THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Abstract Book

17th Annual International Symposium on Agricultural Research
24-27 June 2024, Athens, Greece

Edited by
Timothy M. Young & Olga Gkounta

2024

Abstracts
17th Annual International Symposium on Agricultural Research

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(In Alphabetical Order by Author's Family Name)

Preface

This book includes the abstracts of all the papers presented at the *17th Annual International Symposium on Agricultural Research* (24-27 June 2024), organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this symposium will be considered for inclusion in one of ATINER's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this symposium (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to ATINER's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

Table 1. *Publication of Books of Abtracts of Proceedings, 2010-2024*

Year	Papers	Countries	References
2024	23	18	Young and Gkounta (2024)
2023	35	23	Young and Gkounta (2023)
2022	34	23	Uddin and Gkounta (2022)
2021	11	10	Papanikos (2021)
2020	8	6	Papanikos (2020)
2019	29	18	Papanikos (2019)
2018	26	15	Papanikos (2018)
2017	41	23	Papanikos (2017)
2016	39	23	Papanikos (2016)
2015	87	43	Papanikos (2015)
2014	54	21	Papanikos (2014)
2013	53	29	Papanikos (2013)
2012	33	18	Papanikos (2012)
2011	63	24	Papanikos (2011)
2010	61	23	Papanikos (2010)

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this symposium and its subsequent publications together.

Gregory T. Papanikos
President

Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Agriculture. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the symposium.

ATINER's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The 17th Annual International Symposium on Agricultural Research accomplished this goal by bringing together academics and scholars from 18 different countries (Australia, Bulgaria, Canada, China, Hungary, Italy, Japan, Jordan, Lithuania, Malaysia, Morocco, Qatar, Romania, South Africa, Taiwan, Türkiye, UK, USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this symposium will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

Timothy M. Young & Olga Gkounta
Editors

17th Annual International Symposium on Agricultural Research, 24-27 June 2024, Athens, Greece

Organizing & Scientific Committee

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by reviewing the submitted abstracts and papers.

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Timothy M. Young, Head, Agriculture Unit, ATINER, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

FINAL CONFERENCE PROGRAM

17th Annual International Symposium on Agricultural Research, 24-27 June 2024, Athens, Greece

PROGRAM

08.45-09.30
Registration
09:30-09:45
Opening and Welcoming Remarks:

- **Gregory T. Papanikos**, President, ATINER.

10:00-11:30 Session 1
Moderator: Timothy M. Young, Head, Agriculture Unit, Athens Institute, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

1. **Ying Chen**, Professor, University of Manitoba, Canada.
   ***Title**: Canola Emergence at Different Soil Compaction Levels.*
2. **John Ogola**, Professor, University of Venda, South Africa.
   ***Title**: The Effect of Maize/Legume Rainfed Intercropping Systems on Soil Quality Varied with Location.*
3. **Eleonora Cataldo**, Research Fellow, University of Florence, Italy.
   ***Title**: Effects of Zeolite, as Soil Applications in the Vineyard, on Grape Characteristics.*

11:30-13:00 Session 2
Moderator: Ying Chen, Professor, University of Manitoba, Canada.

1. **Husnu Demirsoy**, Professor, Ondokuz Mayıs University, Türkiye.
   ***Title**: Turkish Cherry Industry.*
2. **Leyla Demirsoy**, Professor, Ondokuz Mayıs University, Türkiye.
   ***Title**: Advancements in Late Season Strawberry Cultivation with Day-Neutral Varieties: A Case Study in Türkiye.*
3. **Stefan Gandev**, Professor, Fruit Growing Institute – Plovdiv, Bulgaria.
   Plamen Ivanov, Assistant Professor, Fruit Growing Institute – Plovdiv, Bulgaria.
   Angel Dimitrov, Assistant Professor, Fruit Growing Institute – Plovdiv, Bulgaria.
   Penka Filyova, Assistant Professor, Fruit Growing Institute – Plovdiv, Bulgaria.
   ***Title**: Cleft Grafting Propagation of Pome and Stone Fruit Trees during the Dormancy Period in a Hot Water System.*

13:00-14:30 Session 3
Moderator: John Ogola, Professor, University of Venda, South Africa.

1. **Mohamed Khan**, Professor & Assistant Director, NDSU Extension, North Dakota State University, USA.
   ***Title**: Successfully Managing C. beticola in Sugar Beet by Combining Fungicides with Improved Genetics.*
2. **Muhammad Tayyib**, Junior Researcher, Kaunas University of Technology, Lithuania.
   Linas Svilainis, Professor, Kaunas University of Technology, Lithuania.
   ***Title**: Plant Physiological Parameter Estimation Using Resonant Ultrasound Spectroscopy with Improved Bandwidth and Enhanced SNR.*

14:30-15:30 Lunch

16:00-17:30 Session 4
Moderator: Dillip Das, Associate Professor, University of KwaZulu-Natal, South Africa.

1. **John Smallwood**, Professor, Nelson Mandela University, South Africa.
   Mauritz Van Rooyen, Graduate Student, Nelson Mandela University, South Africa.
   ***Title**: The Impact of Climate Change on the Built Environment: Built Environment Professionals'*

Perceptions and Practices.

2. **Yasameen Al-Ameen**, Senior Lecturer, Nottingham Trent University, UK.
   ***Title**: Underground Thermal Energy Storage Systems.*
3. **Mohammad Shbool**, Associate Professor, The University of Jordan, Jordan.
   Yara Altarawneh, Research Assistant, The University of Jordan, Jordan.
   Raghad Bani Hamad, Industrial Engineering Graduate, The University of Jordan, Jordan.
   Rand Alqa'aydeh, Industrial Engineering Graduate, The University of Jordan, Jordan.
   Ammar Al-Bazi, Senior Lecturer in Operations and Supply Chain Simulation (Associate Professor equivalent), Aston Business School – Aston University, UK
   Mohammad Al-Tahat, Professor, Industrial Engineering, The University of Jordan, Jordan
   Thahabia Abedeljawad, Assistant Director of Quality Department, Jordan University Hospital, Jordan
   Mohammed Bashir, Professor & Department Head of Environmental Engineering, Universiti Tunku Abdul Rahman, Malaysia.
   ***Title**: Predictive Modelling of Chemical Waste Generation in Healthcare Facilities: Enhancing Waste Management Strategies.*

17:30-19:00 Session 5 – A Round-Table Discussion on The Future of Sciences and Engineering Education & Research
Moderator: Gregory T. Papanikos, President, Athens Institute

1. **Glen Bright**, Dean, Head of the School of Engineering, University of KwaZulu-Natal, South Africa.
   ***Title:** The Impact of Disruptive Technologies on Science and Engineering.*
2. **Timothy Young**, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.
   ***Title**: The Future of Human Activity in Work as The Application of Innovation and Artificial Intelligence Research Accelerates.*
3. **Theodore Trafalis**, Professor, The University of Oklahoma, USA.
   ***Title**: Artificial Intelligence in Sciences and Engineering Education & Research.*
4. **Dimitrios Goulias**, Associate Professor, University of Maryland, USA.
   ***Title**: Integrating Sustainability and Resilience in Engineering & Sciences through Experiential Learning.*
5. **George Zahariadis**, Associate Professor, Faculty of Medicine, Memorial University of Newfoundland, Canada.
   ***Title**: Why Are Educational Institutions Suing Social Media Providers?*
6. **Evangelos Kaisar**, Professor, Florida Atlantic University, USA.
   ***Title**: Integrating Research and Teaching in the Classroom: Benefits for Instructors and Student.*

20:30-22:30
Athenian Early Evening Symposium (includes in order of appearance: continuous academic discussions, dinner, wine/water, music)

Tuesday 25 June 2024

09:00-10:30 Session 6
Moderator: Stathis Pauls, DPFLI Site Manager & Programs Coordinator, MSU Extension, USA.

1. **Mihai Stavarache**, Deputy Scientific Director, Research and Development Station for Meadows Vaslui, Romania.
   Simona Dumitriu, Director, Research and Development Station for Meadows Vaslui, Romania.
   Cristian-Sorin Gavrila, Deputy Technical Director, Research and Development Station for Meadows Vaslui, Romania.
   Elena-Manuela Vacarciuc, PhD Student, Research and Development Station for Meadows

Vaslui, Romania.
***Title**: The Quality of the Seed Material in Some Fodder Species under the Influence of Climatic Conditions, in the North Eastern Part of Romania.*

2. **Mouaad Amine Mazri**, Researcher, National Institute of Agricultural Research, Morocco.
   Hassna Radi, PhD Student, National Institute of Agricultural Research, Morocco.
   Meriyem Koufan, Researcher, National Institute of Agricultural Research, Morocco.
   Ilham Belkoura, Professor, National School of Agriculture of Meknes, Morocco.
   ***Title**: Effects of Disinfection Methods, Plant Growth Regulators and Activated Charcoal on Argan (Argania Spinosa (L.) Skeels, Genotype G41) Propagation by Microcutting Dispose d'un Menu Contextual.*
3. **Happy Bango**, Operational Officer, University of Limpopo, South Africa.
   ***Title**: Influence of NPK Fertilizer on the Phytochemical Constituents and Antioxidant Activity of Indigenous Tea (Jatropha zeyheri) of South Africa under Microplot Conditions.*

10:30-12:00 Session 7
Moderator: Mihai Stavarache, Deputy Scientific Director, Research and Development Station for Meadows Vaslui, Romania.

1. **Chin-Yuan Hsu**, Professor, Chang Gung University, Taiwan.
   ***Title**: Behavior Studies on the Magnetoreception of Honey Bees (Apis Mellifera).*
2. **Stathis Pauls**, DPFLI Site Manager & Programs Coordinator, MSU Extension, USA.
   ***Title**: Urban Food Forests from Detroit to Athens: An Exploration into the Benefits of Edible Landscapes and Perennial Fruit Access in Large Urban Centers.*
3. **Xinliang Wang**, Deputy Director, Zhejiang University of Water Resources and Electric Power, China.
   Zhijiang Zhao, Director, Zhejiang University of Water Resources and Electric Power, China.
   ***Title**: Research on Factors Affecting Non-food Transformation of Farmland in China's Coastal Areas.*

12:00-13:30 Session 8
Moderator: Happy Bango, Operational Officer, University of Limpopo, South Africa.

1. **Bernadett Kovacs**, Associate Professor, Hungarian University of Agriculture and Life Sciences, Hungary.
   ***Title**: Application of AI Approaches in Supporting Dairy Herd Management Decisions.*
2. **Lei Lei**, Research Fellow, IDE-JETRO, Japan.
   Li Zhou, Professor, Tongji University, China.
   Junjie Shao, Professor, Tongji University, China.
   ***Title**: Impact of Cadmium Risk Communication on Household Cadmium Reduction Technology Adoption – Based on a Randomized Controlled Trial in China.*

13:30-14:30 Lunch

14:30-16:00 Session 9
Moderator: John Smallwood, Professor, Nelson Mandela University, South Africa.

1. **Faris Tarlochan**, Professor, Qatar University, Qatar.
   ***Title**: A Conceptual Framework for Inquiry Based Learning in Engineering Laboratories.*
2. **Izabela Stroe**, Associate Professor, Worcester Polytechnic Institute, USA.
   ***Title**: Integrating Entrepreneurial Mindset and Value Creation in Teaching Physics to Engineering Students for Innovation and Impact.*
3. **Nicholas Haritos**, Academic Associate/Director, Honorary Principal Fellow, The University of Melbourne & Adjunct Professor, Swinburne University of Technology, Australia.
   ***Title**: Experiential Learning in Engineering Courses is not just from Work Placements.*
4. **John Paul Tharakan**, Professor, Howard University, USA.
   ***Title**: Creating the 21st Century Engineer for Sustainable Development and Social Justice.*

17:00-20:00 Session 10
Old and New-An Educational Urban Walk

The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by ATINER exclusively for the conference participants.

20:30-22:00
Dinner

Wednesday 26 June 2024
An Educational Visit to Selected Islands
or Mycenae Visit

Thursday 27 June 2024
Visiting the Oracle of Delphi

Friday 28 June 2024
Visiting the Ancient Corinth and Cape Sounion

Yasameen Al-Ameen
Senior Lecturer, Nottingham Trent University, UK

Underground Thermal Energy Storage Systems

This presentation presents an experimental and numerical investigation into recycling building waste materials to use as alternative backfills to improve the thermal performance of underground horizontal ground heat exchanger (HGHE) systems. The examined categories of backfill material include various soils and recycled enhancers. Waste arising from CD&E (construction, demolition, and excavation) and C&I (commercial and industrial) wastes were studied. These waste materials are sent directly to landfills without finding other pathways for reuse and recycle. During this study, multiple tests were conducted on these waste materials to obtain their thermal and physical properties. Then, an experimental HGHE model was designed, constructed and tested with several backfill materials to assess the model charging (thermal energy storage) and model discharging (thermal energy extraction) trends. Charging and discharging trends using various backfill materials were compared to that of sand. The discharging process was quantified by the duration and quantity of hot fluid produced and the energy extracted from the model for space heating. Several circulating heat transfer fluid (HTF) flow rates were tested in the model ranging between 0.04 to 0.26m/s. Results show that the rate of thermal extraction from the model was dependent on the HTF flow rate, and thermal properties of backfill materials.

Additionally, two transient three-dimensional numerical models were developed using the ANSYS Fluent software to simulate (i) the experimental model for validation purposes and (ii) a larger full-scale working model of the HGHE. The numerical solution was developed to assess the temperature distributions and heat transfer inside the HGHE. The models were used to approximate the required time to heat the HGHE, the hot water output and energy extracted from the HGHE model. The initial and boundary conditions for the simulation were investigated for the inlet HTF flow rates and backfill material thermal and physical properties. When considering the quantity and duration of hot fluid produced from the experimental and numerical models, results show that utilizing selected alternative materials, improved the thermal performance of the HGHE, in terms of heating time and extracted energy, by up to 70%. In addition, mixtures composed of recycled waste blended with soil, improved the HGHE's thermal performance. Further results showed that placing backfill material in

mixes was better than putting the backfill material in layer form inside the HGHE. Overall, design guidance has been provided based on the thermal output results obtained in this study from both experimental and numerical testing.

Happy Bango
Operational Officer, University of Limpopo, South Africa

Influence of NPK Fertilizer on the Phytochemical Constituents and Antioxidant Activity of Indigenous Tea (*Jatropha zeyheri*) of South Africa under Microplot Conditions

Tea fertilization is one of the key factors influencing tea's physiological, physical and chemical qualities. However, the influence of NPK fertilizer on phytochemical constituents and antioxidant activity of *Jatropha zeyheri* indigenous tea has not been documented. Therefore, this study aimed at assessing whether different fertilizer application rates would affect the phytochemical constituents and antioxidant activity of *J. zeyheri* tea leaves under microplot conditions. Six treatments constituting NPK fertilizer rates (0, 2, 4, 8, 16 and 32 g) were arranged in a randomized complete block design, with five replications. After 130 days, leaves were harvested and oven-dried for 72 h at a temperature of 60°C. The dried leaves were ground through a 1 mm sieve using a grinder before analysis. After laboratory preparations, phytochemicals and antioxidant activity were analyzed using the UV-visible spectrophotometer. Data were subjected to ANOVA using the Statistix 10.0 software. Treatments had high significant effects ($P \leq 0.01$) on total tannin content (TTC) and total flavonoids content (TFC) contributing 98 and 86% in total treatment variation (TTV), respectively. In contrast, antioxidant activity (AA) and total phenolic content (TPC) were not significantly affected by increasing NPK fertilizer rates. *Jatropha zeyheri* tea leaves TTC and TFC exhibited positive quadratic relations with increasing fertilizer levels. Fertilizer requirements for phytoconstituents were optimized at 4.64 g fertilizer/plant. In the current study, increasing NPK fertilizer affected TTC and TFC which resulted in an increase with an increasing NPK application rates. In conclusion, total tannin and total flavonoid contents were affected by increasing NPK fertilizer rates.

Eleonora Cataldo
Research Fellow, University of Florence, Italy

Effects of Zeolite, as Soil Applications in the Vineyard, on Grape Characteristics

Nowadays, the use of clinoptilolite in agriculture is a fast-spreading soil management against climate change problems, such as drought stress and high temperatures. In fact, in many wine-growing regions, there has been unbalanced maturation, with problematic vintages. Due to a lack of acclimatization of the plant to excessive stress, the bunch at harvest appears to have a depletion of the anthocyanin component and a significant reduction in the weight of the berry, compromising the final production. This kind of zeolite applied to soils, both as natural zeolites or combined with organic fertilizers, not only increases production but also leads to a better balance of grapes quality indices corroborating the well-being of the plants.

This experiment was born to improve the quality of the grapes, through the application of zeolite to the soil compared with the traditional irrigation technique.

With a randomized block design, four treatments on a young Sangiovese vineyard were conducted (2022-2023): Zeolite and irrigation (WWt), Zeolite (WSt), irrigation (WW), and no-treated plants (WS). The parameters of plant yield, technological maturity, fractionation of anthocyanins (Cyanidin-3-glucoside, Delphinidin-3-glucoside, Malvidin-3-acetyl glucoside, Malvidin-3-cumaryl glucoside, Malvidin-3-glucoside, Peonidin-3-acetyl glucoside, Peonidin-3-cumaryl glucoside, Peonidin-3-glucoside, and Petunidin-3-glucoside), Caffeic Acid, Coumaric Acid, Gallic Acid, Ferulic Acid, Kaempferol-3-O-glucoside, Quercetin-3-O-rutinoside, Quercetin-3-O-glucoside, Quercetin-3-O-galactoside, and Quercetin-3-O-glucuronide were analyzed.

The weight of the berry was significantly higher in both years in the treatments with zeolite and/or irrigation.

It was observed a higher percentage of peonidin and cyanidin (disubstituted anthocyanins) in the grapes of the WS treatment in both years. Furthermore, in WS treatment, it was noted a greater accumulation of quercetins Q-3-O-glucuronide, Q-3-O-glucoside, and Q-3-O-rutinoside + Q-3-O-galactoside in the 2022 harvest and quercetin-3-O-glucuronide in the 2023 harvest.

The reduction of the severe water stress during the 2022 year allowed the treated vines to direct their carbon resources towards the bunch which showed excellent maturity indices; while during the less

intense year from the point of view of temperatures and stress the treatments led to a more balanced maturation and closer to modern objectives, moving towards fresher and less alcoholic wines.

Ying Chen
Professor, University of Manitoba, Canada

Canola Emergence at Different Soil Compaction Levels

Extremely low emergence rates have been reported for canola crops in Manitoba, Canada. One of the major causes of the low emergence is excessive soil compaction. In this study the emergence and early growth of canola were investigated under five different compaction levels (L0, L1, L2, L3, and L4) for three different soil types (sandy loam, silt clay, and clay). Canola was seeded in containers, and emergence and growth were monitored in an environmental chamber. Plant emergence and growth were recorded daily for a time period of 14 days. The results indicated that for the sandy loam and silt clay soils, the increase in soil compaction reduced the emergence rate, plant height, and biomass of canola. For the clay soil, the effects of soil compaction were not significant. Assuming an acceptable emergence rate of 80%, the recommended compaction level for the sandy loam soil was L1 or lower (i.e. light compaction or no compaction), and that for the silt clay was L0 (i.e. no compaction). At the indicated compaction level for those two soils, plant height and biomass were found to be good as well. However, the clay soil did not reach the acceptable emergence rate at any of the applied compaction levels.

Husnu Demirsoy
Professor, Ondokuz Mayıs University, Türkiye

Turkish Cherry Industry

The sweet cherry (Prunus avium L.) is indigenous to certain regions of northern Anatolia. Türkiye holds the top position in global cherry production and stands as a key player in cherry exports. Sweet cherry cultivation is widespread in provinces such as Izmir, Konya, Bursa, Manisa, Afyon, Isparta, and Amasya in Türkiye. Recent years have witnessed a significant surge in the value of cherries, particularly in both domestic and international markets, prompting the transformation of small, traditional cherry orchards characterized by large trees into expansive orchards employing modern cultivation systems across Türkiye. Despite facing significant challenges in pollination and fertilization, the '0900 Ziraat' cultivar remains paramount in the Turkish cherry industry. Nevertheless, ongoing adjustments in cultivar selection are evident, aligning with the evolving demands of producers and markets. Concurrently, the rootstocks utilized in cherry cultivation are also undergoing a transformation, paralleling the modernization and dwarfing of orchards. In Türkiye, the most prevalent rootstocks include mazzard seedlings and the 'M×M14' clonal rootstock. Europe stands as the primary market for Turkish cherry exports, although efforts to explore new markets persist. In recent years, Türkiye has witnessed a surge in studies related to cultivar and rootstock breeding, leading to the development of several new cherry varieties. This shift signifies Türkiye's transition from conventional to modern cherry production methods, reinforcing its position as a global leader in cherry production.

Leyla Demirsoy
Professor, Ondokuz Mayıs University, Türkiye

Advancements in Late Season Strawberry Cultivation with Day-Neutral Varieties: A Case Study in Türkiye

In horticultural science, strawberries are classified into short-day, long-day, and day-neutral varieties based on their photoperiodic requirements for flower induction. Day-neutral strawberries, which do not require specific photoperiodic conditions for flower bud initiation, are suitable for off-season production. Their ability to enable fresh strawberry production during the summer and autumn months has garnered significant interest in commercial strawberry cultivation. The utilization of day-neutral varieties in commercial cultivation gained traction after the successful transfer of the day-neutral trait to commercial octoploid strawberries in the 1980s at the University of California. However, information regarding their commercial utilization for summer-autumn production purposes remains limited due to the relatively recent adoption of day-neutral varieties in commercial horticulture. Although day-neutral varieties have been utilized in numerous adaptation studies in Türkiye, research on their physiology and cultivation techniques is limited.

This study aims to explore various aspects of summer-autumn fruit production with day-neutral strawberries, including planting time, nursery material, flower removal, variety selection, high-temperature management, and the use of tunnel systems, to evaluate the utilization of day-neutral strawberries in Türkiye and assess their potential for extending the harvest season.

Stefan Gandev
Professor, Fruit Growing Institute - Plovdiv, Bulgaria
Plamen Ivanov
Assistant Professor, Fruit Growing Institute - Plovdiv, Bulgaria
Angel Dimitrov
Assistant Professor, Fruit Growing Institute - Plovdiv, Bulgaria
&
Penka Filyova
Assistant Professor, Fruit Growing Institute - Plovdiv, Bulgaria

Cleft Grafting Propagation of Pome and Stone Fruit Trees during the Dormancy Period in a Hot Water System

The pome and stone fruit trees are heterozygous, and their seed propagation does not lead to the inheritance of the qualities of the selected variety. For this reason, various techniques and methods have been used worldwide for vegetative propagation of these species.

The experiment for the propagation of the pome species – apple and pear, and the stone species - plum and sweet cherry was done by the method of hot callus with a hot water system. The grafting was done in the first ten days of February, i.e., when the fruit species were in winter dormancy. A cleft grafting technique was per-formed. Successfully grafted plants were potted and then adapted for one month.

The apple, pear, and plum fruit species obtained a higher percentage of callus-forming, adapted, and fruit-planting material compared to the sweet cherry. The highest percentage of successful callus-formed plants was observed in apples - 90.0%, followed by plums and pears - 78.8% and 73.8% respectively. The lowest percentage was found in the stone fruit species sweet cherry - 68.8%.

The obtained experimental results give ground to conclude that using a hot water system during the winter dormancy of the fruit species apple, pear, and plum leads to their successful propagation. The percentage of callus-formed, adapted, and produced trees was low in the fruit species sweet cherry. For this reason, the method is recommended for practice for the fruit species apple, pear and plum.

Nicholas Haritos
Academic Associate/Director, Honorary Principal Fellow, The University of Melbourne & Adjunct Professor, Swinburne University of Technology, Australia

Experiential Learning in Engineering Courses is not just from Work Placements

Experiential learning, widely acknowledged as the most effective method for knowledge and skill transfer, is particularly crucial in practical fields like Engineering. Ancient wisdom, such as Aristotle's "For the things we need to learn before we can do them, we learn by doing them," and Confucius' "I hear and I forget. I see and I remember. I do and I understand," remains relevant today. Experiential learning, often referred to as "Learning by Doing," serves as a vital tool for apprentices, proteges, and disciples to gain knowledge and skills. In modern times, the traditional one-to-one learning from a master to a learner has evolved into more structured educational systems, from Kindergarten to Post-Graduate levels, aiming to achieve structured recognition of proficiency levels or even professional qualifications.

In the context of professional engineering courses, traditional face-to-face teaching methods have given way to changes driven by budget constraints and the widespread availability of digital devices. Computer Labs and online platforms now dominate over physical labs and in-person lectures at many Engineering Schools, leading to a reduction in hands-on learning opportunities. Recognizing this shift, several engineering schools incorporate industry placements into their degree programs to provide some semblance of credible practical experience.

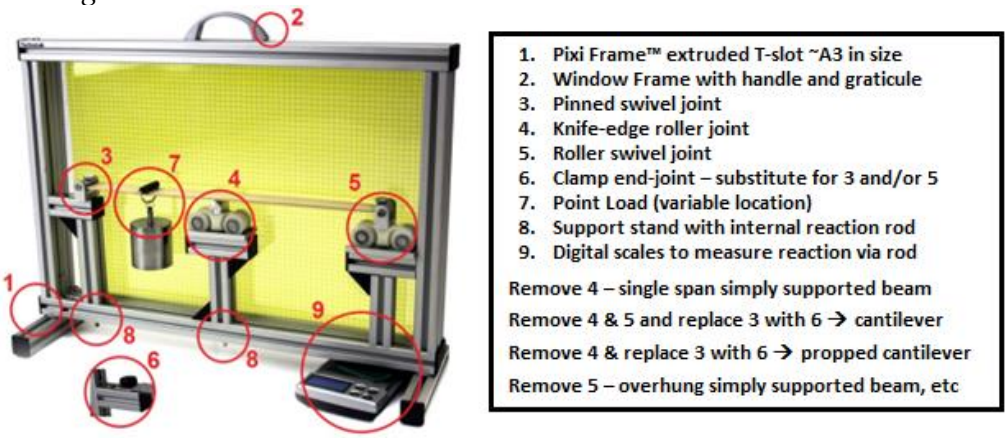
This paper proposes a proactive solution to this challenge: the development of a physical Experiential Learning Platform named TechnoLab™. Unlike traditional laboratories, TechnoLab™ does not require dedicated space and can be utilized in existing classroom settings or even in computer labs. It offers truly hands-on learning experiences for basic and complex engineering concepts at much more affordable pricing compared to demonstration units from other suppliers. The platform concentrates on experiment test rigs pertinent to material covered in Statics, Mechanics of Solids/Materials/Structures, subjects that underpin the knowledge and skill base of most Engineering disciplines and sub-disciplines such as Civil, Mechanical, Structural, Mechatronics, Robotics, Aeronautical, Aerospace, etc. (See example in Figure 1 of setups for Flexure).

TechnoLab™ incorporates thematic experiment test rigs fitted within replicates of (typically) 12 Pixi™ test frames in a classroom. Students work in pairs on experiment conditions specific to their Pixi frame, utilizing a patented photogrammetric mensuration approach for obtaining deflections/reactions. This deep learning experience eliminates the need for complex transducers and wiring, relying instead on a highly visual technique of analyzing digital photos from personal smartphones.

Another significant advantage of the platform lies in its diverse range of experiment test rigs and test conditions, inhibiting plagiarism between student groups. Additionally, the photographic nature of the raw and processed data, stored on the university's intranet, safeguards against artificially generated results by Artificial Intelligence engines.

In a world where AI can produce quality reports of substance, TechnoLab™ not only limits such opportunities through its design but also offers a genuine hands-on fundamental learning experience to students in most engineering disciplines.

Figure 1. *Pixi Frame™ Setup Supporting a Variety of Basic Flexure Experiment Investigations*



Chin-Yuan Hsu
Professor, Chang Gung University, Taiwan

Behavior Studies on the Magnetoreception of Honey Bees (*Apis Mellifera*)

The magnetoreception of honey bees (*Apis mellifera*) has been revealed by determining superparamagnetic magnetite in the iron granules of trophocytes located at the abdomen and magnetic sensing through the ventral nerve cord of the abdomen. In this study, we further investigate the magnetoreception of honey bees using behavioral observations. We keep the bees in a room with a small window, and the bees cannot see the sun directly. Using radar, we attached magnets to homing forager bees, released them, and tracked their homing flight paths. The results showed that honey bees position the site of the hive entrance, not the shape of the hive, during homing that extra magnets reduce the homing rate of bees, and that forager bees with magnets have to redirect and orient themselves to get home. These findings suggested that magnetoreception plays an important role in the homing of honey bees.

Mohamed Khan
Professor & Assistant Director, NDSU Extension, North Dakota State University, USA

Successfully Managing *C. beticola* in Sugar Beet by Combining Fungicides with Improved Genetics

Cercospora beticola causes Cercospora leaf spot (CLS), the most economically destructive disease of sugar beet in the North Central USA. From 1999 through 2015, growers in Minnesota (MN) and North Dakota (ND) used quinone outside inhibitor (QoI), demethylation inhibitor (DMI), triphenyltin hydroxide (TPTH), and thiophanate methyl in an alternation program to successfully manage populations of *C. beticola*. Over time, the pathogen developed resistance to most fungicides. In 2016, growers in the North Central region lost over $200 million to a CLS epidemic because of resistance to QoI and DMI fungicides. Since 2016, there was no new labeled fungicide that provided effective control of *C. beticola* when used alone. KWS seed company incorporated the BvCR4 gene in sugar beet resulting in improved resistance to *C. beticola*. Field trials were conducted in MN and ND using the improved CR+ varieties compared to approved non-CR+ varieties in 2019 through 2023. Fungicide applications were done on a calendar basis, and on an only when needed based on the presence of symptoms and favorable environmental conditions. In 2019, under environmental conditions favorable for fungicide applications, the newer improved CR+ variety provided higher recoverable sucrose than one non-CR+ variety and similar yields to a second non-CR+ variety. In 2020, under conditions favorable for CLS, the new CR variety produced significantly higher recoverable sucrose compared to the non-CR varieties. In a dry and warm 2021 season, fungicides provided protection for the non-CR varieties, but were not necessary for the CR+ variety. In 2022 and 2023, conditions were not favorable for development of *C. beticola* until late August. One or two timely fungicide applications based on the presence of symptoms and thresholds resulted in low disease severity and recoverable sucrose similar to treatments with five applications that started before or at row closure. Overall, CR+ varieties evaluated required significantly less fungicide applications than the non-CR+ varieties and there was no adverse impact on total recoverable sucrose. Since 2021, CR+ varieties became available and at one of the cooperatives, its use increased from 15 to 99% in 2023. The availability and use of the CR+ varieties will improve the economic viability of the

sugar beet industry. However, fungicides will have to be used judiciously to prolong the usefulness of the CR+ varieties.

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Application of AI Approaches in Supporting Dairy Herd Management Decisions

Milking robots or Automated Milking Systems (AMSs) have become a significant advancement in dairy farming. Vast amount of data (i.e. big data) is generated by AMSs, enabling the real-time monitoring of various quality parameters and quantified components of produced milk. As machine learning algorithms understands large and multi-dimensional datasets, an approach can be applied to evaluate stability of individual lactation periods and rationalize selection decisions made on the Holstein Friesian cow herds. Unsupervised clustering algorithms and supervised classification methods were employed for the above purposes. Cows were grouped into productivity clusters, and the stability of the clusters were analyzed over periods of time. As the cost of raising up a heifer for replacement is significant for the dairy management, a better grounded culling decision is a need for financially competitive milk production. Week stability indicates that insemination protocol being based on lactation productivity may not be the most effective strategy. Accuracy level of classification of cows into further insemination versus culling groups – especially at the time of installing the milking robots – demonstrate disagreement between human decision making and machine learning based decisions. The methodology was employed on three dairy farms in Hungary, which recently established AMS. We conclude that ML supported decision making efficiently, but - depending on the learning algorithms and their parameters - with various effectiveness assists farmers in selecting cows to retain for future lactation periods.

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Impact of Cadmium Risk Communication on Household Cadmium Reduction Technology Adoption - Based on a Randomized Controlled Trial in China

A stratified randomized controlled trial was conducted in rice-growing areas of China to examine how do different communication modes of soil cadmium contamination affect smallholder households' cadmium reduction technology adoption. We find no significant effects of three information interventions (manual, SMS, and combination) on adopting cadmium reduction technology. The stable cost-benefit ratio and the cognitive biases may be the main reasons that the information intervention is ineffective. Furthermore, we identify the living environment of households as the threshold of effective information intervention. Households living in cadmium risk areas are more vulnerable to the impact of manual intervention, which makes them more easily transform from pollution victims to pollution controllers. In examining factors improving the effects of information intervention, we find that social media and village cadres can help strengthen the positive effects of information intervention in cadmium risk areas. These findings suggest that low-cost information intervention is not always effective, and the heterogeneity of household information responses should be further considered. Thus, it should adjust information measures to local conditions in trials.

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Effects of Disinfection Methods, Plant Growth Regulators and Activated Charcoal on Argan (*Argania Spinosa* (L.) Skeels, Genotype G41) Propagation by Microcutting Dispose d'un Menu Contextual

Argan (*Argania spinosa* (L.) Skeels) is an agroforestry species that produces one of the most expensive oils in the world. Unfortunately, argan is threatened by many factors such as the successive years of drought, climate change, goat overgrazing and habitat destruction. Propagation of argan using *in vitro* techniques is of high importance for mass propagation and genetic conservation of this species. In fact, the conventional methods cannot be used for rapid and large-scale propagation. Accordingly, developing efficient tissue culture protocols for argan is now primordial to rehabilitate argan groves. The purpose of this investigation was to evaluate the effects of disinfection methods, plant growth regulators (PGRs) and activated charcoal on argan propagation by microcutting.

Semi-hardwood stem cuttings of argan genotype G41 were collected from the experimental station Melk Zhar of INRA-Morocco then were washed with tap water. The cuttings were soaked in 50% commercial bleach for 10 min, followed by three rinses in sterile distilled water. This disinfection protocol was applied either once or twice (24h between each one). The cuttings were then cut into small segments (microcuttings) of 1.5-2 cm length bearing two axillary buds. The explants were cultured on PGR-free half-strength Murashige and Skoog (MS/2) medium for one month then transferred to MS/2 medium, with or without 1 g/L activated charcoal, and supplemented with 0.5, 1 or 2 mg/L gibberellic acid (GA_3), or with 1 mg/L indole-3-acetic acid and 1 mg/L 6-benzyladenine to promote axillary bud development. To achieve root induction from microshoots, the effects of three different media were evaluated: (i) MS/2, (ii) MS/2 + 1 mg/L indol-3-butyric acid (IBA) and (iii) MS/2 + 2 mg/L IBA. Our results

showed that the use of 2 disinfections resulted in a significantly higher disinfection rate (66.6%) than 1 disinfection. After 3 months of culture, it was found that 1 mg/L GA_3 resulted in the highest average shoot length, with 4.1 cm. Besides, the use of activated charcoal resulted in a morphologically superior plants, with greener leaves and low rates of browning. During the rooting phase, it was found that MS/2 + 1 mg/L IBA medium resulted in a higher rooting percentage than the other media. The findings of the present investigation would contribute to the rapid and large-scale propagation as well as sustainable conservation of argan.

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The Effect of Maize/Legume Rainfed Intercropping Systems on Soil Quality Varied with Location

Maize is the major staple crop in South Africa and hence maize production plays a hugely significant role in the country's food security. However, continuous maize monocropping leads to deterioration of soil health and consequent decrease in crop productivity especially within the smallholder farmlands. Incorporation of legumes into the maize-based cropping systems may improve maize productivity through an increase in crop diversity and enhanced soil quality. Therefore, this study assessed the effect of rainfed maize-legumes intercropping systems on soil quality variables. A field experiment, consisting of five cropping systems (sole maize, sole chickpea, sole mungbean, maize + chickpea, maize + mungbean) laid out in a randomized complete block design and replicated three times, was conducted under rainfed conditions at Mankweng and Thohoyandou, NE South Africa in 2020. Three soil samples were randomly collected from each experimental plot at 0–15 cm depth after harvesting at both sites for the determination of bulk density, aggregate stability, pH (KCl), electrical conductivity (EC), organic matter (OM), soil organic carbon (SOC), phosphorus (P), ammonium (NH_4^+), nitrate, active carbon, and potentially mineralizable nitrogen (PMN). Neither cropping system nor location affected soil bulk density, active carbon and PMN. In contrast, aggregate stability and electrical conductivity were higher at Mankweng compared to Thohoyandou but were not affected by cropping system at either site. The response of soil pH, organic matter content, soil organic carbon, phosphorus, ammonium, and nitrate varied with location. For example, the effect of cropping system on soil pH, P (Mankweng) and nitrate content (Thohoyandou) was significant at only one site. However, intercropping increased OM (97-134% vs 119-144), SOC (75-80% vs 231-240%), and NH_4^+ (40% vs 248-344%, relative to sole maize at Mankweng and Thohoyandou, respectively but the magnitude of the increase was greater at Thohoyandou compared to Mankweng. Intercropping with maize improved soil quality variables, relative to sole maize but this effect varied with location/soil type which suggests that maize-legume intercropping systems may boost soil functioning of the maize-based cropping systems and may be crucial to sustainable crop production especially amongst smallholder farmers. However, we recommend

further studies, incorporating more legume species and locations, over several seasons before definite conclusions can be drawn.

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Urban Food Forests from Detroit to Athens: An Exploration into the Benefits of Edible Landscapes and Perennial Fruit Access in Large Urban Centers

Our food access project, MSU Extension's Detroit Partnership for Food, Learning, and Innovation (DPFLI) is an urban agriculture research site that also produces fruits, veggies, and nuts on 3.3 acres. The main project at the DPFLI has been the conversion of most of the property into an edible forest. The edible forest increases local food production, creates an attractive green space, supplies produce to a food pantry, and educates vulnerable populations on the benefits of local food. Moreover, the orchard serves as a space for teaching, relaxation, and protecting biodiversity.

A localized, sustainable, and ecologically diverse, and stable food system is critical and evidence shows it offers pathways to mitigate and manage many of today's pressing issues – food insecurity, instability of global supply chains, rapid loss of biodiversity, major ecological collapse, and impending climate catastrophes. As most people now live in urban areas, it is imperative that the built environment looks to the past to incorporate more fruit and nut bearing trees into parks, streetscapes, private yards, and other publicly accessible areas. Edible forests are more resilient to climate change, sequester carbon in soil, capture stormwater and reduce flooding, and when plants reach maturity, the yields are abundant, nutrient dense sources of protein, carbohydrates, and healthy fats. Furthermore, studies show that large woody plants that create shade reduce the impact of "urban island heat affect", which contributes to health issues in urban communities.

What paths are available to us now or in the future to implement edible landscaping and urban food forests in Athens? As the city has rapidly urbanized and densified, residents of Athens are left with some of the lowest levels of green space access per capita in Europe. Not only can urban food forests and edible landscaping aid in addressing this pressing issue for Athenians, but it can also provide more access to fruits and nuts in an innovative manner. While many municipalities in North America have implemented selective plantings of fruit and nut trees in public spaces there has yet to be a transformative policy change to shift the paradigm of how urban residents interact on a consistent basis with fruit and nut trees. By thinking innovatively, Athens can implement strong policy changes to create long-lasting, transformative

changes in how cities interact and address access to fruits, nuts, greenspaces, urban orchards, and more. These policies can lead to impactful change to implement across the urban agriculture ecosystem globally.

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Predictive Modelling of Chemical Waste Generation in Healthcare Facilities: Enhancing Waste Management Strategies

The accumulation of chemical waste in healthcare facilities is a critical issue that necessitates effective management strategies. This manuscript presents a system dynamics modeling approach to forecast chemical waste generation rates within hospitals supply chain. The model incorporates diverse variables to mitigating environmental impact and enhancing public health outcomes. Various factors, including patient flow rates, are integrated into the model to create a holistic understanding of the waste generation process. A comprehensive case study at a healthcare facility validates and illustrates the proposed model's practical application. Through this methodology, the research identifies key departments, such as Main Operations, Obstetrics, Catheter, and Tissue, as significant contributors to healthcare chemical-waste generation. The study's findings underscore the pivotal role played by specific hospital departments in influencing chemical waste generation rates. Notably, the Main Operations, Obstetrics, Catheter, and Tissue departments emerge as substantial contributors. This insight into department-specific contributions provides a nuanced understanding of the dynamics of waste generation within healthcare facilities,

allowing for targeted interventions. The study further emphasizes the importance of capacity planning, scheduling, and resource allocation for waste management departments to effectively address the identified areas of concern. This research carries dual significance. Firstly, it unravels the intricate factors influencing chemical waste generation in healthcare facilities, pinpointing the departments contributing to the problem. This information is invaluable for hospitals seeking to optimize waste management practices. Secondly, the study equips waste management departments with actionable insights, facilitating better planning and resource allocation. Hospitals can bolster environmental sustainability and improve public health by enhancing waste management practices. The study's predictive capabilities and identification of key departments offer a foundation for developing comprehensive, long-term waste management programs.

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The Impact of Climate Change on the Built Environment: Built Environment Professionals' Perceptions and Practices

Literature indicates the built environment contributes to GHG emissions, the increase in the earth's surface temperature has resulted in forced climate change, and climate change has been linked to the increase, severity, and frequency of natural disasters.

The aim of the study reported on was to investigate the effects of climate change on the built environment, the objectives being to determine built environment professionals' (BEPs') knowledge, perceptions, and practices relative to climate change and the built environment.

The quantitative method was adopted, which entailed the distribution of a self-administered questionnaire to a sample stratum of BEPs in the form of architects, architectural technologists, electrical and mechanical engineers, and construction project managers.

The salient findings include: respondents' hardly attended three climate change courses/seminars; the internet predominates among respondents' source of climate change information; respondents rate themselves marginally above average in terms of knowledge relative to climate change; respondents rate themselves below average in terms of knowledge relative to climate change future predictions, current global processes to reduce greenhouse gas emissions, and current climate change related research, and respondents understand and appreciate the extent to which activities / processes contribute to GHG emissions, the extent to which manifestations are caused by climate change, the extent to which climate change impacts on the built environment, and the extent to which eight interventions seek to reduce GHG emissions.

Conclusions include: climate change has been linked to the increase, severity, and frequency of natural disasters; increasing urbanisation contributes to the built environment's contribution to GHG emissions; climate change has impacted on the built environment in several ways, and South African designers' climate change knowledge is inadequate.

Recommendations include: green transition strategies must be accelerated, and new investments must be focused on the decarbonisation of all sectors of the economy; new construction projects should be

designed to minimise artificial heating and cooling and promote passive heating and cooling; the use of renewable energy must be incorporated into new structures and existing buildings must adapt and be retrofitted to reduce energy usage; strategies are required to better communicate climate change strategies to BEPs; climate change information should be easily accessible, and tertiary education should educate BEPs in terms of sustainable design and construction processes.

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The Quality of the Seed Material in Some Fodder Species under the Influence of Climatic Conditions, in the North Eastern Part of Romania

Species of grasses and perennial legumes for meadows are considered among the most important species in the vegetation of permanent grasslands and in the structure of agricultural crops sown in arable land, with a multifunctional role in the sustainable development of agriculture. This group of plants, for their economic importance and agronomic value, are considered the "biological engine of agriculture", because they strongly influence the entire system of services and skills of an agronomic, alimentary and environmental nature. Thus, the production of seed in perennial meadow grasses and legumes species should be one of the concerns of agriculture, with the aim of improving permanent meadows, the restoration of new land and the considerable growth of temporary meadowareas, which require ever-increasing amounts of seed.

The research conducted during the 2020-2023 period at the Research and Development Station for Meadows, Vaslui (RDSM Vaslui) (46°40'-36°10' north latitude and 27°44'-20°40' east longitude) followed the influence of climatic conditions specific to the area, on the seed production and quality of the seed material in two of the perennial meadow grasses and legumes species: *Bromus inermis* Leyss. and *Onobrychis viciifolia* Scop., species with an important role in combating erosion and increasing the fertility of degraded soils. Structurally, the territory of the RDSM Vaslui is located on the Central Moldavian Plateau. In the area where the study was conducted, there is a temperate continental climate, with excessiveness nuances. Multiannual

precipitation average in the area is 533.2 mm, and the average multiannual temperature is 9.9 °C.

Seeds productions, germination parameters, seed index (1000 grains weight) were analyzed at the seed material produced within the RDSM Vaslui in the 2020-2023 period. The results obtained showed that each of the main climatic elements, namely the temperature, precipitation and humidity of the air, profoundly influenced the production of seed material and the analyzed parameters, being observed peculiarities out of the ordinary.

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Integrating Entrepreneurial Mindset and Value Creation in Teaching Physics to Engineering Students for Innovation and Impact

Worcester Polytechnic Institute is committed to the education and training of engineers for the needs of the 21st century by connecting science content to issues of critical local, national, and global importance. Recent survey done by Kettering University of industry employers shows that a large gap exists between what employers consider the "most essential competencies" for workforce readiness and graduates' proficiency. For example, engineering students were competent in some key scientific and technological areas and were strong at continued learning; however, they lacked key skills, knowledge, and mindset to be successful in innovation with impact. To close the gap, we redesign the physics curriculum to integrate Entrepreneurial Mindset (EM) and Value Creation Framework (VCF) as a tool that empowers each student to connect physics topics to real-world societal problems and to innovate with impact. The integration of EM and VCF as a tool in teaching Physics courses proved to be impactful not only in the upper-level courses, but also in the large introductory physics courses. This is particularly important, as it shows that undergraduate students can learn to innovate with impact from day one in college. Therefore, engineering students better understand the critical needs of society, they are more motivated to learn and innovate, and they are overall more ready to successfully contribute to global partnerships.

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A Conceptual Framework for Inquiry Based Learning in Engineering Laboratories

A thorough conceptual framework for improving the efficacy of inquiry-based learning (IBL) in engineering labs is presented in this paper. Because inquiry-based learning encourages students to actively explore and analyze real-world situations, it is known to build critical thinking, problem-solving abilities, and a deeper comprehension of the subject matter. Laboratories are essential for converting theoretical ideas into real-world applications in engineering education. However, a clear framework is necessary for the best possible integration of IBL principles into engineering laboratory environments. Important elements including curriculum design, teaching methodologies, assessment techniques, and the application of cutting-edge technology are all included in the suggested conceptual framework. Itplaces a strong emphasis on how laboratory exercises relate to actual engineering problems, supporting a student-centered approach that fosters curiosity and independent study. The framework also discusses the facilitator role that teachers have in helping students through the process of inquiry while fostering their independence and creativity. Additionally, the framework investigates the integration of contemporary technologies to enhancethe educational process and provide students a more comprehensive understanding of engineering methods. These technologies include data analytics, virtual laboratories, and simulation tools. The framework's adaptation to different engineering disciplines is taken into account, guaranteeing its relevance in a range of educational settings. This conceptual framework provides an organized method for implementing and evaluating inquiry-based learning in engineering laboratories through a detailed analysis of the body of existing research, educational theories, and real-world experiences. The suggested framework is a useful tool for instructors, curriculum designers, and organizations looking to improve engineering education by encouraging a culture of creativity and inquiry in lab environments. In the end, using this frameworkcould foster the development of a new generation of engineers who possess the essential abilities required to take on challenging, real-world engineering problems.

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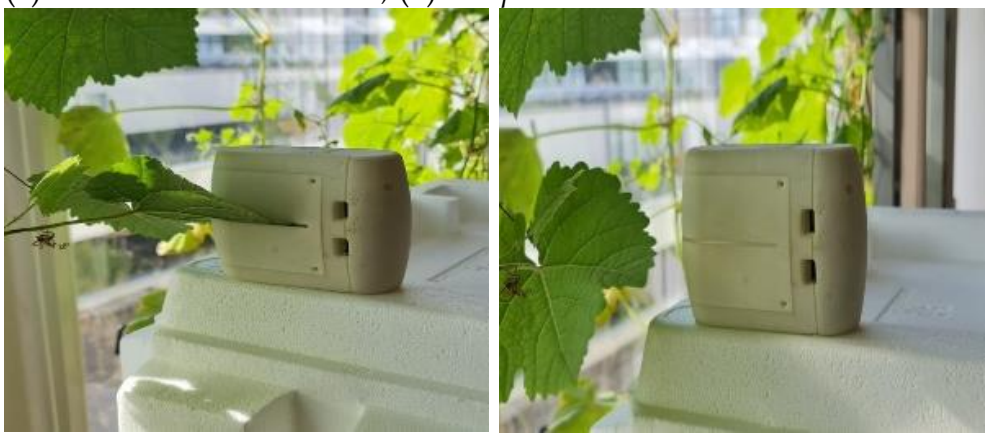
Plant Physiological Parameter Estimation using Resonant Ultrasound Spectroscopy with Improved Bandwidth and Enhanced SNR

Plant physiology is important to scientists in the determination of its health and other characteristics. The conventional approaches to investigate the plant are invasive, expensive, and not real-time. Using resonant ultrasound spectroscopy, an innovative non-invasive, cheap, and real-time approach is proposed which investigates the properties of plants. The idea is to use ultrasound for the determination of essential parameters, i.e. thickness, density, velocity and attenuation, based on these parameters relative water content and turgor pressure could also be investigated. In the resonant ultrasound spectroscopy signal-to-noise ratio and bandwidth are most crucial for the experiments, thus, using air-coupled ultrasound transducers an approach is developed which compensate the high energy around the center frequency of transducers and push it towards the edges to achieve increased bandwidth. This problem is solved using arbitrary position and width pulse which are compensated signals instead of simple pulse excitation signal which has lower energy and limited bandwidth.

The parameter extraction is crucial to the investigation, therefore using inverse solution approach and layer modeling, the essential parameters are calculated and thereafter compared with real measured parameters. The errors are studied between real and calculated values, to reduce the errors particle swarm optimization is used which optimize the parameters to limit the errors. The evaluation process for proposed technique is based on the comparison of different excitation signals for same sample, i.e. *Vitis vinifera* (grape) leaf's, comparative analysis indicates that proposed approach not only increase the bandwidth of signal, and improves the signal-to-noise ratio, but also errors are reduced significantly. The proposed approach using air-coupled ultrasound is shown in Figure 1, where measurement required two readings, calibration: without leaf and sample: with leaf inserted between transducers.

Figure 1. *Resoant Ultrasound Spectroscopy Measurement of Vitis vinifera,* (a) *Calibration Measurement,* (b) *Sample Measurement*



(a) (b)

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Creating the 21st Century Engineer for Sustainable Development and Social Justice

Engineering educators bear a profound ethical responsibility as the stewards of the next generation of critical and innovative thinkers. It is imperative that we equip our engineering graduates not only to confront the monumental challenges facing humanity but to be the architects of innovative technologies, products, and processes that directly contribute to achieving sustainable development goals. This entails more than the traditional role of problem solvers; it requires a fundamental shift in the paradigm of engineering education.

The conventional approach, often characterized by chalk-and-talk lectures and limited assessment methods like problem sets and exams, must evolve to meet the demands of the 21st century. In this presentation, we endeavor to showcase tangible strategies for implementing transformative changes within engineering programs. Our goal is to guide educators in updating and upgrading curricular and programmatic approaches, ensuring that their graduates emerge as transformative thinkers and adept problem solvers, well-equipped to navigate the complex landscape of contemporary engineering challenges.

Central to this transformation is a departure from traditional teaching methods. Project-Based Learning (PBL) stands out as a pedagogical approach that immerses students in real-world, open-ended projects, fostering the development of critical thinking, collaboration, and problem-solving skills. PBL not only bridges the gap between theory and practice but also instills a sense of purpose by directly addressing real-world challenges.

Service Learning (SL) is another pivotal element that can be seamlessly integrated into engineering curricula. By engaging students in community-based projects, SL not only enriches their educational experience but also underscores the social responsibility inherent in engineering practice. These projects, ranging from sustainable energy solutions in rural communities to water treatment initiatives, not only provide practical learning experiences but also contribute to the betterment of society.

Open-ended design (OED) thinking is an essential aspect that encourages students to approach problems with creativity and flexibility. OED projects allow students to explore multiple solutions,

fostering innovation and adaptability. By incorporating OED thinking, engineering programs can cultivate a mindset that is attuned to the dynamic and evolving nature of the engineering profession.

Moreover, an integral aspect of this presentation will be an exploration of the ethical dimensions of engineering. Recognizing the profound impact of engineering projects on society, we will emphasize the importance of ethics and social justice considerations. Engineers must be cognizant of the broader implications of their work, ensuring that their solutions are not only technically sound but also ethically and socially responsible.

In conclusion, this paper seeks to be a catalyst for change in engineering education, advocating for a paradigmatic shift that aligns with the needs of the 21st century. Through the integration of PBL, SL, OED thinking, and a heightened awareness of ethics and social justice, we aim to empower engineering educators to nurture a new generation of professionals who will not merely solve problems but transform the world for the better.

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Research on Factors Affecting Non-food Transformation of Farmland in China's Coastal Areas

Coastal regions in China are major grain-importing areas characterized by dense populations and economic development. Ensuring stable self-sufficiency in grain production and reducing the phenomenon of "non-food transformation" on coastal lands are integral components of the national food security strategy. Taking Zhejiang Province as a case study, this research collected relevant data on farmland utilization and grain production in the province. By employing an error correction model, a regression analysis was conducted on the time series data spanning from 2004 to 2021. The study results indicate that the level of "non-food transformation" in Zhejiang Province is influenced by various factors, including the proportion of non-agricultural employment, urbanization rate, irrigation assurance level, gross domestic product, total mechanical power per unit of cultivated land area, and agricultural subsidies, among others. Based on these findings, this paper proposes policy measures to address this issue, including diversifying farmers' sources of income, enhancing agricultural production facilities, and improving agricultural subsidy policies. These measures are aimed at reducing the extent of "non-food transformation" in Zhejiang Province and ensuring the stability of grain production.

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