

IECHo
2025
Conference

The 2nd International Electronic Conference on Horticulturae

27-29 May 2025 | Online



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The 2nd International Electronic Conference on Horticulturae

27–29 May 2025 | Online



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Prof. Dr. Luigi De Bellis

Prof. Dr. Yuyang Zhang

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Welcome from the Chairs

The 1st International Electronic Conference on Horticulturae held shortly after the COVID-19 pandemic was a great success. The event proved the invaluable role of virtual conferences in promoting global collaboration and knowledge exchange among researchers and other stakeholders all over the world.

Therefore, we are excited to invite you to join the 2nd International Electronic Conference on Horticulturae (IECHo2025), where we will explore the forefront of research in horticultural science. This conference will serve as a platform for vibrant collaboration and innovation in a world facing the challenges of climate change, a growing population, and the increasing demand for high-quality and sustainable horticultural products, ranging from fruits and vegetables to ornamental plants.

The conference will feature multiple sessions that cover the key research areas in horticultural science such as the following:

- S1. Genomics and Molecular Biology;
- S2. Abiotic and Biotic Stress;
- S3. Precision Horticulture;
- S4. Greenhouse and Indoor Farms;
- S5. Postharvest Physiology and Technology;
- S6. Politics and Economy.

We look forward to seeing you present and share your latest research work and ideas at this conference. The virtual format offers numerous advantages, including the elimination of registration fees and travel expenses, saving time, and enhancing personal comfort, which on-site events may not provide. Moreover, your presentation will reach hundreds of researchers worldwide.

This conference is hosted by MDPI, and all accepted abstracts will be published as one dedicated volume in *Proceedings*.

The Conference Committee will recommend manuscripts to be published in one Special Issue of *Horticulturae* (20% discount on APC) after the conference.



Prof. Dr. Luigi De Bellis
Conference Chair

Department of Biological and
Environmental Sciences and
Technologies (DiSTeBA),
Salento University, Lecce,
Italy



Prof. Dr. Alberto Pardossi
co-Conference Chair

Dipartimento di Scienze
Agrarie, Alimentari e Agro-
ambientali (DiSAAA-a)
University of Pisa, Pisa, Italy



Prof. Dr. Yuyang Zhang
co-Conference Chair

National Key Laboratory for
Germplasm Innovation and Utilization
of Horticultural Crops, Hubei,
Hongshan Laboratory, College of
Horticulture and Forestry Sciences,
Huazhong Agricultural University,
Wuhan 430070, China



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Horticulturae (ISSN 2311-7524) is an international, multidisciplinary, peer-reviewed, open access journal focusing on all areas and aspects of temperate to tropical horticulture. It publishes original empirical and theoretical research articles, short communications, reviews, and opinion articles. We intend to encourage scientists to publish and communicate their results concerning all branches of horticulture in a timely manner and in an open venue, after being evaluated by the journal editors and randomly selected independent expert reviewers, so that all articles will never be judged in relation to how much they confirm or criticize the opinions of other researchers.

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Session Chairs



Prof. Dr. Maria Dulce Carlos Antunes

Faculty of Science and Technology,
University of Algarve, Campus de
Gambelas, 8005-139 Faro, Portugal



Dr. Konstantina Argyropoulou

Agricultural University of Athens, Iera
Odos 75, 11855 Athens, Greece



Dr. Pedro Marques

University of Trás-os-Montes
e Alto Douro, Vila Real,
Portugal



Prof. Gianluca Brunori

Department of Agriculture, Food
and Environment, University of Pisa,
Via del Borghetto, 80-56124 Pisa,
Italy



Prof. Dr. Anabela A. Fernandes-Silva

Centre for Research and Technology of
Agro-Environmental and Biological
Sciences, UNIVERSIDADE DE TRÁS-OS-
MONTES E ALTO DOURO Quinta de
Prados, 5000-801 Vila Real, Portugal



Prof. Dr. Antonio Ferrante

Sant'Anna Scuola
Universitaria Superiore Pisa,
Pisa, Italy



Prof. Dr. Dimitrios Savvas

Laboratory of Vegetable
Production, Department of Crop
Science, Agricultural University of
Athens, Athens, Greece



Prof. Dr. Gianfranco Romanazzi

Department of Agricultural, Food and
Environmental Sciences, Marche
Polytechnic University, 60131 Ancona,
Italy



Prof. Dr. Isabel Lara

Department of Chemistry,
Physics, Environmental and
Soil Sciences, Universitat de
Lleida (UdL) - AGROTÈCNIO-
CERCA Center, Lleida, Spain



Prof. Dr. Silvia Scaramuzzi

Department of Agriculture, Food,
Environment and Forestry (DAGRI),
University of Florence, Florence,
Italy



Prof. Dr. Stefano Pavan

Department of Soil, Plant and Food
Science, University of Bari "Aldo Moro",
Via Amendola, 165/A, 70126 Bari, Italy

Keynote Speaker



Prof. Dr. Petronia Carillo

Department of Environmental,
Biological and Pharmaceutical
Sciences and Technologies,
University of Campania "Luigi
Vanvitelli", Caserta, Italy

Invited Speakers



Dr. Alice Trivellini

Department of Agricultural, Food and Agro-Environmental Sciences, University of Pisa, 56124 Pisa, Italy



Dr. Christophe El-Nakhel

Department of Agricultural Sciences, University of Naples Federico II, 80055 Portici, Italy



Dr. Daniele Vergamini

Department of Agriculture, Food, And Environment, University of Pisa, Pisa, Italy



Dr. Francesco Di Gioia

Department of Plant Science, Pennsylvania State University, University Park, PA 16802, USA



Dr. Lihong Liu

Department of Horticulture, Zhejiang University, Hangzhou 310058, China



Dr. Tajana Čop

Department of Management and Rural Entrepreneurship, Division for Agroecology and Informatics, University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia



Prof. Dr. Angelo Signore

Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Via Amendola 165/A, 70120 Bari, Italy



Prof. Dr. Boris Duralija

Department of Pomology, Division of Horticulture and Landscape Architecture, University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia



Prof. Dr. Mario Njavro

Department of Management and Rural Entrepreneurship, Division for Agroecology and Informatics, University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia



Prof. Dr. Mirjana Ljubojevic

Department of fruit growing,
viticulture, horticulture and
landscape architecture, University
of Novi Sad, 21000 Novi Sad,
Serbia



Prof. Dr. Pietro Santamaria

Department of Soil, Plant and Food
Sciences, University of Bari Aldo
Moro, Via Amendola 165/A, 70120
Bari, Italy



Prof. Dr. Riccardo Lo Bianco

Department of Agricultural, Food
and Forest Sciences, University of
Palermo Viale delle Scienze, Edificio
4 ingresso H, 90128 Palermo, Italy

Program Overview

	27 May	28 May	29 May
Morning	Session 2. Abiotic and Biotic Stress	Session 3. Precision Horticulture	Session 4. Greenhouse and Indoor Farms
Afternoon	Session 1. Genomics and Molecular Biology Session 6. Politics and Economy	Session 5. Postharvest Physiology and Technology	Flash Poster Session

IECHo 2025 Program

27th May 2025 (Tuesday)

Session 2. Abiotic and Biotic Stress

Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
09:00–09:05	Prof. Dr. Luigi De Bellis Event Chair	Opening Speech
09:05–09:10	Prof. Dr. Alberto Pardossi Event Chair	Opening Speech
09:10–09:15	Prof. Dr. Antonio Ferrante Session Chair	Welcome from the session chair
09:15–09:45	Prof. Dr. Petronia Carillo Keynote Speaker	Physiological mechanisms of plant resistance to water and heat stresses
09:45–10:00	Cosimo Beltrami Selected Speaker	Wood-waste bio-products for sustainable agriculture: exploring plant–soil interactions in treated lettuce under abiotic stress conditions
10:00–10:15	Ilaria Marchioni Selected Speaker	Effects of Water stress mitigation of new biostimulants on tomato leaves and fruits
10:15–10:30	Xavier Rius Garcia Selected Speaker	A Comparative Analysis of Novel and Established Olive Cultivars for Super-High-Density Olive Orchards
10:30–10:45	Mariarosaria De Pascali Selected Speaker	Proline Accumulation and Expression Profiles of Metabolism-Related Genes in Almond Trees in Response to Xylella fastidiosa
10:45–11:00	Alessandra Francini Selected Speaker	Multi-Omics approaches for identifying Salt- and Drought-tolerant Olive Cultivars
11:00–11:15	Fakhrul Islam Monshi Selected Speaker	Deciphering the Performance of Groundnut (Arachis hypogaea L.) Genotypes in Acidic Soil: Insights from Morphological and Genetic Analysis
11:15–11:30	Rocío Asencio-Vicedo Selected Speaker	Effectiveness of Equisetum arvense as a biostimulant in tomato plants under saline stress
11:30–11:45	Alice Mwanjiwa Kanyerere Selected Speaker	Investigating The Response of Amaranthus caudatus to Short-term Water Deprivation
11:45–12:00	Leone Boatto Selected Speaker	Salad and vinegar: can Wood Vinegar promote growth in lettuce and basil under nutrient stress?

Session 1. Genomics and Molecular Biology

Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:05	Prof. Dr. Stefano Pavan Session Chair	Welcome from the Session Chair
14:05–14:25	Dr. Lihong Liu Invited Speaker	Regulation of carotenoid metabolic pathway for quality improvement in tomato
14:25–14:40	Rosalinda Nicastro Selected Speaker	Human Urine Derivatives as Fertilizers: Role in Gene Expression Regulation in Soilless Lettuce Cultivation
14:40–14:55	Alice Petrini Selected Speaker	Multilevel Evaluation of Physiological, Transcriptomic, and Metabolomic Responses of Wild Rocket Plants to the Application of a New Biostimulant
14:55–15:10	Mian Muhammad Ahmed Selected Speaker	Identifying and characterizing genes that regulate ripening, texture, flavor, and color in citrus

15:10–15:25	Rabiatul Adawiah Zainal Abidin Selected Speaker	PapayaNetBase: A knowledge-based digital platform to support papaya research and breeding
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Session 6. Politics and Economy

Time: 15:25 (CEST, Basel) | 9:25 (EDT, New York) | 21:25 (CST Asia, Beijing)

CEST Time	Speaker	Title
15:25–15:35	Prof. Dr. Silvia Scaramuzzi Session Chair	Welcome from the Session Chair
15:35–15:55	Prof. Dr. Angelo Signore Invited Speaker	The BiodiverSO project as a model for preserving the biodiversity of vegetable crops in Puglia (Southern Italy)
15:55–16:15	Dr. Mirjana Ljubojevic Invited Speaker	Greening the economy and economizing the greenery – case study of Novi Sad
16:15–16:35	Prof. Dr. Boris Duralija Prof. Dr. Mario Njavro Dr. Tajana Čop Invited Speakers	Strategic risk management in horticultural value chains – role of AI and agritech
16:35–16:55	Dr. Daniele Vergamini Invited Speaker	Innovation and Transformation for a more equitable and resilient Horticulture

28th May 2025 (Wednesday)

Session 3. Precision Horticulture

Time: 10:00 (CEST, Basel) | 04:00 (EDT, New York) | 16:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
10:00–10:05	Prof. Dr. Anabela A. Fernandes-Silva Session Chair	Welcome from the Session Chair
10:05–10:25	Prof. Dr. Riccardo Lo Bianco Invited Speaker	Proximal sensing of fruit tree water status: from trunk to leaf to fruit sensing
10:25–10:40	Beatrice Falcinelli Selected Speaker	Agronomic and Environmental Evaluation of Nitrogen Enhanced-Efficiency Fertilizers in Processing Tomato
10:40–10:55	Mahadi Hasan Monshi Selected Speaker	Unlocking the Potential of Dragon Fruit (<i>Hylocereus</i> spp.): A Comprehensive Assessment of Yield Traits and Biochemical Adaptation in Medium Lowland Agriculture
10:55–11:10	Pedro Tomas Bulacio Fischer Selected Speaker	A Preliminary assessment of a Predictive Model for Stomatal Conductance Using 'Fylloclip' Sensors
11:10–11:25	Rūta Sutulienė Selected Speaker	The impact of MoO ₃ nanoparticles on peas' macro- and micro-elemental composition
11:25–11:40	Nicolò Iacuzzi Selected Speaker	Application of the Water Footprint in Sustainable Management and Protection of Water Resources for Processed Tomato Cultivation in Mediterranean Environments

Session 5. Postharvest Physiology and Technology

Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:20	Dr. Alice Trivellini Invited Speaker	Optimizing Postharvest Longevity and Quality of Cut Flowers and Foliage: A Sustainable Approach
14:20–14:35	Mian Muhammad Ahmed Selected Speaker	Polyphenolic Composition and Antioxidant Stability in Stored Pear Under Different Storage Conditions

14:35–14:50	Muhammad Nadeem Selected Speaker	Synergistic effect of blanching and sonicated edible coatings on the shelf stability of blackberries stored at various temperatures
14:50–15:05	Cindy Dias Selected Speaker	Breaking the Ripening Barrier in 'Rocha' Pears Treated with 1-MCP: The Role of Absciscic and Glyoxylic Acids
15:05–15:20	Roberta Passafiume Selected Speaker	Binary Synergistic Effect of Organic Coating and PA/PE Film in Passive Atmosphere on Preservation and Quality of Fresh Lychee during Cold Storage
15:20–15:35	Vitalis Laužikas Selected Speaker	Preharvest conditions for better postharvest apples
15:35–15:50	Annalisa Meucci Selected Speaker	Transport simulation of <i>Bulbine frutescens</i> and evaluation of post-production performance
15:50–16:05	Younes Noutfia Selected Speaker	A comparative investigation of the impact of infrared drying coupled with cold storage on selected physicochemical attributes of two Moroccan date (<i>Phoenix dactylifera</i> L.) cultivars
16:05–16:20	Elige Salame Selected Speaker	Metabolomic and transcriptomic profiling of Red Delicious apple stored under static (CA) and dynamic controlled atmosphere (DCA)

29th May 2025 (Thursday)

Session 4. Greenhouse and Indoor Farms

Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
09:00–09:10	Prof. Dr. Dimitrios Savvas Dr. Konstantina Argyropoulou Session Chairs	Welcome from the session chairs
09:10–09:30	Dr. Francesco Di Gioia Invited Speaker	Light as a driver for the quality of microgreens
09:30–09:50	Dr. Christophe El-Nakhel Invited Speaker	Growing Smart: Microgreens in Controlled Environments
09:50–10:05	Fatjon Cela Selected Speaker	Aeroponic system vs pot-grown sweet basil (<i>Ocimum basilicum</i> L.), an all-year-round comparison of their intensive production and quality in a greenhouse in Tuscany (Italy)
10:05–10:20	Alessandro Esposito Selected Speaker	Suitability of <i>Apium graveolens</i> var. <i>secalinum</i> for hydroponic cultivation in baby leaf production
10:20–10:35	Darko Jovanović Selected Speaker	Yield components of sweet corn in greenhouse depending on the method of production and genotype
10:35–10:50	Fabio Scotto di Covella Selected Speaker	Pulsed LED Lighting effects on the cultivation of green and red lettuce cultivars in vertical farming
10:50–11:05	Cristian Hernández-Adasme Selected Speaker	Impact of ambient light spectrum modifications on agronomic traits and phenolic profile of green lettuce plants
11:05–11:20	Konstantinos Zoukidis Selected Speaker	Application of innovative technologies on growth and quality of leafy vegetables grown under high-salinity water in a floating-disk hydroponic system
11:20–11:35	Irene Ventura Selected Speaker	Wild accessions of <i>Salicornia perennans</i> Willd. subsp. <i>perennans</i> as a sustainable solution for aquaculture effluents

Flash Poster Session**Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)**

Session	Poster Presenter	Title
Session 1		
14:00–14:05	Qian Zha	The Identification and Functional Validation of VvAGL15: A Key Regulator for Shortening the Grape Growth Period
14:05–14:10	Yanan Hu	Analysis of HIPPI family genes involved in Candidatus Liberibacter asiaticus infections
Session 2		
14:10–14:15	Dariusz Kulus	Application of Iron Oxide Nanoparticles and Indole-3-Acetic Acid in Synthetic Seed Technology: Effects on Chrysanthemum Generative Growth, Metabolism, and Genetic Stability
14:15–14:20	Eva Sánchez-Hernández	Smart Delivery of Biorationals: A Novel Strategy Against Root Crop Pathogens
Session 3		
14:20–14:25	Panchali Sengupta	Precision Horticulture—A move towards attaining sustainability among farmers of South 24 Parganas, West Bengal, India
14:25–14:30	Shelfali Vinod Ramteke	Optimizing Drone Spraying in Mango Orchards with Ultra-Low-Volume Nozzle Configurations for Sustainable Agriculture in Northern India
14:30–14:35	Pedro Marques	Leaf spectral reflectance and machine learning for classifying olive tree cultivars in Northeastern Portugal
Session 4		
14:35–14:40	Alessandro Miceli	Citrulline spray treatments affect tomato and lettuce transplant production
14:40–14:45	Nezha Kharraz	Real-Time Data Analytics and Smart Technologies for Advancing Indoor Farming
Session 5		
14:45–14:50	Giovanna Fusco	Metabolic changes in Brassica rapa L. subsp. sylvestris during postharvest storage
14:50–14:55	Alessandro Frontini	Volatile compounds released by chocolate mint (Mentha × piperita var. chocolate) leaves after different post-harvest procedures
Session 6		
14:55–15:00	Justyna Mazur	Consumer Purchase Behaviour and Preferences for Ornamental Perennials: A Survey from the Małopolska Region, Poland

Session 1. Genomics and Molecular Biology

sciforum-117024: Analysis of HIPP family genes involved in *Candidatus Liberibacter asiaticus* infections

Yanan Hu^{1,*}, Ruimin Li² and Guiyan Huang¹

¹ College of Life Sciences, Gannan Normal University, Ganzhou 341000, China

² Gannan Normal University

Citrus Huanglongbing (HLB) is the most devastating disease affecting citrus trees, primarily transmitted by the citrus psyllid. Once infected, citrus trees develop mottled yellowing symptoms, and the disease can only be managed by removing and destroying infected trees. This has caused severe economic losses to the global citrus industry. HLB is caused by the phloem-limited bacteria *Candidatus Liberibacter asiaticus* (CLas). However, the pathogenic mechanism of this disease currently remains unclear. Heavy metal-associated isoprenylated plant proteins (HIPPs) are known to be susceptible genes in plant-pathogen interaction systems and play a crucial role in maintaining heavy metal homeostasis and in responding to biotic and abiotic stresses. Previous studies have shown that citrus HIPP are potential susceptible targets of CLas, with multiple *HIPP* genes being activated in response to CLas infection. To investigate the function of the *HIPP* gene family in plant immunity, we used three PCR primers and real-time quantitative PCR to identify T-DNA insertion mutants of the *Arabidopsis thaliana* HIPP genes. Reactive oxygen species (ROS) and callose deposition triggered by flg22 in T-DNA mutants were analyzed by DAB staining and aniline blue staining. The PCR results showed that six pure mutants with T-DNA insertion were identified, with a downregulated expression level of *HIPP* genes. Furthermore, the DAB staining results indicated that the ROS triggered by flg22 were not influenced in *HIPP* gene T-DNA mutants. The aniline blue staining results showed that callose deposition was significantly increased in the HMP1T1, HMP52T, and HIPP22T mutants, while callose deposition was significantly decreased in HIPP3T. These findings suggest that *HMP1*, *HMP52*, and *HIPP22* of *Arabidopsis thaliana* may act as negative regulators of plant immunity, whereas the *HIPP3* gene may function as a positive regulator. This study provides an experimental basis for further functional analysis of *HIPP* genes in citrus-CLas interactions and plant immunity.



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sciforum-118128: Exploring plant expression of alkaloid related genes in *Dendromecon rigida* and the plant's relationship with rootzone microbes

Savanah Senn^{1,*}, Steven Carrell², Ray A. Enke³, Rayne Stanis⁴, Jordan Schoonover¹ and Gerald Presley⁵

¹ Los Angeles Pierce College Department of Agriculture Sciences, Plant Science program, Woodland Hills, CA, 91371, USA

² Oregon State University, Center for Quantitative Life Sciences, Corvallis, OR 97331, USA

³ James Madison University, Biology Department, Harrisonburg, VA 22807, USA

⁴ Oregon State University, Department of Horticulture, Corvallis, OR, 97331, USA

⁵ Oregon State University, Department of Wood Science and Engineering, Corvallis, OR 97331

We established the first transcriptome of *Dendromecon rigida*, known as Tree Poppy. It can be distinguished from other *Papaveraceae* by its lanceolate leaves and woody stems, which are uncommon for the family. During the same sampling event, we procured metagenomic data from the rootzone soil bacteria. Alkaloid production and gene expression in this plant have been little studied, although the plant's resilience following a disturbance is most certainly related to its secondary metabolites as well as its fire ecology. The interest in this plant comes from its resistance to pathogens, as well as its potential for synergy in the production of secondary metabolites with rootzone microbes, based on our previous work. The plant is known to have few pest and disease problems due to the high amount of antifungal, antioxidant, anti-herbivory, and insecticidal compounds like berberines within it.

The data we procured consisted of 16S metabarcoding, WGS metagenomics, and plant whole transcriptome data from Tree Poppy leaf, flower, and fruit. The metagenomics analysis employed QIIME2, Nephele, and STAMP. The plant transcriptome was assembled de novo in Trinity, expression was quantified with salmon, and completeness was assessed using BUSCO. Transcripts were annotated with the best SPROT blastx hits, and of those with a length > 1000 and TPM > 10, a subset of secondary metabolite and resistance genes were selected for further analysis.

The assembly had a total of 369,483 transcripts with an average length of 856 and a high degree of completeness > 95%. From the transcripts, several candidate genes for alkaloid production were identified including methyltetrahydroprotoberberine, (RS)-norcoclaurine, S-stylophine, and 3-O-actylpapaveroxine. Protoberberines have antifungal properties and contribute to allelopathy. Norcoclaurine is a precursor to benzoisoquinoline alkaloids and is present in other *Papaveraceae*. S-stylophine is bitter and deters insects and animals from eating the plant. Papaverine is an antifungal precursor to thebaine, common in fire-adapted plants in this family.

Compared with other plants from the nearby area on the Green Trail, including Woolly Blue Curls and Yerba Santa, Tree Poppy rootzone soil samples showed a higher proportion of reads from Actinomycetales. When compared with Coast Live Oak rootzone samples from the Gold Creek Preserve, Tree Poppy soil samples reflected elevated copies of mycothiol production genes in the metagenomic data, based on STAMP output. In the next steps, we will map secondary metabolite genes to closely related species from *Papaveraceae* and analyze the potential for the production of related compounds by rootzone bacteria.



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sciforum-115487: Genetic Diversity and Population Structure analysis of Cucumis species (*Cucumis sativus* L. and *Cucumis melo*) revealed by SSR Markers

Rekha Bheemappa Chittapur^{1,*}, Backchand Tembhurne^{2,3}, raghavendra gunnaiah^{4,5}, Prabhuling Guranna⁶, Kisan jadhav⁷, Namita Raut⁸ and Satish D⁹

¹ University of Horticultural Sciences, University of Horticultural Sciences, Bagalkot, Karnataka, 587104, India

² Professor and Head, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur

³ College of Agriculture, University of Agricultural Sciences, Raichur

⁴ Assistant Professor Molecular Biology and Biotechnology,

⁵ Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot

⁶ Professor and Head, Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot

⁷ Associate Professor, Department of Biotechnology, College of Agriculture, Raichur

⁸ Assistant Professor, Department of Vegetable Science, University of Horticultural Sciences, Bagalkot

⁹ Associate Professor, Department of Genetics and Plant Breeding, College of Horticulture, Bagalkot

Cucumis is the highly diverse genus of the family Cucurbitaceae. Two commercially cultivated species are *Cucumis melo* and *Cucumis sativus*. *Sativus* types are less diverse in fruit traits compared to melons. A group of melons commonly known as cucumbers due to their similarity in fruit traits with cucumbers of *Cucumis sativus* were cultivated in Karnataka, revealing high genetic diversity. To study the genetic diversity and structure within and between the species, 150 *cucumis* germplasm, including *Cucumis melo* and *Cucumis sativus*, collected from the different regions of Karnataka, were fingerprinted with 47 highly polymorphic Simple Sequence Repeat (SSR) markers, which were evenly distributed in the genome. Genetic diversity parameters among the collections revealed wide diversity among the melons compared to *sativus* types. A total of 602 alleles were identified through gel electrophoresis with a mean PIC value of 0.8. Based on the SSR data, a population structure analysis revealed the presence of four distinct populations, largely corresponding to species differentiation. The results showed that all *sativus* types, along with some melons, were grouped in Population 2, while the remaining melons were grouped into three distinct populations, indicating a high degree of heterogeneity in the base population of melons, while the lowest degree was seen in *sativus* types. The AMOVA result showed that the percent of genetic variation among and within *Cucumis* species is 78 percent, and between populations, it is 12 percent. The highest *F*_{is} value of 0.881 indicates the maximum extent of genetic similarity among the collections, and the *F*_{st} value (0.118) revealed less diversity among the populations. The highest Nei's genetic identity was between Population 4 and Population 3 (0.639), indicating gene flow during evolution, and the maximum genetic distance was between Population 1 and Population 2 (0.734) among the four populations, indicating that individuals of both the populations are highly diverse. Admixtures between the populations are evidence of hybridization and migration during the evolution of species. The present findings of the genetic structure of *Cucumis* species revealed the existence of a wide diversity in melons that could aid in the exploitation for the development of improved varieties and species conservation.



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sciforum-118245: Human Urine Derivatives as Fertilizers: Role in Gene Expression Regulation in Soilless Lettuce Cultivation

Rosalinda Nicastrò^{1*}, Christophe El-Nakhel², Giovanna Marta Fusco¹, Danny Geelen³,
Youssef Roupheal², Stefania De Pascale² and Petronia Carillo¹

¹ Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania "Luigi Vanvitelli", Via Vivaldi 43, 81100 Caserta, Italy

² Department of Agricultural Sciences, University of Naples Federico II, 80055 Portici, Italy

³ HortiCell Lab, Department of Plants and Crops, Ghent University, 9000 Ghent, Belgium.

One of the biggest challenges today is to reduce the application of chemical fertilizers by promoting waste recycling and obtaining organic raw materials for agriculture according to the principles of circular economy. This is due to the rapid growth of the population and food demand, which have led to higher reliance on chemical fertilizers in agriculture, leading to intensive strain on natural resources. Hence, we explored the impact of human urine derivatives (UDs) compared to commercial fertilizers on lettuce (*Lactuca sativa* L. cv. Grand Rapids) metabolic profile and antioxidant activity in a soilless cultivation (Nicastrò et al., 2024). Furthermore, to gain a better understanding of the effects of UD on plant metabolism by gene regulation, this research investigated their impact on gene expression, particularly on genes encoding enzymes involved in essential biochemical pathways, thus looking into possible stress responses or various regulation effects. Treatment with K-Struvite resulted in the highest expression levels of genes encoding key enzymes involved in nitrogen metabolism, nitrate reductase (NR), glutamate synthase (GOGAT X1), and glutamine synthetase (GS), with the lowest expression levels in plants treated with hydrolyzed urine. The latter, however, showed an increased expression of genes encoding stress-related enzymes like GOGAT X2, catalase (CAT), and glutamate decarboxylase (GAD). Additionally, the expression of *P5CS* (Δ^1 -pyrroline-5-carboxylate synthase), a key gene in proline synthesis, decreased across all treatments compared to the control, with the most significant reduction detected in ED concentrate and K-Struvite. Genes encoding CHS2 (chalcone synthase), AGPase (ADP glucose pyrophosphorylase), and cytGR (glutathione reductase cytosolic) enzymes showed higher expressions in plants treated with K-Struvite. Meanwhile, genes for PAL (phenylalanine ammonium lyase) and chlGR (Glutathione reductase, chloroplastic) enzymes were significantly overexpressed after treatment with ED concentrate compared to the NPK control. Fertigation with UD in soilless cultivation of lettuce affects gene expression levels by supplying various forms of nitrogen, while also inducing various morphological and metabolic responses as a result of their distinct composition.



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sciforum-111566: Identifying and characterizing genes that regulate ripening, texture, flavor, and color in citrus

Mian Muhammad Ahmed^{1,2,*}, **Muhammad Asim**³, **Pan Zhiyong**^{4,5}, **Hamid Syeda Maira**^{1,6} and **Guo Xingyu**⁷

¹ College of Life Science and Technology, Tarim University, Alar Xingjiang, 843300, China

² National and Local Joint Engineering Laboratory for High-Efficiency and High-Quality Cultivation and Deep Processing Technology of Characteristic Fruit Trees in Southern Xinjiang, 843300, China

³ National Key Laboratory for Germplasm Innovation and Utilization of Horticultural Crops, Huazhong Agricultural University, Wuhan, 430070, Hubei, China

⁴ College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, P.R. China

⁵ National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizhishan Street, Hongshan District, Wuhan, Hubei, 430070 China.

⁶ Key Laboratory of Protection and Utilization of Biological Resources in Tarim Basin, Alar, Xinjiang, 843300, China.

⁷ National and Local Joint Engineering Laboratory for High-Efficiency and High-Quality Cultivation and Deep Processing Technology of Characteristic Fruit Trees in Southern Xinjiang, 430070, China

Oranges, lemons, and mandarins are among the most popular fruits consumed worldwide; they are valued for their flavor, color, and texture. Numerous intricate genetic, biochemical, and physiological mechanisms affect the quality of citrus fruits, especially during ripening. Enhancing the quality, shelf life, and marketability of fruit requires an understanding of the genetic foundations underpinning important ripening characteristics such as texture, flavor, and color. The purpose of this research was to identify and describe the genes that control citrus ripening, with an emphasis on the genetic regulation of the fruit's texture, flavoring, and color development. We examined the gene expression profiles at different phases of fruit ripening in a variety of citrus cultivars, such as sweet oranges and mandarins, using a mix of transcriptomic and genomics techniques. Differentially expressed genes (DEGs) that are involved in fruit development were identified using RNA sequencing, and these genes were linked to important phenotypic features using genome-wide association studies (GWASs). The fruit texture was discovered to be significantly influenced by genes that encode enzymes that are involved in the manufacture and degradation of cell wall components, such as pectin methylesterases and polygalacturonases. Genes that produce flavor and fragrance molecules, such as terpene synthases, and enzymes that are involved in the phenylpropanoid pathway were also investigated. Another important area of study is the control of fruit's color, which is mostly caused by carotenoid production. An in-depth analysis was carried out on genes such as phytoene synthase (PSY) and lycopene β -cyclase (LCYB), which control the build-up of carotenoids and, consequently, the orange hue of mature citrus fruit. We also examined how ethylene, a hormone that is important for fruit ripening, interacts with these genes and how it regulates their expression. Our goal was to achieve a thorough understanding of the molecular mechanisms influencing citrus ripening features by describing these genes. Ultimately, breeding programs can use the identification of genetic markers that are linked to desired fruit attributes such as texture, flavor, and color to create new citrus varieties that are more palatable to consumers, have longer shelf lives, and are more resilient to environmental stressors. This study contributes to the future of sustainable agriculture in the citrus sector by opening the door for the use of molecular breeding techniques in citrus development.



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sciforum-118189: Multilevel Evaluation of Physiological, Transcriptomic, and Metabolomic Responses of Wild Rocket Plants to the Application of a New Biostimulant

Alice Petrini^{1,2,*}, Giacomo Cocetta¹ and Antonio Ferrante^{1,3}

¹ Dipartimento di Scienze Agrarie e Ambientali, Università di Milano, Via Celoria 2, 20133 Milano, Italia

² L.Gobbi s.r.l unipersonale, Via Valle Calda 33, 16013, Campo Ligure, Italia

³ Istituto di Produzioni Vegetali, Scuola Superiore Sant'Anna, Via L. Alamanni, 22, 56010 Ghezzano PI, Italia

Developing new biostimulant products is a multifaceted process that includes screening potential substances, investigating their modes of action, and conducting efficacy trials. Since biostimulants operate through diverse mechanisms, and their effectiveness is closely linked to these processes, it is crucial to analyse plant responses at multiple levels, including physiological, biochemical, and molecular aspects.

This study aimed to evaluate the physiological, transcriptomic, and metabolomic responses of wild rocket plants following the application of a biostimulant candidate.

Wild rocket plants (*Diplotaxis tenuifolia* L.) were cultivated in pots under controlled conditions. The product LG527, made from plant extracts and metabolites, was applied to leaves at a concentration of 50 µL/L. Physiological analyses were performed after three treatments (24, 48, and 96 hours post-treatment). Omic analysis included transcriptomic sampling at 24 hours and metabolomic sampling at 96 hours.

Results demonstrated a positive impact on photosynthetic performance, evidenced by the enhanced efficiency of photosystem II (Fv/Fm) and reduced energy dissipation (Dlo/RC). The performance index (PI) increased in treated plants, supported by the modulation of genes related to photosynthesis. This effect was confirmed by the positive regulation of crucial photosynthesis genes (psbP and lhcb5). No significant changes were observed in chlorophyll content; however, treated plants exhibited an increase in sucrose at 48 hours and a decrease in reducing sugars at 96 hours. The treatment effectively reduced nitrate concentrations after 48 hours. This effect has been linked to the activation of biosynthetic amino acid pathways, as indicated by the increased expression of genes involved in nitrogen metabolism (glutamine synthetase and ribulose-phosphate 3-epimerase). Other significant modulations of genes involve calcium signalling and hormonal responses. The down-regulation of auxin and cytokine response regulators suggests an influence on plant growth and development.

The findings highlight LG527's potential as a biostimulant, reinforcing previous trials that demonstrated its efficacy in improving plant quality attributes and stress resilience. The collected data contribute to the formulation of potential usage claims.



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sciforum-114531: PapayaNetBase: A knowledge-based digital platform to support papaya research and breeding

Rabiatul Adawiah Zainal Abidin^{1,*}, Hani Suraya Tajudin², Nurul Anis Najwa Khairul Anuar³, Sanimah Simoh⁴ and Norliza Abu Bakar⁴

¹ Malaysian Agricultural Research and Development Institute (MARDI)

² Bioinformatics Programme, Department of Biological Sciences & Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM), 43600 Bangi, Selangor

³ OR Technologies Sdn Bhd, 55200 Kuala Lumpur, Malaysia

⁴ Malaysian Agricultural Research & Development Institute (MARDI), 43400 Serdang, Selangor

Papaya (*Carica papaya* L.) is one of the most important tropical fruits cultivated in tropical climate countries, and its production is often threatened by abiotic and biotic stressors, which significantly affect the yield and quality of papaya. In recent years, papaya genomics resources have become available, which has promoted papaya research and breeding. However, no dedicated digital platform for papaya genomics resources has been developed for the research and breeding communities. Potential users such as papaya geneticists, breeders, and pathologists require genomics resources and easy-to-handle tools to support their decision-making in selecting suitable genes and molecular markers. To address this issue, we developed a papaya knowledge-based digital platform, PapayaNetBase. PapayaNetBase comprises three papaya genome data sets (Eksotika, Sekaki, and Sunset varieties), genomic variation, transcriptomes, and metabolites. PapayaNetBase web interface was developed using WordPress, while MySQL was used as a database management system (DBMS). The database functionalities include search query and filter functions that can be performed based on the SNP identifier (ID), gene ID, pathway, and variety name. The search results are displayed in table format. The output of the search results can be downloaded in text, comma-separated value (CSV), or Excel formats. Data in FASTA format (i.e., scaffold, transcript and protein sequences) can be retrieved via the 'Downloads' menu. We also developed a knowledge graph dashboard for papaya traits utilising the Neo4j platform (<http://bit.ly/papayanetbaseV1>) to facilitate the easy dissemination of these genomics resources. Using the PapayaNetBase knowledge graph, users can visualise papaya traits with integrated genomics information, such as gene description, a protein-protein interaction network, gene ontology, and pathway. To our knowledge, this is the first integrated platform on papaya genomics that offers resources in a knowledge graph. PapayaNetBase aims to accelerate functional genomics and molecular marker analyses by enabling geneticists and breeders to explore and utilise the molecular information on papaya for application in papaya research and breeding programmes.



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sciforum-112140: The Identification and Functional Validation of VvAGL15: A Key Regulator for Shortening the Grape Growth Period

Qian Zha

Shanghai Academy of Agricultural Sciences

Table grape cultivation has substantial economic benefits. Temperature stress often occurs during the fruit-ripening period, causing premature aging of the vine, abnormal softening of fruit, loss of commercial potential, and reduced yield. Temperature stress, therefore, limits the sustainable and stable production of fresh, high-quality grapes. A key way to avoid this temperature stress is to promote early maturation. Studying methods to shorten the fruit growth period and to develop early-maturing grape cultivars provides an important way to optimize the grape-cultivar market structure. In this study, we utilized the grape cultivar Summer Black, known for its extremely short growth period, along with its bud-mutation cultivar Early Summer Seedless, to analyze early-stage fruit development. The cultivar ESS exhibited a significantly greater color change in the peel than SB at 35–42 DAA, indicating that the veraison period is directly associated with a shortened grape growth period. We therefore conducted transcriptomic analysis of berries harvested during this period, identifying 35 key genes that shorten the berry development period. The AGL gene family participates in plant growth and development. Therefore, we examined the roles of the VvAGL members in fruit growth and development. Screening the 94 common DEGs and 34 VvAGL family members identified VvAGL15 (Vitvi13g01861_t001) as a key gene. VvAGL15 is localized to the nucleus in grapes. The relative expression of VvAGL15 was upregulated in the peel and pulp of ESS relative to that of SB. Fluorescence-based qRT-PCR revealed that VvAGL15 was highly expressed in both the peel and pulp of ESS grapes. Pulp VvAGL15 expression was high at 27 to 42 DAA in both cultivars, indicating that VvAGL15 is important during early berry development, especially during the veraison period. Our heterologous expression analysis using tomato plants revealed that VvAGL15 can accelerate tomato fruit development, leading to faster growth, earlier flowering, earlier acid reduction before color transition, and earlier ripening. These findings provide a theoretical basis for promoting the early ripening of grapes and other crops by enhancing VvAGL15 expression.



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Session 2. Abiotic and Biotic Stress

sciforum-114661: *Phyllophaga* ssp. damage to jicama roots during development: Effect on saccharide content

Verónica Cuellar Sánchez^{1,*}, Georgina Calderón Domínguez¹, Ma de la Paz Salgado Cruz¹,
Marcela González Vázquez² and José Honorato Arreguín Centeno³

¹ National School of Biological Sciences, National Polytechnic Institute, Mexico City, C.P. 07738, Mexico

² Institute of Pharmacology, Universidad de la Cañada, Teotitlán de Flores Magón, C.P. 68540, Oaxaca, Mexico

³ Department of Agronomy, National Technological Institute of Mexico/IT of Roque, Guanajuato, C.P. 38194, Mexico

Pachyrhizus erosus (jicama) is a tuberous root cultivated around the world and commonly used as food. Different authors report on their nutraceutical properties, such as the hypoglycemic effect of jicama aqueous extract, which helps in the prevention of type 2 diabetes mellitus, and enhances the growth of *Lactobacillus L. plantarum* due to the presence of prebiotics. The aforementioned functional properties have been related to their saccharides, mainly fibers and oligosaccharides. The aim of this work was to follow the changes in starch, pectin, inulin and other simple saccharides in jicama roots during their growth that were damaged by *Phyllophaga* spp. Regarding the content of reducing sugars, it was observed that during the first two jicama collections (100 and 140 days), these increased (11.12%-18.63% control jicama and 11.98%-28.66% stress jicama), with a significant difference between the development periods ($p > 0.05$) and stress. Regarding the percentage of total sugars, the presence of beetles did not affect the synthesis of the component, observing the minimum values at 100 days of development (11.67%). In the determination of starch, no significant differences ($p > 0.05$) were observed between control jicama and with biotic stress at 100 days, but were at 140 days, while by development time the sample that presented the highest content was jicama, at 180 days. An effect of sample growth development was also observed. Regarding specific components, damaged jicama show smaller starch yield values (50%) than clean samples, while in most other cases, the biocomponents increased their concentration, most of them at 140 days of development, with sucrose being the most noticeable component (250 mg/g-350 mg/g). According to the chromatograms for inulin, nystose, kestose, sucrose, glucose, and fructose were found. In the case of pectin, the following compounds were found: galacturonic acid, glucose, xylose, and arabinose. Some other components only appear in damaged jicama (inulin). This behavior must be triggered by the presence of the parasite promoting different metabolic pathways. More studies are needed in this area.



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sciforum-116141: An in-depth evaluation of an olive genotype tolerant to *Xylella fastidiosa* which shares genetic traits with Tunisian cultivars

Alessandro Bene *, Giambattista Carluccio, Marzia Vergine, Erika Sabella, Mariarosaria De Pascali, Luigi De Bellis and Andrea Luvisi

Department of Biological and Environmental Sciences and Technologies, University of Salento, Lecce, 73100, Italy

Introduction

In the Salento peninsula (southeastern Italy), *Xylella fastidiosa* (Xf) subsp. *pauca* is the cause of Olive Quick Decline Syndrome (OQDS). Approximately 85% of the olive trees in this region are made up of two cultivars, 'Cellina di Nardò' and 'Ogliarola Salentina', both of which are highly vulnerable to Xf. In heavily affected orchards, the sight of withered trees is common. However, certain potentially resistant genotypes stand out, either remaining asymptomatic or showing only mild symptoms.

Goals

The aim of this study is the definition of the performance features of a putatively resistant plant, SX32, which shares genetic traits with Tunisian cultivars like 'Chemlali Sfax' and 'Sayali', in an area with high Xf inoculum pressure.

Methodology

The symptoms and the bacterial count in SX32 were assessed and compared to the two cultivars 'Cellina di Nardò' (susceptible to Xf) and 'Leccino' (resistant to Xf), over the course of all four seasons. Disease severity was assessed using the pathometric scale described by Luvisi et al. (2017) (doi: 10.14601/Phytopathol_Mediterr-20578). Real-time PCR was performed following the protocol outlined by Harper et al. (2010) (doi:10.1094/PHYTO-06-10-0168), and bacterial concentration, expressed as CFU/mL, was determined based on the method described by D'Attoma et al. (2019) (doi:10.3390/pathogens8040272).

Results

The findings indicate that the canopy symptoms of SX32 are minimal, even fewer than those of 'Leccino', and show a constant pattern throughout the four seasons. It is noteworthy that 'Cellina di Nardò' shows an increasing trend, reaching its peak in autumn. In contrast, in relation to bacterial counts, SX32 falls between 10^3 and 10^6 CFU/mL, with the highest bacterial levels recorded in winter and the lowest in summer. 'Cellina di Nardò' exhibits a trend similar to that of SX32, but with a higher bacterial load, between 10^4 and 10^7 CFU/mL, whereas 'Leccino' shows the lowest bacterial count in winter and the highest in autumn, varying between 0 and 10^7 CFU/ml.

Conclusions

SX32 demonstrates notable tolerance to Xf, exhibiting very low symptom levels, and it will be the subject of further study to explore additional sources of resistance to Xf. Although the higher bacterial count in SX32 compared to 'Leccino' was unexpected, it remains intriguing, as it might suggest the involvement of xylem endophytes that exert direct or indirect control over the pathogenic bacterium, helping the plant remain healthy despite the syndrome. Examples of such relationships, previously studied in olive trees, include associations with microorganisms like *Burkholderia*, *Quambalaria*, *Phaffia*, and *Rhodotorula*.



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sciforum-116188: Effectiveness of *Equisetum arvense* as a biostimulant in tomato plants under saline stress

Rocío Asencio-Vicedo *, Borja Ferrández-Gómez, Mar Cerdán, Antonio Sánchez-Sánchez and Juana D. Jordá

Department of Biochemistry, Molecular Biology, Edaphology and Agricultural Chemistry, University of Alicante, 03080, Alicante, Spain

The increase in inappropriate agricultural practices and irrigation with low-quality water has led to a rise in the amount of soil with high salt concentrations. Salinity is a type of abiotic stress that significantly affects the growth and development of crops, including tomato (*Solanum lycopersicum* L.), which is one of the most consumed agricultural products worldwide. One way to mitigate the problems caused by salinity can be the use of biostimulants. Bioactive compounds and secondary metabolites, such as phenolic acids, glycosides, and vitamins mean that the horsetail plant (*Equisetum arvense* L.) can have a biostimulant effect on crops. Also, it accumulates large amounts of Si, which is beneficial for plant growth, the photosynthetic rate, and can help to alleviate the effects of biotic and abiotic stresses. In this context, the aim of this study was to evaluate the effectiveness of *Equisetum arvense* applied to tomato plants under saline stress conditions. For this purpose, an experiment was carried out in a greenhouse where tomato plants were grown in hydroponics under controlled conditions. First, macronutrients and micronutrients, silicon and phenolic compounds, were extracted through magnetic stirring, and then, the *E. arvense* extract (EA-E) obtained was applied via foliar feeding to tomato plants to test its efficacy. Positive results were observed after spraying the extract (EA-E). The treatment with the extract (EA-E) was established according to the concentration of phenolic compounds and silicon. It induced an increase in biomass production and chlorophyll synthesis; fresh weight increased by 24% compared to the saline control (SC); and the chlorophyll concentration reached the values of the normal control (NC). In terms of oxidative stress, EA-E was also effective; MDA and H₂O₂ concentrations were reduced by 57% and 29% and the proline concentration decreased by 23% compared with the saline control (SC). These results show the effectiveness of *E. arvense* extracts (EA-Es) in reducing the effects of salinity on tomato plants under the conditions of this study. For tomato, *Equisetum arvense*, under salt stress, was used as the biostimulant in this study.



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sciforum-117250: Effects of Root-Zone Temperature Regulation on Early Growth and Heat Stress Response in Papaya (*Carica papaya* L.) Seedlings: A Preliminary Assessment

Fadhilnor Abdullah ^{1*}, Ahmad Lutfi Mohd Razuwan ¹, Nurul Afidah Umoruddin ¹, Syarifah Rokiah Syd Kamaruzaman ¹, Badrul Hisham Johari ¹ and Kamarul Aizat Abdul Khalid ²

¹ Institute of Sustainable Agrotechnology (INSAT), University Malaysia Perlis (UniMAP) Sg. Chuchuh Campus, 02100 Padang Besar, Perlis, Malaysia

² Department of Manufacturing, Faculty of Engineering and Mechanical Technology, University Malaysia Perlis (UniMAP), 02600 Arau, Perlis, Malaysia.

Papaya (*Carica papaya* L.) is a highly valued tropical fruit. However, its sensitivity to environmental stress, particularly temperature fluctuations, poses a significant challenge to its successful cultivation. This preliminary study assesses the responses to regulated root-zone temperature in papaya seedlings planted under controlled conditions during initial growth and survival. This research study was conducted at the Institute of Sustainable Agrotechnology (INSAT), Universiti Malaysia Perlis (UniMAP), Malaysia, using papaya seedlings grown under three different temperature treatments: ambient conditions (T0), moderate heat ($\pm 30^{\circ}\text{C}$, T1), and high heat ($\pm 45^{\circ}\text{C}$, T2). The experiment employed a Completely Randomized Design (CRD), with growth parameters, including survival rate, shoot and root dry weights, and root-to-shoot ratio, assessed over a 16-day period. The results revealed that papaya seedlings exhibited the highest survival rates under ambient conditions (T0), whereas exposure to $\pm 30^{\circ}\text{C}$ (T1) resulted in a gradual decline in survival, suggesting an adaptive response to moderate heat stress. However, seedlings exposed to $\pm 45^{\circ}\text{C}$ (T2) experienced complete mortality within five days, highlighting their extreme sensitivity to high-temperature stress. Biomass allocation analysis showed that seedlings under moderate heat (T1) exhibited a significantly higher root-to-shoot ratio compared to the control ($P = 0.05$), indicating a potential stress-induced adaptation mechanism that favors root growth under elevated temperatures. Despite this, overall shoot and root dry weights did not differ significantly between T0 and T1. This study highlights the susceptibility of papaya seedlings to heat stress during early growth conditions. While moderate heat ($\pm 30^{\circ}\text{C}$) may enhance root development, excessive temperatures ($\pm 45^{\circ}\text{C}$) are detrimental to seedling survival, suggesting a narrow thermal threshold for early-stage papaya growth. The findings provide valuable insights into temperature management strategies for papaya cultivation, contributing to improved propagation techniques under changing climatic conditions. Further studies are warranted to explore the physiological and molecular responses of papaya seedlings to temperature stress, which could aid in developing more resilient cultivation practices in the face of climate change.



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sciforum-116585: Warming and eCO₂ in the parental environment alters the seed performance of *Stylosanthes capitata* Vogel (Fabaceae), a tropical legume

Priscila Marlys Sá Rivas^{1,*}, Fernando Bonifácio-Anacleto¹, Ivan Schuster², Carlos Alberto Martinez³ and Ana Lilia Alzate-Marin¹

¹ Department of Genetics, Graduate Program of Genetics, Faculty of Medicine of Ribeirão Preto (FMRP-USP/RP), University of São Paulo, Av. Bandeirantes 3900, CEP 14049-900, Ribeirão Preto, SP, Brazil.

² Longping High-Tech, SP-330, km 296, 14140-000 Cravinhos, SP, Brazil

³ Department of Biology, Ribeirão Preto School of Philosophy, Science and Literature, University of São Paulo (FFCLRP/USP), Av. Bandeirantes 3900, CEP 14040-901, Ribeirão Preto, SP, Brazil.

Tropical cropland systems will face challenges due to the expanding population and climatic changes. We used a temperature- and free-air-controlled enhancement and free-air carbon dioxide enrichment facility to analyze the effects of warming (+2°C) and atmospheric CO₂ (600 ppm) on *Stylosanthes capitata* (Vogel) parental plants' seed quality parameters. *S. capitata* is a Brazilian native forage legume and used in grazing systems. The plants were subjected to four treatments (with four replicates each): Control [C], increased CO₂ [eCO₂], warming [eT], and the combination [eCO₂ + eT]. At the beginning of flowering, four parental plants per replicate were labeled and sampled 9-12 weeks after the first anthesis at the end of April 2015. For the seed quality evaluation, the parameters analyzed were as follows: the number of seeds per inflorescence (unit), 100-seed weights (mg), the percentage of abortions and unviable seeds (%), and the seed coat's color. For the seed germination evaluation, we assessed the seedling vigor and emergence. For the germination time (GT) and germination rate, seedling emergence on moistened Petri dishes was assessed daily until the ninth day, and germinability and the germination speed index (GSI) were calculated. Two-way and three-way ANOVAs were used to analyze treatment effects. Our results showed that warming increased the number of seeds per inflorescence by ~37%, reduced unviable seeds by 55%, and altered the seed coat color frequency to 64% beige with dots. Warming and eCO₂ had opposite effects on seedling vigor, increasing it by 20% and decreasing it by 50%, respectively. The germination rate was influenced by the interaction of temperature and CO₂, mainly from the second to fourth days and the last days, while treatments did not affect the GSI and germination time (GT). Overall, germination rates were around or above 90%. This study demonstrates that warming (+2 °C) and eCO₂ (600 ppm) in the parental environment affect the reproductive and early survival strategies of *S. capitata* offspring. Our results provide a better understanding of the effects of simulated warming and elevated CO₂ on the quality and germination dynamics of this important tropical species.

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sciforum-116345: A Comparative Analysis of Novel and Established Olive Cultivars for Super-High-Density Olive Orchards

Xavier Rius Garcia^{1,2,*}, **Maria Videgain-Marco**², **Jose Casanova-Gascon**², **Luis Acuña-Rello**³ and **Pablo Martín-Ramos**³

¹ Agromillora Group, Plaça Manel Raventós 3-5, St. Sadurní d'Anoia, 08770 Barcelona, Spain

² Department of Agricultural and Environmental Sciences, Higher Polytechnic School of Huesca, University of Zaragoza, Ctra. Cuarte s/n, 22071 Huesca, Spain

³ Department of Agricultural and Forestry Engineering, ETSIAA, University of Valladolid, Avda. Madrid 44, 34004 Palencia, Spain

Introduction

The intensification of olive cultivation in Mediterranean regions faces significant challenges from increasing soil salinity, necessitating a comprehensive understanding of salt tolerance mechanisms across both emerging and established cultivars. Rising global temperatures and reduced water quality are exacerbating soil salinization, particularly affecting intensive olive orchards.

Goals

This study aimed to evaluate and compare salt tolerance mechanisms among three novel olive cultivars (Lecciana, Coriana, Siquitita) and two commercial standards (Arbequina, Arbosana). The investigation focused on characterizing their physiological responses, growth performance, and ion management strategies under saline conditions, with particular emphasis on identifying cultivar-specific adaptation mechanisms and their potential implications for breeding programs.

Methodology

Five olive cultivars were evaluated under controlled greenhouse conditions over a five-month period, using a salt stress treatment (0, 25, 50, and 75 mM NaCl). The comprehensive investigation encompassed multiple parameters: growth measurements (shoot length, trunk diameter, fresh and dry weights), physiological responses (stomatal conductance, transpiration rate), ion relationships (Na^+ , K^+ , Ca^{2+} , Cl^- concentrations in different tissues), and photosynthetic efficiency through chlorophyll fluorescence measurements.

Results

Genotype-specific variations in stress tolerance mechanisms were identified across cultivars, revealing distinct adaptation strategies. Siquitita emerged as promising for moderate-salinity conditions, demonstrating effective biomass maintenance and enhanced stomatal conductance regulation under stress, though showing sensitivity in photosynthetic parameters (reduced $\text{PI}(\text{abs})$ and $\phi(\text{Po})$) at higher salinity levels. Chlorophyll fluorescence measurements revealed cultivar-specific responses: Lecciana maintained stable fluorimetry parameters and SPAD values under moderate salinity, while demonstrating superior potassium retention with the highest K^+/Na^+ ratios across treatments. Arbosana exhibited moderate tolerance across multiple parameters, maintaining consistent biomass production (with only 5.4% reduction at 75 mM NaCl) and showing intermediate photosynthetic responses. Coriana displayed variable responses, with stable fluorimetry values (F_v/F_m and ETo/RC) at moderate salinity but significant limitations in growth and ion discrimination under higher salinity levels. Ion compartmentalization analysis revealed shared patterns across cultivars, with roots accumulating the highest Na^+ concentrations (1.51% at 75 mM NaCl) and wood tissue maintaining the lowest levels (0.54%).

Conclusions

Cultivar performance under saline conditions depends on the complex interaction between growth maintenance, photosynthetic efficiency, and ionic regulation capacity. Siquitita shows promise for areas with moderate salinity where biomass maintenance is crucial, while Lecciana may be more suitable where ion regulation capacity is the primary concern. These findings emphasize the complexity of salt tolerance mechanisms in olive trees and the need for site-specific cultivar selection based on both environmental conditions and desired performance characteristics.



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sciforum-114658: Analysis of secondary metabolites in agricultural residues of jicama (*Pachyrhizus erosus*) under biotic stress by UV spectrophotometry and HPLC

Verónica Cuellar Sánchez^{1,*}, Georgina Calderón Domínguez¹, Ma de la Paz Salgado Cruz¹,
Marcela González Vázquez² and José Honorato Arreguín Centeno³

¹ National School of Biological Sciences, National Polytechnic Institute, Mexico City CP 07738, Mexico

² Institute of Pharmacology, University of La Cañada, Teotitlán de Flores Magón CP 68540, Oaxaca, Mexico

³ Department of Agronomy, National Technological Institute of Mexico/IT de Roque, Guanajuato CP 38194, Mexico

Jicama (*Pachyrhizus erosus*) is a rustic growing plant, of which the only edible part is its tuberous root. It is native to Mexico and Central America, with a national production of 187,916.54 tons in 2023. Currently, the plant has been affected by the attack of pests such as *Phyllophaga* spp. (white grub), causing economic losses for agriculturalists and an increase in agro-industrial residues which have not been given any use. In addition, there are no studies that evaluate the presence of secondary metabolites when jicama is under biotic stress (damage by pests) that could generate toxic compounds such as cyanogenic glycosides, or even some with functional properties such as flavonoid glycosides and hydroxycoumarins, which develop during the process of plant direct defense, especially against the attack of insects. For the above, the present work aims to carry out a comparative study of secondary metabolites, as well as compounds of industrial interest present in healthy and plague-damaged jicama (*Pachyrhizus erosus*). To this end, the following are proposed to determine the presence of secondary metabolites in healthy (CJ) and damaged jicama damaged by *Phyllophaga* spp. (SJ), and will qualitatively be established; finally, the cyanogenic glycosides, hydroxycoumarins, and flavonoid glycosides will be characterized by HPLC. According to the results, the extracts that presented the highest content of saponins were those of jicama at 100 and 140 days of maturity in jicama with stress, decreasing in control jicama. In tannins, no significant differences were observed between the samples at 100 and 180 days, while at 140, the stressed jicama had the highest tannin content; in the case of flavonoids and phenols, the same behavior was observed at 100 and 140 days. The following were found in phenolic compounds: ascorbic, caffeic, rutin, pelargonidin, and ferulic acid. Finally, these results provide a broad understanding of jicama by providing information about morphometric, nutritional, and secondary metabolite changes during the tuberization process.



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sciforum-116497: Application of Iron Oxide Nanoparticles and Indole-3-Acetic Acid in Synthetic Seed Technology: Effects on Chrysanthemum Generative Growth, Metabolism, and Genetic Stability

Dariusz Kulus^{1,*}, Alicja Tymoszek¹, Katarzyna Gościńska², Mateusz Cichorek³ and Magdalena Osiał⁴

¹ Laboratory of Horticulture and Landscape Architecture, Department of Biotechnology, Faculty of Agriculture and Biotechnology, Bydgoszcz University of Science and Technology, Bydgoszcz, Poland

² Department of Agronomy and Food Processing, Faculty of Agriculture and Biotechnology, Bydgoszcz University of Science and Technology, Bydgoszcz, Poland

³ Department of Plant Physiology, Genetics and Biotechnology, University of Warmia and Mazury, Olsztyn, Poland

⁴ Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland

The increasing role of nanoparticles (NPs) in horticulture is transforming agricultural practices by enhancing plant growth, improving nutrient absorption, and enabling the precise delivery of agrochemicals. However, little is known about the use of NPs in the production of synthetic seeds, a propagation technique particularly valuable for seedless species. This research studied the impact of pure iron oxide nanoparticles (Fe_3O_4 NPs), citrate-stabilized iron oxide nanoparticles ($\text{Fe}_3\text{O}_4\text{CA}$ NPs), and indole-3-acetic acid (IAA) on the genetic stability and metabolic activity of *Chrysanthemum* $\times$ *morifolium* (Ramat.) Hemsl. plants obtained from synthetic seeds. For this purpose, axillary buds of chrysanthemum 'Richmond' were embedded in 3% calcium alginate supplemented with NPs and IAA, either singularly or in combination. Next, the synthetic seeds were either stored at 4°C in the dark (for eight weeks) or directly cultured in vitro on an agar–water medium at room temperature for 30 or 60 days. Next, the germinated seeds were transplanted to the greenhouse until the full flowering of the plants. The content of total polyphenols was determined in the leaves and inflorescences of the plants. Moreover, the content of anthocyanins was measured in the inflorescences. RAPD markers were used to assess the genetic stability of plants. It was found that NPs and IAA significantly affected the content of total polyphenols (TCPs) in the leaves of chrysanthemum. Most treatments stimulated the accumulation of these compounds but in a time-dependent manner. No decline in the value of this parameter was reported compared with the untreated control. Conversely, $\text{Fe}_3\text{O}_4\text{NPs}$ and IAA + $\text{Fe}_3\text{O}_4\text{CA}$ NPs stimulated the biosynthesis of polyphenols and anthocyanins in the inflorescences after 30 days of treatment; however, a decline in the content of these compounds was reported after 60 days in most experimental objects, except for $\text{Fe}_3\text{O}_4\text{CA}$ NPs and IAA + $\text{Fe}_3\text{O}_4\text{CA}$ NPs. RAPD analyses confirmed the genetic stability of the resulting plants. This study expands the knowledge on the application of nanoparticles in plant biotechnology.



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sciforum-116341: Beyond Traditional Rootstocks: Comparative Analysis of M-series and Commercial Grapevine Rootstocks Under Salt Stress

Xavier Rius Garcia^{1,2,*}, **Maria Videgain-Marco**², **Jose Casanova-Gascon**², **Luis Acuña-Rello**³ and **Pablo Martín-Ramos**³

¹ Agromillora Group, Plaça Manel Raventós 3-5, St. Sadurní d'Anoia, 08770 Barcelona, Spain

² Department of Agricultural and Environmental Sciences, Higher Polytechnic School of Huesca, University of Zaragoza, Ctra. Cuarte s/n, 22071 Huesca, Spain

³ Department of Agricultural and Forestry Engineering, ETSIAA, University of Valladolid, Avda. Madrid 44, 34004 Palencia, Spain

Background/Introduction

Rising soil salinity poses a significant challenge to Mediterranean viticulture, particularly affecting grapevine productivity and sustainability. While established rootstocks have demonstrated capacity to mitigate salt accumulation in grafted scions, the mechanisms and performance characteristics of novel rootstock varieties remain insufficiently characterized, creating a critical knowledge gap in viticultural adaptation strategies.

Goals

This investigation aimed to evaluate and compare the salt tolerance mechanisms of two novel M-series rootstocks (M2 and M4) against established commercial standards (1103 Paulsen and R110), with specific focus on their physiological responses, growth patterns, and ion management strategies under varying salinity conditions.

Methodology

This study implemented a controlled irrigation protocol with four salinity levels (0, 25, 50, and 75 mM NaCl) over a five-month period. Comprehensive assessment included growth parameters, photosynthetic efficiency measurements, chlorophyll content (SPAD) analysis, ion homeostasis evaluation, and systematic monitoring of visual stress symptoms.

Results

Analysis revealed distinct genotype-specific tolerance strategies among rootstocks. 1103 Paulsen demonstrated superior salt tolerance through maintained photosynthetic efficiency (maintaining 85-90% of control Fv/Fm values) and effective ion exclusion, showing moderate biomass reduction (58.8% decrease in dry weight) under severe stress. M2 exhibited exceptional biomass retention (47.3% reduction in fresh weight) and moderate ion compartmentalization capability, despite showing 30-35% reduction in photosynthetic performance under elevated salinity. R110 displayed effective ion management under moderate stress conditions (maintaining K⁺/Na⁺ ratios above 2.71 at 50 mM NaCl) but suffered substantial growth decline (59.7% reduction in fresh weight) at higher salinity levels. M4 emerged as the most salt-sensitive genotype, exhibiting the highest reductions in both biomass (69.0% decrease in fresh weight) and ionic balance (91% decrease in K⁺/Na⁺ ratio). Organ-specific analyses revealed specialized roles in salt stress management: roots accumulated the highest Ca²⁺ concentrations (4.82-6.44%); leaves showed dramatic increases in Cl⁻ content (from 0.08% to 3.25%); and stems maintained the highest Na⁺ levels (up to 2.37%), serving as crucial buffering zones protecting photosynthetic machinery.

Conclusions

These findings provide crucial insights into rootstock-specific salt tolerance mechanisms and establish a foundation for informed rootstock selection in salt-affected regions. The demonstrated variability in stress responses among genotypes offers valuable direction for

breeding programs aimed at developing salt-tolerant rootstocks for sustainable viticulture in increasingly challenging environments.



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sciforum-116349: Biorational-loaded Nanocarriers: Development and Field Validation for Sustainable Botrytis Control in Viticulture

Eva Sánchez-Hernández^{1,*}, Alberto Santiago-Aliste², Javier García-Martín^{3,4}, Marina Jambrina-González^{3,4}, Jesús Martín-Gil¹, José Casanova-Gascón⁵ and Pablo Martín-Ramos¹

¹ Department of Agricultural and Forestry Engineering, ETSIAA, University of Valladolid, Avenida de Madrid 44, 34004 Palencia, Spain

² Department of Construction and Agronomy, E. Politécnica Superior de Zamora, University of Salamanca, Av. de Requejo 33, 49029 Zamora, Spain

³ Beronia Rueda (González Byass), Camino de la Peña s/n, 47490 Rueda, Valladolid, Spain

⁴ Dominio Fournier (González Byass), Finca El Pinar, Berlangas de Roa, 09316 Berlangas de Roa, Burgos, Spain

⁵ Instituto Agroalimentario de Aragón-IA2 (CITA-Universidad de Zaragoza), EPS, Universidad de Zaragoza, Carretera de Cuarte s/n, 22071 Huesca, Spain

Background/Introduction

Botrytis cinerea Pers. is a devastating fungal pathogen affecting numerous crops, with particular significance in viticulture as the causative agent of grey rot. Under favorable climatic conditions, *B. cinerea* can cause 30–40% fruit losses, representing a major challenge for the wine industry. While chemical fungicides remain the primary control method, increasing pathogen resistance, concerns about human health and environmental impacts, and market demands for residue-free products necessitate alternative control strategies. Biorational products, particularly plant-derived antifungal compounds, show promise as fungal inhibitors, but their field application faces challenges including compound lability, poor solubility, and lack of specificity. Nanoencapsulation technology offers a solution to maximize biorational efficacy through improved delivery and stability.

Goals

This study aimed to develop and validate chitosan oligomer-based nanocarriers for the delivery of biorational antifungal compounds from Dyer's madder (*Rubia tinctorum* L.) and cat's claw (*Uncaria tomentosa* (Willd. ex Schult.) DC.) extracts for *B. cinerea* control in vineyards.

Methodology

This research combined laboratory and field approaches. System stability, the protection of bioactive compounds, and controlled release mechanisms were evaluated under laboratory conditions. Minimum inhibitory concentrations (MICs) were determined against *B. cinerea*. Field trials were conducted at D.O.P. Ribera de Duero (Bodega Dominio Fournier, González-Byass group), using commercial chitosan as a control, to assess effectiveness, phytotoxicity, and compatibility with vineyard management practices.

Results

The laboratory assays revealed significant pathogen inhibition with MICs ranging from 250 to 375 µg/mL, while maintaining the bioactive properties of the encapsulated compounds. The field trials demonstrated the high effectiveness of the nano-delivery systems, showing disease incidence rates of 18–35% depending on the encapsulated bioactive compound, compared to 85% in untreated controls and 37% with commercial chitosan. No phytotoxicity symptoms were observed. The treatment integrated well with current vineyard management practices and did not affect wine organoleptic properties.

Conclusions

The developed nano-delivery systems offer a viable, eco-friendly tool for sustainable viticulture, effectively controlling *B. cinerea* while maintaining wine quality. This approach presents new perspectives for sustainable disease management in high-value wine production.

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sciforum-117158: Deciphering the Performance of Groundnut (*Arachis hypogaea* L.) Genotypes in Acidic Soil: Insights from Morphological and Genetic Analysis

Md. Shaheenuzzamn¹, Md Sarowar Alam², Rehenuma Tabassum³ and Fakhrul Islam Monshi^{4,*}

¹ Senior Scientific Officer, Agronomy Division, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Ishwardi, Pabna 6620, Bangladesh

² Scientific Officer, Agronomy Division, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Akbarpur, Moulvibazar 3210, Bangladesh

³ Associate Professor, Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Bangladesh

⁴ Professor, Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet, Bangladesh

Groundnut (*Arachis hypogaea* L.) is a significant oilseed crop with high market demand in Bangladesh. However, its production is significantly hampered by abiotic stresses, including soil acidity, which is a major constraint in the Greater Sylhet region of Bangladesh. Acidic soils significantly constrain groundnut productivity by limiting nutrient availability and inducing toxicities, particularly of aluminum and manganese. Identifying genotypes with superior adaptation to acidic conditions is critical for sustaining yield and improving crop resilience. This study aimed to evaluate the performance of diverse groundnut genotypes under acidic soil conditions through morphological and genetic analysis. This study evaluated the performance of ten groundnut varieties under acidic soil conditions at the Regional Agricultural Research Station, BARI, Akbarpur, Moulvibazar, Bangladesh, during the Rabi seasons of 2021-22 (Y1) and 2022-23 (Y2). A randomized complete-block design with three replications was employed. The results revealed significant variations among genotypes in their adaptability to acidic conditions, with certain lines exhibiting superior growth performance and yield stability. The analysis of variance (ANOVA) revealed significant varietal differences in most traits across both years, including in plant height, root length, branches per plant, pods per plant, and yield components. Pearson correlation analysis highlighted strong positive associations between root length and fresh/dry stover yield, as well as pods per plant and pod yield per plant, underscoring their role in enhancing yield potential. Negative correlations were observed between harvest index and dry stover yield, indicating that high biomass production may reduce harvest efficiency. Principal component analysis (PCA) grouped the genotypes based on their yield and yield-related traits, identifying Basanti (DG-2), BARI Chinabadam-6, and BARI Chinabadam-9 as the top-performing varieties across both years. This comprehensive approach not only elucidates the morphological and genetic responses of groundnuts to acidic soil but also serves as a foundation for breeding and developing highly resilient varieties. These improved cultivars will be better equipped to thrive in acid-prone regions, ultimately enhancing productivity and sustainability in such challenging environments in Bangladesh.



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sciforum-116235: Effectiveness of a soy protein hydrolysate on lettuce growth and quality

Letizia Scarabattoli^{1,*}, Giulia Franzoni², Antonio Ferrante³ and Giovanna Speranza¹

¹ Università degli Studi di Milano, Dipartimento di Chimica, Via Golgi 19, 20133, Milano

² Università degli Studi di Milano, Dipartimento di Scienze Agrarie e Ambientali, Via Celoria 2, 20133, Milano

³ Sant'Anna, School of Advanced Studies, Pisa, 56127 Pisa PI, Italy

Background/Introduction

In recent decades, the scientific community, in collaboration with private companies, has proposed some technological innovations to improve the quality of agricultural products and make agriculture more sustainable, leading to a significant reduction in the use of fertilizers. Among these, biostimulants represent a promising innovation in agriculture. Protein hydrolysates are a category of biostimulants obtained through the hydrolysis of protein-rich biomass. Enzymatic hydrolysis, which is based on the use of proteases, is a viable alternative to chemical hydrolysis because it can be performed under mild conditions, avoiding side reactions without decreasing the nutritional value of the protein source.

Goals

The objective of this work is to examine the effects of two soy protein hydrolysates, namely SPH A and SPH B, on lettuce (*Lactuca sativa*, var. Batavia Canasta green) under no stress and in conditions of reduced NPK nutrition, in terms of both yield and other parameters.

Methodology

Lettuce plants were grown in an experimental greenhouse, under monitored conditions (25 ± 3 °C, 16 h photoperiod). The first group of plants (thesis 1, standard fertilization, 5 replicates) received complete fertilization (100% N). In the second group, mineral fertilization was reduced to 50% N (thesis 2, reduced fertilization, 5 replicates); the third and fourth groups of plants with 50% N fertilization received SPH A and SPH B, respectively. The nutrients used for fertilization were as follows: Ca(NO₃)₂, NH₄NO₃, K₃PO₄ and K₂SO₄. Destructive analyses were performed, such as total fresh biomass, chlorophylls a+b and carotenoids, the phenol index and anthocyanin, nitrate content, and total and reducing sugars.

Results

Significant differences between the control and stress plants were observed in lettuce yield. Moreover, yields obtained after treatments with SPH A and SPH B were slightly higher (+14% and +17%, respectively) with respect to the stress conditions. The results obtained for chlorophyll a+b, carotenoids and total sugar were not statistically significant. However, plants grown under optimal fertilization conditions showed the highest nitrate levels, while stress resulted in a significant drop regardless of whether treatment A or B was applied.

Conclusions

These results confirm that biostimulants cannot fully replace fertilizers but could be helpful in decreasing the quantity of mineral nutrition or aiding in nutrient deficiency. However, to achieve this goal, a thorough investigation is necessary in order to define not only the NPK uptake for each cultivar but also the application time and dose of protein hydrolysate for each crop and the environmental conditions.



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sciforum-116482: Effects of Water stress mitigation of new biostimulants on tomato leaves and fruits

Ilaria Marchioni*, Jasmine Hadj Saadoun, Martina Galaverni, Margherita Rodolfi, Deborah Beghè, Camilla Lazzi and Tommaso Ganino

Department of Food and Drug – University of Parma

Drought is one of the most relevant abiotic stresses that currently affect horticultural species, and it is mostly due to climate change. The negative effects of water shortage are mostly significant for high-water-demanding crops, such as tomato (*Solanum lycopersicum* L.), and they can occur as morphological, physiological, and biochemical alterations. Nowadays, biostimulants are considered a emerging key strategy for enhancing plant productivity and resilience to abiotic stresses, including drought.

The main goal of this work is to evaluate the effects of new foliar biostimulants on the physiological and biochemical properties of tomatoes (leaves and fruits) grown under water stress conditions in an open field.

Tomato plants (cv. 'Heinz 1301') were arranged on three experimental rows in open field conditions, each of which was subjected to three different irrigation (I) regimes: 100% (I-100), 60% (I-60), and 30% (I-30) of IRRIFRAME recommendations. The biostimulants were distributed by spraying directly onto the leaves: non-fermented kiwi residual biomasses (T2), kiwi residual biomasses fermented with *Lactiplantibacillus plantarum* 4193 (T3), and kiwi residual biomasses fermented with *Companilactobacillus farciminis* 4841 (T4). Control plants (T1) were sprayed with water only. Plant health was assessed after fruit colour change (R1, five weeks from the start of stress) and fruit ripening (R2, eight weeks from the start of stress), measuring leaf colour and SPAD index. At both R1 and R2, leaf samples were collected and analysed for their chlorophylls, polyphenols, total antioxidant content (DPPH assay), and proline content. Fruits were harvested when fully ripe, characterized by size and analysed biochemically (polyphenol, lycopene, and soluble sugar content; titratable acidity; and antioxidant activity).

Severe water stress (I-30) caused an increase in leaf SPAD index (R1), a reduction in a^* (redness) colour coordinates (R1 and R2), and a decrease in the total chlorophyll content (R1 and R2). This latter negative effect was reduced by all biostimulants. Leaves counteract drought stress by increasing their total polyphenols (R2) and proline content (R1) (only I-30), and no positive effect was detected for any treatments.

The reduction in fruit weight and size was observed under severe drought conditions. In I-60, an increase in the lycopene content was detected, along with a decrease in the percentage of titratable acidity and the fructose content. The use of the T3 biostimulant had a positive effect on the fruit size both in I-100 and I-60, also showing the highest content of polyphenols in I-30, in comparison with the other treatments.



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sciforum-118244: Explant type as a key factor in adventitious organogenesis success of *Galanthus nivalis* in vitro

Monika Cioć* and Barbara Prokopiuk

Department of Ornamental Plants and Garden Art, Faculty of Biotechnology and Horticulture, University of Agriculture in Krakow, 29 Listopada 54, 31-425 Kraków, Poland

Galanthus nivalis (snowdrop) is a popular ornamental, bulbous plant, widely admired for its early spring bloom and delicate white flowers. It also has medicinal significance, with reported health benefits including antioxidant and anti-inflammatory properties. The in vitro propagation of this plant remains challenging, and reports on its micropropagation in the literature are limited.

This study investigated the impact of explant type on biometric parameters during adventitious organogenesis. Two types of explants collected from in vitro cultures of *G. nivalis* were used: leaf blade fragments (leaf-derived explants) and bulb fragments (bulb-derived explants). Culture was carried out on solidified Murashige and Skoog medium enriched with 30g/L sucrose and the following growth regulators: 5 µM 6-benzyladenine cytokinin (BA) and 0,5 µM auxin 1-naphthaleneacetic acid (NAA). The conditions in the growth chamber, with a 16/8 h photoperiod (day/night), were as follows: temperature 25/23 ± 1°C, 80% relative humidity, PPFD ~ 35 µmol m⁻²s⁻¹. After 6 weeks of culture, biometric observations were carried out. All explants used regenerated (100%), but only leaf-derived explants formed calluses (80%). A higher regeneration of shoots (developing leaves without bulbs at the base) was observed from leaf-derived explants (regeneration rate of 1.00) compared to bulb-derived explants (0.21). Explant type did not significantly affect the regeneration rate of bulbs (closed bulbs without developing leaves). However, the number of bulbs was higher from leaf-derived explants (mean of 7.04 per one explant) compared to bulb-derived explants (2.33). Bulb-derived explants did not regenerate roots, while leaf-derived explants regenerated roots with a rate of 0.94, producing an average of 2.33 new roots with a mean length of 5.8 mm per explant. Explant type did not affect the average number of new shoots (mean of 6.4), nor the average diameter of newly formed bulbs (2.6 mm).

Leaf-derived explants of *G. nivalis* showed more effective regeneration during in vitro adventitious organogenesis compared to bulb-derived explants, with higher shoot and root formation, as well as a greater number of new bulbs. This potential can be used for improving the propagation efficiency of these plants.



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sciforum-118185: Exploring the Diverse Functions of Acyl-CoA-Binding Proteins in the Chinese Gutta Percha Tree: Insights into Developmental Processes and Drought Stress Adaptation

Yang Yang

Hainan Normal University

To comprehensively identify acyl-CoA binding protein (ACBP) genes in the Chinese gutta percha tree, we utilized known ACBP sequences from Arabidopsis, rice, and poplar as references, employing blastp, hmmer, and domain analysis techniques. This led to the identification of five distinct ACBPs (EuACBP1-EuACBP5) characterized by varying amino acid content and molecular weights, all of which are acidic with an instability index suggesting inherent instability. Chromosomal mapping revealed these genes on chromosomes 7 and 8, with a uniform distribution across different plant species' chromosomes. Exon-intron organization analysis indicated a consistent structure within subgroups, reflecting potential functional significance and evolutionary patterns. Predicted subcellular localizations showed EuACBP1, EuACBP2, and EuACBP4 in the cytoplasm, while EuACBP3 and EuACBP5 were in the chloroplasts and nucleus, respectively. Comparative phylogenetic analysis categorized EuACBPs into four subgroups, highlighting the evolutionary relationships with homologous genes from Arabidopsis, rice, and poplar. Cis-acting element analysis of promoter regions identified motifs related to stress responses, hormone response, and plant growth, suggesting regulatory roles in various physiological processes. Tissue-specific expression analysis demonstrated distinctive patterns, with EuACBP1 predominantly in seeds and EuACBP5 in roots and stems, indicating their involvement in specific biological functions. Seasonal and drought stress expression analysis revealed significant seasonal specificity and varied responses to drought stress, emphasizing their roles in plant adaptation. This study enriches our understanding of the ACBP gene family in the Chinese gutta percha tree, providing a foundation for future research into their functional dynamics under environmental stresses. Comprehensive gene interaction network, miRNA regulatory effects, and KEGG pathway enrichment analyses further highlighted their crucial roles in metabolism, genetic information processing, and cellular processes. These findings underscore the potential genetic targets for enhancing stress resistance and adaptability in plants. This study comprehensively identified and characterized five ACBP genes in the Chinese gutta percha tree, revealing their distinct amino acid content, subcellular localizations, and chromosomal distributions. Phylogenetic analysis categorized these genes into four subgroups, highlighting evolutionary relationships. Promoter analysis uncovered cis-elements related to stress and hormonal responses, while tissue-specific and seasonal expression patterns indicated their roles in various biological functions and stress responses. These findings enhance our understanding of the ACBP gene family, providing a foundation for future research on their functional dynamics and potential applications in improving stress resistance and adaptability in plants.



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sciforum-116253: Impact of Harvest Season and Solvent Selection on Bioactive Compound Profiles and Antioxidant Capacity of *Prunus spinosa* Fruits

Radenka Kolarov^{1,*}, **Mirjana Ljubojević**², **Jelena Čukanović**², **Đurđa Petrov**³, **Nevenka Galečić**³, **Dejan Skočajić**³ and **Mirjana Ocokoljić**³

¹ Department of Field and Vegetable Crops, Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia

² Department of Fruit growing, Viticulture, Horticulture and Landscape architecture, Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia

³ Department of Landscape Architecture and Horticulture, University of Belgrade - Faculty of Forestry, Kneza Višeslava 1, 11030 Belgrade, Serbia

Background

Blackthorn (*Prunus spinosa* L.) fruits are rich in bioactive compounds, including tannins, flavonoids, and anthocyanins, known for their antioxidant properties and potential applications in functional foods.

Goals

This study investigated the effects of harvest timing in summer and winter and in solvents such as distilled water and 70% ethanol on the chemical composition and antioxidant activity of blackthorn fruit extracts.

Methodology

Following analytical protocols, the total phenols and tannins, flavonoids, and anthocyanins were determined spectrophotometrically. The tannin content was determined by the difference between total phenols and non-tannic phenols. The efficiency of natural antioxidants in the tested samples was determined spectrophotometrically using the FRAP, ABTS+, and DPPH methods.

Results

The results reveal significant seasonal and solvent-based differences in the chemical composition and antioxidant properties of blackthorn fruits. Winter-harvested fruits consistently show higher concentrations of bioactive compounds compared to summer fruits. Ethanol consistently proves to be a more efficient solvent, yielding higher values for all measured parameters across both seasons, although the seasonal differences are less pronounced in ethanol extracts. Fruits collected during winter, with their higher antioxidant capacity and bioactive content, are particularly promising for applications in functional foods or nutraceuticals, especially when processed using ethanol-based extraction methods. Ethanol consistently outperformed water as a solvent, yielding higher concentrations of bioactive compounds and antioxidant activity. Winter-harvested fruits showed a significant increase in tannins (104% higher in water extracts and 50% in ethanol extracts), flavonoids (93% higher in water extracts), and anthocyanins (61% higher in water extracts), while summer ethanol extracts had 15% more anthocyanins. Antioxidant activity, assessed through FRAP, DPPH, and ABTS assays, was notably greater in autumn fruits, with water extracts showing 35–49% higher activity and ethanol extracts displaying 9.5–24% higher activity.

Conclusions

These results highlight the critical role of harvest timing and solvent choice in maximizing the extraction of bioactive compounds and antioxidant potential. Winter fruits, especially when extracted with ethanol, are particularly valuable for developing health-promoting products, emphasizing the importance of optimizing these factors to enhance the nutritional and functional properties of blackthorn fruits.



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sciforum-115514: Incidence and resistance of suckers from *Xylella fastidiosa*-infected olive trees

Letizia Portaccio^{1,*}, Marzia Vergine², Mariarosaria De Pascali², Luigi De Bellis² and Andrea Luvisi²

¹ Department of Biological and Environmental Sciences and Technologies, University of Salento, Lecce, 73100, Italy *
Corresponding author: Letizia Portaccio (e-mail: letizia.portaccio@unisalento.it)

² Department of Biological and Environmental Sciences and Technologies, University of Salento, Lecce, 73100, Italy

Introduction

Xylella fastidiosa (Xf) is a Gram-negative bacterium (Janse & Obradovic, 2010: <https://www.jstor.org/stable/41998754>) that affects numerous plant species, including olive trees, and causes Olive Quick Decline Syndrome (OQDS). Xf obstructs water and nutrient transport by colonizing the xylem vessels, leading to canopy desiccation and plant death. Despite severe damage, olive trees often produce basal shoots, or suckers, which represent a survival mechanism with a peculiar behavior in Xf-positive plants (Camposeo et al., 2022: <https://doi.org/10.3390/agronomy12122917>; Martelli, 2016: <https://doi.org/10.1007/s12600-015-0498-6>).

Goals

The most common reason for the development of suckers is the abandonment of fields, which favors the natural growth processes of the olive tree. These shoots may also represent a survival mechanism as the damaged tree tries to resist by producing suckers. This study aims to determine whether olive tree suckers exhibit enhanced defense mechanisms against Xf by analyzing sucker samples of different ages from three cultivars: Cellina di Nardò, Ogliarola, and Leccino.

Methodology

Four suckers from at least five plants per cvs were collected. Samples were cut from the sucker bases using a sterilized scissors. Approximately 1 g of tissue per sample was homogenized in extraction bags (BIOREBA, Switzerland) with 5 mL of CTAB buffer using a semi-automatic homogenizer (Homex 6, BIOREBA). DNA extraction followed the EPPO Bulletin (2004) (doi:10.1111/epp.12575), employing chloroform for protein removal and ethanol for precipitation. Real-time PCR was performed following Harper et al. (2010) (<https://doi.org/10.1094/PHYTO-06-10-0168>), and bacterial concentration, expressed as CFU/mL, was estimated according to D'Attoma et al. (2019) (<https://doi.org/10.3390/pathogens8040272>).

Results

Xf-incidence in suckers of Cellina di Nardò less than 5 years old was approximately 70%, with bacterial loads varying between 10^3 to 10^6 CFU/mL. These values slightly differed from those of the Ogliarola, in which more than two-thirds of the samples were negative in less than 5-year-old-suckers, while Xf-incidence reach 90% in older ones. The bacterial load in Ogliarola is also similar to Cellina, between 10^3 and 10^7 CFU/mL. Conversely, for Leccino, the younger shoots were mainly negative, while those older than 5 years were mostly positive with a bacterial count between 10^4 and 10^6 CFU/mL.

Conclusions

The findings highlight age-related and cultivar-dependent variability in *Xf* susceptibility among olive suckers. Younger suckers generally exhibited lower infection rates, suggesting a form of temporary resistance, but infection seems to progress as expected in older ones. Further research should explore additional factors, such as endophyte presence, to elucidate their potential role in sucker resistance.



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sciforum-116460: Influence of drought-priming on the improvement of cold-hardiness in grapefruit (*Citrus paradisi*) through the enhancement of physiological and biochemical attributes

Shahid Iqbal *, Carlos Eduardo Aucique-Perez and Muhammad Adnan Shahid

University of Florida

Influence of drought-priming on the improvement of cold-hardiness in grapefruit (*Citrus paradisi*) through the enhancement of physiological and biochemical attributes

Shahid Iqbal (shahidiqbal@ufl.edu) * USA

Carlos Eduardo Aucique-Perez (c.auciqueperez@ufl.edu) * USA

Muhammad Adnan Shahid (mshahid@ufl.edu) * USA

Priming is a phenomenon through which plants are initially exposed to one type of stress to prepare them to better handle another. There is a lack of scientific knowledge regarding the effect of drought-priming on the freeze tolerance mechanism in cold-sensitive grapefruit (*Citrus paradisi*). To investigate whether pre-freezing drought stress can serve as a primer in cold-hardiness, we subjected plants to drought-priming (50%, 75%, and 100% field capacity) and post-priming freezing stress (-6 °C). Drought-priming memory was found to enhance the ability of plants to withstand freezing temperatures by regulating their antioxidant system, osmolyte production, and carbohydrate metabolism. Drought-priming triggered the activities of antioxidant enzymes such as superoxide dismutase (SOD), peroxidase (POD), catalase (CAT), glutathione peroxidase (GPX), and ascorbate peroxidase (APX), in the range of 1.21, 0.11, 0.10, 1.42, 0.41, and 1.16 U mg⁻¹ protein, respectively, to reduce oxidative damage caused by an excessive formation of reactive oxygen species (ROS) like superoxide (O₂^{•-}) and hydrogen peroxide (H₂O₂), with a minimum concentration of 0.10 and 0.44 nmol g⁻¹ protein in primed plants. Drought-priming also accelerated the accumulation of osmolytes, including proline (0.91 mg g⁻¹ FW) and glycine betaine (0.98 mg g⁻¹ FW), and soluble sugars such as glucose (12.58 mg g⁻¹ DW), fructose (6.60 mg g⁻¹ DW), and sucrose (19.85 mg g⁻¹ DW), which help stabilize cellular structures and maintain osmotic balance under stressed conditions. Drought-primed plants also showed modulated carbohydrate metabolism, sugar biosynthesis, and reduced starch reserves. These adaptive changes helped plants better cope with subsequent freezing stress, improving their resilience by sustaining energy production, maintaining cellular integrity, and ensuring metabolic activity. This corresponding response highlights the valuable impact of drought-priming in improving cold-hardiness in young grapefruit plants through a comprehensive physiological and biochemical stress-alleviating mechanism and highlights the practical potential of drought-priming as a cost-effective and non-invasive strategy to improve cold-hardiness in citrus and related species. By integrating drought-priming into management practices, growers can enhance the resilience of young grapefruit plants to freezing conditions, contributing to sustainable citrus production in regions prone to cold stress or unexpected freeze events in winter or late summer.



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sciforum-118273: Investigating The Response of *Amaranthus caudatus* to Short-term Water Deprivation

Alice Mwanjiwa Kanyerere*, Mulisa Nkuna and Takalani Mulaudzi

University of the Western Cape

Background and Aim of the Study

The agricultural sector is facing enormous challenges to produce 70% more food to cater to the growing population regardless of the detrimental effects of climate change, mainly drought. In plants, water deprivation (WD) induces osmotic stress, leading to the over-accumulation of reactive oxygen species (ROS), which disrupt cellular homeostasis and impede plant growth and productivity. However, plants have evolved complex physiological and biochemical mechanisms to adapt to drought stress. Thus, sustainable agriculture is possible by cultivating climate-smart crops such as *Amaranthus* as an alternative food source. *Amaranthus* belongs to the Amaranthaceae family, which comprises over 70 species renowned for their high nutrient and antioxidant content, fast growth, and stress tolerance traits; however, its drought tolerance mechanism is not yet fully understood. Therefore, this study aims at understanding the effect of short-term water deprivation on *A. caudatus* genotypes including Red Garnet (RG), Love-Lies-Bleeding (LLB), and Ponytail (PT) grown in potting soil under greenhouse conditions.

Methods

Three *A. caudatus* genotypes were established for 2 weeks and then subjected to 7 days of water deprivation under controlled greenhouse conditions. The morpho-physiological parameters measured included fresh and dry weight, relative water content (RWC), and shoot length. ROS accumulation was detected using histochemical staining. Biochemical responses, including proline, hydrogen peroxide (H₂O₂), malondialdehyde (MDA), and total soluble sugars (TSS), were quantified.

Results and Discussion

Under water deprivation (WD), the genotypes exhibited distinct morpho-physiological and biochemical responses compared to well-watered (WW) controls. Red Garnet (RG) showed an increase in shoot length from 8.24 cm to 10.67 cm, while Ponytail (PT) displayed a slight increase from 4.55 cm to 4.60 cm, and Love-Lies-Bleeding (LLB) experienced a decrease from 4.69 cm to 4.01 cm. Fresh weight increased across all genotypes under WD, rising from 1575 mg to 1744.45 mg in RG, from 622.22 mg to 1143.33 mg in LLB, and from 510 mg to 933.22 mg in PT. Relative water content (RWC) remained relatively stable in RG and PT but increased in LLB from 47.83 mg to 58.11 mg. Reactive oxygen species (ROS) accumulation was evident under WD, with H₂O₂ quantification showing increases from 0.18 to 0.19 nmol/g FW in RG and from 0.17 to 0.21 nmol/g FW in LLB, while in PT it showed a decrease from 0.17 µmol/g to 0.14 µmol/g. Proline content increased in RG (51.5 to 56.28 µmol/g FW) and PT (30.77 to 43.09 µmol/g FW) but remained largely unchanged in LLB (39.86 to 40.55 µmol/g FW). Malondialdehyde (MDA) increased in PT from 14.01 to 15.83 mmol/g FW, with smaller changes observed in RG and LLB.



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sciforum-116321: Meta-analysis of available transcriptomic datasets reveals core pathways in the high-light stress response of *Arabidopsis thaliana*

Aleksandr V. Bobrovskikh^{1,*}, Ulyana S. Zubairova² and Alexey V. Doroshkov³

¹ Department of Biotechnology of Agricultural Plants, Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 630090, Russia

² Laboratory of Artificial Intelligence and Big Genomic Data, Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 630090, Russia

³ Sector for the Study of Monogenic Forms of Common Human Diseases, Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 630090, Russia

Introduction and Aim

The study of the genetic systems that are involved in regulating plant stress responses is a promising approach to uncovering the fundamental molecular mechanisms underlying their organization. The availability and intensity of sunlight are among the primary factors influencing plant growth, development, and metabolism. Long-term exposure to excessive light levels is one of the major stress factors that inhibit photosynthesis, restrict growth and developmental processes, and reduce plant productivity. Transcriptomic data can help assess the involvement of genes under different stress conditions and identify key genes and transcription factors involved. Furthermore, meta-analysis of transcriptomic data is a powerful approach for identifying key molecular genetic systems that are involved in plant stress responses.

Materials and Methods

To date, a substantial amount of transcriptomic data on plants' responses to high light are only available for the model species *Arabidopsis thaliana*, which requires further generalization. This study builds upon our previous meta-analysis, significantly expanding it by incorporating a larger number of datasets. We collected and performed a de novo analysis of data from more than twenty individual transcriptomic experiments on the photosynthetic tissues of *A. thaliana* plants when exposed to various high-light conditions (moderate and severe excess illumination, ranging from several minutes to several days) for the Columbia genotype.

Results and Discussion

We identified a core subset of 1019 differentially expressed genes (DEGs) that were represented in at least half of the experimental points of high-light treatments. This subset is significantly enriched with various stress-responsive genes, including light stress and oxidative stress ones, and 117 transcription factors from bHLH, ERF, MYB, bZIP, C2H2, and other families. Most antioxidant DEGs were found to be preferentially upregulated under high-light conditions (42 out of 62), and almost half of the DEGs involved in the biosynthesis of secondary metabolites were upregulated (386 out of 754); however, most DEGs of hormone signal transduction pathways were characterized by preferential downregulation (70 out of 151). We additionally revealed more than 2000 DEGs to be highly specific to the main experimental conditions (duration of treatment, intensity of high light, age of plants). Taken together, our results align with existing findings, while significantly expanding and refining them.

Future Perspectives

The applied bioinformatics approach has proven effective and can be used to generalize various large sets of stress-induced plant transcriptomes.



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sciforum-116869: Multi-Omics approaches for identifying Salt- and Drought-tolerant Olive Cultivars

Alessandra Francini

Institute of CROP SCIENCE, SCUOLA SUPERIORE SANT'ANNA , 56010, via Alamanni 22, Ghezzano (PI), Italy

Introduction

Salinity and drought could be considered the most common environmental constraints in the Mediterranean area. Olive is a tree that is adapted to long dry periods and saline soil, but the degree of tolerance to these two adverse situations is cultivar-dependant. However, drought and salinity are two abiotic stresses that are increasingly present in the Mediterranean region, and identifying olive cultivars that can tolerate these adversities is a research priority.

Goals

As salinity and drought are limiting factors for olive production, the goals of this research were to detect consistent descriptors that could be used for underlying genotype-dependent performance under conditions of environmental disturbance that will occur in the future due to climate change, such as drought and salinity stress for olive plants.

Methodology

The multi-omics approach was used for screening olive cultivars that are well adapted to drought and salinity, including 'Phenomic', 'Ionomic', 'Transcriptomic' and 'Metabolomic' approaches. Using the 'Phenomic' approach, the physiological responses to the photosynthetic process in terms of gas exchange regulation and chlorophyll a fluorescence can be investigated. Moreover, visible symptoms of salt and drought stress, including foliar chlorosis and necrosis, reduced growth, and a general reduction in leaf area, can be monitored. Using the 'Ionomic' approach, the macro- and micro-element imbalance in all organs of olive trees were evaluated. Finally, the 'Transcriptomic' and 'Metabolomic' approaches were used to reveal the genes and metabolic pathways that are regulated in olives and determine their sensitivity or tolerance under drought and salinity conditions.

Conclusions

Considering recent research on olive under drought and salinity conditions, an overview of the principal mechanisms that olive plants adopt to overcome these two abiotic stresses is provided, examining anatomical, physiological, and metabolic traits. The selection of these traits could be used as a rapid olive screening method for selecting cultivars that can keep up with climate change without losing productivity.



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sciforum-120512: Octanoic Fatty Acid Significantly Impacts the Growth of Foodborne Pathogens and the Quality of Mabroom Date Fruits (*Phoenix dactylifera* L.)

Elshafia Ali Hamid Mohammed ^{1,2,3,*}, Károly Pál ⁴ and Azza Siddig Hussien Abbo ^{5,6}

¹ Department of Animal Husbandry, Institute of Animal Science, Biotechnology and Nature Conservation, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, 4032 Debrecen, Hungary

² Doctoral School of Animal Science, University of Debrecen, Böszörményi út. 138., Hungary

³ Agricultural Research Corporation, Integrated Pest Management Research Center, Wadmadani, P.O. Box 126, Sudan

⁴ Institute of Food Technology, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, 4032 Debrecen, Hungary

⁵ University of Khartoum, Department of Crop Protection, Faculty of Agriculture, Khartoum North, Sudan

⁶ Ministry of Municipality, Doha, Qatar

Mabroom date (*Phoenix dactylifera* L.), which belongs to the *Arecaceae* palm family, has gained considerable importance as a staple food source for millions of people worldwide. This species is recognized as one of the most important agricultural crops in Qatar. Fresh fruit dates are susceptible to mold and postharvest bacterial spoilage, resulting in significant financial losses. Octanoic fatty acid (OFA) has been shown to regulate the growth of disease-causing organisms such as fungi and bacteria. It is known to have antibacterial properties. The objective of the current study was designed to evaluate the effect of OFA on postharvest pathogens of mabroom fruits under in vitro conditions. Fresh, healthy, and fully ripe mabroom dates were obtained from the National Agriculture and Food Corporation (NAFCO). The chosen fruits were packed in sterile, well-ventilated plastic boxes and transported under controlled conditions. Then, the fruits were distributed into five groups (G1 to G5). The groups G1, G2, and G3 received 1, 2, and 3.5% OFA, respectively, while G4 was left untreated and G5 was washed only with tap water. Each group contained 200 g of fresh and healthy semi-soft dates. The samples were then dried and incubated in a humidity chamber at 25°C ±2 for seven days. Signs and symptoms of decay were monitored and recorded. The presence of pathogens was confirmed by way of phenotypic- and microscopic-based methods. The results showed a significant difference ($P \leq 0.05$) between the groups. OFA at 3.5% had the strongest inhibitory action against postharvest pathogens, followed by OFA 2%. However, there were no differences ($P \leq 0.05$) between OFA 1% and the control groups. *Aspergillus niger*, *Penicillium* spp., *Rhizopus* spp., and *Botrytis* spp. were most abundant in the control group, followed by OFA 2% and OFA 1%, respectively. In conclusion, octanoic fatty acid at 3.5% may improve the quality of date fruit through its high antimicrobial activity, reduce the effect of post-harvest decay, minimize the loss of date fruit during storage, and improve the sustainability of date fruits.



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sciforum-118194: Ozone and plant defenses: a new strategy to protect plant health?

Chiara Pastacaldi^{1,2,*}, Dario Gaudio¹, Cosimo Beltrami¹, Benedetta Gunnella¹ and Stefania Tegli^{1,2}

¹ Laboratorio di Patologia Vegetale Molecolare, Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali (DAGRI), Università degli Studi di Firenze, Florence, Italy

² Joint Lab Ozone Plant Health, DAGRI, Università degli Studi di Firenze, Florence, Italy

In a world increasingly threatened by climate change, the agricultural sector faces several challenges in keeping up with the rising demand for food while minimizing its environmental impacts. With growing awareness of the harmful effects of traditional pesticides and fertilizers, the development of innovative and eco-friendly strategies to protect plant health has become pivotal for sustainable agriculture. In this scenario, ozone (O₃), a powerful oxidizing agent, presents a promising eco-friendly alternative due to its rapid degradation and the fact that it does not release harmful residues into the environment. However, despite its potential, the molecular mechanisms underlying the role of O₃ in plant defenses are not fully understood.

This study aimed to investigate the bioactivity of O₃ on the growth, development, and defense responses of plants. Specifically, O₃ was applied as ozonated water to the soil of plants grown in pots in field experiments. The model plant *Nicotiana tabacum* and agronomically important crops such as tomato, lettuce, and bean were included in this study. Furthermore, O₃ was directly applied to the nutrient solution of hydroponically grown lettuce. Several physiological parameters were assessed, including plant weight, chlorophyll content, and stomatal conductance, to evaluate the effects of O₃ on plant growth. Moreover, differences in the expression of specific defense-related genes, including those involved in the auxin and salicylic acid (SA) pathways, were evaluated in O₃-treated plants and compared to untreated control plants. The analysis of these physiological parameters revealed that the effects of O₃ were species-specific, with varying responses among the plant species tested. Additionally, gene expression analysis revealed that the O₃ treatment led to significant changes in hormonal and defense signaling pathways. Notably, O₃ induced plant defenses, primarily through the activation of pathogenesis-related (PR) proteins and the SA pathway. Overall, these findings provide valuable insights into the potential of O₃ as an elicitor of plant defense mechanisms, which could enhance plants' resistance to both biotic and abiotic stresses.



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sciforum-116458: Photosynthetic damage in citrus leaves under freezing stress revealed by OJIP chlorophyll fluorescence kinetics

Carlos Eduardo Aucique-Perez *, Iqbal Shahid and Muhammad Adnan Shahid

Horticultural Science Department, North Florida Research and Education Center, University of Florida/IFAS, Quincy, FL, 32351, USA

Cold stress in citrus fields is threatening fruit production and the establishment of new fields in the north of Florida. Losses in the photosynthetic capacity of citrus plants under low temperatures result from stomatic and non-stomatic limitations derived from structural damage in cell membranes. The present study was conducted to gain insight into how the photosynthetic machinery of citrus leaves is affected by freezing temperatures, using the method of OJIP fluorescence transients. Two-year-old citrus plants were transferred to the growth chamber and posteriorly submitted to a progressive temperature reduction from 22 °C to reach -6 °C. The plants were kept at -6 °C by 1.5 h. The OJIP test was measured on leaves ($n = 6$) that were darkness-adapted using a portable LI-6800 fluorometer. A light pulse of $1 \mu\text{mol photons m}^{-2} \text{s}^{-1}$ for 50 ms was applied to determine the minimum fluorescence (F_0), followed immediately by a light saturation pulse of $3000 \mu\text{mol photons m}^{-2} \text{s}^{-1}$ for 1 s to determine the maximum fluorescence (F_m), the maximum photosynthetic quantum yield of PSII (F_v/F_m), and the actual quantum yield of PSII (photosystem II) electron transport (Φ_{PSII}). Freezing stress caused a significant reduction in F_0 , F_m , F_v/F_m , and Φ_{PSII} parameters, confirming structural and functional damage in the photosynthetic machinery of citrus leaves. On the other hand, OJIP curves showed reductions in the fluorescence levels in the J-I and I-P stages, suggesting limitations in the reduction status of electron carriers (J-I stage) and dysfunctionality in the PSI (photosystem I) because of a low electron flow (I-P stage). Our data demonstrated the negative impact of the freezing stress at specific points of the electron transport chain of photosynthesis. In addition, the OJIP test is a powerful tool to characterize photosynthetic damage and its promising use in high-throughput plant phenotyping programs, which are focused on the selection of citrus plants with high basal tolerance to cold stress.



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sciforum-116252: Proline Accumulation and Expression Profiles of Metabolism-Related Genes in Almond Trees in Response to *Xylella fastidiosa*

Mariarosaria De Pascali*, Marzia Vergine, Luigi De Bellis and Andrea Luvisi

Department of Biological and Environmental Sciences and Technologies, University of Salento, Lecce, Italy

Introduction

In Salento (Apulia, South Italy), *Xylella fastidiosa* subsp. *pauca* (Xf) has caused significant damage to the local economy, highlighting the urgent need for crop renewal aimed at developing new production chains and increasing the biodiversity of the area. To achieve this, it is essential to use species that are considered immune or resistant to the bacterium. The almond tree (*Prunus dulcis* Mill.) is an excellent candidate, as some varieties have shown resistance to the bacterium and can also grow in conditions of water shortage. Additionally, almond tree cultivation holds significant traditional and economic value in the Apulia region.

Goals

In this work, we report the performance of two almond cultivars, “Filippo Ceo” and “Tuono”, which are presumed to be resistant to Xf. We evaluated changes in various physiological parameters, focusing on the proline content and the expression profiles of genes associated with its metabolism, as proline plays a key role in plant stress responses. Insights from this analysis may reveal stress tolerance mechanisms and support sustainable strategies to combat Xf.

Methodology

This study was conducted in an 18-year-old almond orchard in Veglie (Lecce, Italy), an area that has been affected by Xf since 2015, using a randomized block design with seasonal sampling. The bacterial concentration was measured in CFU/ml (D'Attoma et al. 2019), while the proline concentration was determined using the method developed by Bates et al. (1973). Our gene expression analysis involved RNA extraction with a CTAB-based protocol, cDNA synthesis with TaqMan® reagents, and Real-Time PCR using SYBR Green. Expression levels were calculated using the $\log_2 2^{-\Delta\Delta C_t}$ method.

Results

During the 2023–2024 trial, no trees exhibited significant symptoms of Xf infection. The PCR analyses identified approximately one-third of Xf-positive plants, which showed bacterial concentrations below 10^3 CFU mL⁻¹. The free proline content was low in healthy uninfected plants but significantly increased in Xf-positive ones of both cvs, with no significant variation across different sampling periods. Moreover, genes linked to proline metabolism were induced by Xf, with notable differences in expression levels between the two cvs.

Conclusions

Proline is a multifunctional amino acid that plays a pivotal role in plant stress responses. In the context of resistance to Xf infection, proline accumulation and its metabolic pathways may provide insights into the mechanisms underlying stress tolerance and adaptation. Such findings may be useful in the development of targeted breeding programs and sustainable management strategies to mitigate the impact of Xf.



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sciforum-118258: Salad and vinegar: can Wood Vinegar promote growth in lettuce and basil under nutrient stress?

Leone Boatto^{*}, Dario Gaudio¹, Chiara Pastacaldi, Cosimo Beltrami and Stefania Tegli

Laboratorio di Patologia Vegetale Molecolare, Dipartimento di Scienze e Tecnologie Agrarie, Alimentari Ambientali e Forestali (DAGRI), Università degli Studi di Firenze, Florence, Italy.

Hydroponic farming is a sustainable method for growing crops without soil, but maintaining optimal nutrient levels is essential for plant health and yield. Although the hydroponic system is a more controlled environment than soil, plant protection remains crucial. Currently, several natural treatments are adopted in hydroponic farming to boost the plants' immune systems and mitigate stress and nutrient imbalances without relying on harmful chemicals. Wood vinegar, a natural byproduct of biomass pyrolysis, has gained attention for its potential to enhance plant growth and stimulate plant defenses. With an estimated 200 billion tons of lignocellulosic biomass produced annually by agriculture and forestry worldwide, the utilization of such byproducts could play a key role in sustainable agricultural practices.

This study investigates the impact of wood vinegar on hydroponic lettuce (*Lactuca sativa*) and basil (*Ocimum basilicum*) under nutrient stress, aiming to explore the possibility of applying lower quantities of chemically synthesized nutrients and achieving more sustainable production. Several separate and independent experiments were conducted for lettuce and basil, with each species undergoing four treatments. The control groups included one with 100% nutrient solution and another with a nutrient-deficient solution (*i.e.* 20%). Two additional treatments combined the 20% nutrient solution with wood vinegar at 0.3% and 0.1% dilutions of an extract that had a total phenolic content of 2,3 mg/mL. Wood vinegar was applied weekly. Growth parameters were measured to assess its potential benefits.

The results showed species-dependent and concentration-sensitive effects. In basil, the 0,1% treatment slightly increased the plant height and leaf number compared to the 20% control, suggesting a mild growth-promoting effect. However, the 0.3% concentration was shown to be phytotoxic and reduced plant growth. In lettuce, the 0.3% treatment led to severe phytotoxicity, significantly stunting growth. The 0.1% treatment initially performed similarly to the 20% control but, by the sixth week, caused root blackening and decay, leading to a marked decline in plant health.

These findings suggest that the effects of wood vinegar depend on both the concentration and the plant species. While a lower concentration showed slight benefits for basil, it ultimately harmed lettuce by damaging its root health. Higher concentrations were phytotoxic to both crops. These results indicate that while wood vinegar may have potential as a plant growth enhancer, concentration management is crucial. Further research should explore its long-term impact on root health and its interactions with hydroponic nutrient solutions to determine its viability in nutrient-limited hydroponic systems.



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sciforum-116350: Smart Delivery of Biorationals: A Novel Strategy Against Root Crop Pathogens

Eva Sánchez-Hernández ^{1,*}, Rubén Celada-Caminero ^{1,2}, Alberto Santiago-Aliste ³,
Vicente González-García ⁴, Jesús Martín-Gil ¹, José Luis Marcos-Robles ⁵ and Pablo Martín-Ramos ¹

¹ Department of Agricultural and Forestry Engineering, ETSIIAA, University of Valladolid, Avenida de Madrid 44, 34004 Palencia, Spain

² AIMCRA, Association for the Improvement of Sugar Beet Cultivation, Calle de Villabañez 201, 47017 Valladolid, Spain

³ Department of Construction and Agronomy, E. Politécnica Superior de Zamora, University of Salamanca, Av. de Requejo 33, 49029 Zamora, Spain

⁴ Biopesticides Group, Instituto de Ciencias Agrarias-CSIC, C/ Serrano 115 dpdo, 28006 Madrid, Spain

⁵ Department of Materials Science and Metallurgical Engineering, Graphic Engineering, Cartographic Engineering, Geodesy and Photogrammetry, Mechanical Engineering, and Manufacturing Process Engineering, ETSIIAA, University of Valladolid, Avenida de Madrid 4

Background/Introduction

Sustainable disease management in horticultural crops, particularly root vegetables, faces significant challenges due to the dependence on synthetic fungicides. Nanotechnology presents promising applications in agriculture, offering solutions to increase crop production while reducing environmental impact. Nanocarriers (NCs) enable the efficient transport of biologically active molecules, minimizing the required amount of bioactive compounds and allowing for controlled release over time. However, the integration of biorational products with nanotechnology for root crop protection remains largely unexplored.

Goals

This study aimed to develop and evaluate chitosan-based NCs loaded with biorational compounds from Dyer's madder (*Rubia tinctorum* L.) and cat's claw (*Uncaria tomentosa* (Willd. ex Schult.) DC.) extracts for the sustainable control of major root crop pathogens.

Methodology

The research encompassed laboratory experiments, controlled environment in vivo tests, and field studies. In vitro experiments evaluated efficacy against *Botrytis cinerea* Pers., *Cercospora beticola* Sacc., *Rhizoctonia solani* J.G.Kühn, and *Sclerotinia sclerotiorum* (Lib.) de Bary. Artificial inoculation in vivo trials were conducted on sugar beet and carrot plants under controlled conditions. Field validation was performed during the 2024 growing season at AIMCRA's (Asociación de Investigación para la Mejora del Cultivo de la Remolacha Azucarera) testing plots in Villafranca de Duero (Valladolid, Spain), specifically focusing on *Cercospora beticola* control.

Results

Laboratory studies demonstrated significant mycelial growth inhibition, with effective concentrations ranging from 187.5 to 375 µg/mL for *R. tinctorum*-loaded NCs and 187.5 to 500 µg/mL for *U. tomentosa*-loaded NCs. Controlled environment trials achieved complete plant protection at doses between 187.5 and 500 µg/mL, varying by pathogen. Field trials showed superior control of *C. beticola* compared to other non-synthetic fungicides, with no observed phytotoxicity symptoms.

Conclusions

The developed biorational-loaded nanocarriers demonstrate significant potential as sustainable alternatives to conventional fungicides in root crop production. This approach offers an effective pathway for reducing synthetic chemical inputs while maintaining robust crop protection, particularly for sugar beet disease management.



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sciforum-118267: Use of glue traps for the control of Cherry fruit fly (*Rhagoletis cerasi* (L.) (Diptera: Tephritidae) as a component of an organic protection system

Igor Shevchuk ^{1,*}, Oleksandr Denisiuk ¹ and Olga Shevchuk ²

¹ Institute of Horticulture, National Academy of Agrarian Sciences of Ukraine

² Institute of Plant protection, National Academy of Agrarian Sciences of Ukraine

The cherry fly (*Rhagoletis cerasi* (L.) (Diptera: Tephritidae) poses a significant challenge in Ukraine, necessitating continuous monitoring and the implementation of protective measures to mitigate its impact on crop yield. This pest is also common in numerous countries across Europe, Asia, and North America. Colored glue traps have emerged as a key component in the arsenal of control measures against the cherry fly. Specifically, yellow glue traps have demonstrated remarkable efficacy in detecting adult cherry flies and in monitoring the population dynamics of the pest, facilitating the timely application of insecticides and other protective measures. Glue traps have been identified as a viable, environmentally safe measure within organic protection systems. In particular, our studies demonstrated their efficacy against the black plum sawfly.

This study was conducted to assess the effectiveness of yellow glue traps for controlling *Rhagoletis cerasi* in sweet cherry plantations (cv. Amazonka) under the conditions of the northern Right-Bank Forest-Steppe of Ukraine. The traps were installed immediately following the onset of flight, which coincided with the change in the color of the early ripening fruits from green to yellow. The experiment involved the deployment of two to seven traps per tree, with no insecticides being applied to the experimental plots.

Depending on weather conditions, the flight period began in the middle to the end of May and lasted until the beginning to the middle of July. With 2-3 traps per tree, the reduction in fruit damage by cherry fly was low. As the number of traps increased, their effectiveness became higher. For variants with four and five traps, the effectiveness of the protective measure ranged from 69.5 to 70.3%. The average number of captured adults was 1,145 and 1,220 imago/trap per season. Further increasing of the number of traps per tree did not lead to a significant increase in efficiency.

In conclusion, the findings of the study indicated that the optimal number of traps for providing effective protection of cherries from the cherry fly ranged from 4 to 5 per tree.



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sciforum-117978: Volatile Organic Compounds as Diagnostic Biomarkers for Seed-Borne Pathogens: a Sustainable Approach to Legume Crop Health Management

Dario Gaudioso *, Luca Calamai, Chiara Pastacaldi, Cosimo Beltrami, Leone Boatto and Stefania Tegli

Laboratorio di Patologia Vegetale Molecolare, Dipartimento di Scienze e Tecnologie Agrarie, Alimentari Ambientali e Forestali (DAGRI), Università degli Studi di Firenze, Florence, Italy

Leguminous crops are a cornerstone of global agriculture, valued for their high protein content, nitrogen-fixing capabilities, and contribution to sustainable food systems. As global demand for legumes rises, so does the risk of spreading seed-borne pathogens, including *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* (*Cff*), a Gram-positive bacterium causing the "bacterial wilt of common beans". Legumes not only provide a low-cost, high-quality source of proteins but also play a crucial role in biodiversity conservation and ecosystem services. They contribute significantly to global diets, particularly in emerging countries, where they account for over 60% of protein intake. Their ability to improve soil fertility and their gluten-free nature further enhance their value in sustainable agriculture and human nutrition. Despite these benefits, the expansion of legume cultivation and trade has heightened the risk of spreading seed-borne pathogens. The latent nature of *Cff* infections and its systemic colonization of xylem tissues complicate early detection, highlighting the need for innovative diagnostic strategies.

The potential of volatile organic compounds (VOCs) as biomarkers for non-invasive pathogen detection was explored through the characterization of VOC profiles emitted by different *Cff* strains in vitro. More than 100 VOCs were identified, with five major compounds—2-methyl-1-butanol/3-methyl-1-butanol, phenylmethanol, 6,10-dimethyl-5,9-undecadien-2-one, and 2-methoxy-4-vinylphenol—produced by *Cff* strains in legume flours. These compounds were chosen based on statistically significant differences in production or degradation between *Cff*-inoculated and non-inoculated samples. VOCs were analyzed using HS-SPME-GC-MS (headspace solid-phase microextraction coupled with gas chromatography–mass spectrometry). Samples were incubated at 60°C for 10 minutes before exposing the SPME fiber to the headspace for 30 minutes. Further in vivo validation on artificially *Cff*-infected Cannellino beans confirmed the diagnostic relevance of phenylmethanol and 2-methoxy-4-vinylphenol, which uniquely differentiate *Cff* from other bacterial pathogens, including *Pseudomonas savastanoi* pv. *phaseolicola* and *Xanthomonas phaseoli* pv. *phaseoli*. Additionally, VOC profiles produced by *Cff* strains varied significantly when grown on legume flours compared to synthetic media, reinforcing the potential of substrate-specific VOCs for pathogen identification.

Accordingly, VOC fingerprinting emerges as a promising tool for the rapid and reliable screening of asymptomatic seeds, offering a sustainable approach to seed health management. Given the increasing globalization of seed trade, improving phytosanitary control is mandatory to prevent the introduction of seed-borne pathogens into new regions. The development of portable VOC-detection technologies could enhance pathogen surveillance at critical points in the seed trade chain, mitigating risks of disease outbreaks and supporting sustainable legume production in the face of growing global challenges.



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sciforum-116580: Warming and water deficit alter the sporoderm and starch content in the *Stylosanthes capitata* pollen grain

Fernando Bonifácio-Anacleto^{1,2,*}, **Andrea Guadalupe Reutemann**³, **Juca Abramo Barrera San Martin**³, **Raul Ernesto Pozner**³, **Carlos Alberto Martinez**⁴ and **Ana Lilia Alzate-Marin**^{1,2}

¹ Department of Genetics, Ribeirão Preto Medical School, University of São Paulo, Av. Bandeirantes 3900, Ribeirão Preto, SP 14049-900, Brazil

² Department of Genetics, Graduate Program in Genetics, Ribeirão Preto Medical School, University of São Paulo, Av. Bandeirantes 3900, Ribeirão Preto, SP 14049-900, Brazil

³ Institute of Botany Darwinion (National Council of Scientific and Technical Research), Labardén 200, CC 22, San Isidro, BA, Argentina

⁴ Department of Biology, Ribeirão Preto School of Philosophy, Science and Literature, University of São Paulo, Av. Bandeirantes 3900, Ribeirão Preto, SP 14040-901, Brazil

Increased temperature (*eT*) and water stress (*wS*), alone and in combination, are among the factors that have the greatest influence on plant development and reproduction in the tropics. Using the T-FACE (Temperature Free-Air Controlled Enhancement) facility to increase canopy temperature integrated with a drip irrigation setup, under field conditions, we investigated the effects of water deficit and warming (+2 °C) on the pollen grains of *Stylosanthes capitata*, a leguminous species native to Brazil with significant economic and ecological importance. Plants were subjected to four treatments: *aToW* (ambient temperature with optimal water conditions), *aTwS* (ambient temperature with water stress), *eToW* (elevated temperature with optimal water conditions), and *eTwS* (elevated temperature combined with water stress). Flowers collected in the experiment were dehydrated in increasing ethanol series, pre-included in absolute ethanol and resin, and embedded in synthetic resin for pollen structure analysis within the flower's keel. Sections were cut with a Leica rotary microtome (2-4 microns) and stained with Toluidine Blue (TB) and Periodic Acid-Schiff (PAS). Histochemical staining included Alcian Blue, Sudan Black, Sudan III, Coomassie Blue, and Basic Fuchsin. PAS and PAS+TB reactions identified positive starch with Lugol's stain added. Analyses were conducted using a Nikon Microphot-FXA Fluorescence Light Microscope (LM). The results revealed a significant interaction between elevated temperature and water deficit on starch density within the pollen grains. As an immediate response to the imposed stresses, the starch within the pollen grain acts as an energy source to sustain pollen tube growth and facilitate successful fertilization. Moreover, the combination of these stresses led to the compaction of the intine in the pollen grain aperture region, which may hinder pollen tube germination and disrupt the reproductive processes of the species. These findings suggest that the physiological changes induced by water deficit, in combination with elevated temperature (+2 °C), can significantly impact the reproductive success of *S. capitata*.

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sciforum-118208: Waterlogging-Induced Stress and Its Synergistic Effects on Peach Gummosis: Mechanisms and Mitigation Strategies

Muhammad Asim¹, Mian Muhammad Ahmed^{1,2,*} and Muhammad Atiq Ashraf¹

¹ National Key Laboratory for Germplasm Innovation and Utilization of Horticultural Crops, Huazhong Agricultural University, Wuhan, 430070, Hubei, China

² College of Life Science and Technology, Tarim University, Alar, China

Waterlogging-induced stress significantly affects peach (*Prunus persica*) orchards, leading to physiological disturbances and increased susceptibility to diseases such as peach gummosis. This study investigates the synergistic effects of waterlogging and gummosis under controlled experimental conditions to determine the mechanisms linking soil saturation to disease severity. The experiment was conducted using *Prunus persica* cv. 'Spring Snow' plants grown in pots with well-drained loamy soil. Waterlogging treatments were imposed by submerging the root zone for 7, 14, and 21 days, while control plants were maintained at a 60% field capacity. Physiological responses, including root hypoxia (oxygen diffusion rate), chlorophyll content, stomatal conductance, and enzymatic antioxidant activity, were assessed. Additionally, gummosis severity was evaluated by measuring gum exudation rates and lesion development following inoculation with *Lasiodiplodia theobromae*.

Results revealed that prolonged waterlogging (≥ 14 days) significantly reduced root oxygen diffusion rates by 45%, leading to increased ethylene production and oxidative stress. Chlorophyll content and stomatal conductance declined by 32% and 41%, respectively, indicating waterlogging-induced photosynthetic impairment. Enzymatic antioxidant activity (SOD, POD, and CAT) initially increased by 25%, 18%, and 22%, respectively, but declined after 14 days, suggesting an overwhelmed defense system. The severity of peach gummosis was markedly higher under waterlogged conditions, with infected trees exhibiting 56% greater gum exudation and 48% larger lesions compared to non-waterlogged counterparts. Soil microbial analysis indicated a shift toward anaerobic and pathogenic fungal dominance in waterlogged soils, further aggravating disease incidence.

To mitigate these effects, the study evaluated the efficacy of microbial inoculants containing *Bacillus subtilis* and *Trichoderma harzianum*, as well as improved drainage practices. Trees treated with microbial amendments exhibited 38% lower gum exudation and 42% improved root recovery post-waterlogging. Additionally, trees grafted onto waterlogging-tolerant rootstocks (*Prunus persica* $\times$ *Prunus davidiana*) displayed 61% higher survival rates and 49% reduced gummosis severity compared to those on susceptible rootstocks. These findings underscore the importance of integrating water management strategies and biological control methods to minimize the adverse effects of waterlogging on peach trees. By identifying key physiological and microbial interactions, this research provides practical recommendations for improving orchard resilience under excessive soil moisture conditions.



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sciforum-118256: Wood-waste bio-products for sustainable agriculture: exploring plant–soil interactions in treated lettuce under abiotic stress conditions

Cosimo Beltrami^{1,*}, Carlos Garcia Izquierdo², Chiara Pastacaldi¹, Dario Gaudioso¹, Margherita Bellini¹ and Stefania Tegli¹

¹ Laboratorio di Patologia Vegetale Molecolare, Dipartimento di Scienze e Tecnologie Agrarie, Alimentari Ambientali e Forestali (DAGRI), Università degli Studi di Firenze, Florence, 50144, Italy

² Department of Soil and Water Conservation, Centro de Edafología y Biología Aplicada del Segura, C.S.I.C., Campus Universitario de Espinardo, Apartado de correos 164, C. P. 30100 Murcia, Spain

Many nations are promoting the use of renewable natural resources to address environmental and health challenges, using plant biomass management as a key strategy. Annually, 200 billion tons of lignocellulosic biomass are produced globally. Governments are implementing policies for a green, circular economy, focusing on high-value products and by-products, residues and waste reduction. Wood residues, for example, from managing forest and green areas, which are rich in bioactive compounds like tannins from plants such as chestnut, have a considerable potential for plant protection within the framework of truly sustainable agriculture by improving plant performance under climate stress, provided they are non-toxic to soil. Moreover, this approach is especially beneficial for marginal rural areas, offering economic opportunities and enhancing resilience to environmental challenges. In this study, a chestnut wood chip extract produced at both the lab and pilot scale was evaluated for its bioactivity and compared to several commercial biostimulants obtained through a pyrolytic process, for which limited scientific data are still available. After assessing the total phenolic content, several tests were performed on lettuce plants grown in arid frank sandy soil (Santomera, Murcia, Spain) under salt and water stress conditions, treated by fertigation with different concentrations of these extracts. The primary objective was to assess their potential in enhancing plant performance under stress factors. Chemical analyses were conducted on both treated and untreated plants to assess their content of micro- and macronutrients and heavy metals in order to evaluate the quality and safety of the final harvest. Additionally, the roots were examined to assess potential secondary, indirect effects of these treatments. Soil analyses were also carried out to investigate the impact of these extracts on the soil microbiome, soil enzyme activities, and overall soil quality. The results indicated no negative effects on soil quality, with values from treated soil being comparable to those of the negative controls. The extracts examined were shown to improve lettuce performance and yields under stress, thus ensuring greater product stability. However, the extracts differed in their overall effects on plant morphology and physiology, as well as in their bioactivity, exhibiting a dose-dependent effect.



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Session 3. Precision Horticulture

sciforum-116065: The impact of MoO₃ nanoparticles on peas' macro- and micro-elemental composition

Rūta Sutulienė^{1,*}, Aušra Brazaitytė¹, Ieva Karpavičienė² and Giedrė Samuolienė¹

¹ Lithuanian Research Centre for Agriculture and Forestry, Institute of Horticulture, Kaunas str. 30, Babtai, LT-54333, Lithuania.

² Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kaunas str. 30, Babtai, LT-54333, Lithuania.

Molybdenum (Mo) is an essential micronutrient and required for nitrogen metabolism and plant enzyme activity. Nanoparticles (NPs) have become an important research topic due to their ability to increase plants' nutritional efficiency and promote growth. Molybdenum trioxide NPs (MoO₃) may be a promising tool to improve the availability of Mo to plants. However, their effects on plants' micro- and macronutrient composition have not been sufficiently studied. The aim of this study was to evaluate the influence of MoO₃ NPs on micro- and macronutrient changes in pea plants (*Pisum sativum*). The research was carried out in a greenhouse, in which seven green pea (Respect') seedlings were grown in 10 L vegetative pots. When the peas reached the 39 BBCH growth stage, they were foliar sprayed to full wetness (ca. 14±0.5 mL plant⁻¹) or watered (100±1 mL per pot) with suspensions containing different concentrations of MoO₃ NPs: 0 (watered or sprayed with distilled water), 0.0125, 0.025, and 0.05 mg mL⁻¹. At the end of the experiment, peas were harvested to assess the interactive effects of MoO₃ NPs on their elemental composition. The results showed that exposure to MoO₃ NPs through the roots led to an increase in Mo content of up to 43%, while foliar treatment resulted in an increase of up to 47% in pea leaves. In pea stems, the Mo content increased by up to 34% when the plants were treated through the roots, and it rose even higher, by up to 46%, when the pea plants were treated through the leaves. When watering peas with MoO₃ NPs, the accumulation of Mo in the roots was 2 to 3.6 times greater, and after foliar application, the accumulation was 1.3 to 1.8 times higher compared with untreated plants. MoO₃ NPs strongly reduced the accumulation of Ca, Mg, Na, and Fe in pea leaves and stems. The study results reveal the potential of MoO₃ nanoparticles in sustainable crop production but emphasize the need for precise regulation of their use.



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sciforum-116490: A Preliminary assessment of a Predictive Model for Stomatal Conductance Using 'Fylloclip' Sensors

Pedro Tomas Bulacio Fischer^{1,*}, Gabriele Milazzo¹, Alessandro Carella¹, Roberto Massenti¹, Martin Thalheimer² and Riccardo Lo Bianco¹

¹ Department of Agricultural, Food and Forest Sciences (SAAF), University of Palermo, 90133 Palermo, Italy

² Research Center for Agriculture and Forestry Laimburg, Laimburg 6, 39040 Auer/Ora, Bz, Italy

The current trial investigated a low-cost leaf proximal sensor, known as 'Fylloclip', which detects the condensing water vapor resulting from the leaf transpiration process. This simple and inexpensive device enables an approximate evaluation of a plant's water status by comparing the daily patterns of leaf transpiration and solar radiation. In theory, when the plant is well hydrated, there is likely to be a strong correlation between condensation and sunlight. However, deviations from these patterns are indicative of a potential drop in the plant's hydration level. It is important to note that the sensor still requires validation with established parameters for assessing plants' water status. This study was conducted on one-year-old potted lemon trees grown in a greenhouse. Measurements included leaf transpiration (capacitance), stomatal conductance (g_s) assessed with a gas exchange analyzer, and climate data. Pearson correlation analysis was used to select relevant features, followed by a machine learning approach to develop a predictive model for g_s . The model incorporated capacitance data and other variables, including the leaf temperature, stem water potential, and air relative humidity. Among the tested models, Random Forest emerged as the most suitable, yielding an $R^2 = 0.72$ and a mean absolute error (MAE) = 13.53 between the observed and predicted g_s values. These results indicate that capacitance alone is insufficient for accurately predicting g_s . Integrating additional sensors, such as leaf temperature and relative humidity sensors, could improve the prediction accuracy. These preliminary results may serve as a starting point for developing models and algorithms to estimate plants' water status by correlating 'Fylloclip' output data with common indicators of plants' hydration status, such as the stem water potential and g_s . Moreover, this sensor may represent an affordable component of a Decision Support System (DSS) for efficient and sustainable irrigation management. The next step could be to test this sensor in an open field to obtain additional data supporting its validity.



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sciforum-118238: Agronomic and environmental evaluation of nitrogen enhanced-efficiency fertilizers in processing tomato

Beatrice Falcinelli*, Michela Farneselli, Andrea Onofri and Francesco Tei

Department of Agricultural, Food and Environmental Sciences; University of Perugia; Perugia; 06121; Italy

For optimal nitrogen (N) fertilization management in processing tomatoes, Nitrogen Enhanced-Efficiency Fertilizers (N-EEFs) can help regulate N availability in the soil, synchronize it with plant demand, and reduce the risk of N leaching. Within the Agritech project Task 3.2.2, two N-EEFs with different modes of action were selected to determine their effect on processing tomato growth, yield, and quality, as well as on N-leaching risks. These N-EEFs were AGROCOTE 44 2-3m (44% N, controlled release) and NUTRITEC 46 (46% N, with nitrification inhibitor).

Processing tomato (cv. HEINZ 5108) was transplanted on May 25, 2024, and four treatments were compared using a complete-block design with three replicates: the two abovementioned N-EEFs together with two controls, i.e., an unfertilized control and a control fertilized with urea. All fertilizers were broadcast at transplanting at a dose of 200 kg N ha⁻¹. Growth analyses were performed by sampling plants every 10–14 days from about 1 month after transplanting until the final harvest. N crop status was monitored at each sampling by a chlorophyll meter (SPAD-502, Minolta), sap nitrate meter (LAQUAtwin, Horiba), and a portable multispectral radiometer (Rapidsan CS-45). Plots were equipped with suction cup lysimeters to monitor the N leaching risk at 0.6 m depth.

Preliminary results suggest that N-crop status, plant growth, and yield were similar in the different fertilized treatments. On average, the aboveground biomass of fertilized treatments was approximately 8.5 t ha⁻¹ (dry weight), while the marketable fruit yield was 58 t ha⁻¹ (fresh weight). For fruit quality parameters, no significant differences were observed among treatments, although °Brix from EEF treatments was generally lower (on average 4.1 °Brix) than that for the urea (5.0 °Brix) and unfertilized treatments (4.8 °Brix). Concerning N-leaching, preliminary lysimeter data showed that cumulative N leaching over the crop cycle did not differ significantly among treatments. Future research will focus on replicating this experiment in spring 2025 to further investigate the effects of N-EEFs on processing tomato growth, yield, and nitrogen leaching.



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sciforum-115952: Application of the water footprint in sustainable management and protection of water resources for processed tomato cultivation in mediterranean environments

Nicolò Iacuzzi *, Noemi Tortorici and Teresa Tuttolomondo

Department of Agricultural, Food and Forest Sciences, University of Palermo, Viale delle Scienze 13, Building 4, 90128 Palermo, Italy

The water footprint is an environmental sustainability indicator gaining increasing importance for certifications and labels in agricultural production. Processed tomatoes require considerable amounts of water, and existing studies on water footprint present methodological uncertainties, often failing to account for the impact of different calculation strategies for water requirements. Furthermore, the growing challenges of water scarcity demand smart and innovative irrigation solutions. The aim of this study was to explore the impact of the calculation method and water requirement return strategy on the water footprint of processed tomatoes. This study was conducted during the spring-summer periods of 2022, 2023, and 2024 in two different coastal areas of Sicily. The processed tomato variety tested was Tayson F1 (Nunhems®). Water requirements were estimated using the FAO's CROPWAT 8.0 model, calibrated and validated for field data, as well as moisture (TEROS 12) and matric potential (TEROS 21) sensors placed in the soil. Additionally, two different irrigation strategies were evaluated for each of the two-water requirement return methods: full restoration of crop water requirements (FULL: 100% CWR) and regulated deficit irrigation (RDI: 70% CWR from transplanting to first flower emission; 100% CWR from first flower emission to fruit enlargement; 70% CWR from fruit enlargement to harvest). The CWR values, obtained for each calculation method and irrigation strategy, were used to calculate the total water footprint according to the guidelines of the Water Footprint Assessment Manual. Specifically, the CROPWAT 8.0 model overestimated the CWR by approximately 50 mm compared to the moisture sensors, resulting in an increase in all components of the water footprint. The results suggest not only inconsistencies in the classification of tomato production systems based on water footprint but also recommend the development and broader implementation of smart systems for determining CWR. Furthermore, this study highlights the potential to mitigate water scarcity challenges. Adopting a smart integrated approach becomes imperative for accelerating water security in sustainable agriculture, ensuring resilient and efficient water supply for future agricultural demands.



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sciforum-116439: Effect of methyl jasmonate on formation of adventitious bulbs in *Tulipa tarda* Stapf. in vitro culture

Małgorzata Maślanka

Department of Ornamental Plants and Garden Art, University of Agriculture in Kraków, Al.29 Listopada 54, 31-425 Kraków, Poland

In recent years, there has been growing interest in *Tulipa tarda*, a species belonging to the botanical tulip group, in the bulb plant market. This species is valuable as a bedding plant, mainly due to its multi-flowered stems and star-shaped, yellow flowers blooming in April, but also due to its ability to grow in one place for many years.

The low efficiency of traditional tulip propagation has led to the search for more effective in vitro propagation methods. The presented research focused on the formation of adventitious bulbs using methyl jasmonate (Me-JA) as a factor influencing micropropagation among ornamental geophytes.

The experiment used scales from adventitious bulbs obtained from an in vitro collection of *T. tarda* at the University of Agriculture, Kraków. The bulb scales (approx. 10 mm length, 4 mm width) were cultured in Petri dishes on MS solid medium containing 6% sucrose, 0-400 mg l⁻¹ Me-JA, and 0-0.5 mM 6-benzyl-aminopurine (BAP). After four weeks, Me-JA was removed from the medium. The cultures were maintained in the dark at 20°C.

After 12 weeks of culture, the presence of Me-JA alone in the medium reduced bulb formation. However, the combined application of 100 mg l⁻¹ Me-JA and 0.5 mM BAP enhanced the propagation efficiency (with 86% of explants forming bulbs) in comparison to the control (BAP treatment, with 70% of explants forming bulbs). Higher concentrations of Me-JA significantly reduced adventitious bulb regeneration, with only 38% of explants forming bulbs. An average of 1.2 adventitious bulbs per explant was obtained, which was not significantly higher than the control (1.1 bulbs per explant). All adventitious bulbs formed roots at a similar level (approx. 3 roots/bulb). The bulbs also began to develop leaves. The treatment with 100 mg l⁻¹ Me-JA and 0.5 µM BAP led to twice as many bulbs developing leaves (22%) compared with the control (10%).

In conclusion, the combined application of 100 mg l⁻¹ Me-JA and 0.5 mM BAP positively influenced adventitious bulbs regeneration and leaf development.

Future research should investigate the long-term viability of these bulbs and assess their performance under greenhouse or field conditions.



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sciforum-113327: Estimating the water requirements of citrus trees using multispectral and radar imagery

Yasmine Bouchibti ¹, Nouredine Belkadi ², Nour-Eddine Bassa ³, Allal Hamouda ¹ and Yassine Mouniane ^{4,*}

¹ Institute Agronomic and Veterinary Hassan II, Rabat, Morocco

² International Academy of Agricultural Technologies and Innovations, Casablanca, Morocco

³ International Academy of Agricultural Technology, Casablanca, Morocco

⁴ Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, Ibn Tofail University–KENITRA-University Campus, Kenitra 14000, Morocco

The efficient monitoring of crop water requirements is fundamental to ensuring sustainable agricultural practices and optimizing irrigation strategies to conserve increasingly scarce water resources. This study focuses on the integration of radar and multispectral remote sensing technologies to provide a precise, scalable, and continuous solution for assessing the water needs of orange trees, a key component of citrus cultivation. Radar images, with their unparalleled ability to penetrate cloud cover and operate independently of light conditions, enable uninterrupted temporal monitoring. By calculating radar indices such as VH-VV, these images contribute to accurate assessments of crop coefficients. Meanwhile, multispectral images, rich in detailed vegetation indices like NDVI, offer critical insights into the water status and overall vegetative health of plants, further enhancing monitoring precision. Data were acquired from Sentinel-1 radar and Sentinel-2 multispectral satellite missions over a comprehensive five-year period (2019–2023). This extensive dataset allowed for robust temporal and spatial analyses, capturing the dynamic water needs of orange trees across various growth stages and environmental conditions. Vegetation and radar indices were computed and integrated into advanced water requirement models, validated meticulously against reference field measurements. Results showed that multispectral-derived crop coefficients achieved a root-mean-square error (RMSE) of 0.1938 during periods of high water demand, underscoring the reliability of the approach. Radar-derived crop coefficients exhibited an even lower RMSE of 0.050, reflecting the superior accuracy of radar data in modeling water requirements. These findings highlight the transformative potential of combining radar and multispectral indices for irrigation monitoring. This integrated approach delivers unprecedented precision in both temporal and spatial scales, significantly reducing reliance on labor-intensive and time-consuming field measurements. The proposed methodology not only enables efficient water resource allocation but also supports informed decision-making in agricultural management, paving the way for enhanced crop productivity and resilience to climatic variability. Furthermore, this research provides a significant contribution to the global agenda for sustainable water management, addressing challenges in agricultural systems increasingly affected by water scarcity and environmental stresses. By advancing the application of remote sensing technologies, this study sets a benchmark for precision agriculture and offers a scalable framework adaptable to other crops and agro-ecosystems.



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sciforum-116425: Genetic Diversity of Jujube (*Ziziphus mauritiana*): Identifying Superior Genotypes for Yield and Biochemical Content in Medium Lowland Agroecosystems

Muntarina Hussan Mouri ^{1,*}, Mahadi Hasan Monshi ², Rehenuma Tabassum ¹, Sandip Debnath ³ and Fakhrul Islam Monshi ⁴

¹ Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh

² Green Care Agro Farm, Debidwar, Comilla-3530, Bangladesh

³ Department of Genetics and Plant Breeding, Institute of Agriculture, Visva-Bharti University, Sriniketan, West Bengal-731236, India

⁴ Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh

Jujube (*Ziziphus mauritiana* L.) holds untapped potential for morphological and biochemical diversity, yet their adaptation and performance under medium lowland agroecosystems remain underexplored. This study aimed to evaluate the genetic diversity, morphological traits, yield-related traits, and biochemical composition of 19 jujube genotypes to identify superior genotypes suitable for medium lowland conditions, typically utilised for irrigated rice cultivation in Cumilla, Bangladesh. The research was conducted over two consecutive growing seasons (2022-2023 and 2023-2024) and focused on assessing yield and biochemical components to determine overall genotype performance and adaptability. Genetic parameters such as the genetic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, genetic advance (GA), and genetic advance as a percentage of the mean (GA%) were analysed to quantify trait variability and selection potential. Notably, fruit length, fruit width, fruit weight, pulp weight, and vitamin C concentration exhibited high heritability and substantial GA, indicating their potential for genetic improvement. Correlation analyses revealed significant relationships between morphological and biochemical traits, with fruit size and weight positively correlated with total soluble solids (TSSs) and soluble sugars, whereas a negative correlation was observed with non-reducing sugar. Furthermore, fruit weight, pulp weight, juice weight, and TSSs were identified as key determinants for selecting high-yielding genotypes. Multivariate analyses, including hierarchical clustering, cluster mean evaluation, principal component analysis biplots, and heatmaps were employed to identify genotype groupings and trait-specific contributions and obtain variability for superior genotype selection. Among the evaluated genotypes, Ball Sunduri and Local Kul-4 demonstrated high performance in both yield and biochemical composition, making them suitable for cultivation in medium lowland agroecosystems. This study provides a nuanced understanding of the relationship between genetic diversity and environmental factors, contributing to the optimisation of jujube cultivation in diverse agroecological settings. By demonstrating the feasibility of medium lowlands as an alternative agroecosystem for high-value jujube production, this research paves the way for innovative land-use strategies and climate-resilient agricultural practices.



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sciforum-116488: Leaf spectral reflectance and machine learning for classifying olive tree cultivars in Northeastern Portugal

Pedro Marques *, Luís Pádua, Joaquim J. Sousa and Anabela Fernandes-Silva

University of Trás-os-Montes e Alto Douro

The identification of olive tree cultivars is essential to support agricultural sustainability, improve biodiversity conservation, and certify the traceability and the quality of olive oil. This is particularly important in regions such as Trás-os-Montes e Alto Douro in Portugal, where “Cobrançosa”, “Madural”, and “Verdeal de Trás-os-Montes” are predominant olive cultivars, being crucial in the agricultural economy, sustainability, and cultural heritage. As the world’s seventh largest producer of olive oil, Portugal depends on its olive-growing regions, with this region ranking as the second most important contributor to national production. Traditional methods for identifying olive cultivars rely on cataloging and using germplasm collections of cultivars and accessions, achieved through the application of both morphological and molecular markers. Nevertheless, these methods are laborious and time-consuming, limiting their scalability. Spectral reflectance analysis, using spectroscopic instruments to measure light interactions with plant surfaces at a specific wavelength, presents an efficient and reliable method for cultivar identification. In this study, spectral reflectance data from the leaves of “Cobrançosa”, “Madural”, and “Verdeal de Trás-os-Montes” olive tree cultivars were collected using a spectroradiometer (500–900 nm). To address the high dimensionality of the dataset, principal component analysis (PCA) was applied to retain essential information while reducing complexity, creating a dataset with 50 features and 432 samples (144 for each cultivar). Different machine learning algorithms—eXtreme Gradient Boosting (XGBoost), Random Forest (RF), Support Vector Classifier (SVC) and Decision Tree (DT)—were then trained to classify the olive tree cultivars, with XGBoost achieving the highest classification accuracy of 93.1%, while DT showed the lowest accuracy of 80%. The results also revealed a variation in the effectiveness of differentiating the three olive tree cultivars. The cultivar “Madural” demonstrated the highest F1-score (0.953), indicating clear spectral distinction from the others. In contrast, the cultivar “Cobrançosa” showed the least differentiation (F1-score of 0.918) due to a greater spectral overlap with the cultivar “Verdeal de Trás-os-Montes”. Thus, the results suggest the need for further refinement of the approach to address higher intra-class variability. This refinement would be particularly advantageous when incorporating new cultivars with spectral signatures that may increase interclass similarity. This study shows the potential of spectral reflectance and machine learning for precision agriculture. The results provide a methodology, even in preliminary stages, for applying spectroscopy to sustainable crop management. Future research could expand the dataset to include additional cultivars while exploring advanced machine learning techniques to further improve classification performance.



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sciforum-116561: Optimizing Drone Spraying in Mango Orchards with Ultra-Low-Volume Nozzle Configurations for Sustainable Agriculture in Northern India

Pritish Kumar Varadwaj¹ and Shefali Vinod Ramteke^{2,*}

¹ Professor, Department of Applied Sciences, Indian Institute of Information Technology Allahabad, Jhalwa, Prayagraj, Uttar Pradesh-211015

² Department of Applied Sciences, Indian Institute of Information Technology Allahabad

Mango cultivation in Northern India is crucial for the agricultural sector but faces significant challenges due to complex tree canopy structures, which hinder efficient and uniform application of agricultural treatments. This study explores the use of drone spraying technology with Ultra-Low Volume (ULV) nozzles to overcome these challenges, aiming to enhance resource efficiency and agricultural sustainability.

This research was conducted in mango orchards during the June–August 2024 growing season (during the mango flowering and early fruit-setting phase), utilizing two different types of ULV nozzles: TeeJet® 110° XR and HYPRO® ULV. These nozzles were systematically tested to assess their spray coverage and droplet penetration capabilities across various canopy layers—upper, middle, and lower. The methodology involved detailed evaluations under varying environmental conditions to measure the effectiveness of each nozzle in delivering dye, simulating the application of agrochemicals. The specific parameters measured included spray coverage area and droplet size distribution, assessed under different environmental conditions, including wind speed and humidity. The initial results highlighted the TeeJet® nozzle's superior performance in penetrating the upper and middle canopy layers, whereas the HYPRO® nozzle showed enhanced effectiveness in reaching the lower canopy. Statistical analyses, including ANOVA, revealed significant differences in spray distribution patterns based on nozzle type and canopy layer ($p < 0.05$). Post-hoc tests identified the optimal configurations for maximizing coverage and minimizing waste.

These findings highlight the importance of customized drone spraying strategies in modern agriculture. By selecting the appropriate nozzle types and configurations, farmers can significantly improve the precision of pesticide applications, reduce resource wastage, and mitigate environmental impacts. These insights are crucial for developing drone spraying protocols that can adapt to the specific physical and environmental contours of mango orchards. This study not only contributes to the field of precision agriculture, but also supports the development of sustainable farming practices that can be adapted to other crops and regions facing similar challenges.



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sciforum-117363: Precision Horticulture—A move towards attaining sustainability among farmers of South 24 Parganas, West Bengal, India

Panchali Sengupta

Department of Zoology, West Bengal State University, Berunanpukaria, Malikapur, Barasat, West Bengal, India

Precision in horticulture refers to a management strategy using electronic information amalgamating other technologies to gather, process and analyze spatial and temporal data. The goal of this strategy is to optimize agricultural outputs. Horticulture significantly contributes to Indian economy by augmenting farm output, generating employment and supplying raw materials. In contrast to traditional farming practices, the lack of advanced technologies for soil, light and temperature control, crop monitoring, water management, and pest and disease identification remains a major challenge in horticultural production. This study was conducted in Sonarpur, Mathurapur, Baruipur, Jaynagar and Lakhmikanapur blocks of South 24 Parganas, West Bengal, India. The study focused on the cultivation of *Solanum lycopersicum*, *Abelmoschus esculentus*, *Solanum melongena*, *Capsicum annuum*, *Raphanus sativus*, *Luffa acutangula*, *Lagenaria siceraria*, *Momordica charantica*, *Cucumis sativus* and *Cucurbita pepo* in mono-culture fields from January to December 2024. Transfer learning using ImageNet has been utilized for identification of vegetables whose pictures are already available. Images of remaining species (*Lagenaria siceraria*, *Capsicum annuum*, *Abelmoschus esculentus* and *Cucurbita pepo*) were also obtained from high-resolution RGB aerial cameras operating from 30, 40 and 50 meters above ground. Approximately 20 video frames per tree were captured, with a shift of 20 pixels per frame. KNN, SVM and Naïve Bayes were used for classification and detection of pest and diseases of crops also predicting crop losses. Equipped with computer vision, drones could monitor the quality of crop growth and minimize damage. The application of automated precision irrigation could also reduce wastages, improving resource utilization. AlexNet, VGG-16, ResNet- 50, Faster RCNN, YOLO v3, Mask RCNN, Inception ResNet architectural models were utilized for image processing. Mask-RCNN was helpful in detecting and counting the number of fruits while YOLOv3 proved beneficial with fruit localization. Fruit classification based upon the ripening stage was carried out using AlexNet, ResNet, VGG-16 and Inception Net. The ResNet model displayed an accuracy of 86.54%, F1 score of 0.849 and recall score of 84.1% for fruit detection. AlexNet also yielded fruitful results with a recall score of 88.14%, F1 score of 0.854 and an accuracy of 86.75%. Faster RCNN showed greater performance (mean average precision i.e. mAP-83%) as compared to Mask-RCNN (mAP-72.3%) and VGG-16 (mAP-70.38%) for disease identification. SVM classification reached the highest accuracy of 86.4% compared to KNN (81.4%) and Naïve Bayes (76%) for pest detection and classification. Future research could explore the integration of Industry 4.0 technologies, such IoT, cloud computing and blockchain, to further improve horticultural practices, optimize resource consumption and promote sustainability.



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sciforum-118243: Reducing nitrogen and phosphorus for sustainable soilless cultivation of saffron under controlled conditions

Stefania Stelluti^{1,*}, Francesco Berruto² and Valentina Scariot¹

¹ Department of Agricultural, Forest and Food Sciences, University of Torino. Largo Paolo Braccini 2, Grugliasco, TO, 10095, Italy

² Department of Agricultural, Forest and Food Sciences, University of Torino. Largo Paolo Braccini 2, Grugliasco, TO, 10095, Italy; Department of Life Sciences and Systems Biology, University of Torino, Viale P.A. Mattioli 25, Torino, I-10125 Italy.

Crocus sativus L., known for the precious spice of saffron, is a geophyte propagated through underground corms. Corm size influences both spice yield and the production of new corms, as corms below 10 g do not produce flowers in the same year. Saffron is mainly grown in open fields, but there is an increasing interest in growing it under controlled conditions. Precision farming can increase crop productivity, sustainability, and profitability by optimising input use through precise nutrient dosing. Therefore, the aim of this study was to evaluate the possibility of reducing nitrogen and phosphorus levels in soilless saffron cultivation without affecting production and quality. The experiment was carried out in an unheated greenhouse. Corms ≥ 19 g were planted at the end of the summer in 4 L pots, with one corm per pot, using sterile expanded perlite as the growing medium. Fertigation was applied every two weeks until leaf senescence in spring, using two different solutions: a modified Long-Ashton solution containing 600 μM phosphorus (P) and 2 mM nitrogen (N), and another Long-Ashton solution with half the concentrations of P (300 μM) and N (1 mM). Surveys were conducted on spice yield and quality during the flowering phase, as well as on morphological and physiological parameters along with corm yield during the vegetative phase. The results showed that the reduced concentration of the two macronutrients did not affect the analysed parameters. In both treatments, the spice yield was ~ 29 mg per corm and its quality was in the category I (ISO 3632). Leaf length (~ 38 cm), number (~ 42), and photosynthesis ($E = 3.2 \text{ mmol m}^{-2} \text{ s}^{-1}$, $A = 6.7 \text{ } \mu\text{mol m}^{-2} \text{ s}^{-1}$, $g_s = 174.2 \text{ mmol m}^{-2} \text{ s}^{-1}$, $C_i = 480.5 \text{ ppm}$) were also not affected. Lastly, corm production was ~ 5.5 per plant, with an average weight of ~ 3.2 g. These results are consistent with the fact that corm growth mainly depends on photosynthesis during the winter vegetative phase. Thus, fertiliser reduction could be a viable strategy for sustainable saffron production in soilless systems, potentially reducing environmental impacts and costs without compromising crop quality or yield.



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sciforum-116237: Unlocking the Potential of Dragon Fruit (*Hylocereus* spp.): A Comprehensive Assessment of Yield Traits and Biochemical Adaptation in Medium Lowland Agriculture

Mahadi Hasan Monshi^{1,*}, Muntarina Hussan Mouri², Fakhru Islam Monshi³ and Rehenuma Tabassum²

¹ Green Care Agro Farm, Debidwar, Comilla-3530, Bangladesh

² Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh

³ Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Fruit crops are highly vulnerable to climate change, which threatens global fruit production. Dragon fruit (*Hylocereus* spp.) has shown potential for heat and drought resistance, making it a promising candidate for cultivation in changing climates. This study assessed the adaptability of dragon fruit to medium lowland agroecosystems in Bangladesh over three years (2021-2023), focusing on morphological and biochemical traits across five genotypes at Cumilla. The research aimed to identify key traits related to yield and stress tolerance, employing statistical analyses such as ANOVA, boxplots, genotypic and phenotypic coefficients of variation (GCV and PCV), heritability, genetic advance as a percentage of the mean (GA%), Pearson's correlation, principal component analysis (PCA), and heatmap analysis. Morphological evaluation revealed significant genetic variation among the genotypes over the three years, particularly for fruit traits. Purple dragon exhibited the highest fruit weight (572.78g), pulp weight (434.99g), and peel weight (162.73g), whereas Vietnamese red had the lowest values for these traits (fruit weight: 210.45g; pulp weight: 145.22g; peel weight: 62.24g). However, Vietnamese red achieved the highest yield (10.24) in all three years, while purple dragon produced the lowest yield (4.75). Significant variation was observed in traits such as the number of branches per plant (1.57-9.94), flower bud length (19.56-26.11 mm), pericarpal length (203.78-245.65 mm), pericarpal width (31.78-39.98 mm), fruit length (9.95-17.23 cm), and fruit diameter (6.75-12.10 cm). Fruit weight showed significant positive correlations with pericarpal length ($r=0.91$), pericarpal width ($r=0.98$), fruit length ($r=0.98$), and fruit diameter ($r=0.96$). Yield correlated positively with the number of branches ($r=0.82$) and flower bud length ($r=0.64$). Biochemical traits also displayed considerable variability over the three years, with total soluble solids (TSS%) ranging from 9.76 to 16.58%, vitamin C ranging from 9.98 to 17.18 mg/100g, reducing sugar ranging from 6.87 to 9.83%, and total sugar ranging from 8.44 to 11.49%. Reducing sugar was positively correlated with total sugar ($r=0.93^{***}$) and TSS ($r=0.85^{***}$), while vitamin C showed a negative correlation with reducing sugar ($r=-0.88^{****}$) and TSS ($r=-0.84^{***}$). These findings provide insights into key traits that can be targeted in breeding programs to develop stable, resilient, and high-yielding dragon fruit varieties with desirable biochemical properties, capable of withstanding the increasing challenges posed by climate change.



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Session 4. Greenhouse and Indoor Farms

sciforum-116477: Citrulline spray treatments affect tomato and lettuce transplant production

Alessandro Esposito, Alessandro Miceli*, Alessandra Moncada and Filippo Vetrano

Dipartimento Scienze Agrarie, Alimentari e Forestali, Università di Palermo, Viale delle Scienze 4, 90128 Palermo, Italy

Citrulline is a non-protein amino acid intermediate in the arginine biosynthetic pathway. It has been observed to accumulate in plants such as watermelon, melon, and chickpea under environmental stress. It has also been demonstrated that this amino acid has the capacity to neutralise hydroxyl radicals and protect cellular enzymes from oxidative damage. It has been hypothesised that endogenous citrulline plays a role in facilitating nitrogen assimilation, deposition, and transport in higher plants. However, there is limited information on the effect of exogenous citrulline supplementation on crop plants. This study aimed to evaluate the effect of citrulline spray treatments on the growth of lettuce and tomato seedlings in transplant nursery production. The experiment was repeated over two production cycles during autumn and spring. The seeds of lettuce and tomato were sown in trays filled with a commercial substrate, and the plants were then grown in a greenhouse with an ebb-and-flow system supplementing a complete nutrient solution. The seedlings were sprayed with citrulline at increasing concentrations (0 , 10^{-5} , 10^{-4} , 10^{-3} , 10^{-2} , 10^{-1} M) in three distinct growth stages: at the emission of the first true leaf and after 7 and 14 days. Some morpho-physiological and chemical parameters (height, stem size, fresh and dry biomass, number of leaves, leaf area, SLA, WUE, NUE) were evaluated when the seedlings were ready for transplant (5-6-true-leaf stage). The supply of exogenous citrulline via foliar application had a positive effect on the growth rates and biomass accumulation of the seedlings of both species, with some differences according to the citrulline concentration and growth season. The intermediate doses of citrulline (10^{-4} - 10^{-3} M) produced a moderate positive effect on these parameters compared with the untreated control (0 M), whereas the highest growth-promoting effect was found at the highest dose of citrulline (10^{-1} M), especially during spring. Citrulline also positively affected the contents of mineral elements in the vegetable seedlings. Citrulline foliar treatments were found to exert a growth-promoting effect on tomato and lettuce plants, but further studies are necessary to fully understand its effect on plant growth and metabolism.



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sciforum-116392: Wild accessions of *Salicornia perennans* Willd. subsp. *perennans* as a sustainable solution for aquaculture effluents

Irene Ventura*, Martina Puccinelli and Tiziana Lombardi

University of Pisa

The growing demand for sustainable food production systems requires the development of innovative approaches to optimize the utilization of natural resources and reduce the environmental impact of human activities. Marine aquaculture, a significant source of marine-derived products, produces effluents rich in organic and inorganic compounds. If not properly managed, these effluents can lead to the eutrophication of aquatic ecosystems. The genus *Salicornia* (*Salicornia spp.*) has a great economic potential due to its multiple applications, ranging from culinary uses to biomass production for biofuels. Due to their natural ability to tolerate high salinity and phytodepuration capability, *Salicornia* species are the perfect candidates for sustainable closed-loop systems, such as aquaculture. However, the selection of wild local accessions and the optimization of cultivation practices are still poorly understood, especially in hydroponic systems using effluent from marine aquaculture. The aim of this study was to assess the adaptability of a local glasswort (*Salicornia perennans* Willd. subsp. *perennans*) to hydroponic cultivation using aquaculture effluent and to evaluate the yield and quality characteristics of the final product. Two wild accessions of *S. perennans* were used in this experiment. Seeds were collected from the two main saltmarshes within the Regional Park of Migliarino, San Rossore and Massaciuccoli (Pisa, Tuscany). The plants were grown for three months, in late spring, in a floating hydroponic raft system with four different nutrient solutions: a standard nutrient solution (0g/L of NaCl) for leaf vegetables; a salinized standard nutrient solution (25 g/L of NaCl); and two salinized artificial effluents (25 g/L of synthetic sea salt), one with the same mineral content of a real sea bream aquaculture effluent and the other with the same mineral content of the standard solution. In both accessions, an optimal mineral content and the addition of salt in the nutrient solution were essential for high total fresh biomass production, while the total dry mass content was not significantly influenced by the treatments. Regarding nutraceutical parameters, in both experiments, antioxidant capacity, flavonoids, phenols and nitrates showed a similar trend, with their content decreasing in salinized nutrient solutions compared to the non-salinized treatment. However, a higher total chlorophylls content was recorded in the fresh shoots grown in the non-salinized standard solution, but only for the Galanchio accession. The results show the feasibility of cultivating wild accessions of *S. perennans* using effluent from saline aquaculture systems. Furthermore, the mineral composition of the effluent is crucial to a high-quality product.



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sciforum-118265: Application of innovative technologies on growth and quality of leafy vegetables grown under high-salinity water in a floating-disk hydroponic system

Konstantinos Zoukidis ^{1,2,*}, Athanasios Gertsis ¹, Christos Kissoudis ¹, Ramonna Kosheleva ³, Antonios Apostolidis ¹, Zoi Pitsouni ², Efsthios Panagiotis Karapetsas ², Nikolaos Grammenos ², Georgios Strouthopoulos ¹ and Anastasia Giannakoula ²

¹ Department of Sustainable Agriculture and Management, Perrotis College, Thessaloniki, Greece

² Department of Agriculture, International Hellenic University, Thessaloniki, Greece

³ Hephaestus Laboratory, Department of Chemistry, Democritus University of Thrace, Kavala, Greece

Leafy vegetables often need a high quantity of water to grow and among the most critical factors and stressors are high soil and water salinity levels and the concomitant reduction in optimum arable areas. Salinity increases by the intrusion of salts in the underground and surface water due to overfertilization and reduces the amount of available freshwater for irrigation (Kumar, 2022). In the EU, especially in the southern European Member States, most of all arable land will be affected by salinization and yields of non-irrigated crops are projected to decrease by up to 50 % by 2050 (Christopoulos and Ouzounidou, 2021). The objective of this study was to evaluate irrigation with high-salinity water (ECi= 10 dS/m) with the application of two innovative technologies for growing leafy vegetables species in four different tanks. One technology is the use of a nanobubble (NB) generator (Hephaestus Lab: <https://chem.duth.gr/>) and the other is an electronic water treatment system, using low-frequency radiation waves (MAXGROW: <https://maxgrow.tech/>). The study was conducted in the Greenhouse Laboratory of the Perrotis College/American Farm School, Thessaloniki, Greece, under a floating-disk hydroponic system, in which three leafy vegetables species (endive and two lettuce varieties, Lollo Rossa and Butterhead) were grown in four different sections/tanks, each one filled with irrigation water of different salinity: a. Control (E.C.i ~1 dS/m); b. saline water (E.C.i = 10 dS/m) enriched with NB; c. saline water (E.C.i = 10 dS/m) + MAXGROW; and d. saline water (E.C.i = 10 dS/m) + MAXGROW + NB. Various vegetable agronomic parameters (total fresh weight, height, root weight, SPAD units, etc.), plant tissue analysis (macro- and micronutrients), water parameters (dissolved oxygen, pH, EC, nutrients, temperature, size and concentration of NB, etc.), and the environmental conditions [temperature (°C), humidity (%), PAR, and CO₂] inside the greenhouse were recorded. Additionally, quality parameters (Chlorophyll, flavanols, anthocyanins, etc.) were measured. This study will continue with evaluations in different vegetable species, growing seasons, and hydroponic systems to further assess the potential of the innovative system used in high salinity levels. The results so far showed that both water treatment devices increased yield. Finally, both innovative technologies could provide efficient energy use, low operation cost, and sustainability and mitigate high-salinity irrigation problems in crop production systems.



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sciforum-117917: Commercially available resistant cultivars that reduce the impact of diseases in courgette and pumpkin

Antonio Manzano Torres*, Israel Guerrero Cozar, Maria del Carmen Garcia Garcia, Francisco Miguel De Cara Garcia, Dirk Janssen and Maria Leticia Ruiz Garcia

IFAPA

The genus *Cucurbita* includes fourteen species, of which only three are cultivated on a global scale: *Cucurbita maxima* and *C. moschata*, commonly referred to as 'pumpkins', and *C. pepo*, known as courgettes. It is estimated that approximately 40% of global agricultural food production losses are due to pests and diseases. Among these, viruses, fungi, and nematodes are the most prevalent emerging threats worldwide.

The objective of this study was to analyse the commercial cultivars of the *Cucurbita* genus, focusing on quantifying their resistance to diseases caused by viruses and pests. Additionally, this analysis connected these resistance levels to the specific diseases that limit their production. To achieve this, data were collected from the 2023 edition of the Portagrano manual.

According to our analysis, 56% of the varieties of *Cucurbita* sp. that are available on the market do not have resistance to any disease. Based on typology, squash varieties that are destined for consumption have the highest number of cultivars with no genetic resistance (84%), while 90.6% of rootstock varieties and 74.4% of courgettes are resistant to some disease. Of all the commercially available courgette varieties, 69.2% have resistance to one or more viruses, while this percentage decreases considerably for pumpkins (9.2%) and rootstocks (3.2%). Resistance to fungal diseases is found in the majority in commercial rootstock varieties (93.3%). Fungal resistance is present in 55.2% of courgettes and 7.5% of pumpkins, but in the case of courgettes, it is mainly intermediate resistance to powdery mildew. Resistance to nematodes of the genus *Meloidogyne* is only found in 6.5% of the cultivars of *Cucurbita* sp. intended for use as rootstocks.

Among the virus-resistant cultivars, the majority are resistant to zucchini yellow mosaic virus (ZYMV), watermelon mosaic virus (WMV), and cucumber mosaic virus (CMV), with resistance rates of 69.54%, 55.75%, and 33.33%, respectively. Resistance to papaya ring spot virus (PRSV) and tomato yellow curl leaf virus (ToLCNDV) is less common, at 16.67% and 2.30%, respectively. Developing resistant varieties is a crucial strategy for crop improvement. Breeding for virus resistance can significantly mitigate the impact of diseases on cucurbit crops, leading to higher yields and enhanced sustainability. This approach also fosters a more resilient agricultural system, particularly in the face of changing environmental conditions. Our findings underscore the urgent need for increased investment in the improvement of courgettes and pumpkins to promote sustainable crop development.

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sciforum-116427: Comparative Study of 7 Varieties of “Garrofón” Bean: Agronomic and Quality Aspects

Montserrat Cano *, Fernando Pascual, María del Carmen García-García, María Esmeralda Delgado, María Medrán, Emilio Martín-Expósito and Leticia Ruiz

IFAPA La Mojonera. Andalusian Institute for Agricultural, Fisheries, Food and Organic Production Research and Training. CAPADR, Regional Government of Andalusia.

This work was carried out in the province of Almería (Spain), which has more than 33,464 ha of greenhouses, with bell pepper and tomato crops representing 37.2% and 25.6%, respectively, of the total area. This is why the introduction of other crops is necessary for the diversification of horticultural crops in the area.

The “garrofón” bean or lima bean corresponds to the species *Phaseolus lunatus* L. and is native to Central and South America. In Spain, it is mainly cultivated in the Valencian Community, mainly because its tender and tasty beans, known as “garrofós”, are used as an ingredient in the preparation of “paellas” (typical culinary dish of Valencia). The fruits are green pods containing several kidney-shaped seeds. The objectives of the trial were to evaluate, characterize, and select the accessions that were best adapted to greenhouse growing conditions and to the climatic conditions of the province of Almería, with milder winters than in its traditional growing area.

A 1000 m² greenhouse trial was carried out under netting, in which the agronomic performance of 7 cultivars of locust bean, 5 accessions from the COMAV germplasm bank (University Institute for the Conservation and Improvement of the Valencian Agrobiodiversity), and 2 commercial cultivars from the company Intersemillas S.A. (Pintada and Peladilla) was evaluated.

The total production obtained ranged from 7.2 kg.plant⁻¹ for cultivar BGV016529 to 14.3 kg.plant⁻¹ for cultivar BGV008283. The commercial cultivars Pintada and Peladilla yielded 9.2 and 10.4 kg plant⁻¹, respectively. However, no significant differences were obtained between cultivars.

As for quality analysis, all cultivars were first studied for physical parameters (weight, length, and width of the pod; weight, length, and width of the grain; number of grains per pod). As for chemical and nutritional parameters, acidity, texture, pH, soluble solids, and ascorbic acid content were measured.

The analyses showed that the pod length is between 12.9 and 16.1 cm and the width is between 3 and 3.3 cm. The number of grains per pod is 2.4–3.7, with a fresh weight of grain between 2.4 and 3.8 g. Values for acidity (around 0.03%) or ascorbic acid content (0.4 mg AA/100 mg p.f.) were very homogeneous among all the accessions. They did show variability in soluble solids content (between 1.3 and 1.8 °Brix) or firmness (between 26.8 N and 35 N).



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sciforum-117960: Aeroponic system vs pot-grown sweet basil (*Ocimum basilicum* L.), an all-year-round comparison of their intensive production and quality in a greenhouse in Tuscany (Italy)

Fatjon Cela*, Rita Maggini, Giulia Carmassi, Martina Puccinelli and Luca Incrocci

Department of Agriculture, Food and Environment, University of Pisa, Via del Borghetto 80 56124 Pisa, Italy

Basil is an important aromatic plant largely used in medicine and for the preparation of traditional dishes in the Mediterranean area. The purpose of this work was to compare two closed soilless cultivation systems—aeroponics and a pot system—in terms of the quality, shelf-life and yield of the sweet basil (*Ocimum basilicum* L.) they produced, which is grown in an all-year-round production site in Pisa, Tuscany (Italy). The content of total chlorophylls, carotenoids, total phenols, antioxidant capacity, and rosmarinic acid content, as well as a post-harvest storage analysis, were investigated in fresh-cut sweet basil from both cultivation systems. Numerous postharvest tests have been carried out during each season (spring, summer, autumn, winter), evaluating the quality of the basil after its packaging and storage in a fridge at about 6–8°C in the dark on different days after harvest (3, 6 and 9 days), simulating the normal commercial cycle of fresh-cut sweet basil in supermarkets. Our study showed that sweet basil plants cultivated in aeroponics produced almost double the yield for the same area, with a better water use efficiency (WUE), and had a higher shelf-life in comparison with basil grown in pots in the same periods and with the same climatic conditions. Tests of post-harvest production in sweet basil have shown that the quality obtained by the aeroponic system was similar or sometimes higher compared to that of pot cultivation. Nitrates, on the other hand, tended to be higher in the pots cultivated in spring; however, the values were lower than the maximum limits indicated by the European Food Safety Authority (EFSA). The aeroponic cultivation system tested provided a good qualitative–quantitative production of sweet basil across the four seasons. The aeroponic system, like all closed soilless cultivation systems, has the advantage of increasing production compared to cultivation in a substrate, with a higher water and fertiliser use efficiency and the advantage of not producing exhausted substrate at the end of the cultivation cycle.



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sciforum-114665: Effect of Plasma-Activated Water Application on the Growth of Canola and Barley Microgreens

Luis Puente-Díaz^{1,2,*}, Devansh Patel², Malinda S. Thilakarathna² and M. S. Roopesh²

¹ Department of Food Science and Chemical Technology, Faculty of Chemical Sciences and Pharmaceutical, Universidad de Chile, St. Dr. Carlos Lorca Tobar 964, Independencia, Santiago 8380000, Chile

² Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB T6G 2P5, Canada

Cold plasma technology is an innovative tool with diverse applications, ranging from the food and agriculture industry to medicine and materials science. One of the most notable uses of cold plasma and plasma-activated water (PAW) in agriculture and plant sciences is the treatment of seeds and the enhancement of plant nutrition, due to the activity of the highly reactive species present in it. This study aimed at evaluating the impact of PAW on the growth of barley and canola microgreens. PAW was generated by injecting plasma reactive species into distilled water using a plasma jet that operated with air as the feed gas. Pre-germinated barley and canola seedlings treated with PAW were compared to those treated with Hoagland's nutrient solution based on several physiological and growth parameters. Root diameter, root surface area, root length, and root volume were measured using WinRHIZO software. Additionally, SPAD (Soil-plant Analysis Development) and LEF (Linear Electron Flow) were assessed using PhotosynQ and Multispeq V2.0. The results indicated no significant differences between PAW and Hoagland's solution in terms of growth characteristics for both plant systems. For barley, Hoagland's solution resulted in higher mean values for root length, root surface area, and light intensity, while PAW showed superior values for root volume, root diameter, and SPAD measurements. When Hoagland's solution was treated with the plasma jet, it yielded higher mean values for root length, root surface area, and light intensity compared to both the standard Hoagland's solution and PAW. In the case of canola, Hoagland's solution exhibited higher mean values for root length, root surface area, root volume, SPAD, and photosynthetically active radiation (PAR) values. In conclusion, for enhanced growth performance in barley, the use of plasma jet is recommended, while Hoagland's solution is preferable for canola samples. Since no significant difference was found between PAW and Hoagland's solution, PAW can be considered an alternative to Hoagland's solution; however, further studies on the effects of reactive oxygen and nitrogen species (RONS) on plant growth are needed.



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sciforum-116280: Evaluating peat-free substrates for sustainable cultivation of *Tagetes erecta*: growth, flowering, and physiological performance

Szewczyk-Taranek Bożena*, Anna Kapczyńska and Bożena Pawłowska

Department of Ornamental Plants and Garden Art, Faculty of Biotechnology and Horticulture, University of Agriculture in Krakow

Introduction

The production of ornamental container plants in peat-free substrates is essential for advancing sustainable horticulture, mitigating environmental impacts, and preserving valuable peatland ecosystems.

Goals

This study aimed to investigate the potential of growing *Tagetes erecta* 'Antiqua Yellow' in three different commercially available substrates: (1) a substrate with a 20% reduced peat content (P1), (2) a peat-free substrate with perlite (P2), and (3) a peat-free substrate based on wood industry waste (P3).

Methodology

The experiment was conducted from March 21 to May 30, 2024, in experimental greenhouses at the University of Agriculture in Krakow, Poland. Each treatment included four replicates of 25 plants grown on cultivation benches at a temperature of $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ during the day and $16^{\circ}\text{C} \pm 2^{\circ}\text{C}$ at night. After ten weeks of planting *Tagetes erecta* 'Antiqua Yellow' seedlings in the P9 pots (0.5 dm³), plant growth and development were assessed. The control group consisted of plants grown in a standard 100% peat substrate (PK). All tested substrates were enriched with dried and grounded mushroom (*Agaricus bisporus*) fruiting bodies (2.5% vol.) to be assessed as a potential biostimulator.

Results

The tallest plants were observed in the P1 substrate, while those grown in PK, P2, and P3 were approximately 2 cm shorter. The addition of the mushroom-based stimulator inhibited plant height but enhanced branching, although no substrate outperformed the control (PK), which demonstrated the highest tillering. Flower buds appeared fastest in the P3 substrate; however, all substrates exhibited visible flower buds by the third week. The development of flower buds to full bloom occurred most rapidly in peat-free substrates (P2 and P3) enriched with dried mushrooms. The best physiological parameters were observed in marigold leaves grown in the control substrate (PK), including chlorophyll fluorescence, SPAD readings, and photosynthetic pigment content (chlorophyll a, chlorophyll b, carotenoids).

Conclusions

While peat-free substrates demonstrated potential for supporting marigold growth and flowering, none matched the physiological performance or overall quality of plants grown in 100% peat. Future research should focus on refining alternative substrates to bridge this performance gap, contributing to sustainable horticulture practices.



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sciforum-110919: Impact of ambient light spectrum modifications on agronomic traits and phenolic profile of green lettuce plants

Cristian Hernández-Adasme ^{1,*}, Herman Silva ², María Gabriela Vargas-Martínez ³, Álvaro Peña ⁴, Carolina Salazar-Parra ⁵, Bo Sun ⁶ and Víctor Hugo Escalona ⁷

¹ Centro de Estudios de Postcosecha (CEPOC), Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile

² Laboratorio de Genómica Funcional y Bioinformática, Departamento de Producción Agrícola, Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile

³ Laboratorio de Desarrollo de Métodos Analíticos, Facultad de Estudios Superiores Cuautitlán, Universidad Nacional Autónoma de México, Cuautitlán Izcalli, México

⁴ Departamento de Agroindustria y Enología, Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile

⁵ Instituto de Investigaciones Agropecuarias (INIA), Centro Regional La Platina, Santiago, Chile.

⁶ College of Horticulture, Sichuan Agricultural University, Chengdu, China

⁷ Centro de Estudios de Postcosecha (CEPOC), Departamento de Producción Agrícola, Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile

Modifying the light spectrum that plants are exposed to may be an optimal strategy to balance growth, yield, and the accumulation of antioxidant compounds, particularly in lettuce plants since it is one of the most economically important vegetables worldwide due to its high consumption and export. The purpose of this study was to evaluate the impact of ambient light enrichment with different LED light spectra on biomass, the relative index of chlorophyll concentration (RICC), polyphenol concentration, and the relative gene expression of enzymes associated with their formation in young green 'Levistro' lettuce leaves grown in an NFT hydroponic system under greenhouse conditions. Ambient light was enriched with blue (B), white (W), red-blue (RB), and red (R) LED lights for 14 days. Each lamp was mounted on a 120 × 35 cm thin wooden panel which shaded the experimental unit, resulting in a mean daily light integral (DLI) of 14.0 mol m⁻² d⁻¹. The control was ambient greenhouse light (DLI = 21.8 mol m⁻² d⁻¹). Fresh weight was similar across the enrichment treatments and the control, while dry matter (%) significantly decreased under B compared to the control, by 5.7%. The number of leaves increased significantly under RB compared to the control, by 24.4%. RICC rose as the plants grew, with no significant difference between the enrichment treatments and the control. Chlorogenic acid (ChIAc) concentration was significantly higher under RB compared to R, B, and W, by 136.4%, 116.7%, and 62.5%, respectively. Meanwhile, total quercetin (TQ) concentration was significantly higher under W and RB compared to the control, by 81.0% and 71.4%, respectively. Interestingly, the expression of the *coumarate 3-hydroxylase* (*C3H*) gene, associated with ChIAc formation, was higher under RB compared to the control and the other enrichment treatments, while the expression of the *flavonol synthase* (*FLS*) gene, which is linked to quercetin formation, increased under W and RB compared to the control and the other light enrichment treatments. Therefore, the modulation of the environmental light spectrum with a lower DLI than the control allowed for the maintenance of normal and adequate morphology and growth of green lettuce 'Levistro,' while RB promoted the concentration of ChIAc and TQ by increasing the expression of the *C3H* and *FLS* genes, respectively.

Keywords: LED light; greenhouse; agronomic characteristics; polyphenol; gene expression



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sciforum-116976: Impact of CuO Nanoparticles on Swiss Chard Cultivated under Red–Blue and White–Red–Blue Lighting

Aušra Brazaitytė*, Ieva Karpavičienė, Vitalis Laužikas and Rūta Sutulienė

Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kaunas str. 30, LT-54333, Babtai, Lithuania

Copper (Cu) is an essential trace element that plays a vital role in various physiological processes in plants. Due to its significance, copper oxide (CuO) nanoparticles (NPs) are increasingly being incorporated into fertilizers as an alternative to traditional forms. However, there is a limited understanding of how CuO NP spraying and light conditions affect plants, particularly leafy vegetables grown hydroponically indoors. This study aimed to evaluate the impact of different LED lighting spectra and CuO NP spraying on the growth and antioxidant potential of Swiss chard (*Beta vulgaris* var. cicla, 'Barese'). The plants were cultivated in hydroponic systems using two types of lighting: a red and blue spectrum (R90%:B10%) and a white, red, and blue spectrum (W65%:R30%:B5%), with an intensity of $250 \pm 5 \mu\text{mol m}^{-2} \text{s}^{-1}$. The plants were sprayed with an aqueous suspension of CuO NPs at a concentration of 30 ppm (size 40 nm). Various growth parameters—such as fresh weight, dry weight, and leaf area—were measured, along with antioxidant indices. The results indicated that CuO NPs positively influenced plant growth under white, red, and blue (WRB) illumination, but had no effect under red and blue (RB) illumination. Cu accumulation was higher under RB illumination, yet it remained within safe limits. In terms of antioxidant capacity, RB illumination enhanced DPPH, ABTS, and FRAP values compared to WRB; however, significant effects of CuO NPs were only observed for DPPH (with RB) and FRAP (with WRB). CuO NPs did not significantly impact the total phenolic content, although this content was higher under WRB illumination. This study found varying effects of CuO NPs on antioxidant enzymes: ascorbate peroxidase, monodehydroascorbate reductase (MDHAR), and superoxide dismutase increased under RB illumination, while glutathione reductase, MDHAR, dehydroascorbate reductase, and catalase increased under WRB. In conclusion, the findings suggest that CuO NPs positively influence the growth of Swiss chard and enhance its antioxidant system, particularly under WRB LED illumination.



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sciforum-116432: Impact of reduced fertigation on fig yield and quality

Emilio Martín-Expósito *, Montserrat Cano, María Medrán, María Esmeralda Delgado, Fernando Pascual and María del Carmen García-García

IFAPA La Mojonera (Almería). Andalusian Institute for Agricultural, Fisheries, Food and Organic Production Research and Training. CAPADR, Regional Government of Andalusia.

It is becoming increasingly necessary to look for alternative crops to conventional horticultural crops in greenhouses in order to diversify crops and agricultural products. The protected cultivation of figs can be an interesting alternative crop as consumers increasingly demand products and fruits of all kinds, which have great taste and are grown in an organic and natural way. In addition, demand is increasing in the United States and Europe for fresh, dried and frozen figs. On the other hand, most fig crops are cultivated with a traditional dry farming system, although in recent years the irrigated cultivation area for the fresh and export market is increasing. In recent years, the IFAPA La Mojonera Center has been working on the development of the protected cultivation of fig trees, achieving very good yields. However, the tests carried out in the intensive cultivation of fig trees in greenhouses seem to determine that water consumption is high.

The objective of this work is to find out if the reduction in fertigation volume in fig tree cultivation in a semi-intensive organic system, with consequent savings in water and fertilizers, affects the production and quality of the fruit. For this purpose, the cultivar “San Antonio” was tested in an organic greenhouse with mesh cover, with a planting frame of 4m x 4m and an irrigation system with four drippers of 3 l h⁻¹ per tree. Two treatments were established, depending on the volume of fertigation provided, with one treatment fertigating for half the time of the other. To evaluate the production of the crop, each harvest was weighed and to determine the quality of the fruit, morphological parameters and chemical and nutritional parameters such as soluble solids, pH, citric acid, vitamin C, carotenes and phenolics were evaluated in the fruit obtained in each of the treatments.

In our growing conditions, the reduction in fertigation volume had no effect on fig production; however, it did affect the soluble solids of the figs, with a higher sugar concentration observed in fruits obtained with a lower fertigation volume.



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sciforum-116248: Pulsed LED Lighting effects on the cultivation of green and red lettuce cultivars in vertical farming

Fabio Scotto di Covella^{1,*}, Elige Salame², Alice Trivellini³ and Antonio Ferrante¹

¹ Institute of Crop Science, Sant'Anna School of Advanced Studies, Pisa, Italy

² Department of Agricultural and Environmental Science, University of Milan, Milan, Italy

³ Department of Agriculture, Food and Environment, University of Pisa, Pisa, Italy

LED lighting has been increasingly used in vertical farming as a sustainable alternative to HPS (High-Pressure Sodium), offering benefits like enhanced plant growth, improved shelf-life, and a better nutritional quality of horticultural products at lower costs. Optimized light treatments can increase key metabolites, such as vitamins and bioactive compounds. Pulsed LED lighting, delivering high-intensity light with lower energy consumption, has shown promising effects. By adjusting the duty cycle, it is possible to achieve high production while saving energy. This study investigated the effects of pulsed LED light on two lettuce cultivars, green and red (*Lactuca sativa* L., var. "Multifolia"), over a 48-day growing cycle. Two duty cycles were compared, 50% (D50) and 25% (D25), both at 1000 Hz frequency and a photoperiod of 16 hours, using a spectrum of 82% red, 11% green, and 6% blue lights. PPFD in the two chambers was measured: in D50, it was 122 $\mu\text{mol m}^{-2}\text{s}^{-1}$, while in D25, it was 71 $\mu\text{mol m}^{-2}\text{s}^{-1}$. A greenhouse with natural light during the autumn season served as the control. After harvest, the quality was evaluated over a period of 10 days at 4°C. Analyses of various physiological and biochemical parameters were conducted. The results showed that at harvest the red-leaf cultivar had the highest fresh weight compared with the green lettuce. Leaf pigments such as total chlorophyll and carotenoids were higher under the D25 treatment in both cultivars. Nitrate concentration was also higher in pulsed treatments compared to control plants in the greenhouse but remained under the EU limits (4000 mg kg⁻¹ FW). The maximum quantum efficiency of photosystem II (F_v/F_m) showed that plants under pulsed lighting were less stressed and showed better light use efficiency compared to the greenhouse conditions. The green lettuce showed better leaf performance. The effect of pulsed light was also observed during the postharvest period. Ethylene and CO₂ production, particularly after 7 days of cold storage, were significantly reduced under the D25 treatment. Considering energy saving, D25 reduced electric consumption by 34% compared with D50.

This study highlights the effectiveness of pulsed LED lighting, especially the D25 treatment, in improving growth, physiological traits, and energy efficiency in lettuce cultivars. Further analysis of secondary metabolites will be carried out to better understand plant responses and maximize the potential of these treatments.



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sciforum-114671: Real-Time Data Analytics and Smart Technologies for Advancing Indoor Farming

Nezha Kharraz ^{1,*} and István Szabó ²

¹ PhD student

² Institute of Mechanical Engineering - Hungarian University of Agriculture and Life Sciences

Indoor farming has emerged as a pivotal innovation in modern agriculture, addressing critical challenges such as limited arable land, water scarcity, and environmental unpredictability. As the global demand for food continues to rise, the need for innovative solutions that maximize efficiency and sustainability has become increasingly urgent. This study explored the integration of smart technologies and real-time data analytics to optimize resource utilization, enhance crop yields, and reduce environmental impacts in controlled farming environments. By leveraging the Azure IoT Hub and advanced sensor networks, the research demonstrates a scalable system for monitoring critical environmental parameters, including temperature, humidity, light intensity, and nutrient levels.

The acquired data were processed through cloud-driven analytics platforms, enabling precise decision-making, predictive modeling, and real-time control of farming conditions that can help predict sensitive data. These capabilities not only ensure optimal crop growth but also significantly reduce resource wastage, such as water and energy, which are critical concerns in agriculture. A case study focusing on precision plant production highlighted how real-time feedback and automated control systems enhance the crop management efficiency. By extending traditional logistic growth models into a multi-dimensional approach, the study provides novel insights into crop growth dynamics under varying environmental conditions.

The results indicate substantial improvements in resource efficiency, plant health, and yield predictability, demonstrating the transformative potential of integrating IoT and data-driven strategies into indoor farming. This work contributes to the advancement of precision agriculture by offering a replicable and adaptable framework for integrating smart technologies into horticultural practices. Furthermore, the study highlights future opportunities, such as incorporating advanced machine learning models for further optimization, as well as exploring the use of renewable energy sources to enhance sustainability and scalability. By bridging the gap between technology and agriculture, this research aims to inspire innovations that address the pressing global need for resilient and sustainable food systems.



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sciforum-116240: Resource Efficiency of Swiss Chard Crop in Vertical Hydroponic Towers under Greenhouse Conditions

Manuel Felipe Lopez Mora ¹, María Lorena Solano Betancourt ¹, Calina Borgovan ², Carlos Alberto Gonzalez Murillo ³, Maria Fernanda Quintero Castellanos ¹ and José Miguel Guzmán ⁴

¹ Faculty of Agronomy & Veterinary, Autonomous University of San Luis Potosi, San Luis Potosi, Mexico

² Department of Agronomy, University of Almeria, CeIA3, CIAIMBITAL, Almeria, Spain

³ Department of Civil and Agricultural Engineering, National University of Colombia, Bogota, Colombia.

⁴ Almería University

Resource efficiency is essential in today's approach to horticulture. The global problems of water scarcity, soil pollution, biodiversity loss, and rapid growth of the global population require increased food production with fewer resources. Resource efficiency is an index that allows us to define how much biomass an agri-food system is capable of producing per unit of the resource used. Closed hydroponic systems such as vertical towers (VHTs) have high resource use efficiency. In these systems, the water use efficiency (WUE) and the nutrient use efficiency (NUE) can be calculated in terms of the water lost through transpiration (T) and the concentration of the fertigation solution. The objective of this research was to determine the WUE and NUE for chard crops in VHT under greenhouse conditions and to evaluate its feasibility as an urban and peri-urban system for leafy vegetable production. The trials were carried out with chard in the late fall of 2024 in a tunnel-type greenhouse on the outskirts of the city of San Luis Potosi. The VHTs were built with a 20 L square lower tank on which a cylindrical pipeline of 115 cm in diameter and 1.6 m in height was placed. Each pipe had 45 growing containers distributed on 15 levels of three containers spaced vertically 9 cm apart and a growing density of 25 plants·m⁻². The experimental design was completely randomized with three treatments (75, 100, and 125% of Steiner's universal nutrient solution) and three replications. The transpiration (T) of the crop (recording weight loss in the water tank) and the fresh weight (FW) of the plants (nine plants per VT) were measured daily using a precision scale. An ANOVA and Tukey's test for mean differentiation were performed with p 0.05. Significant differences were found between treatments for FW, T, and WUE, obtaining the best results at 75% using Steiner's nutrient solution. These results are equal to or superior to those obtained in horizontal hydroponic systems or vertical farms reported to date. The data show water savings of more than 70% and up to a 30% reduction in the fertilizers used compared to the conventional agricultural systems of chard crops. Vertical hydroponic towers in greenhouses are an optimal horticultural production system that uses resources very efficiently, so their implementation is feasible in areas where water scarcity is critical or areas that are densely populated.



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sciforum-116478: Suitability of *Apium graveolens* var. *secalinum* for hydroponic cultivation in baby leaf production.

Alessandro Esposito^{1,*}, Alessandro Miceli², Alessandra Moncada² and Filippo Vetrano²

¹ Dipartimento Scienze Agrarie, Alimentari e Forestali, Università di Palermo

² Dipartimento Scienze Agrarie, Alimentari e Forestali, Università di Palermo, Viale delle Scienze 4, 90128 Palermo, Italy

Consumers are constantly seeking innovative foods that could provide nutraceutical substances that are beneficial for their health. This has resulted in the search for new or underutilized leafy vegetables with the potential to satisfy consumers' demand for new healthy food while concurrently promoting the diversification of crops, the expansion of cultivation areas, and the enhancement of agrobiodiversity. Cutting celery (*Apium graveolens* var. *secalinum*) differs from ribbed celery (*Apium graveolens* var. *dulce*) in terms of its smaller size, shorter leaves, reduced petiole length, and higher aromatic flavor. This research aimed to develop an agronomic protocol for the hydroponic cultivation of cutting celery to produce baby leaves for fresh-cut products. The seeds of a local ecotype of cutting celery were sown (January and April 2023) in trays filled with a commercial substrate at two growing densities (615 or 947 plants m⁻²). The plants were grown in a greenhouse with an ebb-and-flow system supplementing, for each plant density, three different concentrations of nutrient solution as follows: 0 (control); FS, standard Hoagland's solution; and HS, 50% reduced Hoagland's solution. The leaves were harvested when the plants had 5-6 leaves by mowing them 3-4 cm above the plant collar. The regrowth capacity of the plants allowed us to perform a second round of mowing after approximately four weeks. For both mowing activities, the morphological, biochemical, and yield characteristics were evaluated. A sensory analysis was performed on the leaves from the first mowing activity of each growing season by a group of 20 non-specialized consumers aged between 24 and 60 years according to standardized methodologies. Soon after mowing was complete, the fresh-cut leaves from HS and FS were packed and stored at 4°C for 21 days to assess the shelf-life of the minimally processed product. The experimental factors influenced the morphological characteristics of the leaves in terms of length and leaf area. The total yield of the celery baby leaf was higher in winter than in spring. The availability of nutrients influenced the yield levels in various ways according to both the period and the plant density at cultivation. The shelf-life of the baby leaves surpassed 14 days for all the treatments. The sensory parameters were found to be influenced by the treatments and production cycle. The baby leaves of cutting celery had a good vitamin and mineral content, but this varied as a result of the growth parameters and growing season. Cutting celery was shown to be a suitable species for hydroponic cultivation and produced baby leaves with a good shelf-life and nutritional quality.



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sciforum-115486: The Spectrum of Productivity: Exploring the Impact of Red–Blue and Red–Blue–Green LED Light on the Growth and Reproductive Stages in 'Festival' Strawberry

Rosniza Kassim^{1,*}, Ahmad Hafiz Baharom², Suhana Yusof², Suhanna Ahmad², Siti Aisyah Abdullah² and Farahzety Abdul Mutalib²

¹ Malaysia Agriculture Research and Development Institute

² Malaysia Agriculture Research and Development Institute (MARDI)

Optimising light spectra is critical for enhancing plant growth, physiological efficiency, and reproductive success in controlled environment agriculture. This study investigates the effects of red–blue (RB) and red–blue–green (RBG) LED light treatments on the growth, physiological responses, flowering, and fruiting of *Fragaria × ananassa* cv. Festival (Festival strawberry). Plants grown under RB light exhibited significantly enhanced vegetative growth compared to those under RBG. Specifically, RB light treatment resulted in taller plants (25.30 cm) with more petioles (12.28), outperforming RBG (22.80 cm and 7.99, respectively). Physiological efficiency, indicated by chlorophyll fluorescence (Fv/Fm), was also superior under RB (0.78) than under RBG (0.76). These findings demonstrate the pronounced effect of RB light in enhancing vegetative parameters. Reproductive development was profoundly influenced by light spectra. RB light significantly accelerated flowering, with plants flowering in 53.57 days, compared to the delayed response under RBG (102.25 days). Fruit yield was substantially higher under RB, with an average of 7.3 fruits per plant, compared to only 2.0 fruits per plant under RBG. Interestingly, fruit quality attributes, including fruit length, weight, and soluble solids concentration (Brix), were not significantly influenced by the inclusion of green light in the RBG spectrum. These results suggest that green light does not provide a measurable advantage for improving fruit quality, further highlighting the effectiveness of RB light in driving key growth and reproductive traits. Heatmap analysis visually confirmed RB light's superior ability to promote growth, early flowering, and reproductive output, while RBG light treatment exhibited limited benefits, often diminishing the effects of red and blue light. These findings underline the critical importance of red–blue light combinations in optimising plant productivity, particularly during the reproductive stage, in controlled environment systems such as vertical farms and plant factories. Future studies should explore fine-tuning spectral ratios and light intensities to further maximise productivity, resource efficiency, and crop quality, paving the way for sustainable horticultural practices and enhanced food security.



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sciforum-116217: Traditional fig trees cultivated in a mesh greenhouse: characterization of five varieties

María Esmeralda Delgado*, María Medrán, Almudena Felipe, Emilio Martín-Expósito, Montserrat Cano, Pedro Gómez and María del Carmen García-García

IFAPA La Mojonera. Andalusian Institute for Agricultural, Fisheries, Food and Organic Production Research and Training. CAPADR, Regional Government of Andalusia.

The fig tree is a profitable and ecologically versatile fruit crop, as it adapts to all types of soils. Agronomically, it is a little-known fruit tree that requires research due to a lack of knowledge about the plant material, the most appropriate cultivation techniques and conditions, and the packaging used for its preservation, especially when intended for fresh consumption.

Among the issues to highlight in modern fig cultivation are the orientation and destination of the product, productivity, fruit size, color, harvesting costs, and timing of the harvest.

The fig tree presents industrial exploitation possibilities that allow for the production of new processed products, jams, syrups, ice cream, and liqueur in order to increase supply and facilitate commercialization in a timely manner.

For generations, traditional fig varieties have been cultivated and selected in different rural areas. These traditional varieties are those that have the best adaptation to local conditions, promote agricultural biodiversity, and promote sustainable farming practices. Furthermore, they are more resistant to disease and adverse climates.

Fig tree planting is part of a strategy developed by several research centers to prevent depopulation in at-risk areas. At the IFAPA La Mojonera center, fig seedlings have been cultivated using ecological techniques, grafted onto the San Antonio rootstock, from five varieties: Pajarera, Negra rabo largo Alpujarra, Verdál, Gota de miel, and Brevera Mulería.

The varieties analyzed have been characterized through the evaluation of various morphological descriptors, both leaf and fruit, as specified by the International Plant Genetic Resources Institute (IPGRI) and the Union for the Protection of New Varieties of Plants (UPOV). The soluble solids content (°Brix) of the different varieties has also been analyzed, as it is the most significant parameter in intrinsic characterization due to its direct relationship with the sweetness and flavor of the fruit.

In terms of fruits, the Negra Rabo Largo Alpujarra cultivar produced the sweetest and highest-quality figs due to their juiciness.

The Verdál cultivar has the largest fruit size, although it has little flavor. It features a large ostiole, which is sensitive to cracking, which can be a disadvantage due to the potential for insect and mite entry, which can lead to internal contamination.

The Pajarera cultivar is the smallest in size, and due to its characteristics, it could be marketed as dried figs.



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sciforum-116314: Yield components of sweet corn in greenhouse depending on the method of production and genotype

Jelena V. Stojiljković¹, Vera Rajčić², Ivan Tupajić¹, Darko Jovanović^{1,*}, Milan Ugrinović¹, Nenad Đurić¹ and Biljana Šević¹

¹ Institute for Vegetable Crops Smederevska Palanka, Karađorđeva 71, 11420 Smederevska Palanka, Serbia

² University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia

Background: Sweet corn is a vegetable that is being increasingly cultivated in the world because of its nutritional value and wide application. **Objectives:** The aim of this research was to examine the influence of different crop establishment methods (direct seeding and transplanting) and genotypes (Sweet Nugget and 255 DDST) on the yield components of sweet corn under greenhouse conditions. **Materials and Methods:** This research was conducted in 2024 in a protected area (greenhouse with dimensions 41x8x3.5 m) at an altitude of 225 m (43°05'38.31" N, 21°96'77.54" E) in the village of Bogojevce, near Leskovac, southern Serbia. Sowing was carried out on May 18, 2024, with a spacing of 70 cm between rows, 20 cm between rows within the strip, and 20 cm between plants. Statistical analysis was performed using IBM SPSS Statistics 26.0 and Minitab (Trial version). ANOVA and LSD tests evaluated factor effects at p0.05 and p0.01, while Pearson's correlation analyzed trait relationships. **Results:** The results of this study show that the investigated factors had a significant impact on yield components. A higher average ear weight (160.08 g) was achieved in the 255 DDST hybrid, while in the Sweet Nugget hybrid, it was 136.50 g. Transplantation has an advantage over direct sowing, especially regarding ear length and diameter. In the hybrid Sweet Nugget, an average ear length of 21.68 cm and a diameter of 3.61 cm were measured, while in the hybrid 255 DDST, a length of 20.81 cm and a diameter of 3.61 cm were obtained. Statistical analysis showed that the method of sowing and the interaction method of sowing x genotype had a significant effect on the length and diameter of the ear, while the genotype did not significantly affect the length of the ear. A strong and positive correlation was found between the total mass of the piston and the length of the piston ($r=0.63^{**}$), and the total mass of the piston and the diameter of the piston ($r=0.60^{**}$), while a negative correlation was recorded between the total mass of the piston and random ($r=-0.47^{**}$). **Conclusion:** It was concluded that transplantation is a more efficient way of establishing crops in greenhouse production conditions, which is reflected in higher values of yield components. These results provide important information for the optimization of sweet corn production under sheltered conditions.



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Session 5. Postharvest Physiology and Technology

sciforum-116447: Breaking the Ripening Barrier in 'Rocha' Pears Treated with 1-MCP: The Role of Absciscic and Glyoxylic Acids

Cindy Dias^{1*}, Clara Sousa², Marta W Vasconcelos², Antonio Ferrante³ and Maria Manuela Pintado²

¹ Centro de Biotecnologia e Química Fina -Escola Superior de Biotecnologia

² Universidade Católica Portuguesa, CBQF- Centro de Biotecnologia e Química Fina- Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, Porto, 4169-005, PORTUGAL

³ Department of Agricultural and Environmental Sciences, Università degli Studi di Milano, ITALY

Extending the cold storage of 'Rocha' pears through 1-methylcyclopropene (1-MCP) and controlled atmosphere storage is a widely used strategy to prevent postharvest disorders. However, this approach inhibits natural fruit ripening, often compromising consumer quality and presenting a significant challenge to the fruit industry. Basically, 1-MCP binds to the ethylene receptor proteins found in fruit, not allowing ethylene to bind, and triggering the ripening response. Recently, several studies, strategies to mitigate the antagonist ripening effect of 1-MCP have been attempted. In this study, we investigated the potential of abscisic acid (ABA) and glyoxylic acid (GLA) to counteract the antagonist effects of 1-MCP and restore normal ripening. 'Rocha' pears treated with 1-MCP were immersed in ABA or GLA solutions, respectively, and stored at $20 \pm 2^\circ\text{C}$ for 15 days. Ripening indicators, including firmness, skin color, ethylene and volatile organic compound (VOC) production, sugar content, and the expression of ethylene-related genes (PcACS, PcACO, PcETR1, PcETR2, and PcETR5), were assessed throughout storage. Our multivariate and clustering analysis revealed that ABA effectively disrupted the 1-MCP-induced ripening inhibition, significantly boosting ethylene production and, consequently, promoting fruit softening, degreening, sugar accumulation, and specific pear-ripening volatile emissions. These changes were justified by the significant measured increased expression of ethylene biosynthesis (PcACS, PcACO) and receptor (PcETR2) genes, highlighting ABA's pivotal role in reactivating ethylene perception, signaling, metabolism and, therefore, the ripening process. In contrast, GLA did not promote an increase in ethylene production or other ripening-related changes, likely due to limited ACC synthase activity. Interestingly, GLA-treated fruits showed elevated respiration rates and higher levels of hexanal, (E)-2-hexenal, and ethanol compared to the control, indicating an influence on alternative stressed metabolic pathways unrelated to ripening. This study sheds light on the regulatory interplay between ABA, GLA, and fruit ripening, providing innovative strategies to overcome ripening inhibition caused by 1-MCP in climacteric fruits, with particular focus on 'Rocha' pear.



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sciforum-116214: A comparative investigation of the impact of infrared drying coupled with cold storage on selected physicochemical attributes of two Moroccan date (*Phoenix dactylifera* L.) cultivars

Younes Noutfia*, Ewa Ropelewska, Justyna Szwejda-Grzybowska, Sebastian Siarkowski, Zbigniew Józwiak, Krzysztof Rutkowski and Monika Mieszczakowska-Frąć

Fruit and Vegetable Storage and Processing Department, The National Institute of Horticultural Research, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland

After harvest, date fruit (*Phoenix dactylifera* L) is characterized by a moderate moisture content (MC) that might negatively affect its storage ability, especially for soft cultivars. Accordingly, drying is often applied at postharvest to reduce MC and maintain the quality attributes of dates during cold storage. In this investigation, the effect of the infrared drying method as an innovative drying technique was tested in association with controlled cold storage conditions to elucidate the changes in the main quality attributes of two soft Moroccan date cultivars with high commercial value. Thus, fresh 'Mejhouli' and 'Boufeggous' cultivars were subjected to infrared drying (IRD) at 60 °C/50 Hz using an industrial dryer (CONVECO Sp. z o.o., Glinianka, Poland) for 150 minutes. After drying, infrared dried date fruit samples were stored at +4 °C/55% and +4 °C/65% of relative humidity (RH) for four months and assessed for water loss, color attributes, total soluble solids (TSS), acidity, and total sugars based on glucose and fructose. Therefore, the structure of the experimental design included four blocks:

IRD 'Mejhouli' stored at +4 °C/55% (M-IRD55).

IRD 'Mejhouli' stored at +4 °C/65% (M-IRD65).

IRD 'Boufeggous' stored at +4 °C/55% (B-IRD55).

IRD 'Boufeggous' stored at +4 °C/65% (B-IRD65).

The results showed that the initial water activity prior to cold storage was, respectively, 0.568 and 0.662 for 'Mejhouli' and 'Boufeggous', and it was a critical attribute, in addition to RH, in impacting the storage ability of each cultivar. Thus, the highest water loss was recorded for B-IRD55 with -3.97%, followed by B-IRD65 and M-IRD55 with a slight dehydration of -0.78% and -0.32%, respectively. However, a water gain of +1.67% was documented for M-IRD65. All color attributes (lightness, redness, yellowness, and chroma) were changed during storage and influenced the browning index that increased for all blocks after four months of storage, reaching, respectively, 43.4, 38.8, 34.4, and 29.1 for M-IRD65, M-IRD55, B-IRD65, and B-IRD55. Acidity showed an opposite and slight fluctuation for the two cold storage conditions according to the cultivar since this parameter increased for 'Boufeggous' and decreased for 'Mejhouli'. For TSS, only B-IRD55 was highly impacted at the end of storage, while date cultivars stored at lower RH (55%) exhibited a slightly higher sugar content compared to those stored at 65%.

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sciforum-116403: Binary Synergistic Effect of Organic Coating and PA/PE Film in Passive Atmosphere on Preservation and Quality of Fresh Lychee during Cold Storage

Alessandra Culmone, Roberta Passafiume*, Pasquale Roppolo, Ilenia Tinebra, Eristanna Palazzolo, Antonino Pirrone, Raimondo Gaglio and Vittorio Farina

¹ Department of Agricultural, Food and Forest Sciences (SAAF), University of Palermo, Palermo, 90128, Italy

² Centre for Sustainability and Ecological Transition, University of Palermo, Palermo, 90100, Italy

Lychee (*Lychee chinensis* Sonn.), a tropical fruit renowned for its attractive red color, sweet taste, and nutritional benefits, faces significant post-harvest challenges. These include color degradation and dehydration due to oxidative stress, which are accelerated by unfavorable storage conditions. This study investigates the combined effects of an organic olive oil-based coating and polyamide/polyethylene (PA/PE) film in passive atmosphere storage on the preservation of lychee during cold storage. Lychee fruits, harvested at commercial maturity, were divided into two groups: one treated with an organic coating made from a blend of Sicilian olive oils (OC) and the other left untreated as a control (CTR). The treated fruits were stored in PA/PE bags, which regulate the exchange of gases and moisture, at $5\pm1^{\circ}\text{C}$ and $90\pm5\%$ relative humidity. The fruits were analyzed at 0 (as fresh), 3, 6, and 9 days of storage for various physical, chemical, microbiological, nutritional, and sensory characteristics. The results demonstrated that the combination of the organic coating and PA/PE film significantly improved the preservation of lychee quality compared to the untreated control. The organic coating acted as a protective barrier, reducing oxidative reactions, preventing enzymatic browning, and preserving the fruit's color and texture. The PA/PE film, on the other hand, helped create a controlled internal atmosphere by reducing oxygen levels and increasing carbon dioxide, thereby slowing respiration and delaying ripening processes. This dual treatment not only minimized weight loss but also significantly extended the shelf-life of the fruit. The treated lychee exhibited a slower rate of maturity index decline, preserving both its sensory attributes and nutritional value for a longer period. The combination of the organic coating and modified-atmosphere packaging (MAP) proved to be an effective, eco-friendly solution for extending the shelf-life and maintaining the quality of lychee during cold storage. These findings offer a promising strategy for the sustainable preservation of fresh lychee, ensuring that it retains its visual appeal, flavor, and nutritional content during storage and transport.



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sciforum-118253: Effect of Far-UVC and violet irradiation on the microbial contamination of spinach leaves and their vitamin C and chlorophyll contents

Alexander Gerdt *, Anna-Maria Gierke, Petra Vatter and Martin Hessling

Biotechnology Lab, Institute of Medical Engineering and Mechatronics, Technische Hochschule Ulm (University of Applied Science), Albert-Einstein-Allee 55, D 89091 Ulm, Germany

Background

Microbial contamination of food can lead to faster spoilage, but also to infection of the consumer. This is why disinfection processes that are efficient but have as little detrimental effect as possible on the nutritional content are required. In terms of disinfection, two spectral ranges have become increasingly important in recent years. The first is the so-called Far-UVC spectral range, with a wavelength below 230 nm, which only damages bacteria but barely any eukaryotic cells due to favorable DNA and protein absorption properties. The second range is visible violet light around 405 nm, which can also inactivate microorganisms such as bacteria and fungi in high irradiation doses but does not pose a great danger, at least to humans and human cells. In this study, leaf spinach was used to investigate the extent to which these radiations have an inactivating effect on *E. coli* as a typical microbial contaminant, but also to determine if the vitamin C content of the spinach leaves was reduced following these treatments.

Methods

Spinach (*Spinacia oleracea*) leaves were contaminated with *E. coli* x pGLO, which is easy to detect by means of GFP fluorescence, and irradiated with both a 222 nm krypton chloride lamp and 405 nm LEDs. The achieved bacterial reduction was determined at different time points by plating the material on agar plates and through subsequent counting. The vitamin C concentration was determined by means of redox titration, and the concentrations of chlorophyll a and chlorophyll b were determined using spectrometry.

Results

Both irradiations exhibited a strong antimicrobial impact on *E. coli* x pGLO, and a reduction of approximately 99% was achieved under the selected irradiation conditions. The average doses were 19 mJ/cm² (222 nm) and 87 J/cm² (405 nm). The vitamin C concentration decreased by 30% (222 nm) or 20% (405 nm), and the chlorophyll concentrations decreased by 22 and 33%.

Conclusions

Both irradiation approaches are able to substantially reduce the number of microorganisms on spinach leaves, but this is associated with a reduction in nutrient content.



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sciforum-116133: Estimation of content of selected chemical compounds in fermented samples of chili pepper using image parameters

Ewa Ropelewska*, Justyna Szwejd-Grzybowska and Anna Wrzodak

Fruit and Vegetable Storage and Processing Department, The National Institute of Horticultural Research, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland

Lacto-fermentation can be used to preserve chili pepper after harvesting. It extends the shelf life of fruit. Additionally, lacto-fermented products can be characterized by health-promoting properties.

The main objective of this study was to assess the usefulness of image parameters of the flesh of chili pepper for the estimation of the changes in the content of chemical compounds in samples during spontaneous fermentation. Therefore, this study aimed at assessing changes in the image parameters of the flesh and the content of chemical compounds of chili pepper after specified fermentation periods, determining the correlations between the image parameters and chemical properties of samples, and setting the regression equations to assess the chemical properties of chili pepper using image textures.

The raw material consisted of the chili pepper belonging to two cultivars, 'Cyklon' and 'Picasso'. The spontaneous lacto-fermentation of whole fruit was carried out using mustard seeds, black pepper, bay leaves, allspice, and 3.5% brine. For raw material and samples after 7, 14, 21, 28, and 56 days of the process, image parameters from the images acquired using a flatbed scanner and chemical properties analyzed by HPLC (high-performance liquid chromatography) were determined. Image processing was performed using MaZda 4.7 software (Łódź University of Technology, Institute of Electronics, Łódź, Poland). Models to classify the raw material and samples after specific periods of lacto-fermentation were developed using MATLABR2024a (MathWorks, Inc., Natick, MA, USA). The differences in means of the analyzed parameters between fresh and lacto-fermented samples, linear correlations, and regression equations were determined using STATISTICA 13.1 (Dell Inc., Tulsa, OK, USA, StatSoft Polska, Kraków, Poland).

The developed models and mean comparison indicated significant changes in the values of selected image textures after the first 7 days of the process, and after the following periods, smaller changes occurred. In the case of samples of both cultivars, fermentation influenced a statistically significant decrease in the content of L-ascorbic acid, glucose, fructose, and total sugars as the processing time increased. For the 'Cyklon' cultivar, the strongest correlations were found between total sugars and image texture RS5SV5SumAverg ($R=0.995$) and fructose and RS5SV5SumAverg ($R=0.994$). In the case of 'Picasso', the strongest correlations were between fructose and GS5SN1SumEntrp ($R=-0.997$), total sugars and GS5SN1SumEntrp ($R=-0.993$), and L-ascorbic acid and SSGKurtosis ($R=0.993$). For both chili pepper cultivars, regression equations and high coefficients of determination were determined.



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sciforum-116310: Formulation and characterisation of Horticultural crops-based pollen and nectar food substitutes for bees and to conserve their wellbeing during dearth periods

Jadala Shankaraswamy

Sri Konda Laxman Telangana State Horticultural University

Changing temperature regimes can cause a misalignment between honey bees foraging for pollen and nectar and the availability of floral resources from horticultural crops, potentially leading to decreased nutrition and colony collapse disorders. Hence, the present research focuses on formulating natural imitations of pollen and nectar substitutes from sea buckthorn fruit, sweet potato and yam starch, and red banana peel pulp extracts. A baobab fruit, monk fruit sugar, and Nannari root extract-based pollen formulation 1 (P1) had a particle size distribution of 605.3 ± 0.02 nm, a pH of 3.5 ± 0.03 , total polyphenol content of 1.14 ± 0.05 mg GAE/g, carbohydrate content of $79.4 \pm 4.84\%$, crude protein content of $4.02 \pm 0.23\%$, ash is $2.48 \pm 0.2\%$, $8.4 \pm 0.52\%$ moisture content, and $5.7 \pm 0.45\%$ crude fat. Meanwhile, for a sea buckthorn fruit, sweet potato starch, nannari, and liquorice root extract with a black acacia gum-based pollen formulation 2 (P2), we recorded a particle size distribution of 508.9 ± 0.02 nm, a pH of 3.2 ± 0.29 , total polyphenol content of 1.28 ± 0.09 mg GAE/g, $79.9 \pm 4.39\%$ carbohydrates, $1.35 \pm 0.08\%$ crude protein, $3.36 \pm 0.19\%$ ash, $9 \pm 0.5\%$ moisture content, and $6.3 \pm 0.57\%$ crude fat. P1 contains 17 amino acids, with aspartic acid being the most prevalent. P2 contains 17 amino acids, with aspartic acid being the most prevalent. Nectar formulation 1 (N1) prepared from thaumatin, baobab fruit, seabuckthorn fruit, red banana pulp and peel, nyctanthes extract along with yeast mogroside, polycrystalline sugar, and monk fruit juice concentrate possessed viscosity of 0.0011 ± 0.0001 Pa. s, osmolarity of 643 ± 28.94 mmol/L, 3.59 ± 0.27 ° Brix total soluble solids, and 38.53 ± 3.04 mg/g total sugars. For nectar formulation 2 (N2) prepared from polycrystalline and monk fruit sugar with seabuckthorn fruit juice, the viscosity was 0.00089 ± 0.00005 Pa. s, the osmolarity was 773 ± 64.33 mmol/L, with 3.4 ± 0.27 ° Brix total soluble solids and 44.26 ± 2.97 mg/g total sugars. The lysine content was the highest in N1 and aspartic acid content was the highest in N2. The research on *A. mellifera* bees' dietary choices and their consumption patterns revealed the highest consumption of the pollen substitute was noted for P2 at 3.66 g/colony in June, while the lowest consumption of P1N2 was also recorded in June at 2.8 g/colony. N1 led the nectar substitutes with 691.67 ml. Pollen diet acceptance was highest in P2 at 0.86 g in June and reached 0.97 g for P1 and P2N1 in July. The sealed brood area peaked at 272.69 cm^2 in P1 (June) and 523 cm^2 in N1 (July), showing the effectiveness of targeted diets. All formulations showed autofluorescence from 455 nm to 525 nm; as a result, it has been concluded that the pollen and nectar formulations are mimicked the natural pollen and nectar substitutes.



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sciforum-113631: Mechanisms of Browning Inhibition and Quality Preservation in Apples: The Role of Tragacanth Gum as a Postharvest Coating

Mian Muhammad Ahmed ^{1,*}, Ahmad Sattar Khan ², Saqib Ayyub ² and Pan Zhiyong ^{3,4}

¹ National and Local Joint Engineering Laboratory for High-Efficiency and High-Quality Cultivation and Deep Processing Technology of Characteristic Fruit Trees in Southern Xinjiang, Tarim University, Alar, 843301, China

² Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38000, Pakistan

³ College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, P.R. China

⁴ National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizhishan Street, Hongshan District, Wuhan, Hubei, 430070 China.

Postharvest browning is a major factor contributing to quality loss and reduced shelf life in apple (*Malus domestica*) fruits, leading to diminished consumer appeal and marketability. The enzymatic browning process, primarily driven by polyphenol oxidase (PPO) and peroxidase (POD) activity, significantly affects the texture, color, and overall quality of apples during storage. The present study investigates the potential of tragacanth gum, a natural polysaccharide, as an edible coating to mitigate postharvest browning and preserve the sensory attributes of apples during refrigerated storage. Apples were treated with a 1% (w/v) tragacanth gum solution and stored at 0°C under controlled atmosphere (CA) conditions with 90–95% relative humidity for 20 days. The effects of the coating on browning were evaluated through visual inspection, color measurements (L*, a*, and b* values), and enzymatic activity assays for PPO and POD, which are key enzymes responsible for oxidative browning. In addition, sensory attributes such as firmness, texture, aroma, flavor, and overall acceptability were assessed by a trained panel. The results demonstrated that tragacanth gum coatings effectively reduced the rate of browning in the apples, as evidenced by improved color retention and a significant reduction in PPO and POD activity compared to the untreated control. The treated apples maintained a more vibrant appearance, with less discoloration and a longer-lasting fresh look. Furthermore, the tragacanth gum-coated apples exhibited enhanced firmness and texture with no significant loss of aroma and flavor, resulting in improved overall sensory quality. The overall acceptability scores of the treated apples were higher than those of untreated controls, indicating that the coating preserved the sensory appeal of the fruit. These findings suggest that tragacanth gum acts as a natural and effective postharvest treatment to delay browning, maintain texture, and enhance flavor, thereby improving the marketability and shelf life of apples. This study highlights the potential of tragacanth gum as an eco-friendly, non-toxic alternative to synthetic coatings, offering a promising strategy for postharvest management and quality preservation in apples under refrigerated and controlled-atmosphere storage conditions.



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sciforum-118115: Metabolic changes in *Brassica rapa* L. subsp. *sylvestris* during postharvest storage

Giovanna Marta Fusco*, Pasqualina Woodrow, Laura Alberico and Petronia Carillo

Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania "Luigi Vanvitelli", 81100 Caserta CE, Italy.

At harvest, leafy vegetables undergo profound metabolic changes, causing oxidative stress and accelerating senescence, compromising their nutritional, nutraceutical, and organoleptic quality. These physiological modifications involve the degradation of key metabolites, affecting both primary and secondary metabolic pathways. Storage conditions play a crucial role in modulating these postharvest alterations, influencing metabolic responses related to oxidative stress, nutrient storage, and overall tissue integrity. Understanding these changes is essential for optimizing postharvest processing strategies and extending shelf life while maintaining the product quality. This study investigates the postharvest metabolic responses of *Brassica rapa* L. subsp. *sylvestris* (Friariello Napoletano), ecotype Sessantino, stored at 4 °C and 10 °C for 2 or 20 days. The results show that fresh samples (control) had higher levels (by over 50%) of sugars, proteins, chlorophylls, reduced ascorbate, and relative water content (RWC) compared to stored samples. Storage caused a decrease in sucrose and starch (by 75%), while the presence of several amino acids, including asparagine and glutamine, increased by more than 100% in stored samples. The increase in amides is due to amino acid catabolism, which releases carbon skeletons (acetate and oxalacetate), but also ammonia, which must be re-organized to avoid further metabolic disturbances. Postharvest senescence was also evident after 20 days at 10 °C, showing a reduction in chlorophylls (by 80%) and ascorbate (by 85%), both of which are essential for preserving photosynthetic efficiency and antioxidant capacity. Interestingly, the tocopherol content increased by over 200%, probably due to the phytol released during chlorophyll degradation. This suggests that tocopherols act as protective molecules against oxidative stress, mitigating cell damage induced by storage conditions. Overall, prolonged cold storage, particularly at 10 °C, induces substantial metabolic changes in *Brassica rapa* L., reflecting stress adaptation mechanisms and marked changes in primary and secondary metabolism. Understanding these biochemical changes provides valuable indications for improving postharvest handling strategies of leafy vegetables, with the aim of prolonging shelf life while preserving nutritional and functional quality.



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sciforum-116245: Metabolomic and transcriptomic profiling of Red Delicious apple stored under static (CA) and dynamic controlled atmosphere (DCA)

Elige Salame^{1,*}, Benedetto Ruperti², Pietro Tonutti¹ and Stefano Brizzolara¹

¹ Institute of Crop Science, Scuola Superiore Sant'Anna, Piazza Martiri della Libertà, 33, 56127 Pisa, Italy.

² Department of Agronomy, Food, Natural Resources, Animals and Environment, Via dell'Università, 16, 35020 Legnaro (PD), Italy.

Red Delicious (RD) apples benefit from low oxygen storages, that delay ripening allowing for a better maintenance of fruit quality. However, RD is sensitivity to such conditions and often results in an excessive accumulation of ethanol and other off flavors, as well as the onset of storage disorders, leading to unmarketability and important postharvest losses. To mitigate these effects, dynamic controlled atmosphere (DCA) storage has been adopted particularly for pome fruits. DCA uses extremely low oxygen levels that are adjusted based on the fruit's physiological responses. These conditions induce modulations in both fundamental and specialized metabolisms. To investigate these adaptations, RD apples stored under different CA protocols (normoxia; static 0.3% and 0.8% oxygen; dynamic oxygen modulation from 0.3 to 0.8%) under cold storage at 1 °C. Responses were evaluated for peel and pulp tissues separately focusing on the molecular and metabolic adaptations. For this aim, transcriptomics analysis using both RNA-sequencing (RNA-seq) and RT-qPCR in addition to metabolomics analysis involving VOCs, polyphenols, and primary metabolites were conducted to provide a comprehensive overview of the fruit status. Results confirmed the marked induction of ethanol and subsequent accumulation of ethyl esters and alanine under static 0.3% conditions. Common and tissue-specific responses between peel and pulp have been identified. Both tissues accumulated non-ethyl esters under normoxia, fermentation-related VOCs under static CA conditions, and amino acids like valine and lysine under DCA, along with the retention of higher firmness levels and absence of storage disorders. Among tissue-specific responses, polyphenols appeared to differentially accumulate at higher levels in the pulp under DCA and in the peel under normoxia. Transcriptomics analysis confirmed and aligned the metabolomic findings and highlighted the involvement of ERFs transcription factors in response of apple fruit to different levels of low oxygen stress.

The study provided insight into the metabolic and molecular responses of RD apples to DCA protocols, helping to clarify and deepen the understanding of both common and tissue-specific responses of apple pulp and peel tissues.



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sciforum-116635: Polyphenolic Composition and Antioxidant Stability in Stored Pear Under Different Storage Conditions

Muqaddas Muqaddas ¹, Nimra Hayat ¹, Saqib Ayyub ², Mian Muhammad Ahmed ^{3,4,*}, Syeda Maira Hamid ^{3,5} and Pan Zhiyong ⁶

¹ College of Food Science and Engineering, Tarim University, Alar, 843300, China.

² Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38000, Pakistan

³ College of Life Science and Technology, Tarim University, Alar, Xingjiang, China.

⁴ National Key Laboratory for Germplasm Innovation and Utilization of Horticultural Crops, Huazhong Agricultural University, Wuhan, 430070, Hubei, China.

⁵ Key Laboratory of Protection and Utilization of Biological Resources in Tarim Basin, Alar, Xinjiang, China.

⁶ National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizhishan Street, Hongshan District, Wuhan, Hubei, 430070 China.

Postharvest storage conditions significantly impact the polyphenolic composition and antioxidant stability of pears (*Pyrus spp.*), which are crucial for fruit quality, shelf life, and nutritional value. Polyphenols, including flavonoids and phenolic acids, contribute to the antioxidant potential of pears, but their stability varies under different storage conditions. This study investigated the effects of **cold storage (4°C, 85% RH)**, **controlled atmosphere (CA) storage (2% O₂ + 3% CO₂, 2°C)**, and **ambient storage (25°C, 60% RH)** on the polyphenolic profile and antioxidant activity of pear fruit over 0, 15, 30, and 60 days of storage. Polyphenols play a vital role in delaying senescence and enhancing fruit defense against oxidative stress. Previous studies indicate that **low-temperature storage reduces enzymatic oxidation**, while CA storage minimizes metabolic degradation, preserving polyphenol levels. However, ambient storage accelerates oxidative reactions, leading to significant degradation. Although such storage effects have been well-documented in apples and berries, limited research has explored these mechanisms in pears. In this study, polyphenols were quantified using **high-performance liquid chromatography (HPLC)**, while antioxidant activity was evaluated through **DPPH and ABTS assays**. The enzymatic activity of **polyphenol oxidase (PPO) and peroxidase (POD)** was also measured to assess oxidative degradation. The results showed that **CA storage best preserved polyphenol content**, followed by cold storage, whereas ambient storage led to significant degradation ($p < 0.05$). Chlorogenic acid and quercetin derivatives exhibited the most substantial losses under ambient conditions. Antioxidant assays confirmed that pears stored in CA conditions maintained **higher antioxidant activity**, while enzymatic analysis indicated significantly lower PPO and POD activities under CA and cold storage, reducing oxidative damage. These findings suggest that **CA storage effectively delays polyphenol degradation by reducing oxidative stress and enzymatic activity, thereby maintaining the antioxidant properties of pears**. This supports the growing use of CA storage for prolonging fruit shelf life while preserving bioactive compounds. Future research should explore metabolomic and transcriptomic approaches to further elucidate the molecular regulation of polyphenol metabolism in pears during postharvest storage.



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sciforum-116354: Preharvest conditions for better postharvest apples

Vitalis Laužikas * and Kristina Laužikė

Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kauno 30, Babtai, Kaunas distr., Lithuania

Apple is a unique fruit, characterized by excellent nutritional properties and good postharvest properties. Following the harvesting process, it is crucial to maintain the integrity of the fruit and ensure that its nutritional properties remain largely unchanged for an extended period, or at least to minimize any alterations. The postharvest quality of apples is significantly affected by the conditions under which they are cultivated, as well as by the management practices that are implemented preharvest. The aim of this study was to evaluate the impact of growing conditions on the postharvest quality of apples and the quality of the fruit during storage. Eight distinct combinations of growth control techniques, including manual pruning, mechanical pruning, spraying, and trunk cutting, were selected for this experiment. The experiment was carried out in an experimental intensive orchard in Lithuania, (55°60' N, 23°48' E). Apples (*Malus Domestica* Borkh.) for the experiment were collected from fully grown trees. The collected apples were stored and placed in boxes in a temperature-controlled (temperature 4±2°C degrees) storage facility for 6 months, after which the postharvest quality and any quality changes in the apples were evaluated. It was observed that the lowest incidence of apples being affected by rot resulted from a combination of mechanized and manual pruning techniques, with a recorded damage rate of 20 percent. Furthermore, these apples demonstrated the highest levels of soluble sugars during storage, with their sucrose levels increasing by more than threefold due to the decomposition of starch. Conversely, the highest proportion of rotten apples, at 40 percent, was noted following trunk cutting with the aim of growth regulation. This method also led to the greatest loss of moisture and the lowest accumulation of sugars. Combining manual pruning with mechanized pruning allows for the highest quality of fruit, which can be maintained with minimal losses during storage. The experiment's results indicate that proper growth control techniques can enhance the postharvest quality of apples without the need for additional tools.



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sciforum-116250: Role of Micronutrients in Enhancing Floral Quality and Shelf Life of *Ixora coccinea*

Kuna Karthik^{1,*}, M Ganga¹, Shaik Sumera¹ and Devanakonda Venkata Sai Chakradhar Reddy²

¹ Department of Floriculture and Landscaping, Tamil Nadu Agricultural University, Coimbatore - 641003, India

² Division of Agricultural Physics, Indian Council of Agricultural Research (ICAR) - Indian Agricultural Research Institute (IARI), New Delhi - 110012, India

Diverse agro-climatic conditions in India provide an optimal environment for cultivating ornamental crops, including *Ixora coccinea* (West Indian Jasmine). This evergreen shrub, known for its striking year-round bloom clusters, holds significant commercial, ornamental, and ecological value. Despite its promise as a high-value loose-flower crop, there is a lack of research focused on optimizing its cultivation practices like spacing, irrigation, and nutrient requirements, particularly for micronutrient management for enhancing flower yield and quality. This study investigates the impact of foliar-applied micronutrients on *Ixora*'s flowering, physiological, and post-harvest parameters from 2021 to 2022 at the Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University, Coimbatore. The study evaluated four *Ixora* varieties (Red, Pink, Orange, and Yellow) under five foliar micronutrient treatments, including FeSO_4 , ZnSO_4 , and boric acid, applied at monthly intervals. A Factorial Randomized Block Design (FRBD) was used to assess the varietal and treatment-specific responses systematically. The results showed significant improvement in floral and post-harvest traits across all the treatments. Among the varieties, Pink (V_2) demonstrated the best performance, with a flower bud length of 5.15 cm, bud width of 0.38 cm, and corolla tube length of 3.73 cm. This variety also exhibited the longest shelf life, lasting 5.20 days under ambient conditions and 6.21 days under refrigerated conditions. The interaction between the pink variety (V_2) and the foliar treatment of NPK + FeSO_4 (0.5%) + ZnSO_4 (0.5%) + boric acid (0.2%) ($V_2 \times T_4$) produced optimal results, with a flower bud length of 5.44 cm, bud width of 0.44 cm, corolla tube length of 3.95 cm, and an extended shelf life of 6.09 days at room temperature and 7.13 days under refrigerated conditions. Foliar micronutrient applications significantly improved the nutrient uptake, photosynthetic efficiency, and also the overall flower quality. This study highlights the importance of strategic micronutrient management in enhancing the yield, quality, and profitability of *Ixora* flowers, offering promising opportunities for empowering small and marginal farmers and advancing India's floriculture sector.



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sciforum-116492: Synergistic effect of blanching and sonicated edible coatings on the shelf stability of blackberries stored at various temperatures

Muhammad Nadeem ^{1,*} and Muhammad Adnan Shahid ²

¹ University of Sargodha, Sargodha, Pakistan

² Horticultural Science Department, North Florida Research and Education Center, University of Florida/IFAS, Quincy, FL, 32351, USA

Blackberries (*Rubus fruticosus* L.) are known as functional foods due to their rich concentration of bioactive compounds. Due to their limited shelf life and susceptibility to postharvest quality deterioration, it is imperative to investigate postharvest interventions that can prolong the fruit's quality. The aim of this research was to develop a sonicated and microwave-assisted pasteurized edible coating containing citrus peel essential oil (CPEO), and investigate its impact on the quality of blackberries stored at low and elevated temperatures through physico-chemical and antioxidant analysis. The coating effect on maintaining the quality of blackberries during storage was more prominent when it was applied on blanched blackberries. About 33.78% weight loss was observed in control blackberries (BB) after 21 days at 4°C; blanched and coated blackberries indicated 18% reduction in fruit weight loss; and 65.11% reduction occurred in fruit decay. About 69.43% weight loss was recorded after 3 days in control blackberries stored at 30°C. The pH of control blackberries increased by 9.36% whereas blanched and coated fruits indicated a 5.52% increase after 21 days. Blanched and coated blackberries indicated a 10.71% lower decrease in titrable acidity at 20°C, whereas a 36.36% decline in acidity was observed in control blackberries stored at 30°C. About 22.86% loss in TSS was observed in control blackberries after 21 days. The TSS/acidity ratio gradually increased during storage, reaching its maximum value (13.60) after 21 days in blanched and coated fruits. The sonicated edible coating reduced 23.65% loss in the total flavonoid and 24.50% loss in total flavanols compared to the uncoated fruits kept at 4°C after 21 days. Blanched and coated samples displayed a 22.12% reduction in the loss of the total flavonoid at 20°C and 17.30% at 30°C and 18.05% reduced loss was obtained for the total flavanols at 20°C and 15% at 30°C. Blanched blackberries coated with a sonicated edible coating indicated a 16.91% reduction in the loss of total phenolic content and 27% TAA after 21 days. Blanched and coated blackberries indicated a 12.20% reduction in the loss of DPPH radical scavenging activity after 21 days at 4°C. The sonicated edible coating comparatively maintained 19.59% DPPH radical scavenging activity compared to the control. The promising results concluded that sonicated edible coating is an innovative solution for effective postharvest quality during storage. However, additional work needs to be conducted to analyse the potential of sonicated edible coatings with different essential oils on different horticultural commodities at various storage temperatures.



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sciforum-116224: Transport simulation of *Bulbine frutescens* and evaluation of post-production performance

Annalisa Meucci^{1,*}, Elige Salame², Alice Trivellini³, Antonio Ferrante⁴ and Anna Mensuali⁴

¹ Crop Science Research Center, Scuola Superiore Sant'Anna, 56127 Pisa, Italy

² Department of Agricultural and Food Sciences, University of Milano, Via Celoria 2, 20133 Milano, Italy

³ Department of Agricultural, Food and Agro-environmental Sciences, University of Pisa, Via del Borghetto, 80, 56124 Pisa, Italy

⁴ Institute of Crop Science, Sant'Anna School of Advanced Studies, Piazza Martiri della Libertà, 33, 56127 Pisa, Italy

The ongoing climate change imposes abiotic stresses on the agricultural sector, pushing towards the search for multifunctional plant species which are not only capable of coping with stress but also have high nutritional and ornamental values. The *PRIN-NATIVASA* project for the Italian floristry sector focusses on selecting new native Australian and South African species resistant to environmental challenges and creating opportunities to develop sustainable ornamental commodities. In these regions, native bushy species are considered the main source of indigenous food sustenance for their high nutraceutical value and their adaptability to drought and arid environments. *Bulbine frutescens*, originally from South Africa, represents a good example of an edible plant rich in vitamins and antioxidants, making it a powerful medicinal plant due to its antiseptic and anti-inflammatory effects. This plant exhibits also remarkable resilience, thriving in harsh environments with rapid growth and exceptional drought tolerance due to its succulent leaves. This study investigates the shelf-life response of *B. frutescens* during post-production, specifically addressing ethylene sensitivity and the impact of chemical treatments on maintaining quality. Plants were subjected to simulated transportation (dark conditions for one week at room temperature), followed by a retail phase (low light intensity for one week). Pre-treatments with melatonin (100 µmol) and 1-MCP (10 ppm) were conducted. Ethylene sensitivity was evaluated in plants exposed for 24h to ethylene (10 ppm) and were compared to control in light conditions. Physiological and biochemical analyses were conducted, measuring ethylene and CO₂ production, chlorophyll content, carotenoids, lipid peroxidation (MDA), and visual quality. The results showed that the 1-MCP and melatonin treatments were effective in maintaining plant quality by keeping chlorophyll a, carotenoids, and the Chla/Chlb ratio high after the transport period (in the dark), in addition to lower values of MDA and gases production. On the other hand, *B. frutescens* showed minimal sensitivity to exogenous ethylene treatment, as ethylene and CO₂ production, along with other physiological parameters, remained comparable to untreated control plants kept under light.

This study emphasizes the resilience of *B. frutescens* to post-production stresses and highlights the potential of 1-MCP and melatonin to further enhance its marketability as a novel ornamental species. Future studies will focus on evaluating and studying other native potential candidates with superior post-production performance, supporting the development of sustainable, climate-resilient ornamental commodities.



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sciforum-116451: Volatile compounds released by chocolate mint (*Mentha × piperita* var. *chocolate*) leaves after different post-harvest procedures

Alessandro Frontini*, Carmine Negro, Andrea Luvisi, Samar Min Allah, Marina De Filippi and Luigi De Bellis

Department of Biological and Environmental Sciences and Technologies (DiSTeBA), Salento University, Via Prov.le Lecce-Monteroni, 73100 Lecce, Italy

Background

Chocolate mint (*Mentha × piperita* var. *chocolate*) is a peppermint variety which owes its name to a chocolate-like scent and dark-red staining of the stems. It is a medicinal and ornamental plant, spread throughout the world due to nursery activities. Chocolate mint essential oil was previously characterized, while the aroma of the whole leaves has been scarcely studied. Indeed, though essential oils are commonly used in cosmetics and perfumery, whole mint leaves are broadly consumed as food products.

Goals

Fresh mint leaves were compared with hot and freeze-dried leaves with the aim of observing the differences between the volatile organic compounds (VOCs) of mint leaves subjected to different post-harvest treatments, and assessing the best method to preserve the quality of the final product.

Methodology

Chocolate mint plants (*Mentha × piperita* var. *chocolate*) were grown in 10 cm pots at the botanical garden of the University of Salento. After 4 months from planting, 3–4 apical leaves were harvested from plants and mixed in stock. Some of them were analyzed immediately (fresh sample), while others were hot-dried at 42 °C for 16 hours (hot-dried sample) or freeze-dried for 22 hours after freezing at -22 °C for two hours (freeze-dried sample). The three samples were sealed in a 20 ml vial, and a solid phase microextraction (SPME) fiber was exposed to headspace to capture the emitted VOCs. The compounds were then analyzed by gas-chromatography coupled with mass spectrometry (GC/MS).

Results

A total of 17 VOCs were detected among the three samples, with monoterpenes being the most represented category. Most of the compounds found in fresh leaves were preserved after drying, while, interestingly, some compounds occurring in dried leaves were scarcely emitted by fresh leaves. Some differences were also observed for compounds included in the menthol synthesis pathway.

Conclusions

Both hot-drying and freeze-drying preserved the characteristic aroma of chocolate peppermint leaves, proving to be effective methods for post-harvest treatments, allowing for long-term product storage. Furthermore, the data demonstrated a variable presence of chemicals part of the menthol pathway as a result of the various treatments.



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Session 6. Politics and Economy

sciforum-116441: Analysis of Sustainable Practices in Greenhouse Horticulture in Almeria (Spain)

Susana Aparicio Castro*, Virginia Navarro Cuesta, Antonia González Vizcaíno and Maria del Carmen García García

IFAPA

Greenhouse vegetable production in Andalusia is concentrated in Almeria (Spain), with 33.400 hectares, 80% of which are cultivated under biological control strategies and 3.492 hectares in organic farming. Almeria's agricultural model is distinguished by its cultivation techniques focused on economic, social and environmental sustainability. The Institute for Agricultural Research and Training (IFAPA) supports the sustainability and development of this agricultural model through research, training and knowledge transfer projects that seek to improve the capacity of this horticultural sector.

To assess the current situation of Almeria's greenhouses, we conducted a survey of young farmers on the sustainable practices applied in their farms. This survey provided information on the cultivation systems used, the use of organic fertilizers, pest and disease control methods, biodegradable materials used and waste management.

A total of 105 surveys were conducted, revealing that 62% of the greenhouses use conventional cultivation, 24% opt for integrated pest management and 14% for organic. Although the use of phytosanitary products is common, more than half of the respondents use natural enemies and refuge plants and disinfect the soil mainly with solarization. In organic fertilization, manure is the most used. Two thirds of the respondents manage organic waste with specialized companies, while the rest self-manage it by burying or composting. The management of inorganic waste is mostly entrusted to a management company.

Based on this study, we can conclude that the use of natural enemies and refuge plants is becoming a common practice, promoting greenhouse biodiversity; the percentage of self-management of plant waste has increased over the years, although it is still mostly delivered to a composting plant; studies are being carried out on the use of biodegradable materials for greenhouses; and the delivery of inorganic greenhouse waste contributes to reducing its negative effects on the environment.



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sciforum-116479: Consumer Purchase Behaviour and Preferences for Ornamental Perennials: A Survey from the Małopolska Region, Poland

Justyna Mazur*, Anna Krajewska and Anna Kapczyńska

Department of Ornamental Plants and Garden Art, University of Agriculture in Krakow

Numerous marketing studies have shown that consumer groups exhibit different preferences and purchasing behaviours, influenced by various factors. Ensuring business stability and growth requires a strong market orientation and effective strategies, emphasising the importance of monitoring consumer preferences and behaviour. This is particularly critical for perishable goods, such as ornamental plants. While research in this sector has focused primarily on cut flowers, potted plants, and nursery trees, there is a significant gap in studies addressing ornamental perennials, despite their growing popularity among individual consumers and businesses specialising in garden and landscape design.

This study assessed consumer preferences and behaviour regarding the purchase of ornamental perennials in different stationary retail outlets across the Małopolska region of Poland. A survey conducted from July to September 2022 covered twenty locations in three types of areas based on population density: Kraków (over 100,000 inhabitants), Gorlice (up to 30,000 inhabitants), and four rural villages, with research conducted at four types of retail outlets in each: garden centres, nurseries, florists, and DIY/home improvement stores. A total of 202 verified surveys, featuring 15 closed-ended questions and a demographic section, were included in the analysis.

Consumers, regardless of age or gender, most frequently purchase perennials from specialised outlets such as nurseries and garden centres, valuing these places for their perceived high-quality products, wide selection, and professional advice. In large cities, large-scale retail stores are also popular, while florists dominate in smaller towns due to greater availability. Price is not a major determinant for most consumers; however, younger and older respondents tend to prefer smaller, cheaper plants, likely due to financial constraints. Online purchases of perennials remain rare, primarily because consumers value the ability to assess plant quality and seek professional advice.

Gender-based preferences are significant. Men prioritise plants with bold, classic inflorescences, such as peony- or lily-like flowers in white or red, as well as decorative foliage. Women, in contrast, favour intensely flowering, fragrant plants with delicate structures in pink, purple, or white. Women are also more inclined to select plants that promote biodiversity and use recycled packaging, a trend also observed among the youngest and oldest consumers. The perennials most frequently mentioned as favourites include echinacea, salvias, peonies, and daylilies, with ornamental grasses and garden ferns also being highly appreciated.

For producers and distributors, understanding consumer preferences is crucial for developing targeted marketing strategies and tailoring their product assortments to maximize profitability.



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sciforum-116226: The BiodiverSO project as a model for preserving the biodiversity of vegetable crops in Puglia (Southern Italy)

Angelo Signore *, Adriano Ildonna, Onofrio Davide Palmitessa, Massimiliano Renna and Pietro Santamaria

Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Bari, 70126, Italy

The Puglia region is exceptionally rich in agro-biodiversity, showcasing how local vegetable varieties can continue to interact with modern horticulture. Unfortunately, the genetic diversity of vegetable crops in this region has declined due to factors such as rural abandonment, an aging farming population, and the loss of generational knowledge transfer.

This article summarizes the objectives, methodologies, and outcomes of the “Biodiversity of Puglia’s Vegetable Crops (BiodiverSO)” projects. These integrated initiatives, funded by the Puglia Regional Administration under the Rural Development Program, aim to recover, characterize, conserve, and enhance local vegetable varieties.

During the first project edition (2013–2018), activities were organized into eight work packages. For illustrative—yet incomplete—purposes, significant achievements include the recognition and promotion of the “Carota di Polignano” (*Daucus carota* L.), a local carrot variety producing yellow, purple, and orange roots within the same field. Additionally, eight local varieties of globe artichoke were sanitized of viruses such as artichoke Italian latent virus (AILV), artichoke latent virus (ArLV), and tomato infectious chlorosis virus (TICV) using meristem-tip culture and in vitro thermotherapy.

The second project edition (2023–2025) expanded activities to ten work packages, along with two additional actions focused on dissemination and information exchange. Notable progress was made with the “Scopatizzo” (*Cucumis melo* L.), an unripe melon used similarly to cucumbers. In hydroponic cultivation, this variety yielded 5.3 kg/plant (26.2 fruits/plant) within 71 days of transplanting. Furthermore, bitter fruits were observed in this variety, a phenomenon previously reported in some local cucumber varieties.

Another important result, by way of example but not of limitation, involved the “Barattiere”, a landrace of unripe melon (*C. melo* L.). This variety demonstrated resistance to Tomato leaf curl New Delhi virus (ToLCNDV), showing no detectable disease symptoms and recording very low levels of viral DNA accumulation. Consequently, the “Barattiere” has been proposed as a rootstock for ToLCNDV-susceptible cucurbit genotypes.

For both project editions, a computerized database—the BiodiverSO Management System (BMS)—was developed to ensure accurate and efficient management and processing of project data.

The results underscore that while some local varieties were replaced by modern ones before reaching their full potential, their genetic value remains critical for future crop improvement programs.

In conclusion, the BiodiverSO project serves as a model initiative for the protection and recovery of vegetable varieties at risk of genetic erosion, facilitating the identification and valorization of Puglia’s diverse plant germplasm.



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Grosspeteranlage 5
4052 Basel
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Tel.: +41 61 683 77 34

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