound Healing? *J. Wocn*. S.295–300.

Miotto, D., 2010. Elucidation of the components involved in the antioxidant activity of honey. Yüksek Lisans Tezi. Brock University, Biyoloji Bilimi Fakültesi, Kanada.

Molan, P. C., 1995. The Antibacterial Properties of Honey. *Chemistry in New Zealand*, July, 10-14.

Molan P.C. 2000. Balın Modern Tıpta Kullanımı. Çeviren: Mustafa Civan. *Teknik Arıcılık*, 67: S.25–31.

Mundo, M. M., O. I. Padilla-Zakour, R. W. Worobo 2004. Growth inhibition of foodborne pathogens and food spoilage organisms by select raw honeys. *International Journal of Food Microbiology* 97. S.1–8.

Özmen, N. ve Alkın, E., 2006. Balın Antimikrobiyel Özellikleri ve İnsan Sağlığı Üzerine Etkileri. *Uludağ Arıcılık Dergisi*, Kasım, S:155-160.

Pyrzynska, K., Biesaga, M., 2009. Analysis of Phenolic Acids And Flavonoids in Honey. *Trends in Analytical Chemistry*, 28:7 893-902.

Rice- Evans, C.A. and Miller, N.J., 1997. Papanga, G. Antioxidant Properties of Phenolic Compounds, *Trends Plant Science*, 2,4, 152-159.



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Sarıkaya, A.O., 2009. Kestane Bal ve Propolisinin Fenolik Asit Kompozisyonu ve Antioksidan Özelliğinin Belirlenmesi. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Karadeniz Teknik Üniversitesi, Trabzon.

Sıralı, R. 2002. General Beekeeping Structure of Turkey. Uludag Arıcılık Dergisi: S.30–39.

Snow, M. J., M. Manley–Harris 2004. On The Nature of Non– Peroxide Antibacterial Activity in New Zealand Manuka Honey. Food Chemistry 84: S.145–147.

Swellam, T., K. N. Miyanaga, M. Onozawa, K. Hattori, K. Kawai, T. Shimazui, H. Akaza 2003. Antineoplastic activity of honey in an experimental bladder cancer implantation model: *In*

vivo and *in vitro* studies. International Journal of Urology 10: S.213–219.

Weston, R. J., L. K. Brocklebank 1999. The Oligosaccharide Composition of Some New Zealand Honeys. Food Chemistry 64: S:33–37.



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AFFECTION OF ADDITIONAL DIFFERENT DOSE ENZYME (GRINDAZYM GP 5000) TO RATIONS ON FEEDING AND CARCASS CHARACTERISTICS OF BROILER

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ABSTRACT

This research was carried out to examine the effect of enzyme supplementation on maize broiler diets on fattening power and carcass characteristics. In this study, 162 broiler chickens were used. Chickens were fed for 6 weeks on 3 different diets containing maize with enzyme preparations by 0, 0.5 and 1 kg / tons. Live weights gains were found not significant in the all weeks. Body weight gains were insignificant in all weeks. Live weight gain increased from 365.47 g to 466.76 g with the addition of 1 kg/ton enzyme in the 6th week. When looked at cumulatively, it is the same relative increase and the total weight gain increased from 1849.32 grams to 1965.21 grams. Feed intake and feed efficiency was not significant at the all groups. When the feed consumptions were examined cumulatively, the addition of enzyme decreased feed consumption relatively and decreased the feed consumption from 3681.91 grams to 3624.03 grams. Again, when the feed efficiency values are analyzed cumulatively, there is a relative improvement and the feed efficiency value has decreased from 1.99 to 1.84. The effect of enzyme supplementation on maize diets on viability and moisture content of the litter was insignificant. However, as the amount of added enzyme increased, an improvement in viability and a significant decrease in moisture were observed. Carcass characteristics weights significantly increased ($P<0.05$) with addition 1 kg/ tons enzyme to the maize based ration except wings weights. A relative increase in wing weight was observed. Carcass weights were found as 1277.67 g, 1339.78 g and 1462.33 g, respectively, at the end of the 6th week. Leg weights were found to be 364.44 gr, 385.78 gr and 411.11 gr, back weights 282.33 gr, 309.22 gr and 331.44 gr, breast weights 397.11 gr, 385.89 gr and 465.33 gr, and wing weights 151.57 gr, 161.44 gr and 167.56 gr, respectively. The effect of 1 kg / ton enzyme addition to the rations on gizzard, liver and abdominal fat was significant ($P<0.05$). The gizzard weights were 36.11 gr, 34.44 and 43.22 gr, liver weights were 41.67 gr, 40.89 gr and 53.56 gr, and abdominal fat weights were 22.78 gr, 28.56 gr and 37.78 gr, respectively. As a result, the effect of addition 1 kg/ton enzyme to ration based maize was found possitive,

Keywords: Maize, Enzyme, Broiler, Performance



INTRODUCTION

Poultry products can be utilized to solve the problem of malnutrition as the main problem of our time are food sources can be provided as a quick and cheap. The poultry sector can be mechanized which a small number of people feeding more amounts of animal and can turn into cash more quickly. The aim of the poultry sector produce in the form of meat and eggs as a source of high quality protein-rich food (Erensayın,1991; Kılıç, 1988; Özen, 1986; Akbay,1985; Lepley ve Doğan,1985).

Used in this study grindazym GP - 5000 is a multi-enzyme mixture enzyme (xylanase, β -glucanase and pectinase) and the yeast fermentation was obtained. This enzyme mixture increases in feed digestion of foods. Besides helping the viscosity to better enable the creation of a clean litter. Also increased feed efficiency and carcass quality (Anonymous, 1998).

In recent times due to the expensive price of maize, more economical rations are prepared and by the addition of enzyme a great many studies have been done in order to live weight of the animals increased further.

Sukan et al.(1994) have added to maize based broiler chicken diets 0.5, 1 and 2 % enzyme (α -amilaz: 1700 U/L ve Proteaz : 800 U/L). At the end of 6 weeks. They reported that lower limit of slaughter period they accept 1,500 g body weight limit, can cross animals but 48% in the control group, while the group fed with food supplemented with preparations 0.5% enzyme have reported that reached 70% per.

Canogulları et al.(1999), Added 0.1% amylase, 0.2% protease and 0.1% amylase + 0.2% protease enzymes to the maize-based rations and they found that the utility values for feed were 2.11, 1.98, 2.04 and 2.06.% 0.1 respectively. Amylase increased utilization of feed significantly ($P<0.01$)

According to the reports of Ozturk and Erener (1997) Francesh et al., In addition to 0, 20, 40 and 60 ppm β -glucanase enzyme in 50% maize- based rations they obtained feed consumption values of 87.7, 83.5, 83.2 and 86.0 g / day, respectively. The difference between groups was reported to be statistically insignificant.

Yavuz (1996) reported that the addition of the enzyme (protease, xylanase, amylase) significantly increased carcass yield ($P < 0.05$) in r maize- based rations.



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MATERIALS AND METHODS

In this study, 162 Ross PM3 broiler chickens were used. Diets were formulated according to NRC (Anonymous, 1987) and analyzed at the faculty of agriculture and Veterinary, Y.Y.U-Van. The ingredients and calculated composition of commercial basal diets are given in Table 1.

Table.1. Ingredient composition of the experimental diets

Ingredients, %	Starter Period (0-3. wk)	Finisher Period (3-6. wk)
Maize	64.5	67.8
Soyabean meal	22.3	20.4
Meat bone meal	5.0	5.0
Fish meal	6.0	3.5
Vegetable oil	0.25	1.45
Limestone	0.8	0.8
Salt	0.35	0.35
Vitamins	0.3	0.3
Minerals	0.1	0.1
Methionin	0.2	0.2
Antioxidant	0.1	0.1
Antioxidial	0.1	-
TOTAL	100.00	100.00
Crude protein (%)	21.99	20.02
ME (KCal/kg)	3001.00	3103.00
Ca	1.24	1.12
P	0.81	0.73
Met + Cys	0.92	0.75
Lysine	1.20	1.01

All chickens were wing banded and weighted then assigned to 3 groups with 3 replicates containing 18 chickens each, randomly. Chickens were fed for 6 weeks on 3 different diets containing maize with enzyme preparations by 0, 0.5 and 1 kg / tons. The diets containing, 22% of CP and 3000 ME at the starter period and 20% HP and 3100 ME. At the finisher period. This study continued 42 days (6 weeks), Chickens and feed were weighed by weekly to determine weight gain, feed intake and feed efficiency. The birds were slaughtered at 6 weeks of age to determine carcass traits. Some parts of carcass (things, breast, wing, back, liver, gizzard, heart and abdominal fat weights). The data were analyzed using Harvey's statics packed program (Harvey, 1987). When the F test was significant, the least mean square were compared by using Duncan multiple range test (Duzgunes et al., 1987).



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RESULTS

The feed and rations analyses results using in this study is shown in table 2 and 3.

Table 2. The Feed Analyses Results

Analyses	Maize	Soyabean meal	Meat bone meal	Fish meal
Crude Protein (%)	9.5	47.05	40.64	55.59
Dry Matter (%)	90.13	89.75	95.90	89.42
Crude Ash (%)	1.21	0.95	44.11	18.71
ME (KCal/kg)*	3400	2300	2000	2880

* Based on NRC values

Table 3. The Rations Analyses Results

Group	CP (%)	DM (%)	DA (%)	DS (%)	DO (%)
M (Control) (Starter)	21.66	89.65	7.05	3.19	4.47
M (Control) (Finisher)	19.64	90.10	6.28	3.14	7.49

CP:Crude protein, DM: Dry Matter, DA: Dry Ash, DC: Dry Cellulose, DO: Dry Oil

When weekly average live weight gains were examined (Table 4), the differences between the groups throughout the trial were statistically insignificant

There was no difference in live weight gain by addition of enzyme (Grindazym GP-5000; 12000 un/g xylanase, 5000 un/g glukonase and 7 un/g pektinase to maize-based rations . At 2, 4, and 6 weeks, the relative increase in live weight was positively affected by addition of enzyme to maize-based rations, even if statistically insignificant. By adding 1 kg / ton of enzyme at the 6th week, the live weight gain increased from 365.47 g to 466.76 g. When assessed cumulatively, it was seen that addition of the enzyme also provided a relative increase in live weight gain

Table 4. Some development performances in end of the Trail (6th week).

Weeks	N	1. wk	2.wk	3.wk	4.wk	5. wk	6.wk	0-6.wks
Groups	162	89.96	206.34	321.97	413.25	443.87	419.24	1896.38
		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
MO (Control)	54	87.98	195.30	323.49	405.85	471.23	365.47	1849.32
M 0.5	54	86.75	199.12	298.53	393.27	467.55	449.89	1902.37
M 1	54	88.65	204.54	318.53	449.51	438.24	466.76	1965.21

N.S.: Non Significant



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The average values for feed consumption of the groups are given in Table 5.. Enzyme addition to the maize-based rations did not bring about a difference in feed consumption from week 1 to week 6. Cumulative feed consumption was reduced to 3624 g in the M1 group, while 3681 g in the control group

Table 5. Weekly Feed Consumption of Groups, g

Weeks	1. wk	2.wk	3.wk	4.wk	5. wk	6.wk	0-6.weeks
Groups	133.10	328.40	496.99	739.59	908.03	1055.43	3666.41
	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
MO (Control)	132.80	319.70	527.67	778.90	919.83	1003.00	3681.91
M 0.5	129.17	339.10	491.00	778.17	921.13	1099.43	3758.07
M 1	137.33	318.07	483.87	764.57	876.93	1043.27	3624.03

N.S.: Non Significant

The values of Feed Efficiency to be found in the groups are given in Table 6. The effect of enzyme addition on feed intake to maize-based rations was not significant.

Table 6. Weekly Feed Efficiency values of Groups, kg

Groups	1 wk.	2 wk.	3.wk.	4 wk.	5 wk.	6wk.	1-6 weeks
	1.53	1.59	1.54	1.79	2.05	2.52	1.93
MO,Control	1.51	1.64	1.63	1.92	1.95	2.74	1.99
M 0.5	1.49	1.70	1.64	1.98	1.97	2.44	1.98
M 1	1.55	1.56	1.52	1.70	2.00	2.24	1.84

The carcass characteristics of the groups are shown in Tables 7 and 8.. Enzyme addition (1 kg / ton) to the maize based rations increased the carcass weight significantly ($P < 0.05$).

As the enzyme additions to the maize-based rations increased, the carcass yield increased. Carcass yields were found 67.43%, 69.11 and 73.05 respectively

Enzyme addition to maize based rations increased thigh, breast and back weights significantly ($P < 0.05$). The wing weights did not change. Gizzard, liver and abdominal fat weight increased significantly ($P < 0.05$) by the addition of 1 kg / ton of enzyme.



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Table 7. Carcase Characteristics of Groups

Charasteristics		Carcass (g)	Yield (%)	Thigh (g)	Breast (g)	Back (g)
Groups	N	1345.01	69.57	383.10	403.96	310.711
	270	*	Ö.S.	*	*	*
MO (Control)	18	1272.67c	67.43	364.44c	397.11cb	282.33 c
M 0.5	18	1339.78bc	69.11	385.78bc	385.89cb	309.22 ab
M 1	18	1462.33a	73.05	411.11a	465.33a	331.44 ba
Male	135	1481.78	68.78	422.33	444.31	341.14
Female	135	1208.25	70.05	343.86	363.61	280.28

** : P<0.01, * : P<0.05, a, b, c: Differences between averages with different letters are important (P<0.05)

Table 8. Carcase Characteristics of Groups (Continue)

Charasteristics		Wing. (g)	Gizzard (g)	Liver (g)	Abdominal Fat (g).
Groups	N	159.56	37.57	44.02	30.54
	270	N.S.	*	*	*
MO (Control)	18	151.57	36.11b	41.67b	22.78 b
M 0.5	18	161.44	34.44b	40.89b	28.56 b
M 1	18	167.56	43.22a	53.56a	37.78 a

** : P<0.01, * : P<0.05, a, b, c, d, e, f : Differences between averages with different letters are important (P<0.05)

DISCUSSION

This study was conducted to investigate the effect of enzyme addition on the performance characteristics of maize based broiler rations.. While the differences between the groups were not statistically significant in terms of weekly average body weight gain throughout the trial, relatively enzyme addition positive affected live weight gain. By adding 1 kg / ton of enzyme the live weight gain increased from 365.47 g to 466.76 g. at the end of week 6. There is complete agreement with the results obtained by Yavuz (1996)., Graham explains the cause of this increase, which is affected by the enzyme. He says microscopic examination of the contents of the ileum of the small intestine of broilers fed with maize-based rations showed that large-sized maize endosperm particles were present, This means that the fat and protein of the maize starch can not be completely digested. But enzymes digest non-digestible starch fractions (Yavuz 1996). The results obtained with the addition of enzymes to maize and soyabean -based rations by Kutlu et al. (1995) support this work. Miles et al. (1996) reported that enzyme addition to maize-based rations slightly increased the live weight and the results support this study. Supic et al. (1995) reported that the difference in live weight gain at day 42 with 300 g / ton enzyme added to maize-based rations was insignificant and the results are in agreement with this work. Waytt et al. obtained live weight values of 2871 and 2846 g at the end of 6



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weeks by adding enzyme to the maize-based rations (Çiftçi and Ceylan, 1999) . The differences are statistically insignificant and similar to the results in this study. Canoğulları et al. (1999) have obtained similar results with the addition of α -amylase to maize-based rations.

Enzyme addition to maize-based rations did not bring about a difference in feed consumption from week 1 to week 6. Canoğulları ve ark. (1999), Yavuz (1996), Miles et al.(1996), Supić et al. (1995), Çiftçi and Ceylan (1999) reported that the effect of enzyme addition maize based rations on feed intake is insignificant and supports the results in this study. It is reported that the effect of the enzyme is insignificant because the antinutritional factors are very low in the structure of the maize grain compared to other grains (Çiftçi and Ceylan, 1999).. The effect of enzyme addition on feed intake to maize-based rations was not significant. A slight improvement is seen with the addition of 1 kg / ton enzyme, cumulatively. Yavuz (1996), Çiftçi and Ceylan (1999), Kutlu et al., (1995), Canoğulları et al. (1999), Supić et al. (1995), Miles et al. (1996), their findings fully support this work Çiftçi and Ceylan (1999) conclude that enzymes are beneficial to feed efficiency, primarily by increasing the digestibility of starch, protein amino acid, fat and energy. Enzyme addition (1 kg / ton) to the maize based rations increased the carcass weight significantly ($P < 0.05$).. The carcass weight was 1272.67 g in the control group and 1462.33 g in M1 (1 kg / ton enzyme) group. Yavuz (1996) obtained results of 1281 and 1342 g, with significant differences ($P < 0.05$) and similar results. This increase is commented as an increase in the carcass yield of maize and soyabean-based broiler rations. Enzyme addition to maize based rations increased to carcass yield relatively. Çiftci and Ceylan (1999) obtained yields of 67.7% and 68.3%. In this study higher yields were obtained by addition of enzyme. Yavuz (1996) obtained yields of 73.5% and 74.3%.. In this study, 73.05% value obtained with the addition of 1 kg / ton enzyme is close to the values obtained by Yavuz (1996). Enzyme addition to maize based rations increased thigh, breast and back weights significantly ($P < 0.05$).. But wing weight did not change. Canoğulları et al. (1999) found that enzyme addition significantly increased breast weight, but did not alter thigh back and wing weight. The results in terms of breast and wing weight support the results in this study. Gizzard, liver and abdominal fat weight increased significantly ($P < 0.05$) by the addition of 1 kg / ton of enzyme . When Ciftci and Ceylan (1999) found that the effect of enzyme addition on abdominal fat was significant ($P < 0.05$), Canoğulları et al. (1999), were found to be insignificant. As a result; The cheapest rations can be prepared by adding enzymes to the maize-based rations..New research is needed to fully understand the effect of enzymes



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LITERATURES

- AKBAY, R., 1985. *Bilimsel Tavukçuluk*. Yukarı Ayrancı, Hoşdere Cad. 23/17 ANKARA
- ANONYMOUS, 1987. *Kümes Kanatlılarının Besin Maddeleri Gereksinimleri*. Uludağ Üniv. Ziraat Fak. Zootečni Bölümü (National Academy of Sciences, Washington'dan Tercüme).
- ANONYMOUS, 1998. *Grindazym Feed Enzyme*. General Description. Danisco Ingredients. Edwin Rahrs Vej 38 DK 8220 Brabrand, DENMARK.
- CANOĞULLARI, S., OKAN, F., AYAŞAN, T., 1999. Etlik Piliç Karma Yemlerine α -amilaz ve Proteaz Katkısının Performansa ve Karkas Özelliklerine Etkileri. YUTAV, *Uluslararası Tavukçuluk Konferansı Bildiri Kitabı*, 505-514.
- ÇİFTÇİ, İ., YENİCE., E., GÖKÇEYREK, D., ÖZTÜRK. E., 1999. Arpa ve Buğday İçeren Tavuk Yemlerinde Enzim Kullanımı. *Çiftlik Dergisi, Sayı : 180* Sh: 87-97.
- DÜZGÜNEŞ, O., KESİCİ, T., KAVUNCU, O., GÜRBÜZ, F., 1987. *Araştırma ve Deneme Metodları (İstatistik Metodları II)*. Ank. Üniv. Zir. Fak. Yay. 1021, ANKARA..
- ERENSAYIN, C., 1991. *Bilimsel - Teknik - Pratik Tavukçuluk*. Cilt 1., ANKARA.
- HARVEY, W.R., 1987. *Instruction use of LSMLMN*. Ohio State Univ. Ohio - USA.
- KILIÇ, A., 1988. *Yemler ve Hayvan Besleme*. Ege Üniv. Ziraat Fak. Yay. 89, İZMİR.
- KUTLU, H.R., DEMİR, E., GÖRGÜLÜ, M., ÖZTÜRKCAN, O., 1995. Mısır ve Soyaya Dayalı Rasyonlara Enzim ve Su İlavesinin Etlik Cıvcıvlerin Performansı Üzerine Etkileri. *YUTAV, Uluslararası Tavukçuluk Kongresi Bildiri Kitabı*, 503-510.
- LEPLEY, C.K., DOĞAN, K., 1985. *Tavuk Rasyonlarının Hazırlanması*. Ankara Üniv. Basımevi. ANKARA
- MILES, R.D., BROWN, R.B., COMER, C.W., OELFKE, E., 1996. Influence of an Enzyme and an Antibiotic an Broile Performance. *Journal of Applied Animal Research* 9 (2), 105-117.
- ÖZEN, N., 1986. *Tavukçuluk*. Ondokuz Mayıs Üniv. Ziraat Fak. Yay. 11, SAMSUN.
- ÖZTÜRK, E., ERENER, G., 1997. Etlik Piliç Rasyonlarına Enzim İlavesinin Performansa Etkileri. Trakya Bölgesi II. Hayvancılık Kongresi 9-11 Ocak Tekirdağ, 324-331.
- SUKAN, S., ERKEK, R., BAYSAL, G.Ö., 1994. Cıvciv Yemi Katkı Maddesi Olarak Farklı Konsantrasyonlarda Enzim ve Zeolit Kullanımı. Tr. j. of Agriculture and Forestry 18: 141-144.



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and RURAL DEVELOPMENT
24-25 December 2021
BINGOL, TURKEY**



- SUPIC, B., SAVCK, S., MILOSEVIC, N., 1995. Use of Enzyme Preparations “Bio-Feed Alfa” and “Bio-Feed Plus” in Feeding Fattening Chickens. Nut. Abs. and Rev. (B) Vol 67, No : 6, 440.
- YAVUZ, H.M., 1996. Mısır ve Soyaya Dayalı Rasyonlara Enzim Katılmasının Etlik Piliçlerde Canlı Ağırlık Artışı Yemden Yararlanma ve Karkas Randımanına Etkileri. U.Ü. Vet. Fak. Dergisi, Sayı 1-2-3, Cilt 15, 177-184.
- YU, B., HSU, J.C., CHIOU, P.W.S., 1998. Effects of α -glucanase Supplementation of Barley Diets on Growth Performance of Broilers. Anim. Feed. Sci. Tech. 70: 353-361.



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**BIGHEAD CARP (*HYPOPHTHALMICHTHYS NOBILIS*, RICHARDSON, 1845)
(PISCES: CYPRINIDAE) AS HOST OF NEW PARASITE SPECIES
DACTYLOGYRUS ARISTICHTHYS (LONG & YU, 1958) IN MACEDONIAN
WATERS**

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ABSTRACT

This study aimed to determine the presence of parasite fauna, prevalence, mean intensity, as well as, the seasonal dynamic of parasite species in bighead carp (*Hypophthalmichthys nobilis* Richardson, 1845) from one of the largest cyprinid aquaculture facilities in Macedonia. A total of 53 specimens of bighead carp from one of the most significant and larger cyprinid aquaculture facilities in Macedonia were subjected to parasitological investigation, by seasons. Monogenea *Dactylogyrus aristichthys* (Long & Yu, 1958) was found on gills in bighead carp, in spring and autumn. Parasite identification was performed morphologically, based on the character of significant organs, using referent keys for determination. In total, the prevalence with *Dactylogyrus aristichthys* in bighead carp was 18.87%, while the mean intensity was 70.00. Our findings of *Dactylogyrus aristichthys* in bighead carp are first recorded in Macedonia. At the same time, the bighead carp represent a new host for *Dactylogyrus aristichthys* in Macedonian waters.

Keywords: Monogenea, Parasites, Mean intensity, Prevalence, Aquaculture



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INTRODUCTION

Bighead carp (*Hypophthalmichthys nobilis*, Richardson, 1845) is one of the most important farm-cultured fish species inhabiting the largest cyprinid aquaculture facilities in Macedonia. It is breeding in polyculture together with the common carp, the silver carp, and the grass carp. Bighead carp have not been found yet in open waters in our country. There aren't artificial hatcheries as well. The population of bighead carp in cyprinid aquaculture facilities in Macedonia is maintained by stocking that is carried out by import of fish fry.

The origin of bighead carp is from the Far East, so probably by introducing it in our fish farms, the parasite species that are characteristic of bighead carp have been transferred. Therefore, special care should be taken when buying stocking fish material from other countries. Uncontrolled imports of live fish into the country can contribute to the transmission of various parasites to autochthonous fish species, causing great economic and environmental damage to the fish population. Hoffman and Schubert (1984) believe that some of the imported fish species are carriers of parasites that disseminate widely in new geographical areas and infect indigenous fish species.

According to FAO (2018), the bighead carp is an important species in aquaculture, having the fifth-highest production (7.5%) of all cultured freshwater fish worldwide.

Potential pathogens including parasites constantly attack fish that can cause diseases generally associated with stressful conditions. In natural conditions, parasites may be of minimal importance, but they can contribute to significant problems in aquaculture, especially in inadequate environmental conditions and high density (Parker, 2012).

According to Gibson et al. (1996) and Woo (2006), *Dactylogyrus* spp. represents the most dominant genus within the class Monogenea. These ectoparasites are usually attached to the gills of freshwater fish of the family Cyprinidae. Jiang et al. (2013) and Tu et al. (2015) considered that infestation with monogenean parasites may lead to serious hyperplasia of the gill filaments epithelium, impairs respiratory function, and even associates with high mortalities, especially in young carps.

This study aimed to determine the presence of parasite fauna, prevalence, mean intensity, as well as, the seasonal dynamic of parasite species in bighead carp (*Hypophthalmichthys nobilis* Richardson, 1845) from one of the largest cyprinid aquaculture facilities in Macedonia.



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MATERIAL AND METHODS

Specimens of bighead carp (*Hypophthalmichthys nobilis*) were obtained from one of the largest cyprinid aquaculture facilities in Macedonia. The parasitological investigations were carried out by seasons, and a total of 53 specimens of bighead carp were examined. Fish were caught by net and fish species were determined according to the key of Kottelat and Freyhof (2007). The fish were placed in plastic tanks with water obtained from the collection sites and transferred to the Department of fish diseases at Hydrobiological Institute - Ohrid (Macedonia). Only fresh fishes were subjected to routine identification, dissection, and observation methods. Cleaned parasites were separated and put in certain fixatives, prepared for determination with determined techniques of staining and clearing (Vasiljkov, 1983; Gussev, 1983). Parasite identification was performed by morphometric analysis, using the keys of Bauer (1985) and Gussev (1983), based on the character of the copulatory organ, the haptor sclerites like anchors, bars, and hooks.

Classical epidemiological variables (prevalence and mean intensity) were calculated according to Bush et al. (1997) using the following formulas:

$$\text{Prevalence} = \text{Number of infected fish} / \text{Number of examined fish} \times 100$$

$$\text{Mean intensity} = \text{Total number of parasites} / \text{Number of infected hosts}$$

During the examinations, stereomicroscopes „Zeiss”- Stemi DV4 and „MBS 10”, as well as light microscope „Reichert” with magnifications of 40 - 100 x were used.

RESULTS AND DISCUSSION

A total of 53 specimens of bighead carp (*Hypophthalmichthys nobilis*) from one of the largest cyprinid aquaculture facilities in Macedonia were examined for parasitological investigation by season, in which parasite infestation with *Dactylogyrus aristichthys* was found on gills in 10 specimens of bighead carp, of which 5 specimens in spring and 5 in autumn. This parasite species were found on all sizes of host fish. In total, the prevalence with *Dactylogyrus aristichthys* in bighead carp was 18.87%, while the mean intensity was 70.00. The prevalence with *Dactylogyrus aristichthys* by seasons was as following: spring – 33.0% and autumn - 25.0%, while the mean intensity: spring - 49,60 and autumn - 90,40.

Data on fish examined, fish infected, as well as the prevalence and mean intensity with *Dactylogyrus aristichthys*, total and by season, are given in Tables 1 & 2.



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Table 1. Total prevalence and mean intensity with *Dactylogyrus aristichthys* in bighead carp (*Hypophthalmichthys nobilis*) from Macedonian waters

Fish species	Number of examined fish	Number of infected fish	Mean intensity	Prevalence (%)
Bighead carp (<i>Hypophthalmichthys nobilis</i>)	53	10	70.00	18.87

Table 2. Prevalence (P) and mean intensity (I) with *Dactylogyrus aristichthys* in bighead carp (*Hypophthalmichthys nobilis*) from Macedonian waters, by season

Parasite species	Spring		Summer		Autumn		Winter	
	I	P (%)	I	P (%)	I	P (%)	I	P (%)
<i>Dactylogyrus aristichthys</i>	49.60	33.00	/	/	90.40	25.00	/	/

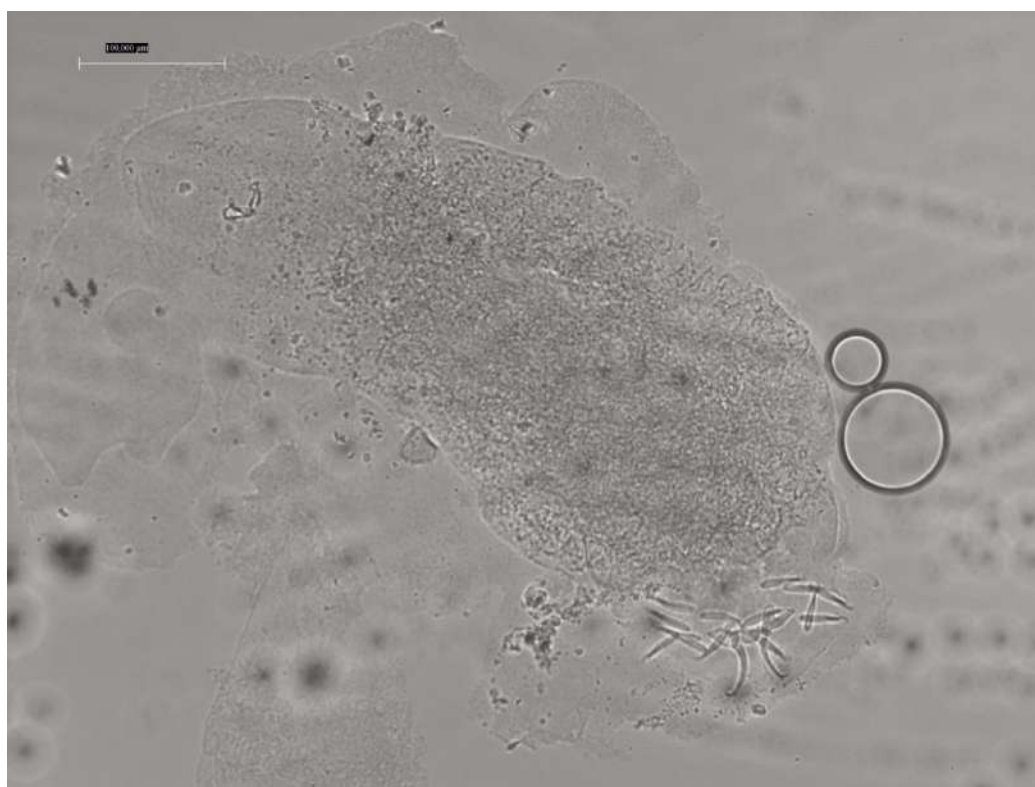


Fig. 1. *Dactylogyrus aristichthys* on gills in bighead carp – whole parasite (original)



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Fig. 2. *Dactylogyrus aristichthys* on gills in bighead carp – hooks (original)

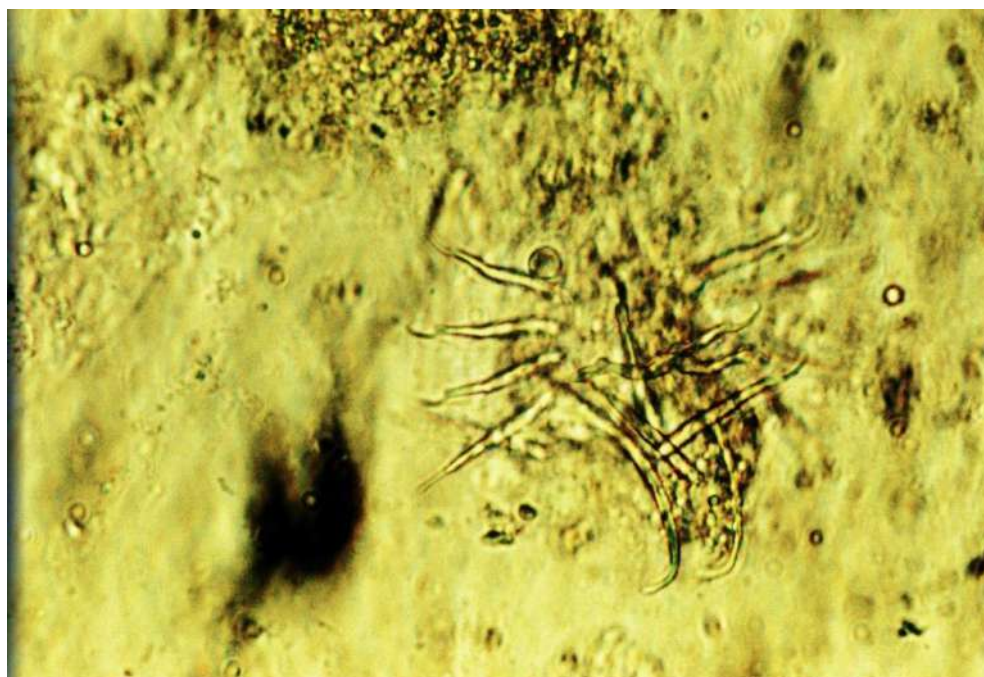


Fig. 3. *Dactylogyrus aristichthys* on gills in bighead carp – hooks (original)



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Fig. 4. *Dactylogyrus aristichthys* on gills in bighead carp – copulatory organ (original)

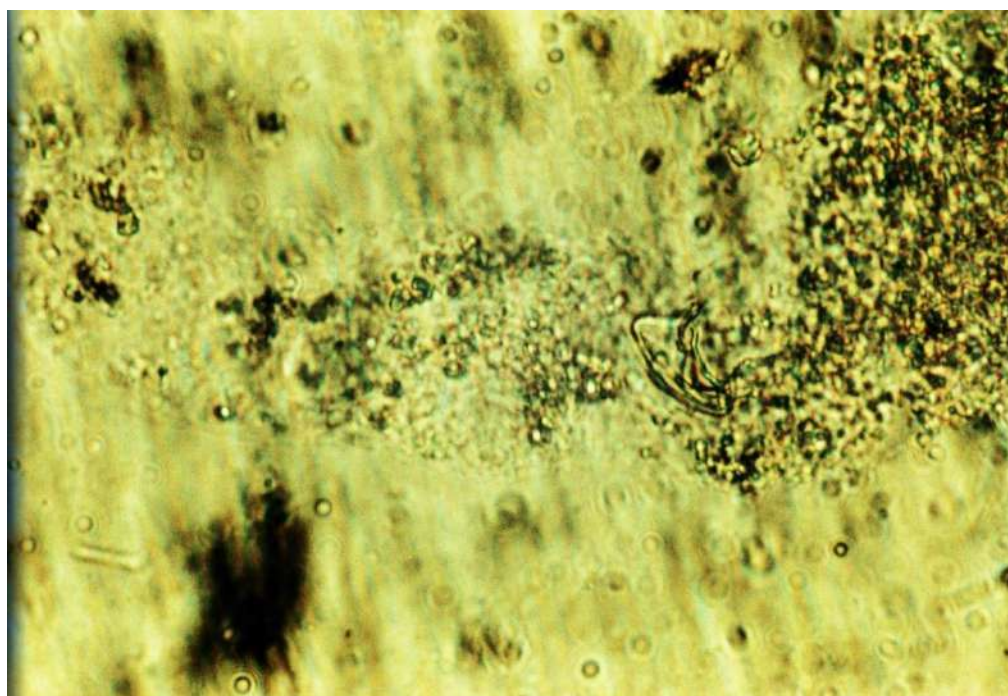


Fig. 5. *Dactylogyrus aristichthys* on gills in bighead carp – copulatory organ (original)



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Our findings of *Dactylogyrus aristichthys* in bighead carp (*Hypophthalmichthys nobilis*) are first recorded in Macedonia. At the same time, the bighead carp represent a new host for *Dactylogyrus aristichthys* in Macedonian waters.

Dactylogyrus aristichthys parasites on the gill filaments of the bighead carp. It is a parasite of small or medium size, up to 0.5 mm long and up to 0.15 mm wide. The length of the peripheral hooks ranges from 0.026 - 0.037 mm; the middle hooks of 0.042 - 0.044 mm; the basic part of 0.038 - 0.039 mm, the inner growth of 0.010 - 0.012 mm; the outer growth of 0.006 - 0.008 mm, and the sharp part of 0.007 - 0.009 mm. The dimensions of the connecting plate are 0.005 - 0.007 × 0.028 - 0.030 mm, and the additional plate 0.002 - 0.004 × 0.032 - 0.038 mm. The length of the copulatory organ is 0.025 - 0.035 mm.

According to world literary reviews, *Dactylogyrus aristichthys* has been identified in bighead carp from fish farms in Guilan and Mazandaran provinces in Iran by Shamsi et al. (2009) and Bozorgnia et al. (2012).

Bauer (1985) concludes that this parasite is widespread in cyprinid fishponds, sometimes with infestations of very high intensity, but pathological changes are rarely observed.

CONCLUSIONS

Our findings of monogenean *Dactylogyrus aristichthys* in bighead carp are first recorded for our country. At the same time, the bighead carp represent a new host for *Dactylogyrus aristichthys* in Macedonian waters. Total, the prevalence with *Dactylogyrus aristichthys* in bighead carp was 18.87%, while the mean intensity, 70.00.

Dactylogyrus aristichthys is found in spring and autumn, in relatively high mean intensity. Maximum prevalence and intensity of parasites occur in the course of a vernal period. Alongside that, there are three factors because of which the fish are physiologically less resistant to parasites during the spawning period: weaker condition, stress, and disruption in the production of estrogen. Also, after the winter period, which is a latent period, the vernal period provides better conditions for the development and reproduction of the parasites, which is mainly why they increase in number.

The population of bighead carp in cyprinid aquaculture facilities in Macedonia is maintained by stocking that is carried out by import of fish fry. For this reason, the introduction of exotic pathogens by fish imports into the country should be strictly controlled and evaluated from the outset, to protect not only autochthonous fish species but also the aquatic ecosystem itself.



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REFERENCES

- Bauer, O.N. (1985) *Opredelitelj parazitov presnovodnih ryb fauni SSSR. Tom II (Paraziticheskie mnogokletotnie. Pervaja chast).* Akademia Nauk SSSR. Izdateljstvo "Nauka", Leningrad.
- Bauer, O.N. (1987) *Opredelitelj parazitov presnovodnih ryb fauni SSSR. Tom III (Paraziticheskie mnogokletotnie. Vtoraja chast).* Akademia Nauk SSSR. Izdateljstvo "Nauka", Leningrad.
- Bozorgnia, A., Youssefi, M.R., Barzegar, M., Hosseinfard, S.M., Ebrahimpour, S. (2012) Biodiversity of Parasites of Fishes in Gheshlagh (Vahdat) Reservoir, Kurdistan Province, Iran. *World Journal of Fish and Marine Sciences*, 4 (3), 249-253. doi: 10.5829/idosi.wjfms.2012.04.03.61326.
- Bush, A.O., Lafferty, K.D., Lotz, J.M., Shostak, A.W. (1997) Parasitology meets ecology on its own terms: Margolis et al. Revisited. *Journal of Parasitology*, 83, 575- 583. doi:10.7939/R3J38KV04
- FAO Fisheries & Aquaculture *Hypophthalmichthys nobilis*". (2018). www.fao.org.
- Gibson, D.I., Timofeeva, T.A., Gerashev, P.I.A. (1996) Catalogue of the nominal species of the monogenean genus *Dactylogyrus* Diesing, 1850 and their host genera. *Systematic Parasitology*, 35, 3-48.
- Gusseu, A.V. (1983) *Methodology of sampling and processing of material of monogeneans, parasitising in fishes.* Academy of Sciences of USSR, Zoological Institute, Leningrad, Russia (In Russian).
- Hoffman, G.L., Schubert G. (1984) Some parasites of exotic fishes. p.p.233- 261 in W. R. Courtenay, Jr. and J. R. Stauffer.
- Jiang, Z., Zhou, Z., Meng, Z., Meng, X., Li, L., Ping, X., Zeng, Y., Mallon, D.P. (2013) Domestic and CITES regulations controlling the international snake trade in China. *Oryx*, 47, 532-534.
- Kottelat, M., Freyhof, J. (2007). *Handbook of European freshwater fish.*
- Malmberg, G. (1970) Excretory system and marginal hooks as a basis for systematics of *Gyrodactylus* (Trematoda: Monogenea). *Arkiv for Zoologi*, 23, 1-235.
- Parker, R. (2012) *Aquaculture Science: 3rd (third) Edition*



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- Shamsi, S., Jalali, B., Aghazadeh, Meshgi, M. (2009) Infection with *Dactylogyrus* spp. among introduced cyprinid fishes and their geographical distribution in Iran. *Iranian Journal of Veterinary Research*, 10 (1), Ser. No. 26.
- Tu, X., Ling, F., Huang, A. and Wang, G. (2015) The first report of *Dactylogyrus formosus* Kulwiec, 1927 (Monogenea: Dactylogyridae) from goldfish (*Carassius auratus*) in central China. *Parasitology Research*. 114 (7), 2689-96. doi: 10.1007/s00436-015-4474-3
- Woo, P.T. (2006) *Fish diseases and disorders*”, Vol. 1: protozoan and metazoan infections. CAB International, London: p.791.



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**ASMA BİTKİSİNDE (*Vitis vinifera* L.) ABC PROTEİNLERİNDEN PDR ALT
AİLESİNİN BİYOİNFORMATİK VE İFADE ANALİZİ**

Selin ALTINTAŞ

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ÖZET

ATP taşıyıcı kaset (ABC) taşıyıcı genleri, evrimsel olarak yüksek oranda korunmuş, tüm organizmalarda bulunan en büyük membran protein sınıflarından biridir. ATP hidroliz enerjisini kullanarak maddelerin içe ve dışa taşınmasında görev almaktadırlar. Plazma zarı, tonoplast, kloroplast, mitokondri ve peroksizomlar gibi bir bitki hücresinin zarlarında lokalizedirler ve çok sayıda işlevi yerine getirirler. Başlangıçta detoksifikasyon işlemlerine katılan taşıyıcılar olarak tanımlanmış daha sonra organ büyümesi, bitki beslenmesi, bitki gelişimi, abiyotik strese cevap, patojen direnci ve bitkinin çevresi ile etkileşimi için gerekli oldukları gösterilmiştir. Ökaryotik ABC taşıyıcılarının tipik bir yapısı, korunmuş iki alandan oluşur: bir transmembran alanı (TMD) ve bir nükleotit bağlama alanı (NBD). Ökaryot ABC taşıyıcıları, sekans benzerliği ve alan organizasyonuna göre yedi ana ailede (ABCA - ABCG) sınıflandırılır. PDR alt ailesi ABCG'nin tam yapı üyelerinden oluşur. Genel olarak, PDR'ler kutiküler lipidlerin üretimi veya taşınmasında görev almaktadır. ABA, JA, sitokininler ve oksinler gibi farklı hormonların taşınmasından sorumludurlar. Ayrıca, bitkilerde abiyotik ve biyotik strese karşı tepkilerde rol oynarlar. Bu çalışmada, *Arabidopsis thaliana*'ya ait ABCG alt ailesinde bulunan PDR sekansları kullanılarak *Vitis* genomu üzerinden BLAST yapılarak 33 VvABCG/PDR geni tespit edilmiş ve bu genlere ait sekanslar, lokasyon bilgileri, gen ve protein yapılarına ait veriler çıkartılmıştır. Elde edilen sekanslarla MEGA10 programı kullanılarak filogenetik ağaç oluşturulmuştur. *Vitis* genomu üzerinden tespit edilen 4 VvABCG/PDR geni, Ensemble Plant veri tabanında BLAST edilmiş ve tüm genlerin Ensemble Plant ID'leri tespit edilmiştir. STRING veri tabanı üzerinden analizler Ensemble Plant ID'si ile yapılmış ve 4 adet VvABCG/PDR proteininin etkileşime girdiği proteinler tespit edilmiştir. Elde edilen verilerde etkileşime girilen proteinlerin çoğu karakterize edilmiş olmadığından dolayı, Ensemble Plant üzerinden bu proteinlerin sekanslarına ulaşılmış ve *Arabidopsis thaliana* genomu üzerinde BLAST yapılarak *Arabidopsis* homologları ve UniProt veri bankası üzerinden homologlarının görevleri tespit edilmiştir. Bu çalışmada, farklı gelişim dönemlerinde alınan üzüm tanelerinden toplam RNAlar izole edilerek cDNA sentezinde kullanılmıştır. VvABCG/PDR gen ailesine ait VvABCG31, VvABCG32 VvABCG33 ve VvABCG34 genlerinin ifadeleri Real-time PCR yöntemi ile analiz edilmiştir.

Anahtar sözcükler: ABC Taşıyıcıları, ABC Proteinleri, ABCG, mRNA ifadesi, *Vitis vinifera*, Real-time PCR



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**EXPRESSION ANALYSIS OF PDR SUBFAMILY GENES OF ABC PROTEINS IN
GRAPEVINE (*Vitis vinifera* L.)**

ABSTRACT

ATP-binding cassette (ABC) transporter genes are one of the largest classes of membrane proteins found in all organisms, evolutionarily highly conserved. They are involved in the transport of substances by using the energy of ATP hydrolysis. They are localized in the membranes of a plant cell, such as the plasma membrane, tonoplast, chloroplast, mitochondria, and peroxisomes, and perform numerous functions. Initially identified as carriers involved in detoxification processes, they were later shown to be essential for organ growth, plant nutrition, plant growth, response to abiotic stress, pathogen resistance, and plant interaction with its environment. A typical structure of eukaryotic ABC transporters consists of two conserved domains: a transmembrane domain (TMD) and a nucleotide binding domain (NBD). Eukaryotic ABC transporters are classified into seven major families (ABCA - ABCG) based on sequence similarity and domain organization. The PDR subfamily consists of full length members of ABCG subfamily. PDRs are involved in the production or transport of cuticular lipids. They are responsible for the transport of different hormones such as ABA, JA, cytokinins and auxins. They are also involved in responses to abiotic and biotic stress in plants. In this study, 33 VvABCG/PDR genes were determined by BLAST on the *Vitis* genome using PDR sequences in the ABCG subfamily of *Arabidopsis thaliana*, and the sequences, location information, gene and protein structures of these genes were determined. Phylogenetic tree was constructed using the MEGA10 programme. 4 VvABCG/PDR genes identified on the *Vitis* genome were BLASTed in the Ensemble Plant database and Ensemble Plant IDs of all genes were determined. Analyzes on the STRING database were made with Ensemble Plant ID and the proteins interacting with VvABCGs were identified. Since most of the interacting proteins were not characterized, the functions of the *Arabidopsis* homologs were identified through the UniProt database by BLASTing on the *Arabidopsis thaliana* genome. In this study, total RNAs were isolated from grapes taken at different developmental stages and used in cDNA synthesis. Expressions of VvABCG31, VvABCG32, VvABCG33 and VvABCG34 genes belonging to VvABCG/PDR gene family were analyzed by Real-time PCR method.

Keywords: ABC Transporters, ABC Proteins, ABCG, mRNA Expression, *Vitis vinifera*, Real-time PCR



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GİRİŞ

Moleküllerin hücrelerin içine ve dışına hareketi, çoğu durumda taşıyıcılar olarak bilinen hücre zarında bulunan özel membran proteinleri tarafından yönlendirilir. ATP Bağlayan Kaset Taşıyıcıları/ ABC Proteinleri/ ABC Taşıyıcıları (ATP Binding Cassette Transporters/ ABC Proteins/ ABC Transporters), en büyük membran protein sınıflarından birini oluşturur (Higgins, 1995; Higgins and Linton, 2004). ATP'nin bağlanması ve hidrolizi sonucu ortaya çıkan enerjiyi kullanarak, ABC taşıyıcıları, iyonlar, şekerler, amino asitler, polipeptitler, toksik metabolitler, ksenobiyotikler ve hatta ilaçlar ve toksinler dahil olmak üzere zarlar boyunca çok çeşitli substratların taşınmasında görev alırlar (Theodoulou et al., 2006). ABC taşıyıcıları bitkilerde gametogenez, tohum gelişimi, tohum çimlenmesi, organ oluşumu ve ikincil büyüme gibi süreçlerde rol oynamaktadırlar.

ABC taşıyıcıları en az iki korunmuş bölgeden oluşur: bir nükleotid bağlanma alanı (NBD) veya ATP binding cassette (ABC) olarak adlandırılan yüksek miktarda korunmuş domain ile daha az korunmuş bir transmembran bölgesi (TMD). Bu bölgeler aynı protein üzerinde veya ayrı ayrı proteinler üzerinde bulunabilir (Holland et al., 2003). ABC proteinleri birçok farklı yapıdaki maddenin içeri ve dışarı yönlü taşınmasından sorumlu olduğu için TMD bölgesi farklı proteinlerde oldukça özgül bir yapıya sahiptir ve hem tür içerisinde hem de türler arasında oldukça çeşitlenmiştir. Bununla birlikte NBD oldukça korunmuş bir yapı göstermektedir (Xiong et al., 2015). Farklı domain sayısı ve domain organizasyonlarıyla, ökaryot ABC taşıyıcıları farklı yapılar gösterir: tek yapı (NBD veya TMD), ABC2 yapısı (NBD-NBD), yarım yapı (TMD-NBD veya NBD-TMD) ve tam yapı (TMD-NBD-TMD-NBD veya NBD-TMD-NBD-TMD) (Xiong J et al., 2015).

Alan organizasyonlarına ve birincil sekans homolojisine göre, ökaryotik ABC taşıyıcıları ABCA'dan ABCG'ye kadar yedi aileye ayrılmıştır. Yedi ABC taşıyıcı ailesinin üyeleri, ökaryotların gemonunda yaygın olarak dağılışı göstermektedir (Klein et al., 1999). Taşıyıcı olarak adlandırılmasına rağmen, iki ökaryotik ABC taşıyıcı ailesi (ABCE ve ABCF) taşıyıcı olarak işlev görmezler, çünkü bunlar TMD alanlarını taşımamaktadır (Xiong et al., 2015). Fakat ribonükleaz inhibisyonu ve translasyon kontrolü dahil olmak üzere diğer hücresel işlemlerde rol oynarlar (Xiong et al., 2015).

ABC taşıyıcı süper ailesinde genlerin büyüklükleri, türler arasında büyük ölçüde değişiklik gösterir ve *Arabidopsis thaliana* ve *oryza sativa* gibi bazı organizmalarda yüz kopyadan daha fazlasına sahip olabilir (Sanchez-Fernandez et al., 2001; Garcia et al., 2004).



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ABC proteinleri içerisinde geri yönlü yapıya sahip tek alt aile ABCG alt ailesidir. Bu alt aile içerisinde yarım molekül grubunu WBC alt grubu ve tam molekül grubunu da PDR alt grubu oluşturur. Bu alt gruplardan WBC bütün canlı gruplarında bulunurken, PDR alt grubu sadece mantar ve bitkilerde tanımlanmıştır. *Arabidopsis* genomunda;29 tane WBC, 15 tane PDR, *Oryza* genomunda;30 tane WBC, 23 tane PDR tanımlanmıştır.

ABCG alt ailesi büyüme ve gelişmeyle birlikte çeşitli stres ve savunma mekanizmalarında büyük rol oynamaktadır. *Arabidopsis*'te yapılan çeşitli çalışmalarda ; AtABCG13 ve AtABCG32'nin kutikular lipid taşıyıcı olarak görev yaptığı, AtABCG12'nin epidermal hücrelerin membranında bulunduğu ve hücre yüzeyine kutikular wax salgılanmasında görev aldığı bildirilmiştir (Bessire et al.,2011). ABCG12'nin petal ve karpellerde ifade olduğu ve çiçeğe özgü kütinlerin taşınmasında görev aldığı, AtABCG26'nın polen duvarlarını oluşturan molekülün taşınmasında görevli olduğu görülmüş ve mutantlarında tohum oluşumu azalmış ve olgun polen oluşturulamamıştır (Teagen et al., 2010). Tütünde NtWBC1 polen tüpü oluşumunda görevli lipidlerin taşınması ve tüpün formasyonunun kontrolünde görevli olduğu, Pamukta GhWBC1 pamuk fibrillerinin olgunlaşmasında gerekli yapıların taşınmasında görevli olduğu bildirilmiştir (Zhu et al., 2003).

ABCG alt ailesi üyelerinin çeşitli hormonların taşınımında da görevli olduğu bilinmektedir. AtABCG25'in tohum ve tomurcuk dormansisi, organ büyüklüğünün kontrolü ve stomatal kapanma gibi çeşitli bitki gelişim aşamalarını uyaran, absisik asit (ABA) hormonunun taşınmasında görev aldığı, bunun yanı sıra AtABCG14'ün sitokininlerin taşınmasında görev alabileceği, AtABCG16'nın da Jasmonik asit (JA) taşınımında görev aldığı bildirilmiştir (Lefevre and Boutry, 2018). AtABCG36 ve AtABCG37 polar oksin taşınımında görevlidir (Geisler M et al.,2005).

ABCG alt ailesi üyelerinin abiyotik ve biyotik streslerde görev yaptığı ve bitki direnç mekanizmalarını desteklediği çeşitli çalışmalarda bildirilmiştir. AtABCG26'nın vakuolar arsenik birikiminde fonksiyonel olduğu çeşitli biyoremediasyon çalışmalarında potansiyel olarak kullanılabileceği düşünülmektedir (Potdukhe et al., 2018). AtABCG30 (PDR2)'un ağır metaller gibi abiyotik streslere cevap verdiği ve patojen savunma hormonları tarafından düzenlendiği bildirilmiş (Crouzet et al., 2006), bir ağır metal akış pompası olabileceği ve aynı zamanda absisik asit taşınımında rol alabileceği düşünülmektedir (Lefevre and Bouty, 2018). AtABCG36 (PDR8)'in savunma yanıtında hücre ölümünün derecesini kontrol eden kilit bir faktör olduğu, hem kallus birikimi hemde glukosinolat aktivasyonu için gerekli olduğu



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bildirilmiş, ayrıca kadmiyum (Cd^{2+}) ve kurşuna (Pb^{2+}) karşı direnç sağladığı, muhtemelen patojen direncine aracılık eden kimyasalların, Me^{2+} ve Me^{2+} konjugatlarının, akış pompası olabileceği düşünülmektedir (Kim et al., 2007) Tüm bunlarla birlikte oksin türevlerinin taşınmasında görev alabileceği de bildirilmiştir (Lefevre and Boutry, 2018). AtABCG34'ün yaprak yüzeyinde bitkiyi netrofik patojenlere karşı koruyan fitoaleksinin ve kemoaleksinin (Khare et al., 2017) ve çeşitli alkaloid türevlerinin (Lefevre and Boutry, 2018) salgılanmasında görev aldığı bildirilmiştir. AtABCG37 (PDR9 ; PDR12)'nin oksinin herbisitlere karşı dayanıklılık sağladığı (Ito and Grey, 2006) ve kök eksüdasına oksijenli kumarinlerin katılmasında görev aldığı (Ziegler et al., 2017) bildirilmiştir. Bazı ABCG proteinleri birden fazla ortaklığa (multiple partnership) sahip olmakla birlikte, diğerleri ise özel işlevler için zorunlu heterodimer (obligate heterodimer) oluşturabilir (McFarlane et al., 2010). Asma bitkisi, çok çeşitli varyetelere sahip bir kültür bitkisidir. Dünyanın çeşitli bölgelerinde yetiştirilen, şaraplık, sofralık, kurutmalık olarak kullanılan bu çeşitler yüksek ekonomik öneme sahiptir. Bu çalışmada biyoinformatik olarak tanımlanmış *Vitis vinifera* L. ABC kaset taşıyıcıları PDR alt ailesinden gen ailesine ait VvABCG31, VvABCG32 VvABCG33 ve VvABCG34 genlerinin ifadeleri Real-time PCR yöntemi ile analiz edilmiştir. Elde edilen sonuçların asmada meyve oluşumunun moleküler düzeyde aydınlatılmasına ve gelecekte yapılacak ürün geliştirme amaçlı ıslah çalışmalarına katkı sağlanması amaçlanmıştır.

MATERYAL VE METOT

Bitki Materyali

Üzüm taneleri Ege Üniversitesi, Ziraat Fakültesi, Menemen Araştırma ve Uygulama Çiftliği bağ alanında bulunan *Vitis vinifera* cv. Sultani Çekirdeksiz çeşidinden 2017 yılında 21 Nisan - 2 Eylül tarihleri arasında 2 hafta aralıklarla hasat edilmiş ve derhal sıvı azota daldırılıp laboratuvara getirilerek, RNA izolasyonuna kadar -80 °C de saklanmıştır.

Biyoinformatik Analizler

Arabidopsis thaliana'ya ait ABCG alt ailesinde bulunan PDR sekansları kullanılarak *Vitis genome Browser x12* üzerinden BLAST yapılarak 33 VvABCG/PDR geni tespit edilmiş ve bu genlere ait sekanslar, lokasyon bilgileri, gen ve protein yapılarına ait veriler çıkartılmıştır. Elde edilen sekanslarla MEGA10 programı kullanılarak filogenetik ağaç oluşturulmuştur.

Vitis genome Browser x12 üzerinden tespit edilen 33 VvABCG/PDR geni, Ensemble Plant veri tabanında BLAST edilmiş ve hepsinin Ensemble Plant ID'si tespit edilmiştir. STRING veri tabanı



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üzerinden analizler Ensemble Plant ID'si ile yapılmış ve 4 adet VvABCG/PDR proteinlerinin etkileşime girdiği proteinler tespit edilmiştir. Elde edilen verilerde etkileşime girilen proteinlerin çoğu karakterize edilmiş olmadığından dolayı, Ensemble Plant üzerinden bu proteinlerin sekanslarına ulaşılmış ve *Arabidopsis Thaliana* genomu üzerinde BLAST yapılarak Arabidopsis homologları ve UniProt veri bankası üzerinden homologlarının görevleri tespit edilmiştir.

Rna İzolasyonu Ve Cdna Sentezi

Toplam RNA izolasyonu Davies ve Robinson (1996) tarafından tanımlanan metot kullanılarak, 2M LiCl ile 16 saat çöktürme adımı eklenerek yapılmıştır (Davies and Robinson 1996). İzole edilen toplam RNA “RNase free DNaseI (Fermentas, USA)” ile muamele edilerek olası DNA kirliliği uzaklaştırılmış ve devamında “RNeasy Purification Kit (Qiagen, Germany)” kullanılarak RNA saflaştırılmıştır. 20 µl son hacimde 2 µg saf RNA'dan “The RevertAid™ H Minus First Strand cDNA Synthesis Kit (Fermentas, USA)” kullanılarak cDNA sentezi üretici protokolü izlenerek yapılmıştır.

Real Time Pcr Analizi

VvABCG ailesine ait 4 adet genin tane gelişim boyunca mRNA değişiminin incelenmesi amacıyla primer çiftleri tasarlanmıştır (Tablo 1). Primer tasarımı PRIMER3 veri tabanı üzerinden mRNA sekansları kullanılarak yapılmış ve primerlerim iki ekzon arasına yerleşecek şekilde, 18-24 nükleotid uzunluğunda, GC içeriğinin %40-60 oranında ve erime sıcaklığının (Tm) $\approx 60^{\circ}\text{C}$ olmasına dikkat edilmiştir. Primerler OligoCalc veritabanı üzerinden kontrol edilerek seçilmiştir. Bunların dışında genlerin ifadesinin karşılaştırılacağı içsel kontrol olarak Aktin geni kullanılmıştır.

Tane gelişimi 21 nisan, 02 mayıs, 18 mayıs, 31 mayıs, 18 haziran, 30 haziran, 15 temmuz, 28 temmuz, 2 eylül 2017 tarihlerinde toplanan tanelerden izole edilen mRNA'lar kullanılarak analiz edilmiştir.

Real Time Reaksiyonu için; 1µL cDNA, 12,5 µL SYBR® Green Master Mix, 2 µL Forward ve 2 µL Reverse primer (10 µM) ve 7,5 µL dH₂O tüplere total hacim 25 µL olacak şekilde amplifikasyon gerçekleştirilmiştir. Real Time PCR reaksiyonları Ege Üniversitesi Biyoteknoloji Enstitüsü Merkez Laboratuvarı'nda Rotor Gene Q Real Time PCR cihazında gerçekleştirilmiştir.



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Tablo 1. VvABCG alt ailesine üyelerine ait primerler

Primer Adı	Primer Dizisi	Tm (°C)	Baz Sayısı
VvABCG31F	GATGCGGTAGATTTGGAATTT	54	21
VvABCG31R	ATTCCTTAACAAGGCCTCACTC	59	23
VvABCG32F	ATATGCCACAGCAATGAAAG	56	21
VvABCG32R	CCCACAACATGTCTAGGAGA	60	21
VvABCG33F	TTGTTAAACCGTCAAGGATGACT	57	23
VvABCG33R	TGGCACAATTCATTTAGCCTAT	55	23
VvABCG34F	CATCCCTGAACCAGAGAAACA	58	21
VvABCG34R	GTAAGTCCACCACTGCTTCCA	60	21

BULGULAR VE TARTIŞMA

GEN YAPILARININ İNCELENMESİ

VvABCG alt ailesine ait genlerin sahip olduğu ekzon-intron sayısı, lokasyonları ve transkript uzunluğu gibi özellikleri belirlenmiş ve tabloda gösterilmiştir (Tablo 2).

Tablo 2. VvABCG alt ailesi üyelerinin özellikleri

Name	Ensemble Plant ID	Vitis genome X12 browser ID	Lokasyon	zincir	Gen uzunluğu	Transkript uzunluğu	Exon	intron
VvABCG31	VIT_11s0016g04540	GSVIVT01015456001	chr11:3825506..3837096	+	11591bp	4266bp	24	23
VvABCG32	VIT_11s0016g04590	GSVIVT01015461001	chr11:3887993..3897672	-	9680bp	5925bp	21	20
VvABCG33	VIT_09s0002g03560.t01	GSVIVT01016991001	chr9:3229012..3244545	+	15534bp	2853bp	19	18
VvABCG34	VIT_09s0002g03570.t01	GSVIVT01016992001	chr9:3244545..3246079	+	1535bp	969bp	5	4
VvABCG35	VIT_09s0002g03580.t01	GSVIVT01016993001	chr9:3246544..3252734	+	6191bp	2073bp	13	12
VvABCG36	VIT_09s0002g03630.t01	GSVIVT01016998001	chr9:3318607..3327354	-	8748bp	4368bp	25	24
VvABCG37	VIT_09s0002g03640.t01	GSVIVT01016999001	chr9:3328286..3336959	-	8674bp	4482bp	21	20
VvABCG38	VIT_09s0002g05360.t01	GSVIVT01017184001	chr9:5099104..5114849	-	15746bp	4749bp	29	28
VvABCG39	VIT_09s0002g05370.t01	GSVIVT01017185001	chr9:5115461..5134896	-	19436bp	4929bp	31	30
VvABCG40	VIT_09s0002g05400.t01	GSVIVT01017187001	chr9:5146238..5168948	-	22711bp	5313bp	40	39
VvABCG41	VIT_09s0002g05410.t01	GSVIVT01017188001	chr9:5168995..5182779	-	13785bp	4941bp	27	26
VvABCG42	VIT_09s0002g05490.t01	GSVIVT01017196001	chr9:5216635..5238081	-	21447bp	4089bp	28	27
VvABCG43	VIT_09s0002g05530.t01	GSVIVT01017198001	chr9:5257252..5268154	-	10903bp	5124bp	32	31
VvABCG44	VIT_09s0002g05560.t01	GSVIVT01017201001	chr9:5281157..5294157	-	13001bp	4614bp	29	28
VvABCG45	VIT_09s0002g05570.t01	GSVIVT01017202001	chr9:5294436..5301677	-	7242bp	4356bp	24	23



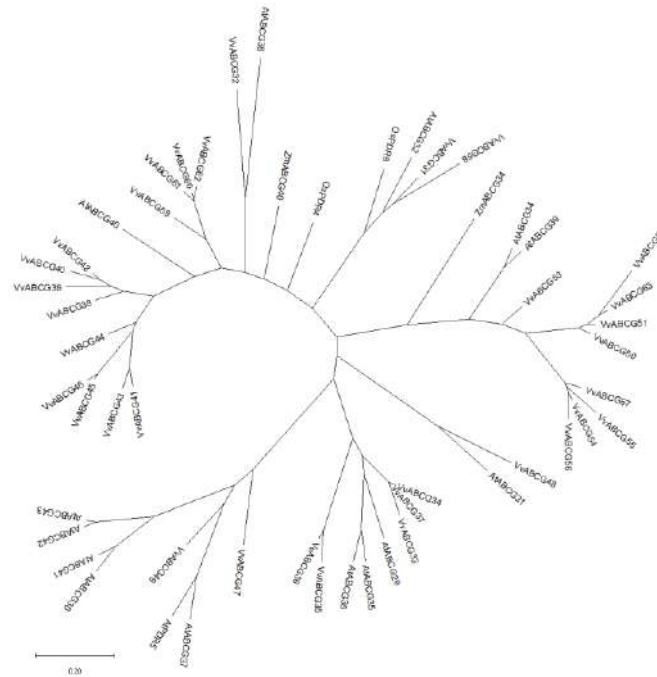
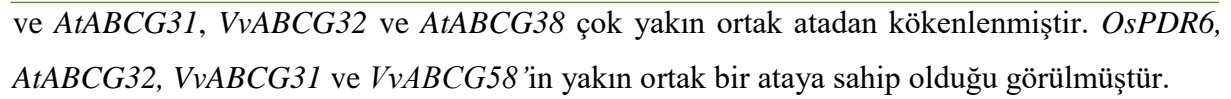
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VvABCG4 6	VIT_09s0002g05600.t0 1	GSVIVT0101720400 1	chr9:5316069..5343724	-	27656bp	9429bp	60	59
VvABCG4 7	VIT_05s0020g00680.t0 1	GSVIVT0101767600 1	chr5:2543551..2558096	+	14546bp	4461bp	25	24
VvABCG4 8	VIT_06s0004g06560.t0 1	GSVIVT0102474300 1	chr6:7284289..7297469	+	13181bp	4452bp	27	26
VvABCG4 9	VIT_14s0060g00470.t0 1	GSVIVT0103131400 1	chr14:439701..448856	+	9156bp	4221bp	24	23
VvABCG5 0	VIT_06s0061g01490.t0 1	GSVIVT0103137700 1	chr6:19360714..1936839	-	7684bp	4167bp	23	22
VvABCG5 1	VIT_06s0061g01480.t0 1	GSVIVT0103137800 1	chr6:19347375..1936024	-	12866bp	4383bp	21	20
VvABCG5 2	VIT_06s0061g01470.t0 1	GSVIVT0103138000 1	chr6:19331347..1933976	-	8414bp	3345bp	24	23
VvABCG5 3	VIT_08s0007g03710.t0 1	GSVIVT0103380400 1	chr8:17659640..1766941	+	9780bp	4074bp	20	19
VvABCG5 4	VIT_13s0074g00660.t0 1	GSVIVT0103474100 1	chr13:8817915..8828337	-	10423bp	4353bp	23	22
VvABCG5 5	VIT_13s0074g00680.t0 1	GSVIVT0103474500 1	chr13:8859680..8875297	-	15618bp	6591bp	26	25
VvABCG5 6	VIT_13s0074g00690.t0 1	GSVIVT0103474600 1	chr13:8876000..8895143	-	19144bp	4335bp	25	24
VvABCG5 7	VIT_13s0074g00700.t0 1	GSVIVT0103474800 1	chr13:8897703..8904965	-	7263bp	4167bp	21	20
VvABCG5 8	VIT_04s0008g04230.t0 1	GSVIVT0103571500 1	chr4:3596651..3605452	-	8802bp	4281bp	25	24
VvABCG5 9	VIT_04s0008g04790.t0 1	GSVIVT0103578000 1	chr4:4227019..4234518	-	7500bp	4311bp	24	23
VvABCG6 0	VIT_04s0008g04820.t0 1	GSVIVT0103578400 1	chr4:4258543..4265236	+	6694bp	4140bp	25	24
VvABCG6 1	VIT_04s0008g04790.t0 1	GSVIVT0103578500 1	chr4:4265752..4286094	+	20343bp	2415bp	16	15
VvABCG6 2	VIT_04s0008g04840.t0 1	GSVIVT0103578600 1	chr4:4286128..4295628	+	9501bp	1815bp	12	11
VvABCG6 3	VIT_06s0080g00040.t0 1	GSVIVT0103618400 1	chr6:19713908..1972329	+	9388bp	4638bp	23	22

VvABCG31 ve *VvABCG32*, 11. kromozom üzerinde farklı zincirlerde lokalize olmaktadır. *VvABCG33*, *VvABCG34*, *VvABCG35*, 9. Kromozom üzerinde ileri zincirde yer alırken *VvABCG36*, *VvABCG37*, *VvABCG38*, *VvABCG39*, *VvABCG40*, *VvABCG41*, *VvABCG42*, *VvABCG43*, *VvABCG44*, *VvABCG45* ve *VvABCG46* reverse zincir üzerinde yan yana lokalize olmaktadır. *VvABCG47*, 5. Kromozom, *VvABCG48*, 6. Kromozom, *VvABCG49* 14. Kromozom, *VvABCG53*, 8. kromozom üzerinde forward zincirde yer alır. *VvABCG50*, *VvABCG51*, *VvABCG52*, 6. Kromozom geri zincir üzerinde yan yana yer almaktadır. *VvABCG54*, *VvABCG55*, *VvABCG56*, *VvABCG57*, 13. Kromozom üzerinde geri zincirde bulunmaktadır. Kromozom 4 üzerinde *VvABCG58*, *VvABCG59* geri zincirde, *VvABCG60*, *VvABCG61* ve *VvABCG62* ileri zincirde lokalize olmaktadır. *VvABCG63* ise 6. Kromozomun ileri zincirinde bulunmaktadır. *VvABCG46* en uzun transkripte sahipken, en kısa transkript uzunluğu *VvABCG34'* e aittir.

VvABCG alt ailesine ait 33 birey ve diğer bazı bitkilerde bulunan ABCG protein dizilerinin arasındaki akrabalık ilişkisini gösteren filogenetik ağaç oluşturulmuştur (Şekil 1). *VvABCG48*



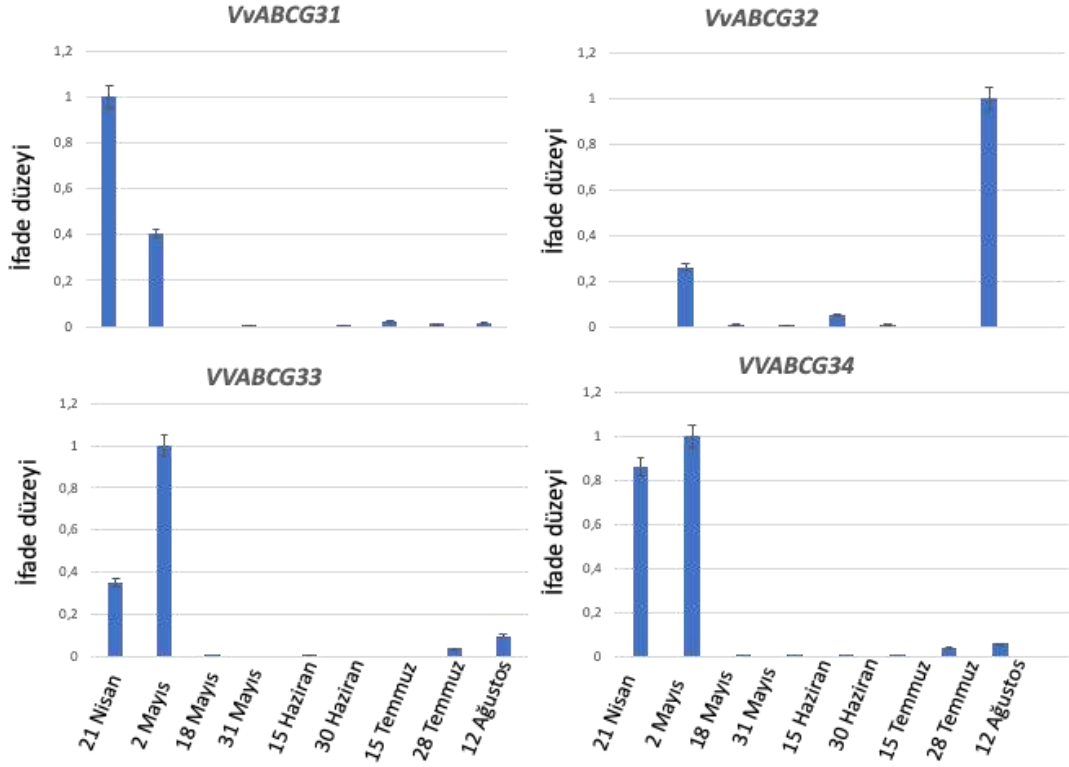
Şekil 1. Farklı ABCG proteinlerine ait filogenetik ağaç

V_vABCG ALT AİLESİNE AİT GENLERİN İFADE PROFİLLERİ

Tane gelişiminin 21 Nisan, 02 Mayıs, 18 Mayıs, 31 Mayıs, 18 Haziran, 30 Haziran, 15 Temmuz, 28 Temmuz, 2 Eylül tarihlerinde toplanan tanelerden izole edilen mRNA'lar kullanılarak VvABCG ailesine ait 4 adet genin tane gelişim boyunca mRNA değişiminin Real Time PCR yöntemiyle analiz edilmiş ve ifade profilleri belirlenmiştir (Şekil 2).



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Şekil 2. VvABCG31'in farklı gelişim dönemlerine ait ifade grafiği

VvABCG31'in ifade profili incelendiğinde 21 Nisan ve 2 Mayıs döneminde tanelerde genin ifadesinin yüksek olduğu, ancak onu izleyen diğer dönemlerde çok düşük olduğu görülmüştür (Şekil 2).

02 Mayıs tarihinde tanelerde VvABCG32 geninin ifadesi arttığını, 15 Temmuz tarihinde ise ifadesinin baskılandığını ve 28 Temmuz döneminde en yüksek ifadeyi gösterip tekrar baskılanmıştır (Şekil 2).

VvABCG33 geni 02.05 döneminde ise ifade seviyesi artmıştır. Bendüşme sonrası döneme kadar ifadesi baskılanmış, bendüşme sonrasında tekrar ifade olmuştur (Şekil 2).

VvABCG34 21.04 döneminde yüksek düzeyde ifade göstermiş ve 02.05 döneminde ifade seviyesi artmıştır. Bu dönemden sonra ise bendüşme dönemine kadar ifadesi baskılanmış, bendüşme ile birlikte tekrar ifade olmuş, olgunlaşmaya doğru tekrar baskılanmıştır (Şekil 2).

VvABCG GENLERİNİN STRING ANALİZ SONUÇLARI

STRING bilgi sahibi olmak istenilen proteinlerin bilinen ve öngörülen protein-protein etkileşimlerini ortaya koyan bir veri bankasıdır. STRING, çok sayıda organizma için kapsamlı, ancak kalite kontrollü bir protein-protein birlikteliği sağlayarak bu bilgiye erişimi



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kolaylaştırmayı amaçlamaktadır. Sonuçlar, yüksek verimli deneysel verilerden, veritabanları ve literatürlerde yer alan bilgilerden ve genomik bağlam analizine dayanan tahminlerden kaynaklanmaktadır (Christian von Mering et al., 2004).

VvABCG alt ailesine ait proteinlerin etkileşimde bulunduğu proteinler STRING analiziyle tespit edilmiş, bu proteinlerin hangi yollaklarda ne gibi görevlerde bulunulabileceğiyle ilgili ön bilgi sahibi olmak amaçlanmıştır.

Tablo 3. VvABCG alt ailesi strin analizi sonuçları.

Gen Adı	Ensemble <i>Vitis Vinifera</i> Protein ID	<i>Vitis Vinifera</i>	<i>Arabidopsis</i> Homolog	Ensemble <i>Arabidopsis</i> ID
VvABCG31	VIT_08s0040g03160.t01	Uncharacterized protein	RNA binding (RRM/RBD/RNP motifs) protein	AT3G45630
	VIT_03s0063g01880.t01	Uncharacterized protein	Long chain acyl-CoA synthetase 3	AT1G64400
	VIT_06s0004g03580.t01	Uncharacterized protein	RNA binding (RRM/RBD/RNP motifs) protein	AT5G60170
	VIT_11s0016g04540.t01	Uncharacterized protein; Belongs to the ABC transporter superfamily. ABCG family. PDR (TC 3.A.1.205) subfamily	ABCG32	AT2G26910
	VIT_09s0002g05810.t01	Uncharacterized protein	Boron transporter 4	AT1G15460
	VIT_15s0021g01130.t01	Uncharacterized protein; Belongs to the small GTPase superfamily. Rho family	Rac-like GTP-binding protein ARAC3	AT4G35020
	VIT_04s0008g04980.t01	Uncharacterized protein	Boron transporter 4	AT1G15460
	VIT_01s0137g00180.t01	Uncharacterized protein; short-chain dehydrogenases/reductases (SDR) family	Very-long-chain 3-oxoacyl-CoA reductase 1	AT1G67730
	VIT_11s0016g04740.t01	Uncharacterized protein	BOR4	AT1G15460
	PMT3	Putative polyol/monosaccharide transporter	Probable polyol transporter 3	AT2G18480
	VIT_01s0026g00570.t01	Uncharacterized protein	MLP-like protein 423	AT1G24020
VvABCG32	VIT_15s0048g01390.t01	Uncharacterized protein	Probable carboxylesterase 8, CXE8	AT2G45600
	VIT_11s0016g04590.t01	ABCG family. PDR subfamily protein	ABC transporter G family member ,36 ABCG36	AT1G59870
	VIT_15s0048g01350.t01	Uncharacterized protein	Probable carboxylesterase 9, CXE9	AT2G45610
	VIT_02s0025g02160.t01	Uncharacterized protein	ABC TRANSPORTER F FAMILY MEMBER 3, ABCF3	AT1G64550
VvABCG33	VIT_11s0016g03290.t01	Uncharacterized protein	SNW/SKI-interacting protein, SKIP	AT1G77180
	VIT_09s0002g03560.t01	Uncharacterized protein; Belongs to the ABC transporter superfamily. ABCG family.	ABC transporter G family member 29, ABCG29	AT3G16340
VvABCG34	VIT_11s0016g03290.t01	Uncharacterized protein	SNW/SKI-interacting protein, SKIP	AT1G77180
	VIT_09s0002g03570.t01	Putative uncharacterized protein	ABC transporter G family member ,36 ABCG36	AT1G59870

TARTIŞMA

Vitis Vinifera L. genomunda bulunan ABCG alt ailesine ait genler incelendiğinde *Vitis Vinifera* L. genomu üzerinde ABCG'ler en yoğun olarak 9. Kromozom üzerinde lokalize olmaktadır. Aynı kromozom üzerinde birbirine komşu olan genlerin çok yüksek benzerlik göstermesi asmanın evrimsel süreçte gen duplikasyonu yoluyla genomda gen işlevini arttırmak amacıyla gen sayısını arttırdığını düşündürmektedir. *Vitis vinifera* L. genomunda VvABCG46 en uzun



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okuma çerçevesine sahip olup, *VvABCG34* ise en kısa okuma çerçevesine sahip PDR'dir. Diğer organizmalara ait ABCG'ler ile birlikte çizilen filogenetik ağaç incelendiğinde çok yakın ortak kökene sahip genler olduğunu ve bu genlerin evrimsel süreçte çok uzun yıllar öncesinde oluştuğu düşünülmektedir.

Vitis vinifera L. ABCG alt ailesine ait 4 üyenin gen ifadeleri real time PCR analizi ile; meyve tanesinin 9 farklı tarihli gelişim döneminde incelenmiştir. Ayrıca STRING analizleriyle etkileşime girdiği proteinler tespit edilerek görevleriyle ilgili çıkarımlar yapılmıştır.

VvABCG31'in etkileşime girdiği proteinler incelendiğinde, LACS3 hücresel lipidlerin metabolizmasında görev almakta, KCR1 shinglolipidler, triasilgliseroller, kultikular vax ve suberinlerin elangasyonunda gerekli olduğu, hücre farklılaşmasında rol aldığı bildirilmiştir. Hücre duvarı oluşumunun esas elementlerinden olan boru taşıyan proteinlerle etkileşime girmektedir. Daha önce yapılan çalışmalarda ABCG ailesinin bazı üyelerinin kutin ve suberin taşınımında ve polen tüplerinin oluşumunda gerekli moleküllerin taşınmasında görevli olduğu bulunmuştur. *VvABCG31*'in ifadesine bakıldığında çiçeklenme ve tane tutumu döneminde ifade olduğu görülmüştür. *VvABCG31*'in kütikular lipidlerin ve süberin taşınmasında ve biyosentezinde rol aldığı çiçeklenme ve hücre bölünmesi ve farklılaşması sırasında, hücre duvarı ve polen oluşumu için önemli bir role sahip olabileceğini düşündürmektedir. *VvABCG32*'nin ksenobiyotik degradasyonu ve detoksifikasyonunda görev alan karboksilesterazlarla etkileşimde olması, *VvABCG32*'nin ksenobiyotik detoksifikasyonunda görev alabileceğini düşündürmüştür.

VvABCG33 ve *VvABCG34*, bir post transkripsiyon faktörü olan ve çiçeklenme dönemi genlerinin ifadesini düzenleyen SKIP ile etkileşime girmektedir. Bazı ABCGlerin ve SKIP faktörünün ABA'ya yanıt verdiği bilinmektedir. *VvABCG33*'ün *Arabidopsis* homologu olan *AtABCG29*'un hem lignin öncüsü moleküllerin biyosentezinde hem de fenolik bileşiklerin ve glukosiyonatların taşınmasında görevli olduğu bildirilmiştir. *VvABCG33* ve *VvABCG34*'ün ifadesinin benzerlik göstermesi, çiçeklenme döneminde ve bendüşme sonrası dönemde kademeli olarak ifade olması, *AtABCG29* gibi lignin biyosentezinde ve bendüşme sonrası fenolik bileşiklerin taşınımında görevli olabileceğini düşündürmektedir.

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KAYNAKÇA

- Bessire, M., Borel, S., Fabre, G., Carraca, L., Efremova, N., Yephremov, A., Cao, Y., Jetter, R., Jacquat, A. C., Metraux, J. P., and Nawrath, C., 2011, A member of the PLEIOTROPIC DRUG RESISTANCE family of ATP binding cassette transporters is required for the formation of a functional cuticle in Arabidopsis, *Plant Cell* 23, 1958-70.
- Crouzet, J., Trombik, T., Frayssé, A. S., and Boutry, M., 2006, Organization and function of the plant pleiotropic drug resistance ABC transporter family, *FEBS Lett* 580, 1123-30.
- Davies, C. and Robinson, S.P. (1996) Expression of Anthocyanin Biosynthesis Pathway Genes in Red and White Grapes. *Plant Molecular Biology*, 32, 565-569.
<http://dx.doi.org/10.1007/BF00019111>
- Geisler, M., Blakeslee, J.J., Bouchard, R., Lee, O.R., Vincenzetti, V., Bandyopadhyay, A., et al. , 2005, Cellular efflux of auxin catalyzed by the Arabidopsis MDR/PGP transporter AtPGP1. *Plant J.* 44: 179–194.
- Higgins, C.F., 1995, The ABC of channel regulation. *Cell* 82: 693-696
- Higgins CF, Linton KJ, 2004, The ATP switch model for ABC transporters. *Nat Struct Mol Biol* 11: 918–926
- Holland I.B., Cole S.P.C., Kuchler K., Higgins C.F., 2003, (In) ABC proteins from bacteria to man, Academic Press, San Diego
- Klein, M., Perfus-Barbeoch, L., Frelet, A., Gaedeke, N., Reinhardt, D., Mueller Roeber, B., Martinoia, E., and Forestier, C., 2003, The plant multidrug resistance ABC transporter AtMRP5 is involved in guard cell hormonal signalling and water use, *Plant J* 33, 119-29.
- Khare, D., H. Choi, S.U. Huh, B. Bassin, J. Kim, E. Martinoia, K.H. Sohn, K.H. Paek, and Y. Lee., 2017, Arabidopsis ABCG34 contributes to defense against necrotrophic pathogens by mediating the secretion of camalexin. *Proc. Natl. Acad. Sci. USA* 114: E5712-E5720.
- Kim, D. Y., Bovet, L., Maeshima, M., Martinoia, E., and Lee, Y., 2007, The ABC transporter AtPDR8 is a cadmium extrusion pump conferring heavy metal resistance, *Plant J* 50, 207-18.
- Lefèvre, F. and M. Boutry, 2018, Towards Identification of the Substrates of ATP-Binding Cassette Transporters. *Plant Physiol.* 178: 18-39



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and RURAL DEVELOPMENT
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BINGOL, TURKEY**



- McFarlane, H.E., J.J. Shin, D.A. Bird, and A.L. Samuels., 2010, Arabidopsis ABCG transporters, which are required for export of diverse cuticular lipids, dimerize in different combinations. *Plant Cell* 22: 3066-3075
- Potdukhe, R.M., P. Bedi, B.K. Sarangi, R.A. Pandey, and S.T. Thul., 2018, Root transcripts associated with arsenic accumulation in hyperaccumulator *Pteris vittata*. *J Biosci* 43: 105-115.
- Theodoulou, F. L., Holdsworth, M., and Baker, A., 2006, Peroxisomal ABC transporters, *FEBS Lett* 580, 1139-55.
- Teagen D. Quilichini, Michael C. Friedmann, A. Lacey Samuels, Carl J. Douglas, 2010, ATP-Binding Cassette Transporter G26 Is Required for Male Fertility and Pollen Exine Formation in *Arabidopsis* DOI: <https://doi.org/10.1104/pp.110.161968>
- Xiong J, Mao DA, Liu LQ. Research Progress on the Role of ABC Transporters in the Drug Resistance Mechanism of Intractable Epilepsy. *Biomed Res Int.* 2015;2015:194541. doi: 10.1155/2015/194541. Epub 2015 Sep 27. PMID: 26491660; PMCID: PMC4600483.
- Ziegler, J., S. Schmidt, N. Strehmel, D. Scheel, and S. Abel., 2017, Arabidopsis Transporter ABCG37/PDR9 contributes primarily highly oxygenated Coumarins to Root Exudation. *Sci Rep* 7: 3704
- Zhu, Y. Q., Xu, K. X., Luo, B., Wang, J. W., and Chen, X. Y., 2003, An ATP-binding cassette transporter GhWBC1 from elongating cotton fibers, *Plant Physiol* 133, 580-8.