

IECAG
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Conference

The 4th International Electronic Conference on Agronomy

02-05 December 2024 | Online

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The 4th International Electronic Conference on Agronomy

2–5 December 2024 | Online



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Dr. José David Flores-Félix

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Table of Contents

Welcome from the Chair	1
Session Chairs	4
Event Committee Members	5
Keynote Speakers.....	10
Invited Speakers	12
Program at a Glance	13
IECAG 2024 Program.....	14
Session 1. Crops.....	19
Session 2. Breeding/Selection Technologies and Strategies	52
Session 3. Sustainable Soil Management and Farming Systems.....	75
Session 4. Precision and Digital Agriculture.....	123
Session 5. Biostimulation and Biocontrol Microbial-Based Strategies.....	135
Session 6. Plant–Crop Biology and Biochemistry	167
Session 7. Water Use and Irrigation.....	198

Welcome from the Chair

Dear colleagues, distinguished agronomists,

We are thrilled to welcome you to the upcoming 4th International Electronic Conference on Agronomy (IECAG 2024), proudly sponsored by the MDPI open access journal Agronomy. In line with our commitment to fostering collaboration and knowledge exchange, this electronic conference provides a unique platform for researchers to showcase their work, discuss groundbreaking findings, and engage in meaningful conversations with fellow experts.

Conference Overview: This virtual conference will be held at www.sciforum.net, a platform developed and sponsored by MDPI to organize and provide technical support for electronic conferences. The virtual format offers the distinct advantage of eliminating the need for travel and its associated expenses, allowing you to fully immerse yourself in the conference without any logistical constraints.

Key Themes: The conference will span various key themes, including the following:

- Breeding/Selection Technologies and Strategies;
- Sustainable Soil Management and Farming Systems;
- Crops;
- Precision and Digital Agriculture;
- Water Use and Irrigation;
- Plant–Crop Biology and Biochemistry;
- Biostimulation and Biocontrol Microbial-Based Strategies;

Conference Format: After abstract acceptance, authors are invited to submit a pre-recorded video presentation or a series of narrated slides. These materials will be accessible online and open for discussion, comments, and questions during the entire conference. Additionally, presentations will remain available after the e-conference concludes. Authors are encouraged to submit a full description of their work in a conference paper, which will undergo peer review. The accepted papers will likely be published in the MDPI Biology and Life Sciences Forum journal. However, paper submission is not a requirement for active conference participation.

Free of Charge Participation: We are pleased to inform you that participation in this conference is entirely free of charge for both authors and attendees. The accepted proceedings papers will likely be published in the MDPI Biology and Life Sciences Forum journal, available online on the MDPI website. Selected extended versions of the papers will be published in a Special Issue of the journal Agronomy with a 15% discount on the article processing charge (ISSN 2073-4395).

Awards and Opportunities: The best oral presentation and best poster awards will receive an award of CHF 200, along with an offer to publish an extended paper, in the Special Issue of Agronomy.

We encourage you to explore the conference platform and guidelines provided in advance for a seamless experience. Should you have any queries or require assistance, our dedicated support team is available to ensure your participation is smooth and rewarding.

We look forward to engaging in exciting discussions and hearing new ideas and perspectives from experts in the field. All participants are welcome to join the online conference and contribute to the vibrant intellectual exchange that makes events like IECAG 2024 truly exceptional.

Kind regards,



Dr. Jose David Flores-Felix
Conference Chair

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Journal Webpage: <https://www.mdpi.com/journal/agronomy>

Session Chairs



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Program at a Glance

	Day 1	Day 2	Day 3	Day 4
Morning	Welcome and Opening Remarks Convening Chair (09:00 CET 03:00 EDT 16:00 CST)			
	Keynote Talks (09:10 CET 03:10 EDT 16:10 CST)	Keynote Talks (09:10 CET 03:10 EDT 16:10 CST)	Keynote & Plenary Talks (09:10 CET 03:10 EDT 16:10 CST)	Keynote Talks (09:10 CET 03:10 EDT 16:10 CST)
	Session 1. Crops (Invited and Contributed Oral Presentations) (10:20 CET 04:20 EDT 17:20 CST)	Session 3. Sustainable Soil Management and Farming Systems (Invited and Contributed Oral Presentations) (10:20 CET 04:20 EDT 17:20 CST)	Session 5. Biostimulation and Biocontrol Microbial-Based Strategies (Invited and Contributed Oral Presentations) (10:20 CET 04:20 EDT 17:20 CST)	Session 7. Water Use and Irrigation (Invited and Contributed Oral Presentations) (10:20 CET 04:20 EDT 17:20 CST)
Afternoon	Keynote Talks (13:30 CET 07:30 EDT 20:30 CST)	Keynote Talks (13:30 CET 07:30 EDT 20:30 CST)	Keynote Talks (13:30 CET 07:30 EDT 20:30 CST)	Closing Remarks/ Awards Ceremony Convening Chair (12:30 CET 06:30 EDT 19:30 CST)
	Session 2. Breeding/Selection Technologies and Strategies (Invited and Contributed Oral Presentations) (14:20 CET 08:20 EDT 21:20 CST)	Session 4. Precision and Digital Agriculture (Invited and Contributed Oral Presentations) (14:20 CET 08:20 EDT 21:20 CST)	Session 6. Plant-Crop Biology and Biochemistry (Invited and Contributed Oral Presentations) (14:20 CET 08:20 EDT 21:20 CST)	

IECAG 2024 Program

2 December 2024 (Monday)

Session 1. Crops

Time: 9:00 (CET, Basel) | 03:00 (EDT, New York) | 16:00 (CST Asia, Beijing)

CET Time	Speaker	Title
09:10–09:20	Prof. Dr. Oscar Vicente (UPV, Spain)	Welcome by Session Chair
09:20–09:40	Prof. Dr. Oscar Vicente (UPV, Spain) Keynote Speaker	“Alternative” crops to enhance Mediterranean agrodiversity and fight the climate emergency
09:40–10:00	Prof. Dr. Ana Fita (UPV, Spain) Keynote Speaker	Neglected and Underutilized Plants as a Source of Resilient Crops with Bio-Functional Properties
10:00–10:15	Dr. Amarjeet Kumar Sing (NU, India) Invited Speaker	Understanding the molecular mechanism of K+ deficiency tolerance in chickpea
	<i>Invited and Contributed Oral Presentations</i>	Session 1: Crops
10:15–10:30	Maria Carpena (UVigo, Spain) Selected Speaker	Biopesticides from marine macroalgae against bacterial and fungal pathogens towards crop disease management
10:30–10:45	Asad Muhammad (NAU, China) Selected Speaker	Effect of Inoculation Techniques on Production of Potential of Soybean Varieties Intercropped in Spring Maize
10:45–11:00	Kawtar Abselam (UAlicante, Spain) Selected Speaker	Assessment of organic substrates derived from marine and food waste for the growth of tomato plants
11:00–11:15	Raju Mondal (MTCL, India) Selected Speaker	Decoding the effect of polyploidization on Morus species complex: an integrated transcriptomic and phenomic approach
11:15–11:30	Savanah Senn (LAPC, USA) Selected Speaker	Significance and Interaction of CaCl ² treatments and genetic background in Primula greenhouse crop improvement efforts
11:30–11:45	Thyago Rodrigues do Carmo Brito (UTMAD, Brazil) Selected Speaker	Input costs and volatility price of soybean produced in the state of Pará, Brazil
11:45–13:30		Break

Session 2. Breeding/Selection Technologies and Strategies

Time: 13:30 (CET, Basel) | 07:30 (EDT, New York) | 20:30 (CST Asia, Beijing)

CEST Time	Speaker	Title
13:30–13:40	Dr. Dilip Panthee (NCSU, USA)	Welcome by Session Chair
13:40–14:00	Dr. Dilip Panthee (NCSU, USA) Keynote Speaker	Improving Crops Using Genomic and Biotechnological Resources
14:00–14:20	Pending Confirmation Keynote Speaker	TBD
	<i>Invited and Contributed Oral Presentations</i>	Session 2: Breeding/Selection Technologies and Strategies
14:20–14:35	Mirone Francesco (UP, Italy) Selected Speaker	Canopy management as a short-term adaptation strategy to counteract heatwaves' impacts on grapevine

14:35–14:50	Rahul Sharma (YSPU, India) Selected Speaker	Identification of Novel Bacterial Blight Resistance in Wild Punica granatum L. from North-Western Himalayas using SSR Markers and Hybridization for Developing Resistant F1 Hybrids
14:50–15:05	Noureddine Chaachouay (HFUS, Morocco) Selected Speaker	Exploring how Moroccan farmers in Khemisset province adapt to climate change: perceptions and strategies.
15:05–15:20	Fahim Reza Jhelom (MAD, Bangladesh) Selected Speaker	Impact of Auxin and Cytokinin Concentrations on the Induction of Callus and the Regeneration of in vitro Plantlets in Aromatic Rice Katarivogh (Oryza sativa L.)
15:20–15:35	Ana Paula dos Santos Melo (UEFS, Brazil) Selected Speaker	The Jatropha curcas as a substitute for Ricinus communis in biodiesel production in the semi-arid region of Brazil
15:35–15:50	Darwish Saleh (UCairo, Egypt) Selected Speaker	Stability Analysis of Egyptian Faba Bean Varieties and their Resilience to Variable Environmental Conditions and Orobanche Parasitic Weed Infestation

3 December 2024 (Tuesday)

Session 3. Sustainable Soil Management and Farming Systems

Time: 9:00 (CET, Basel) | 03:00 (EDT, New York) | 16:00 (CST Asia, Beijing)

CET Time	Speaker	Title
09:10–09:20	Professor Mirza Hasanuzzaman (SBAU, Bangladesh)	Welcome by Session Chair
09:20–09:40	Professor Mirza Hasanuzzaman (SBAU, Bangladesh) Keynote Speaker	Harnessing Biostimulants for Improved Metal/Metalloid Stress Tolerance in Plants.
09:40–10:00	Dr. Emanuele Radicetti (UF, Italy) Keynote Speaker	The use of hairy vetch as cover crop subjected to different biomass management for the cultivation of processing tomato under organic farming system
10:00–10:20	Prof. Dr. Carlo Leifert (UPV, Spain) Keynote Speaker	Impact of organic farming systems on food quality and safety
10:20–10:35	Prof. Dr. Amitava Rakshit (BHU, India) Invited Speaker	Societal relevance of soil health in defining ecosystem services that contribute to the UN SDGs
	Invited and Contributed Oral Presentations	Session 3: Sustainable Soil Management and Farming Systems
10:35–10:50	Ronald Kuunya (UDebreten, Hungary) Selected Speaker	Examining the correlation between the consolidation coefficient and impact value of dry humus-rich surface soils
10:50–11:05	Piergiorgio Romano (USalento, Italy) Selected Speaker	MSW-Compost and Mycorrhizae Interaction in Grapevine Roots
11:05–11:20	Gabrijel Ondrasek (UZagreb, Croatia) Selected Speaker	Sewage Sludge as a Valuable Resource of Nitrogen and Phosphorus: Long-Term Monitoring Data from a Wastewater Treatment Plants
11:20–11:35	Olena Dorosh (PP, Portugal) Selected Speaker	Eco-Friendly Fertilizer Solutions: Production and Optimization of Biochars from Vineyard Pruning
11:35–11:50	Elisa Domínguez-Hernández (NAUM, Mexico) Selected Speaker	Circular and agroecological practices to improve integrated systems
11:50–13:30		Break

Session 4. Precision and Digital Agriculture**Time: 13:30 (CET, Basel) | 07:30 (EDT, New York) | 20:30 (CST Asia, Beijing)**

CET Time	Speaker	Title
13:30–13:40	Prof. Dr. Mario Cunha (UPorto, Portugal)	Welcome by Session Chair
13:40–14:00	Dr. Yongliang Qiao (AIML, Australia) Keynote Speaker	Applications of AI and Robotics in Modern Agriculture
14:00–14:20	Dr. Franco Meggio (UPadova, Italy) Keynote Speaker	Use of Satellite Imagery Time-series to Assess Grapevine Productivity Anomalies.
	<i>Invited and Contributed Oral Presentations</i>	Session 4: Precision and Digital Agriculture
14:20–14:35	Marian Butu (NIRDBS, Romania) Selected Speaker	Comparative Analysis of Precision and Digital Agriculture Adoption in Romania And Western Europe
14:35–14:50	Antanas Juostas (VMU, Lithuania) Selected Speaker	Analysis of the Working Efficiency of Telematics Data of Combines Harvester
14:50–15:05	Tommaso Orusa (DISAFA, Italy) Selected Speaker	Assessing Dendrometric Parameters Using GIS and LiDAR Flight Data: A Tree-by-Tree Study in Mont Avic Regional Park, Aosta Valley, NW Italy
15:05–15:20	Benmahmoud Salah (UG, Tunisia) Selected Speaker	Use of Convolution Neural Networks for classification of time series of Sentinel-1 chronological data
15:20–15:35	Luiz Carlos Marques Jr. (UNESP, Brazil) Selected Speaker	EfficientNet Network, Mish Activation Function and Ranger Optimizer Implementation for Plant Leaf Disease Classification
15:35–15:50	Sam Wilson (MU, New Zealand) Selected Speaker	Normalized Difference Vegetation Index and Normalized Difference Red Edge could be useful tools for optimising grazing management in mixed pastures.

4 December 2024 (Wednesday)**Session 5. Biostimulation and Biocontrol Microbial-Based Strategies****Time: 9:00 (CET, Basel) | 03:00 (EDT, New York) | 16:00 (CST Asia, Beijing)**

CET Time	Speaker	Title
09:10–09:20	Dr. Mariateresa Cardarelli (UTuscia, Italy)	Welcome by Session Chair
09:20–09:50	Dr. José David Flores-Félix (USalamanca, Spain) Plenary Speaker	Bacterial biostimulant as a tool to improve secondary metabolites in crops
09:50–10:10	Dr. Catello Pane (CREA, Italy) Keynote Speaker	Innovative strategies to improve biological control of soil-borne fungal diseases in vegetable crops
10:10–10:30	Dr. Sara Di Lonaro (IRET-CNR, Italy) Keynote Speaker	From Soil to Sustainability: Microbial-based Strategies for Plant Growth and Defense
10:30–10:45	Dr. Arianna Grassi (UPisa, Italy) Invited Speaker	Functional diversity of beneficial bacteria associated with mycorrhizal fungi and their biostimulation strategies
	<i>Invited and Contributed Oral Presentations</i>	Session 5: Biostimulation and Biocontrol Microbial-Based Strategies
10:45–11:00	Eva Sanchez-Hernandez (UValladolid, Spain) Selected Speaker	Aromadendrane Sesquiterpenoids from Santolina chamaecyparissus L. Flowers: Chemical Profiling and Antifungal Activity Against Neocosmospora Species

11:00–11:15	Praveen Thangaraj (KARE, India) Selected Speaker	Bio-Potential Activity of <i>Bacillus</i> sp. from Tomato Rhizosphere Soil against Fungal Growth of <i>Pythium aphanidermatum</i> and <i>Fusarium oxysporum</i>
11:15–11:30	Ileana Vera Reye (CIQA, Mexico) Selected Speaker	Biochemical responses induced by SiO ₂ -ZnO nanoparticles in Zea mays plants under water deficit conditions
11:30–11:45	Matilde Rodrigues (CIMO, Portugal) Selected Speaker	Biofortification and Increased Heat Stress Resistance of Pea Microgreens through Selenium Seed Priming
11:45–12:00	Mariano Maestro (FuEDEI, Argentina) Selected Speaker	Intraspecific variability in nematicidal response of <i>Arthrobotrys oligospora</i> , a natural enemy of plant-parasitic nematodes, and how it is affected by availability of prey.
12:00–13:30		Break

Session 6. Plant-Crop Biology and Biochemistry

Time: 13:30 (CET, Basel) | 07:30 (EDT, New York) | 20:30 (CST Asia, Beijing)

CET Time	Speaker	Title
13:30–13:40	Dr. Monica Boscaiu (UPV, Spain) and Dr. Mercedes Verdeguer (UPV, Spain)	Welcome by Session Chairs
13:40–14:00	Prof. Dr. Yongfeng Guo (CAAS, China) Keynote Speaker	Fine-tuned regulation of leaf senescence by peptide signals
14:00–14:20	Dr. Mario Ruiz González (UPV, Spain) Keynote Speaker	Agrodiversity in the 21st century: challenges and strategies for conservation
14:20–14:35	Dr. Agnieszka Hanaka (MCSU, Poland) Invited Speaker	Exploring plant responses to metal contamination
	<i>Invited and Contributed Oral Presentations</i>	<i>Session 6: Plant-Crop Biology and Biochemistry</i>
14:35–14:50	Sabrine Soltane (MKB, Algeria) Selected Speaker	Allelopathy and plant gene expressions under Climate Change and Arid Conditions in Africa: A Systematic Review
14:50–15:05	Mauro Commisso (UVerona, Italy) Selected Speaker	Unravelling the mystery of the roles of tryptamine and serotonin in <i>Solanum lycopersicum</i> .
15:05–15:20	Tarik Mohammed (ABBU, Algeria) Selected Speaker	Phenolic Compounds, Evaluation of Alpha-Amylase Inhibitory Activity, and Antioxidant Effects of <i>Phoenix dactylifera</i> L. Date Seeds
15:20–15:35	Tomas Martins (UEvora, Portugal) Selected Speaker	Genome-wide identification, structural characterization and expression profile of AUX/LAX genes during the development of adventitious roots in <i>Juglans regia</i> L.
15:35–15:50	Mikel Anibarro-Ortega (CIMO, Portugal) Invited Speakers	Post-Harvest Sweet Pepper Plants as a Potential Source of Antioxidant and Antidiabetic Ingredients for Food and Dietary Supplements

5 December 2024 (Thursday)***Session 7. Water Use and Irrigation******Time: 9:00 (CET, Basel) | 03:00 (EDT, New York) | 16:00 (CST Asia, Beijing)***

CET Time	Speaker	Title
09:10–09:20	Prof. Dr. Sofia Pereira (CUP, Portugal) and Prof. Dr. Cristina Calheiros (UPorto, Portugal)	Welcome by Session Chairs
09:20–09:40	Prof. Dr. Spyridon Ntougia (DUT, Greece) Keynote Speaker	TBD
09:40–10:00	Prof. Dr. Cristina Rodrigues (PLVC, Portugal) Keynote Speaker	TBD
10:00–10:15	Prof. Dr. Ruth Perreira (UPorto, Portugal) Invited Speaker	TBD
	<i>Invited and Contributed Oral Presentations</i>	Session 7: Water Use and Irrigations
10:15–10:30	Azdem Driss (MVU, Morocco) Selected Speaker	Seawater Desalination for Agricultural Watering
10:30–10:45	Poonam Biswal (IITK, India) Selected Speaker	Drip Irrigation and Nitrogen Management Effects on Rice Yield, Nitrogen Use Efficiency, and Water Productivity Under Varied Irrigation
10:45–11:00	Ana Paula Melo (UEF, Brazil) Selected Speaker	Expansion of Agricultural Irrigation in the State of Bahia, Brazil, from 1985 to 2023
11:00–11:15	Pelin Soyertas Yapicioglu (HU, Turkey) Selected Speaker	Greywater treatment using agro-industrial biochar: A novel water reuse approach
11:15–11:30	Mian Muhammad Ahmed (UA, Pakistan) Selected Speaker	Optimizing Water Use Efficiency in Precision Agriculture for Enhanced Crop Productivity
11:30–11:45	Sonia Purin da Cruz (UFSC, Brazil) Selected Speaker	Thermotolerant coliforms and their resistance to antibiotics in water from rivers used for agricultural purposes
11:45–12:15		Break
12:15–12:45	Dr. José David Flores-Félix (USalamanca, Spain) Convening Chair	Closing Remarks/ Awards Ceremony

Session 1. Crops

sciforum-103713: Assessment of organic substrates derived from marine and food waste for the growth of tomato plants

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The cultivation of Tomato (*Solanum lycopersicum* L.) involves large extensions of soil or greenhouses, which in recent decades has been reduced due to problems such as erosion. An alternative that has been found to maintain crop yields is the use of culture media and hydroponic systems. Taking into account the problem with the amount of marine and food residues, as well as the rising demand for alternative crop substrates to achieve sustainable and ecological agriculture, the objective of this study was to evaluate different growing substrates obtained from the valorization of residues suitable for the development of tomato. For this purpose, a physicochemical characterization (pH, electrical conductivity, porosity, bulk density, organic matter content, and elemental analysis) of the following substrates was carried out: i) 50% peat+50% vermiculite as the control treatment, ii) 50% compost+50% vermiculite, and iii) 50% *Posidonia oceanica*+50% vermiculite. Subsequently, the development of tomato plants was carried out for 21 days in a greenhouse, and morphological and nutritional parameters were evaluated. Regarding the physical parameters, it should be noted that the *Posidonia oceanica* plants showed slower growth and a stem length of 30 cm, shorter than the 43 cm of the control and the 45 cm of the peat. However, in terms of nutrition, *Posidonia oceanica* showed the best values in terms of chlorophyll concentration. The concentration was higher in the samples developed in *Posidonia oceanica*, reaching a value of 45 mg/kg, followed by the compost (30 mg/kg) and the control (25 mg/kg). Finally, it was observed that *Posidonia oceanica* was the substrate with the highest percentage of the macronutrients Ca, Mg, K, and Na, as well as in the micronutrients Fe, Cu, Zn, B, and Si. Both the compost from food wastes and *Posidonia oceanica* treatments were demonstrated to be suitable components for use as agricultural substrates.



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sciforum-104046: Comparing the effect of chemical and biol fertilization on the yield and quality of greenhouse-grown Cucumber (*Cucumis sativus*)

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Cucumber (*Cucumis sativus*) production in greenhouses has proven to be an efficient alternative for achieving higher yields and better quality compared to open-field cultivation. However, successful greenhouse cultivation also depends on well-balanced fertilization. Conventionally, this is achieved using inorganic fertilizers, but there is a growing push to change this, given the environmental impact of such chemical inputs. This study aims to compare two conventional fertilization treatments using chemical sources and two treatments using biol (liquid organic fertilizer) on the quality and yield of cucumber fruits (Centauro 1 variety). Each treatment repetition was allocated to a greenhouse cultivation bed of 25 m² in a completely randomized design where 120 cucumber seedlings were planted. The fertilization treatments evaluated were Biol30 (100L of 3% biol applied every 30 days), Biol70 (100L of 7% biol applied every 30 days), Nitro (1.9kg urea in 3 applications), and Comp [complete fertilization: 2kg Ca(NO₃)₂, 1.6kg MgSO₄, 0.8kg (NH₄)₂HPO₄, 1.6kg KNO₃, and 1.6kg urea]. Phosphorus and potassium were applied 14 days after planting (dap), and the rest were split into three applications: 14, 42, and 63dap. Fifteen plants per bed were sampled to evaluate size (length and diameter), yield, and fruit weight by harvesting their fruits starting at 50dap. The results showed no significant differences between the organic and chemical treatments regarding yield ($p=0.094$), but Biol70 produced 1.44x higher yields than Nitro, 1.18x higher than Comp, and only 1.09x higher than Biol30. This improvement in yield was caused by the number of harvested fruits in the Biol (Biol30:133; Biol70:149) and Comp (134) treatments, given that Nitro consistently produced the longest, widest, and heaviest ($p\leq 0.029$) but lowest number of fruits ($p=0.046$). In summary, organic fertilization treatments performed favourably, producing fruits of similar quality and greater yield when compared to recommended chemical fertilization treatments.



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sciforum-104800: Metabolomic Discrimination of *Brachiaria decumbens* and *Brachiaria brizantha* using ¹H-Nuclear Magnetic Resonance (NMR) Spectroscopy and Ultra-High-Performance Liquid Chromatography–Mass Spectrometry (UHPLC-MS): A Comparative Phytochemical Analysis

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Brazil is one of the largest herd holders with a dependency on natural and cultivated pastures (*Brachiaria* species (100 million hectares)). The two most reported toxic pasture species (*Brachiaria decumbens* and *Brachiaria brizantha*) were grown in the greenhouse of the Faculty of Animal Science and Food Engineering on different doses of nitrogen (0, 100, 200 and 300 mg/Kg) and were evaluated for a year. We explored the expected secondary metabolic compounds first by performing thin-layer chromatography, and then by confirming the compounds, their types and metabolic profiles, which were identified by ultra-high-performance liquid chromatography. Differential metabolites, steroidal saponin concentrations and their sub-types were confirmed by nano-magnetic resonance. The main source of differential probably toxic components in both species was the protodioscin isomer (Protoneodioscin and Protodioscin). We isolated four steroidal saponins and three sapogenins in leaves of *Brachiaria decumbens* and *Brachiaria brizantha* by MS-MS/MS-ESI/UPLC as diosgenin, dioscin, and yamogenin (already detected earlier) were detected. We identified protoneodioscin isomer (protodioscin and protoneodioscin (19 and 20) as the main differential (probably toxic) component between *B. decumbens* and *B. brizantha* along with acetyl-protodioscin, deoxyhexosyl-hexosyl-hexosyl-3-o-spirostane, and o-hexosyl-protodioscin in *Brachiaria* species. Additionally, the new findings included the fact that flavo-lignans, Tricin-4'-O-(β-guaiacyl glyceryl) ether isomers, acetyl-protodioscin, O-hexosyl-protodioscin, protodioscin isomer, tribulosaponin A and glycoside structures were also detected and established by ¹H and ¹³C NMR spectroscopy.



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sciforum-105573: Effect of Planting Densities on the Growth and Yield of Two Orange-Fleshed Sweet-Potato Varieties in South-East Nigeria

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ABSTRACT

There is a steady increase in the demand for orange-fleshed sweetpotato (*Ipomoea batatas* L.) in South-eastern Nigeria. This study was aimed at determining the planting density appropriate for a high production of orange-fleshed sweetpotato (*Ipomoea batatas* L.). Field experiments were conducted at the National Root Crops Research Institute, Umudike, in 2015 and at the Research farm of Michael Okpara University of Agriculture, Umudike, Umuahia, Abia state, in 2016 to determine the effect of planting density on the growth and yield of orange-fleshed sweetpotato using three planting densities (25,000; 33,333 and 50,000 plants/ha) and two varieties (Tio-joe and Melinda). The trial was conducted as a 2 x 3 factorial laid out in randomized complete block design (RCBD) with six replicates. The results of the experiment indicated a significant effect on vine length from the Tio-joe over Melinda variety at both cropping seasons, and the Melinda variety performed better than the Tiojoe variety in number of branches and number of leaves at 8 weeks after planting (WAP) in 2015 and 12 WAP in 2016. Vine length was influenced by the interaction of planting densities and varieties at 8 WAP in 2015. However, planting density and the treatment combination of the planting densities and varieties had no significant influence on vine length in 2016, number of branches, or number of leaves in 2015 and 2016. Similarly, vine girth, weed density, and weed dry weight were not significantly influenced by the varieties, planting densities, and the interaction of varieties x planting density in both seasons. Findings from this study showed that the yield and yield components of Tio-joe were higher than those of the Melinda variety in both seasons. These yield components were not influenced by planting densities and interactions. Although, it was observed that the highest yield components were obtained from 50,000 plants/ha in both seasons.



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sciforum-103973: A practical analysis of the food traceability procedure across the different stages of the supply chain

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The most widely recognized and accepted meaning of traceability is the tracking and tracing of food products within a supply chain using a record-keeping process. Traceability is an essential means of obtaining information on the safety and quality of foodstuffs and building consumer confidence. This research, carried out during 2023, aimed to evaluate the traceability elements used in products bought in supermarkets in the wilaya of Tlemcen, Algeria. In the first step, consumer attitudes towards traceability were analyzed. In the second step, an examination of food products and commercial transactions was performed. The survey operations were mainly aimed at remedying the shortcomings and imbalances in terms of traceability observed on the market. In Algeria, Executive Decree 12-203 on product safety rules imposes that when goods are released for consumption, they must comply with regulatory requirements concerning safety, health and consumer protection, with regard to the appropriate measures implemented to ensure their traceability mechanisms. As required by "Food Law," Regulation 178/2002 stipulates that all operators in the agricultural and agri-food sectors set up a traceability system. Multiple nations are attempting to control both imported and locally produced products through the introduction of specific legislations. The investigations focused mainly on compliance with the transparency obligation for commercial practices, in particular the invoicing requirement, as well as the failure to provide compulsory consumer information on the origin and designation of the manufacturer or organization responsible for placing the product on the market. In critical situations, the organization of withdrawals or recalls to reduce the risk of food-borne illnesses is paramount. Judicial and administrative measures were taken against offenders at various product supply stages. The dynamic ever-changing flow of commodities and trade transactions in the marketplace implies the need for an appropriate traceability system to identify the owner of both current and all prior commodities.



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sciforum-102099: Analysis of Morphological and Quantitative Characteristics in Brassica Species

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For the production of edible oils intended for commercial usage, major oilseed crops such as *Brassica napus* L. are essential. This study proposed to determine Brassica species' botanical descriptions and assess the performance of different variants of Brassica in terms of quantitative and morphological characteristics. The associated traits and morphological characteristics of fifteen Brassica genotypes were assessed. Using three replications, the trial was carried out using a Randomized Complete Block Design. Quantitative parameters, such as the number of major branches, plant height, the number of seeds per plant, the weight of 1000 seeds, days to maturity, and yield, were noted in the data. The study's findings demonstrate that genotype 10 has the largest plant height (121.33 cm), while genotype 9 has the maximum number of primary branches (6.33), genotype 11 has the maximum number of seeds (29), and genotype 8 has the maximum yield (33.66g). Correlation and analysis of variance are used to assess the accuracy of the data. The study's findings show a favorable and strong association between plant height and yield, seeds, and the number of main branches. The quantity of seeds and the number of primary branches have a negative correlation, but days to maturity and yield are positively correlated. There is a positive relationship between the yield and height of plants and the number of major branches, the number of seeds, and days till maturity.



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sciforum-104090: Application of biostimulants derived from agricultural by-products for the enhancement of plant growth and tolerance to abiotic stress

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In recent decades, global climate change has significantly threatened food production and quality. Salinity, drought, nutrient deficiencies, and extreme temperatures, often accompanied by prolonged dry periods, are among the most common challenges to be overcome. Consequently, there is an urgent need to develop formulations that can enhance crop growth and resistance to abiotic stresses. Biostimulants, known for stimulating natural plant processes, are applied to plants or soil to improve nutrient uptake and tolerance to abiotic stress. Recently, the formulation of biostimulants using by-products generated along the agri-food chain, such as seeds, leaves, peels, and kernels, has been proposed, thereby contributing to the circular economy. This systematic review aims to provide data on the extraction techniques necessary to obtain compounds from agri-food by-products. Techniques include pressurized liquid extraction, supercritical fluid extraction, ultrasound-assisted extraction, maceration, liquid-liquid extraction, and solid-liquid extraction. The review also examines the effects of these by-product-based biostimulants on plant growth and resistance to abiotic stress, and discusses the limitations of this novel approach. By focusing on the utilization of agri-food by-products in biostimulant formulations, this review highlights the potential benefits and challenges of integrating sustainable practices in agriculture to combat the adverse effects of climate change.



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sciforum-104109: Biopesticides from marine macroalgae against bacterial and fungal pathogens towards crop disease management

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In a context where macroalgae are highly valued for their versatility across multiple industries, harnessing these resources to develop sustainable products for crop protection is key. Different European crops are susceptible to bacterial and fungal pathogens that can significantly impact crop health and productivity, including mildew, powdery mildew, and botrytis, which affect a wide variety of crops due to their broad host range, adaptability, and favorable environmental conditions. This study investigates how marine macroalgae can be used as a source of active compounds such as polyphenols, polysaccharides, pigments, lectins, lipophilic compounds, alkaloids, and terpenoids against fungal and bacterial phytopathogens. Through a systematic literature review, the research assesses the infection mechanisms and susceptibility of commercial cultivars to phytopathogens and the use of macroalgae in the formulation of new sustainable bio-based pesticides. By combining a literature review with data analysis from major academic databases, this review aims to identify current knowledge gaps and suggest future research directions. The findings will highlight the potential of macroalgae as effective biopesticides with minimum impact on human and animal health and ecosystems. Moreover, it will help in the transition of agricultural practices as a solution for reducing the use and risk of chemical synthetic products for crop protection.



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sciforum-103960: Combined effects of micro-/nanoplastics and humic substance on *Allium sativum* and importance of humic substance in alleviating toxicity

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The impacts of nanoplastics (NPs) and microplastics (MPs) on terrestrial systems are not yet fully understood, but their increasing accumulation is raising significant concerns, particularly with the use of sewage sludge in agricultural practices. This research aimed to elucidate the effects of polyethylene (PE), humic acid (HA), and their combination on the growth and development of *Allium sativum* (garlic). This study observed the formation of a significant eco-corona after 24 hours of interaction between PE and HA, which led to notable enhancements in garlic plant growth parameters. Specifically, plants exposed to eco-coronated PE exhibited improved growth and higher chlorophyll (Chl) content. Garlic bulbs treated with a combination of PE and HA demonstrated an impressive growth rate of 90%, compared to only 30% for those treated with PE alone. Chlorophyll content measurements further revealed that plants in the HA and PE+HA treatment groups had significantly higher levels of Chl a, b, and total Chl (a + b) compared to those treated with PE alone. Additionally, the HA and PE+HA treatment groups showed lower catalase activity than the groups treated with PE alone, indicating reduced oxidative stress and toxicity. These findings suggest that HA can substantially mitigate the toxicity caused by PE, likely due to the formation of an eco-corona on the PE particles' surface. This eco-corona appears to alter the interaction between the plastic particles and the plants, potentially reducing harmful effects. This study indicates that utilizing eco-coronas could be an effective strategy for protecting plants from xenobiotics such as NPs. Further, this research is essential to fully understand the mechanisms behind these interactions, including how eco-coronas form and function, and to explore their broader implications for terrestrial ecosystems. This knowledge is essential for creating guidelines to manage plastic pollution and protect terrestrial ecosystems from the harmful effects of NPs and MPs.



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sciforum-106945: Decoding the effect of polyploidization on *Morus* species complex: an integrated transcriptomic and phenomic approach

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Using biotechnological intervention to decode the genetic architecture of non-model crops, especially polyploid tree species, is challenging. The reconstruction of repository transcriptome analysis (RNA-Seq) is considered a leading-edge technique used to understand functional aspects of biological consequence; therefore, this technique is thought to be the only approach for deciphering genetic architecture. Currently, a large number of transcriptome datasets from various species are publicly available. Nevertheless, data processing and interpretation remain difficult due to a lack of critical coding skills, computing resources, and costly automated tools. Furthermore, in the non-model system, they became challenging due to inadequate replicates, the absence of the reference genome, and so on. To meet this demand, we introduced a state-of-the-art methodology for repository transcriptome dataset analysis, including downstream analysis like the taxonomic identity of the transcriptome or global transcriptome map/network and functional enrichment of overrepresented genes using publicly available web platforms and software. Here, mature leaf transcriptome data of wild *Morus* species belonging to different ploidy levels were sampled, and this revealed the strong biological effect of polyploidization. Further, to substantiate our prediction, we biologically validated the ploidy-associated attributes. Considering all this, the present research helps to understand the molecular basis of phenotype variation without prior coding knowledge and cost. The optimised protocol and generated data help to decode the biological consequences of the strong effect of polyploids on cellular as well as growth behavior levels for further conservation from the ongoing threat of climate change.



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sciforum-103923: Deep Tillage as a Basic Prerequisite for Increasing the Yield of Lettuce In Greenhouses

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Institute for Vegetable Crops

In conditions of intensive greenhouse vegetable production, lettuce production during the winter without heating occupies a significant place in the crop rotation after tomatoes, peppers, and cucumbers. In addition to being profitable, this type of salad production provides the benefits of phytoextracting excess nutrients and eliminating pathogens and weeds. This research was performed at the Institute for Vegetable Crops in Smederevska Palanka and a purple variety of leafy lettuce; Viola was chosen as the plant material. The experiment followed a random block system with three repetitions in the irrigation system and two types of cultivation: deep tillage (50 cm) and shallow tillage (15 cm). Lettuce was planted at a spacing of 20×25 cm. In both cases of soil cultivation, two types of organic fertilizers were separately applied following the manufacturer's instructions: 1) vermicompost—Lumbrikum Radovanović; 2) briquetted chicken manure—Nervosol organic NPK 4-3-4. The control involved soil cultivation without fertilizer application. The results of our research indicate that deep tillage had a statistically significant impact on the plant height, leaf width, leaf length, leaf color, weight of the aerial part of the plant, and total plant weight. The highest lettuce yield (6.98 kg m⁻²) was achieved on deeply tilled soil in which Nervosol organic NPK 4-3-4 was incorporated, while the highest yield on shallow tilled soil (5.82 kg m⁻²) was measured in the treatment with the vermicompost. The yield in the control on deeply tilled soil was 4.87 kg m⁻², while on shallow tilled soil, it was 4.01 kg m⁻². Deep tillage, combined with the usage of Nervosol organic NPK 4-3-4, was shown to be an effective method for increasing lettuce yield compared to the shallow tilling control. In situations where deep tillage is not possible, the usage of vermicompost is a good alternative.



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sciforum-106884: Effect of Inoculation Techniques on Production of Potential of Soybean Varieties Intercropped in Spring Maize

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Conventional cropping systems in Pakistan have been depleting soil fertility, while an increasing population pressure demands more efficient land-use strategies. To address these challenges, maize–soybean intercropping has emerged as a potential solution for enhancing soil fertility and increasing food production. Inoculation with *Bradyrhizobium japonicum* was also adopted, as the literature suggests it can boost nitrogen fixation in both soybeans and maize, playing a critical role in improving soil fertility and overall crop performance. In order to assess the performance of three soybean varieties, Ajmeri, Rawal-1, and NARC-2, when intercropped with maize, this study was carried out over the course of two consecutive growing seasons (spring 2018 and 2019) at the Agronomic Research Area, University of Agriculture Faisalabad, using three different inoculation techniques: no inoculation, soil inoculation, and seed inoculation with *Bradyrhizobium japonicum*. In this experiment, three replications of a Randomized Complete Block Design (RCBD) were used to intercrop different soybean cultivars with maize in double-row strips. Soil-inoculated Rawal-1 soybeans consistently produced the maximum 1000-grain weight and maize grain yield throughout the course of the two seasons, with values rising from 287.33 g and 6.82 t ha⁻¹ in 2018 to 295.00 g and 7.10 t ha⁻¹ in 2019. On the other hand, untreated Ajmeri soybeans showed the lowest 1000-grain weight and grain yield. Nevertheless, they did show some improvement from 235.00 g and 4.10 t ha⁻¹ in 2018 to 240.00 g and 4.30 t ha⁻¹ in 2019. In soybeans, seed-inoculated Rawal-1 had the highest number of pods per plant, 1000-seed weight, and grain yield; in 2018, it was measured at 125.74 pods, 147.07 g, and 1.23 t ha⁻¹; and in 2019, it increased to 130.00 pods, 150.00 g, and 1.30 t ha⁻¹. Untreated Ajmeri soybeans consistently yielded the lowest values for these parameters: in 2018, 76.99 pods, 87.16 g, and 0.53 t ha⁻¹; in 2019, 80.00 pods, 90.00 g, and 0.55 t ha⁻¹. Pods per plant, 1000-seed weight, and grain yield increased significantly. In conclusion, intercropping maize with Rawal-1 soybeans using both soil and seed inoculation proved to be an economical and sustainable strategy under Faisalabad's agro-ecological conditions across both growing seasons.



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sciforum-106869: Effects of various compost types on growth and yield of corn

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Corn (*Zea mays*) is a vital global crop that is used for human consumption, livestock feed, and biofuel production. It also enhances crop rotation systems by improving soil quality and reducing erosion. This study assessed the effects of six compost types, derived from various organic wastes, on the growth, yield, and physiological performance of GS210 corn. A pot experiment was conducted using six compost variants and two control treatments—one without fertilizer and another with NPK mineral fertilization.

The key indices of chlorophyll fluorescence, such as Fv/Fm (0.80, 0.80, 0.81), Fv/F0 (4.07, 3.99, 4.03), and photosynthetic efficiency (PI: 4.62, 4.22, 5.21) were highest in compost-treated plants, indicating their enhanced photosynthetic performance. Among the growth parameters, NPK fertilization showed the greatest benefits, with plant height reaching 188.9 cm, cob length reaching 17.5 cm, 324 grains per cob, and a thousand-grain weight (MTZ) of 285.2 g. The grain protein content also increased under mineral fertilization (9.5%) compared to the control (8.5%).

Organic fertilizers performed slightly less well in terms of yield but still surpassed the control, with grain protein contents ranging from 9.1% to 9.3%. The compost treatments involving sewage sludge and garden waste, Compost 2 and Compost 4, demonstrated comparable results to NPK in certain parameters, especially in photosynthesis and grain count. However, composts made solely from garden waste showed reduced effectiveness during corn's rapid growth stages.

In conclusion, while NPK mineral fertilization produced the highest growth and yield, certain compost variants proved effective alternatives, particularly for improving soil and plant health. These findings suggest that combining organic fertilizers with mineral nitrogen could optimize corn production, and further study is warranted to refine these approaches for the development of sustainable agriculture.



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sciforum-103273: Efficacy of Biostimulants Obtained from Oil Mill Wastewater on Plants Under Saline Stress

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Salinity is a type of abiotic stress that limits the growth and development of crops, including tomato (*Solanum lycopersicum* L.), one of the most consumed agricultural products worldwide. More and more agricultural soils contain high concentrations of salts due to inadequate agricultural practices and irrigation with low-quality water. At the same time, another environmental problem is the production of olive mill wastewater, which is characterized by its toxicity and high-volume production, affecting Mediterranean countries where olive oil is mainly produced. In this context, the aim of this work was to evaluate the efficacy of olive mill wastewater applied to tomato plants under salt stress conditions. For this purpose, an experiment was carried out in a greenhouse where tomato plants were kept under controlled conditions and two different doses of the olive mill wastewater were applied. Positive effects were obtained when the lowest dose was applied, increasing fresh weight by 25% and dry weight by 19%; oxidative stress effects such as MDA and H₂O₂ production and electrolyte leakage were reduced by 11, 12 and 12%, respectively; and proline content was also reduced by 14% compared to the saline control, so it had some efficacy as a biostimulant. However, the highest dose showed low efficacy as well as possible phytotoxic effects on tomato plants when this treatment was applied, producing an increase in transpiration of 51% compared to the normal control. This effect made the highest dose of olive mill wastewater unsuitable as a biostimulant under the conditions of this study.



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sciforum-104079: Evaluating wheat cultivars for their quality and performance in Kosovo

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Cereal crops, including wheat, corn, barley, and rye, play a fundamental role in global agriculture due to their significant nutritional and economic contributions. These grains are staple foods in many diets and serve as a primary source of sustenance and economic value. In Kosovo, where bread and baked products are central to daily meals, understanding the specific traits and qualities of various wheat varieties is crucial for optimizing agricultural practices and ensuring high-quality end products.

This research focuses on three key wheat cultivars in Kosovo: "Pobeda," "Euclide," and "Europe." By analyzing these cultivars, the study aims to assess their suitability for cultivation and evaluate the quality of the products they produce. The investigation covered a range of agronomic, qualitative, and baking parameters to determine how each cultivar performs under local conditions. Significant differences were noted among the cultivars, with "Euclide" demonstrating the highest flour extraction rate (42.97%) and superior baking performance, positioning it as the most effective choice for producing high-quality bread. Additionally, the chemical analysis revealed variations in fat and fiber content among the cultivars, with "Pobeda" showing the highest levels of both (2.54% fat and 3.21% fiber). Although ANOVA results did not indicate significant differences in some agronomic characteristics, each cultivar exhibited unique features, emphasizing the impact of cultivar-specific traits. Overall, this study provides valuable insights into the characteristics of wheat cultivars in Kosovo. The findings offer practical guidance for farmers and the baking industry, aiming to improve cultivation practices and enhance the quality of wheat-based products.



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sciforum-107044: Explicit utilization of blue green microalgae, *Spirulina platensis* (Gomont) Geitler, as bio-stimulant in cereal seed germination

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Blue-green microalgae *Spirulina platensis* play a significant role in sustainable agriculture by improving soil fertility, crop growth, yield, and environmental quality. This study aimed to assess the efficacy of *S. platensis* as a germination booster in low-fertility soils. Various concentrations of *Spirulina* solutions (2 g/L, 4 g/L, 6 g/L, 8 g/L, and 10 g/L) were prepared, and seeds of paddy (*Oryza sativa*), maize (*Zea mays*), green gram (*Vigna radiata*), and cowpea (*Vigna unguiculata*) were pre-soaked overnight in these solutions. Fifty seeds from each crop were treated, with treatments replicated three times in a randomized block design. A non-treated control group (water alone) was included for comparison. Seed germination and the pH of the *S. platensis* solutions were recorded over 10 days and analysed using ANOVA (p0.05).

Results showed that paddy seeds soaked in a 6 g/L *Spirulina* solution had a significantly higher germination rate (91.11%) by day 7. Maize seeds also exhibited high germination rates (>80%) in both 4 g/L and 6 g/L treatments. In contrast, pulse seeds (green gram and cowpea) showed poor germination rates (50%) in concentrations above 6 g/L, with 100% germination observed in the control group. The poor performance of pulses may be attributed to the high pH (10.6) of the *S. platensis* solution. These findings suggest that *S. platensis* acts as a bio stimulant for cereal seed germination, though further field studies are needed to confirm these results.



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sciforum-108014: Farming systems potentate sustainable soil management and crop production in Africa

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Sustainable crop production depends on several factors, including soil productivity, which is influenced by the type of farming system practiced. This review examined the contribution of farming systems to sustainable soil management and crop production in Africa based on a bibliometric approach. The literature was searched using the keywords “Soil” and “Farming system*” AND “Crop Production”, and metadata were extracted for the period of 1990–2024. In total, metadata from 66 documents from 17 countries were included in this study. The progression of the metadata was evaluated using Mann–Kendall tests, while key contribution linkages were visualised using Vosviewer software (version 1.6.17). The results showed a significant ($p < 0.01$) positive increase in the literature on the role played by farming systems in sustaining soil and crop productivity. Farming systems were proven to be potentates of soil fertility determinants since they influenced soil microbe activity and nutrient dynamics. Predominantly, mixed-cropping and agroforestry systems sustained stable nutrient levels in the soil, especially of nitrogen, in addition to enhancing the diversity of soil microflora. Modifications in farming systems' climate were mainly driven by climate change and the need to ensure food security. Therefore, research into crop agroecosystems in Africa was tailored to three areas: i) optimizing the efficient use of nutrients from external inputs, ii) the intensification of farming systems to ensure soil biodiversity and environmental quality, and iii) utilizing integrated farming systems to optimize crop yields with the advent of climate change.



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sciforum-106336: Flowering, fruiting, and chlorophyll content of pruned and unpruned eggplant (*Solanum melongena*) cv. banate king influenced by GA3 and NAA

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Eggplant styles vary in length, resulting in low fruit production. Exogenous application of plant growth regulators could reduce heterostyly. This study aimed to determine the effects and further improvements in the production of flowers and fruits of eggplant when Gibberellic acid (GA₃) and Naphthalene Acetic Acid (NAA) were applied to pruned and unpruned plants alone or in combination. Horticultural and yield parameters were gathered manually from the experimental area. For physiological parameters, the supernatant of samples was separated, and the absorbance at 400-700 nm was measured using a UV-vis spectrophotometer for chlorophyll determination. All data from the split-plot design were subjected to analysis of variance, and further, Tukey's Honest Significant Difference Test was applied to separate significant and insignificant means. Standing plants that were four months old were used as test plants using the Banate King cultivar for corrective pruning and exogenous hormones. This study was carried out in Mindanao, Philippines, during the summer of 2022, with distinct dry conditions. The pruning technique and foliar spraying did not affect the number of days to flower, days to harvest, or total number of flowers. The plants for which GA₃ was applied alone or in combination with NAA, on the other hand, were the longest. The NAA application contributed to the heavy weight of the fruits. Furthermore, the chlorophyll content of pruned plants increased by 25% compared to the control.



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sciforum-103856: Impact of Neem and Tobacco plant extracts on *Gossypium hirsutum* (Malvales: Malvaceae) sucking insect pests in the Bahawalnagar District of Punjab Province

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Cotton is a cash crop and used all over the world. Plant extracts can be used for the management of pests that are injurious to plants. Plant extracts have an important role in crop protection, although most commonly in combination with other tools including chemical pesticides as part of Bio-intensive Integrated Pest Management. To investigate the controlling effect of plant extracts (PEs) on sucking pests of cotton, a field experiment was conducted and the experiment was comprised of four replications. Plant extracts were applied in three treatments, Control, Foliar application of tobacco extract, and Foliar application of Neem extract. Data regarding pest population was collected after one day after the application of PEs, three days after the application of PEs, seven days after the application of PEs, and,10 days after the application of PEs. Foliar application of Neem extract after the application of three and seven days of extracts showed good results by reducing the jassid and whitefly population to about 60-70%. Similarly, tobacco extract also showed better results by reducing the whitefly and jassid population to about 50-60% as compared to the control treatment in the crop of cotton. These findings will help control sucking insect pests of cotton with or without using of pesticides.



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sciforum-103580: Impacts of *Inga edulis* domestication in South Ecuador

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Inga edulis Mart. (Fabaceae) is a fast-growing, nitrogen-fixing tree native to Central and South America, being prevalent in the Amazon Basin. It is a versatile and valuable tree species with a wide range of traditional uses and benefits, as well as an important local food. However, despite its wide uses, specific studies focused on understanding the patterns of diversity of *I. edulis* are still scarce. In this study, we evaluated how morphological and genetic diversity is distributed across natural and planted *I. edulis* populations, studying a total of 125 samples collected in South Ecuador. Specifically, we asked the following questions: (1) Is genetic erosion occurring in domesticated populations? (2) Does gene flow occur between natural and planted populations? (3) Do different cultivation practices impact the diversity of *I. edulis*? Our results show that fruits are longer and heavier in planted than in wild trees, contrary to genetic diversity, which was found to be significantly higher in wild trees. Agroforestry systems where *Inga* is being used in *Cocoa* and *Coffea* plantations showed low diversity. In contrast, trees used by locals in their homes and gardens still maintain high levels of diversity, being a good source for the conservation of raw genetic diversity. Gene flow occurred between natural and wild populations, although different genetic groups were seen in wild trees supporting the presence of genetic erosion in domesticated populations. Understanding and maintaining this genetic diversity is essential for the conservation of genetic resources. This is critical for the long-term sustainability of breeding programs, ensuring that future generations continue to have access to robust and adaptable genetic resources.



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sciforum-104014: Indoor green and purple lettuce seedling production under LED lights

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In the Balkans' agroecological conditions, early seedling production occurs during winter. The quality and duration of sunlight during this period are suboptimal, preventing the seedlings from reaching their full genetic yield potential due to the deprivation of certain light qualities. Therefore, our study aimed to test whether the usage of energy-efficient light-emitting diodes (LEDs) can fulfill the plants' light requirements during the early stages of seedling production. The research was performed at the Institute for Vegetable Crops Smederevska Palanka, Serbia. We used three commercial lettuce (*Lactuca sativa* L.) cultivars—Genesis, Jukebox, and Viola—for the experiment. In the three-leaf stage, plants were placed in plant growth chambers and exposed to multispectral white (W) and monochromatic blue (B) LEDs for 25 days with a 9/15h and 10/14h (light/dark) photoperiod, to simulate outdoor conditions. Cultivation in a greenhouse using only natural daily light (DL) served as the control. After 25 days, morphological growth parameters such as root and shoot weight were measured. Additionally, the total chlorophyll content was determined spectrophotometrically using the method described by Lichtenthaler. Our results showed that compared with the control, W and B LEDs significantly increased the seedling root and shoot weight, while B LEDs increased the total chlorophyll content. In plants grown under DL and W LEDs, the total chlorophyll content did not differ significantly. The Jukebox genotype exhibited the strongest response to the light treatment. This genotype had the highest total chlorophyll content, as well as shoot and root weight under B LEDs compared to W LEDs and DL. When exposed to B LEDs, the Jukebox genotype reached a shoot and root weight up to 4 times that of to DL. Based on our results, this lettuce cultivation method enhances seedling growth and chlorophyll content and positively affects seedling quality.



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sciforum-099789: Input costs and volatility price of soybean produced in the state of Pará, Brazil

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Brazil has the largest cultivated area and production of soybean, being the global leader of soybean exportations. However, the state of Pará, located in the Brazilian Amazon biome, emerged as a new agriculture frontier of this oilseed. Recently, the COVID – 19 pandemic and the war between Russia and Ukraine broken countless global supply chains, including soft commodities. Thus, our research aims to describe the input costs and volatility of the price of soybean in the Paragominas pole, state of Pará, Brazil, between the seasons 2018/19 and 2024/25. The methodology consisted of to analyse the data supplied by a local agricultural company that makes barter between inputs for soybeans with the farmers, being each soy bag equal to 60 kg. We also pricing and to analysing the historical price trend of soybeans in the futures of Chicago board of trade, as well showing some options of derivative tools for hedging to the farmers. The COVID -19 pandemic did not impact the barter in the season 2020/21 (22.19 bags/ha, input costs = US \$ 470.43/ha and soy bag price = US \$ 21.2). Notwithstanding, in 2021/22 forth, despite the soybean price increased, also were noted a substantial increase in the inputs price and the barter ratio, with the highest peak observed in 2022/23 harvest (28.35 bags/ha, input costs = US \$ 884.52/ha and soy bag price = US \$ 31.2). We suggest that soybeans producers make their barter with some hedge against falling soybean price by taking up a position in the soybeans futures market, seeking to protect of volatility and fluctuations of market.



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sciforum-104992: Investigating the Impact of Different Sowing Methods on Wheat (*Triticum aestivum* L.) Growth and Yield in Larkana

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In the investigation conducted throughout 2023, the impact of various planting techniques on TD-1 wheat (*Triticum aestivum* L.) variety growth and yield was examined. The study encompassed three distinct sowing methods: T1 = drilling, T2 = broadcasting and T3 = ridges. Various parameters were observed, such as the plant's height (cm), the number of tillers per square meter (m⁻²), spike length (cm), number of grains in step with the spike (g), the weight of 1000 grains or the seed index (g), and yield of grains (kg ha⁻¹). The summarized statements of the research are presented below. The wheat variety sown using the drilling method exhibited notably superior performance, showcasing a plant height of 63.30 cm, 452.67 m⁻² tillers, a 10.13 cm spike length, 15.00 spikelets in accordance with spikes, 35.33 grains for each spike, a 43.66 g seed index (1000-grain weight), a 6218 kg ha⁻¹ biological yield, and a 4325 kg ha⁻¹ grain yield. The ridge-sown crop displayed characteristics such as a 63.20 cm plant height, 313.33 m⁻² tillers, a 8.23 cm spike length, 13.33 spikelets contained in each spike, 33.66 grains through to each spike, a 34.66 g seed index (1000-grain weight), a 5614 kg ha⁻¹ biological yield, and a 3922 kg ha⁻¹ grain yield. In contrast, the broadcasting method yielded a plant height of 65.87 cm, 320.67 m⁻² tillers, a 9.03 cm spike length, 13.33 spikelets on account of spikes, 36.00 grains for spikes, a 41.33 g seed index (1000-grain weight), a 6371 kg ha⁻¹ biological yield, and a 4141 kg ha⁻¹ grain yield. In conclusion, the drilling method proved to be the most favorable, resulting in a greater yield of grains of 4325 kg ha⁻¹ compared to broadcasting (4141 kg ha⁻¹) and ridge sowing (3922 kg ha⁻¹).



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sciforum-103892: Optical Remote sensing for estimation of Paddy area in Thanjavur district of Tamil Nadu

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This study focuses on the estimation of kharif paddy area using optical data from remote sensing, particularly during the early monsoon season when cloud-free data is more readily available. Remote sensing for crop monitoring has evolved significantly with the advent of modern satellites offering high spatial and temporal resolution. In the kharif season of 2019, Sentinel-2A optical data from the European Space Agency (ESA) was utilized at the peak flowering stage of paddy to estimate the crop area in Tamil Nadu. The study employed both supervised and unsupervised classification methods, with a preference for supervised classification due to prior knowledge of the study area. Training sites were developed using ground truth data collected during field surveys, leading to the classification of land into six categories: Paddy, Waterbody, Settlements, Barren lands, Other crops, and Miscellaneous. The Sentinel-2A data was then analyzed using the maximum likelihood classifier in ArcGIS software to delineate the paddy area, with iterative refinements and accuracy assessments ensuring reliable results. The final analysis revealed a total kharif paddy area of 22,246.01 hectares in the Thanjavur district. Detailed block-wise statistics were generated, showing Orathanadu block with the highest paddy area of 3,117.43 hectares and Budalur block with the least at 340.97 hectares. The findings highlight the effectiveness of using high-resolution satellite data and supervised classification methods for accurate crop area estimation with kappa index of 0.83.



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sciforum-106981: Optimization of Sowing Dates for Enhanced Yield and Aphid Management in Grasspea, *Lathyrus sativus*

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Aphid infestation and subsequent yield loss are a big problem for legume cultivation. Sowing time plays a critical role in influencing aphid management and seed yield in legume crops, as demonstrated in this study on BARI Khesari (Grasspea)-3 (*Lathyrus sativus*) conducted during two consecutive rabi season (2020-2021) at the Pulses Research Centre (PRC), Bangladesh Agricultural Research Institute (BARI), Ishwardi, Pabna. In both years, seven sowing dates were tested at weekly intervals, starting from 9th November 2020 to 21st December 2020 in the first year and 31st October 2021 to 12th December 2021 in the second year. The results consistently showed that late-sown crops, particularly those sown in December, experienced greater aphid infestation compared to crops sown in November. Aphids preferred the succulent growth stages of late-sown crops, leading to increased feeding and multiplication. In 2020, the highest seed yield (1511 kg/ha) was recorded from the crop sown on 16th November, followed by sowing on the 23rd November (1443 kg/ha), with yields decreasing in crops sown later. Similarly, in 2021, the highest yield (1040.28 kg/ha) was obtained from the crop sown on 14th November, while crops sown in December exhibited lower yields due to both delayed sowing and heavy aphid infestation. Twig infestation rates were significantly higher in late-sown crops, reaching 60.42% and 57.71% in crops sown on 5th and 12th December 2021, respectively. The findings from both years revealed the critical role of sowing time in managing aphid populations and enhancing seed yield. Mid-November was identified as the optimal sowing period to avoid severe aphid damage and achieve higher yields in BARI Khesari-3 cultivation.



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sciforum-089427: Significance and Interaction of CaCl_2 treatments and genetic background in *Primula* greenhouse crop improvement efforts

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Primula (Primrose) is an important horticultural crop grown in glass houses for its ornamental value in the NE US. Plants are prized that exhibit large, prolific flowers. The potential of several combinations or concentrations of CaCl_2 products and a control were tested in on several Primrose cultivars ("Donova Mix", Sakata) at UConn. The products tested were CalOxFT (Biosafe Systems, East Hartford, Connecticut), which is an 8-0-0 fertilizer with 10% mobilized calcium, and DowFlake (Occidental Chemical Corporation, Dallas, TX), which is fundamentally a road salt product adapted to horticulture research. Plant dry weight, number of flowers, and flower diameter were measured.

A Poisson regression model was carried out in R. Statistical analysis revealed that there was interaction between cultivar and CaCl_2 treatment ($p < 0.01$), suggesting a high genetic variance in *Primula* response to CaCl_2 . Flower color was associated with Total flower number, with the positively associated cultivars being Flower Color Pink 1, Flower Color Pink 3, and Flower Color White ($p < 0.05$). For example, the Blue flower color was a mid-performer, with a mean of 62.9 total flowers, and Flower color Pink 1 produced an average of 99.45 total flowers.

In terms of CaCl_2 treatments, DowFlake1X and DowFlakePlusCalOx1/2 were positively associated with number of TotalFlowers ($p < 0.05$). Using Tukey contrasts for multiple comparisons of means, we determined that DowFlake1X resulted in significantly more flowers than the control, and also DowFlakePlusCalOX1/2 produced significantly more flowers per plant than the control during the experiment ($p < 0.005$). The mean number of the flowers for the control group was 72.35; the DowFlake1X group had an average flower number of 81, and DowFlakePlusCalOX1/2 had an average of 79.5 flowers per plant.

There was no honestly significant difference in average flower diameter from CaCl_2 treatments; this parameter was determined by the Flower Color or variety. The average flower diameters varied from 5.033- 5.2cm and were similar for the treatments and control. This research may be applicable to other flowering crops, and suggests that nursery operators may optimize production by selecting the top performers under CaCl_2 treatment.



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sciforum-107080: Source- sink modulation in Chinese potato through agronomic management in the southern laterites of Kerala, India

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Introduction

Tuber crops, considered as second most important food crops after cereals, are bestowed with climate resilient characters that enable it to perform under abiotic stress situations. Productivity in tuber crops is highly governed by canopy development, photosynthetic capacity and translocation of the photo assimilates to the roots, which forms the economic part. Chinese potato [*Plectranthus rotundifolius* (Poir.) Spreng.] is preferred for its short duration, nutritive and good energy value. Nevertheless, the crop is constrained by the higher proportion of miniature tubers, despite it being higher in number. Adoption of proper management strategies can favourably influence the size of tubers and result in higher yields.

Methods

The experiment was laid out in in split plot design with main plot treatments, m₁: bed method (30 cm x 15 cm), m₂: bed method (30 cm x 30 cm), m₃: ridge method (30 cm x 15 cm), m₄: ridge method (30 cm x 30 cm) and m₅: mound method (30 cm x 30 cm) and sub plot treatments, combinations of n₁: 60:30:120 kg NPK ha⁻¹ + PGPR Mix 1, n₂: 60:30:120 kg NPK ha⁻¹) and g₁: humic acid @@ 5 g L⁻¹, g₂: benzyl adenine @ 50 mg L⁻¹ and g₃: water spray) in four replications for two seasons.

Results

Pooled analysis revealed per hectare tuber yield and marketable tuber yield to be significantly the highest in bed method of planting with closer spacing of 30 cm x 15 cm (20.93 and 17.46 t ha⁻¹ respectively). Application of 60:30:120 kg NPK ha⁻¹ + PGPR Mix 1 + humic acid could result in 19.7 to 21.7 per cent increase in yields sole fertilizer application .

Conclusion

Resource management options of planting on beds at 30 cm x 15 cm and NPK application @ 60:30:120 kg ha⁻¹ along with PGPR Mix 1 and humic acid proved superior in enhancing the source strength and realizing higher yields. Per plant performance remained markedly better under wider spacing and per hectare yields in closer spacing.



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sciforum-100882: The Cultivation of Three Varieties of *Solanum tuberosum* L. in Substrates Containing Waste from an Abandoned Polymetallic Sulfide Mine: Effects on Phenological Development and Metal Accumulation in Potatoes

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Potato (*Solanum tuberosum* L.) is one of the most widely produced and consumed crops worldwide and can easily be cultivated in different locations and climates. Given its importance for food and nutritional security, an experimental trial was conducted to evaluate the impact on the phenological development and accumulation of potentially contaminating metals in the vegetative organs of cultivating three varieties (*Red Lady*, *Agria*, and *Désirée*) in substrates containing slag and waste from the Caveira polymetallic sulfide mine, located in Grândola (Beja, Portugal), at proportions of 10:0, 10:1, 10:2, and 10:3. The physicochemical parameters of the substrates were characterised before and after harvest (pH, electrical conductivity, organic matter, Cu, Hg, As, and Pb) and also in the vegetative organs of *S. tuberosum* after harvest (Cu, As and Pb). A physicochemical analysis of the mine leachate was also conducted, presenting a pH of 3.03 and an electric conductivity of 1240 mS/cm. The produced tubers were analysed in terms of their dry weight, number, size, and metal concentration. The tubers revealed the presence of Cu, Pb, and As, varying between 17.3 and 32, 5 and 27.6, and 5 and 14.8 mg/kg, respectively, considering the three varieties and all the substrates. The cultivation substrate impacted the mobilisation and accumulation of Cu, As, and Pb in the different vegetative organs and was dependent on the variety and substrate composition. Regarding the phenological development, no influence was observed. In the three varieties, the number of tubers per plant increased in the substrates that contained mine waste compared to the control substrate. Pearson's and Spearman's correlation coefficients were used to determine the correlations between the metal concentrations in the substrates and those in the vegetative organs of the plants. It was found that potato production in contaminated soils can cause a risk to human health, with a lower risk for the *Agria* variety, as lower levels of contaminating metals accumulate in these tubers.



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sciforum-107041: The Epidemiology of Barley Leaf Spot Diseases and Yield Loss Estimation under No-Till Management in the Semi-Arid Region of Morocco

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Foliar diseases pose a major challenge to barley (*Hordeum vulgare L.*) production, particularly in no-till farming systems, where pathogens thrive in crop residues and persistent soil moisture. This study investigates the epidemiology of barley leaf diseases under no-till conditions and assesses the associated yield losses during the 2023-2024 cropping season. The experiment was conducted in Ouled Boughadi-Beni Khirane on a 2-hectare plot, using a local six-row barley variety. Foliar treatment with a systemic fungicide containing three molecules was applied to half of the plot at the early heading stage. Disease severity and Normalized Difference Vegetation Index (NDVI) measurements were taken at different growth stages (tillering, end of stem elongation, end of booting, early heading, and milk stage). The results showed a low overall foliar disease severity (13%), with powdery mildew at 5.5%, net blotch at 4.1%, and scald at 3.2%. While fungicide treatments reduced the disease severity, there was no significant impact on grain yield, thousand-kernel weight, or biomass. This suggests that climatic conditions, particularly drought stress, had a more substantial effect on the yield than disease pressure. In conclusion, this study reveals that foliar treatments are not cost-effective under low disease pressure and in no-till systems. Additionally, the NDVI was not a reliable indicator of disease severity in this context, as changes in the NDVI were primarily influenced by growth stages rather than disease progression. An integrated approach that considers both disease management and environmental factors is crucial to optimizing crop productivity in no-till systems. Further research is needed to explore the complex interactions between diseases, agricultural practices, and environmental conditions.



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sciforum-106646: Yield, morphological and physiological parameters of organic and pelleted *Avena sativa* L. plants at different fertilization practices

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Oat (*Avena sativa* L.) is one of the most important self-fertilizing field plant belonging to the Poaceae family. It has no great requirements regarding the growing conditions, but with a very good reaction to fertilization. The current study evaluated the significancy effects of solely application of mineral (NPK) and organo-mineral (OM) fertilizers, and their individual combination with calcium hydroxide (Ca(OH)₂), on the yield, certain morphological traits [mean number of leaves per plant - MNLP, minimum leaf length (cm) per plant - MinLL, maximum leaf length (cm) per plant - MaxLL, number of ears per plant - NEP] and physiological parameters (nitrogen balance index - NBI, content of: chlorophyll - Chl, flavonoids - Flv, anthocyanins - Ant), in oat plants, between the treatments and in relation to the control. The NBI and contents of Chl, Flv, and Ant, were measured using Dualex leafclip sensor. The experiment was performed in semi-controlled glasshouse conditions, in pots, from the 4th decade of March to the 4th decade of June, in 2024, using organic and pelleted (graded) oat seeds, with Vertisol soil. The soil is characterized as a light clay with an acid reaction. The obtained results showed that the NBI, the contents of Chl, Flv, and Ant, in both oast, significantly differed between the treatments applied and in relation to control, whereby MNLP, MinLL, MaxLL and NEP insignificantly differed between the treatments. It was also observed a significant increase in all the tested parameters of applied variants in relation to the control, which could also be stated for the yield of both oats. Slightly better data on all tested parameters showed the pelleted oat. The best results were obtained with the use of OM ferilizer+Ca(OH)₂, which could be proposed as an optimal fertilization treatment in pelleted and organic oats cultivation regarding this research.



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sciforum-112622: Neglected and Underutilized Plants as a Source of Resilient Crops with Bio-Functional Properties

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Neglected and underutilized species (NUS) offer a promising avenue to tackle challenges posed by climate change while providing biofunctional compounds beneficial for human health. These plants, either never fully domesticated or underrepresented within mainstream agriculture, hold vast potential to diversify food systems and enhance agricultural resilience.

This work highlights examples of NUS, comprising traditional varieties, studied under projects HortNext and SOLECO for their valorization. Investigations included morphological, genetic, and chemical characterization, as well as assessing tolerance to environmental stressors like salinity. Efforts also integrated collaborations with farmers and consumers to ensure the practical applicability and market acceptance of these crops. The results in these projects revealed that NUS demonstrates robust tolerance to abiotic stressors, including drought and salinity. Furthermore, these plants were rich in biofunctional compounds like glucosinolates, phenols, and antioxidants. For example, specific studies on COMAV's cauliflower collection identified genotypes with unique glucosinolate profiles and partitioning beneficial for pest resistance. A weed like wall rocket (*Diplotaxis tenuifolia*) showcased high phenol levels with a spicy flavour, supporting its potential domestication and use for salads. The consumer acceptance of different NUS has been also tested with consumer panels which affirmed positive perceptions on traditional varieties.

NUS and landraces are invaluable for developing resilient agricultural systems and promoting dietary diversity. Despite their potential, challenges remain, including germplasm recovery, understanding functional properties, integration into modern agriculture, and market promotion. Addressing these hurdles through collaborative research, farmer involvement, and consumer education can unlock the full potential of these crops. Projects like HortNext and SOLECO exemplify the strides being made to achieve sustainable, resilient, and healthy horticulture in a changing climate.

Key words

health, resilience, plant diversity, edible plant

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sciforum-111036: “Alternative” crops to enhance Mediterranean agrodiversity and fight the climate emergency

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The “Green Revolution” (GR) of the 1960s and 1970s allowed huge increases in crop yields and food production by developing new, improved varieties of our major crops. However, the GR also had long-term negative effects as those cultivars require high inputs and intensive production practices, which cause detrimental environmental impacts and are not sustainable. The GR has also led to an intense “genetic erosion”, with thousands of minor varieties lost forever or cultivated at a low scale. This low agrodiversity reduces the opportunities to find new sources of variation to fight new challenges, such as the current climate emergency.

Our modern high-yielding crop varieties are generally sensitive to abiotic stress, especially drought and soil salinity. Therefore, climate change effects – including more intense, longer and more frequent drought periods and other extreme weather phenomena, as well as accelerated soil salinisation – represent the most critical threat to food security worldwide, especially in the Mediterranean, one of the most affected regions.

To fight climate change effects in the Mediterranean, commercial cultivation of stress-tolerant crops domesticated and grown elsewhere represents a complementary approach to the biotechnological improvement of abiotic stress tolerance of our conventional GR-derived crops or the domestication of stress-tolerant wild species (halophytes, xerophytes). Apart from enhanced stress tolerance, the selection of these “new”, alternative crops should consider Mediterranean environmental conditions, soil properties, fertilisation needs, market access and other parameters to make their cultivation profitable for the farmers. In addition, they should help fulfil the EU “Green Deal” objectives, such as reduced agrochemical inputs (chemical fertilisers, pesticides), reduced tillage, adaptation to organic agriculture, healthier food or multiple uses of the harvested products.

This communication will present and discuss the properties and advantages of some candidate crops fulfilling the conditions mentioned above, such as quinoa, teff, tritordeum, camelina, chia and sweet potato.



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Session 2. Breeding/Selection Technologies and Strategies

sciforum-103795: Combination Ability as a Strategy for the Selection of Parents Components for Highly Productive Hybrids F₁ Cucumber

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Data on combining ability are important for determining crossing pairs when obtaining hybrid genotypes. Total combining ability (GCP) shows how effectively parental lines transmit their traits to offspring on average across all combinations. Specific combining ability (SCA) evaluates the efficiency of specific pairs of crosses. Higher SCA values indicate dominant gene effects, whereas high GCA values indicate a significant role of additive gene effects, which is consistent with the literature.

In this study, 5 maternal lines and 4 parental lines (testers) were used to obtain 16 hybrid combinations for the purpose of GCA and SCA analysis for the main selection traits, using diallel analysis by the Griffing method.

The results. During the analysis of the GCA variant, a high reliable difference indicates the differentiation of the parental forms of the hybrids in terms of combining ability. It has been established that in the genetic determination of traits, a significant role belongs to genes of additive action, as well as to non-additive effects of genes. The evaluation of the combining ability of the selection lines in the tester crossings made it possible to identify four parental forms with the largest GCA: maternal – Ivol, SD 96-16, parental – Fen, Toma-18. Four hybrid combinations: F1 (♀ RD 96 2-95 x ♂ Fen), F1 (♀ BD 96-18 x ♂ Fen), F1 (♀ Ivol D 96 x ♂ Toma-18) and F1 (♀ Mag-62 x ♂ Toma-18) showed high SCA.

The results of the study indicate the need for two-step selection – to carry out selection and hybridization between parental forms with high and medium effects of GCA and to carry out further selection work with F₁ hybrid combinations with high SCA. The information obtained in this study was used for heterosis selection of cucumber.



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sciforum-107086: Development of High Yielding, Early Maturing Grain Amaranth

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Leaf vegetable of *Amaranthus* form a major part of the diet in Sub-Sahara Africa. The two popular cultivars are black and pale seeded. Globally, the seed of *Amaranth* is considered very important for confectioneries, biscuits, pastry because of the high content of protein. However, production and utilization of pale seeded (Grain) *Amaranth* is limited. It remains underutilized and has been unable to gain commercial recognition despite its immense nutritional qualities and economic potentials. Therefore, an urgent need to improve the production levels of the *Amaranth* for leaf and seed. *Amaranth* grain seed was selected from advanced population derived from Breeding NHAMARI. DNA extraction was carried out using SDS extraction protocol. Dried leaf protocol was modified to obtain good quality of DNA. The quality was analyzed subjecting the DNA to Agarose gel electrophoresis. The amplified fragments were sequenced using a Genetic Analyzer 3130xl sequencer from Applied Biosystems using manufacturers' manual while the sequencing kit used was that of BigDye terminator v3.1 cycle sequencing kit. Bio-Edit software and MEGA X were used for all genetic analysis. The performance of *Amaranthus* cream seed was excellent when tested in farmers' field. The overall acceptability was 88.5 (in a 100 points scale). The leaf matures for the first leaf harvest in 10 days after transplanting on the field. The sequencing is used to identify and separate NHAMARI from *Amaranthus* cream seed. The phylogenetic tree separated the *Amaranth* into two groups. The new improved variety gave higher yield than the previous released NHAMOLA5 which is known as NHAMARI. The seed yield was 2.8t per hectare compared with 2.5t of NHAMARI.



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sciforum-095660: Exploring how Moroccan farmers in Khemisset province adapt to climate change: perceptions and strategies

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Introduction:

Agriculture, a sector heavily reliant on weather and climate, is particularly vulnerable to the unpredictability and shifts brought about by climate change. This study specifically addresses the impact of climate change on yields and agricultural production in the Khemisset province, a region within the Rabat–Sale–Kenitra area that is notably susceptible to these environmental changes.

Methods:

The methodology used is a combination approach of quantitative and qualitative research. Among other tools for processing data were descriptive statistics and principal component analysis. In total, 120 research units were surveyed in the study area. The middle peasant population was not homogeneous, and four categories of producers were formed to analyze the perceptions and peasant strategies developed. They have been chosen according to the soil, vegetation, and livestock type.

Results:

The main conclusions derived from the study results are as follows: We observed a negative evolution of the climate parameters during the last two decades (1985-2015). Virtually all the producers of the area studied perceive a negative evolution of the different climatic parameters, which is consistent in most cases with the analysis of meteorological data. The changes and climate variability have negative impacts on agriculture. The local populations have a good understanding of the evolution of agricultural yields. Using fertilizers, crop rotation, early varieties of crops, and other types of adaptations are the responses by some Zemmour peasants against the effects of climate change.

Conclusions:

This study suggests that further research into the application of advanced technologies in agriculture could be beneficial. These technologies have the potential to significantly improve crop yields and quality, offering a promising avenue for mitigating the effects of climate change on agriculture.



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sciforum-103870: Unveiling microbial contamination in black pepper (*Piper nigrum* L.) micro propagation

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Black pepper, the "King of Spices", is a globally acclaimed spice, renowned for its distinctive flavour and aroma. To meet the increasing demand for high-quality planting materials, various in vitro propagation techniques have been developed. Despite these efforts, persistent contamination either with fungi or bacteria occurs during the culture process, necessitating a comprehensive investigation into the underlying causes and possible origin of microbial contaminants.

In the present investigation, explants (shoot tips) derived from the black pepper variety IISR Thevam were subjected to various sterilization protocols to minimize contamination and tissue browning. The protocols assessed included combinations of 70% alcohol for 30 seconds to 1 minute, 0.1% mercuric chloride for 2 to 10 minutes, carbendazim at 0.2% and 0.4% for 30 minutes, propiconazole at 0.1% and 0.2% for 30 minutes, and sodium hypochlorite at 0.1% for 2 minutes. The percentage of contamination before subculturing (14 days after inoculation) was 81%, while after subculturing, the contamination reached 100%. The increased concentration and treatment time led to higher browning rates, while reduced treatment time and concentrations resulted in higher contamination rates. Despite efforts to achieve surface sterilization, fungal growth was observed in treatments with fungicides involving carbendazim and propiconazole at tested concentrations. However, the final rinse samples showed no microbial growth, indicating the effectiveness of surface sterilization and the possible role of endophytic microbial contaminants. Subsequently, the fungal contaminants were collected from the contaminated culture tubes and cultured on potato dextrose agar medium; morphological characteristics were documented and subjected to molecular analysis. The morpho-molecular analyses identified the fungal contaminants as *Colletotrichum fructicola*, *Fusarium proliferatum*, and *Fusarium equiseti*. The present study highlights the persistence of endophytic contaminants in black pepper micropropagation and emphasizes the need to evolve effective sterilization protocols in tissue culture protocols to ensure successful in vitro propagation.



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sciforum-106727: Artificial neural networks reveal genetic diversity in acerola (*Malpighia emarginata* DC.) based on fruit quality traits

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Acerola (*Malpighia emarginata* DC.), a tropical fruit, is renowned as one of the richest natural sources of vitamin C. Breeding programs are essential for identifying superior genotypes with the desired attributes for various applications. This study aimed to evaluate the genetic diversity of acerola based on fruit quality traits. Fruits from 35 acerola genotypes, sourced from an active germplasm bank, were harvested at the fully expanded—green—and ripe—red—maturity stages. They were assessed in terms of their diameter, mass, color, firmness, soluble solids (SS) content, titratable acidity (TA), SS/TA ratio, and vitamin C content. Genetic diversity was analyzed using two approaches: (i) a classical hierarchical clustering method, the unweighted pair-group method with arithmetic mean (UPGMA), based on the Mahalanobis distance, and (ii) artificial neural networks via Kohonen self-organizing maps. Significant genetic diversity was observed across all quality traits at both maturity stages. Both clustering methods were consistent in identifying the genetic diversity among the acerola genotypes. The 'Okinawa' genotype was the most divergent at the green stage due to its higher mass and firmness, as well as its high vitamin C content, making it ideal for industrial vitamin C extraction. At the red maturity stage, 'BRS Rubra' was the most divergent, exhibiting the highest SS content and SS/TA ratio, making it suitable for fresh consumption and processing. The SS/TA ratio was the trait that contributed the most to the genetic diversity of acerola, accounting for 24.8% and 46.4% at the green and red stages, respectively. These results underscore the importance of genetic diversity studies in identifying superior genotypes with desirable quality traits. The considerable genetic variability found offers valuable opportunities for future breeding efforts to improve acerola fruit quality and enhance its market potential.



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sciforum-100830: Breeding for Stripe rust resistance against new aggressive pathotypes "238S119" and 46S119 in hot spot "Pyuthan" of Nepal

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Stripe (yellow) rust (YR) is a major disease of wheat grown in the mid hills and river basin area, but with the incursion of new aggressive races adapted to warmer temperatures, it has migrated and spread across Terai/plains of Nepal. Formerly, the national breeding program focused on development of agro-ecological specific resistant varieties, but with the occurrence of YR aggressive races, the strategy has been changed to tackle all three rust-resistant varieties for all domains. The advanced breeding lines were evaluated in the hot spot "Pyuthan" for three consecutive years, 2021/22, 2022/23 and 2023/24, with 84, 124 and 160 entries, respectively, after the knockdown of popular wheat varieties "Sorgadwari" and "WK 1204" with aggressive race 238S119 (238E159) in 2020. The new yellow rust races "238S119" and "46S119" pose threat to national wheat production. The experiments were conducted in an augmented design. In 2021/22, out of 84 entries, 48 entries showed a resistant to moderately resistant/moderately susceptible reaction with severity value less than 30 %. Similarly, in the year 2022/23 and 2023/24, out of 124 and 160 entries, 102 and 122 entries showed resistant to moderately resistant reaction. This indicates that the national wheat breeding program has excellent genetic materials to overcome the incursion of new YR races in Nepal. The newly released biofortified wheat varieties Zinc Gahun 1, Zinc Gahun 2, Bheriganga and Himganga and the pipeline varieties NL 1446, NL 1488, NL 1179, NL 1450 and BL 5168 displayed a good level of resistance against these new aggressive races. The farmer's acceptance test (FAT) and seed multiplication of these high-yielding YR-resistant varieties were also carried out in the farmer's field to replace the popular variety "Sorgadwari", which has covered almost 80% of total area in Pyuthan. The agronomically superior varieties with around a 8-10 % grain yield advantage over "Sorgadwari" along with durable resistance to all three rusts, namely NL 1446, NL 1488, NL 1179 and BL 5168, are the pipeline varieties to be released in the near future for the mid-hill ecology of Nepal.



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sciforum-107948: Canopy management as a short-term adaptation strategy to counteract heatwaves' impacts on grapevine

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Viticulture faces significant challenges due to climate change, impacting grapevine growth, grape quality, and wine production. Environmental factors such as rising temperatures, altered precipitation patterns, and extreme weather events are undergoing substantial changes. These issues, once confined to warmer regions of Southern Europe, now affect cooler areas like Northern Italy, where there is an increasing frequency of storms, heavy rainfall, and heatwaves, which can lead to ripening arrest and quantitative and qualitative losses (i.e. sunburn). This issue affects both red and white grape varieties, with white grapes particularly vulnerable due to reduced acidity levels, crucial for aromatic and sparkling wine production. To address the impact of high day and nighttime temperatures in the summer (from July until harvest), we tested different short-term adaptation solutions, including the use of shading nets and the spraying of particle films such as kaolin and zeolite, the first reducing overall incoming solar radiation and the latter increasing solar radiation reflectance, thereby reducing the temperature of the vine canopy and the grapes. The experiment was carried out in an organic vineyard of *Vitis vinifera* cv. Glera intended for Prosecco wine production. From pre-*véraison* to harvest, continuous monitoring of berry temperature and canopy microclimate was carried out, and physiological and morphological measurements were taken. Overall, the results revealed significant differences among the treatments in terms of plant yield, berry size, and the chemical composition of the grape must, suggesting these approaches may hold relevance for other viticultural regions facing heat-related challenges. Additionally, photosynthetic activity varied between treatments, further highlighting the potential usage of these applications in mitigating the impacts of high temperatures on grapevine physiology and wine production.



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sciforum-107070: Determination of optimum dose of lethal dose and growth reduction using gamma-irradiated Bambara groundnut (*Vigna Subterranea* (L) Verdc.) genotypes.

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Bambara groundnut (*Vigna Subterranea* (L) Verdc.) is one of the smart underutilized and neglected crops of African legumes. Due to cleistogamy, the crop has not been improved regardless of breeding efforts made by different research agencies, hence mutation breeding using gamma irradiation could be used for this crop improvement. Gamma irradiation is a mutagenic agent that induces genetic and phenotypic variability in crops. The optimum doses must be determined before starting a mutation breeding program. The four Bambara groundnut genotypes were treated with gamma irradiation at 0, 100, 200, 300, 400 and 500 Gray(Gy). The study aimed to determine the optimum mean of the lethal dose at 50% (LD₅₀) and growth reduction at 50% (GR₅₀), using a linear regression model. The analysis of variance showed that the growth parameters (seedling length, petiole length and biomass) are significant. The investigation of gamma irradiation on survival percentage, seedling length, biomass and leaves was also conducted. The LD₅₀ for NAMCREAM, NAMBLACK, NAMBROWN and NAMRED are 182, 251, 283 and 395 Gy respectively. The GR₅₀ for NAMCREAM, NAMBLACK, NAMBROWN and NAMRED are 202, 385, 423 and 446 Gy respectively. The optimum doses were determined and variation was observed in gamma-irradiated genotypes and growth parameters. The results from this study will be used for a large-scale mutagenesis plant breeding program.



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sciforum-100869: Effects of Sucrose and Cytokinin on in vitro Regeneration of Small Cardamom (*Elettaria cardamomum* Maton.)

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Cardamom (*Elettaria cardamomum* Maton) is a popular spice crop that has great commercial value. In vitro regeneration of a local variety of cardamom using shoot tips as explants is presented here. MS medium supplemented with different concentrations of sucrose (3% and 6%), cytokinin (1.0 mg/L, 1.5 mg/L, 2.0 mg/L, 2.5 mg/L) and BAP (6-Benzylaminopurine) was used for regeneration purposes. The ANOVA showed significant differences among all the treatments. The highest number of shoots was shown in treatments 1.5 mg/L BAP ($3.10 \pm 0.74a$) and 2.0 mg/L BAP ($2.90 \pm 0.74a$) supplemented with 6% sucrose, whereas the lowest was in 1.5 mg/L BAP ($1.60 \pm 0.70b$) and 2.0 mg/L BAP ($1.50 \pm 0.71b$) with 3% sucrose. The best shoot length was observed in treatments with 1.5 mg/L ($5.50 \pm 0.53a$) and 2.0 mg/L ($5.30 \pm 0.48ab$) BAP with 6% sucrose. In the case of root formation, the best treatments were those with 1.0 mg/L BAP with 3% sucrose ($4.10 \pm 0.88a$), 1.5 mg/L BAP with 6% sucrose ($3.90 \pm 0.86a$) and 2.0 mg/L BAP with 6% sucrose ($4.00 \pm 0.82a$), while the longer roots were observed in the treatments with 2.5 mg/L ($11.60 \pm 1.26a$), 1.5 mg/L ($8.80 \pm 0.79b$) and 2.0 mg/L ($7.20 \pm 0.79c$) BAP mediated with 6% sucrose. The leaf number was highest in treatments with 2.5 mg/L ($2.90 \pm 0.74c$), 1.5 mg/L ($5.30 \pm 0.82ab$), and 2.0 mg/L ($5.90 \pm 0.74a$) BAP with 6% sucrose whereas the lowest was in treatments with 2.0 mg/L BAP with 3% sucrose ($4.10 \pm 0.74c$) and 1.5 mg/L BAP with 3% sucrose ($4.20 \pm 0.92c$). Considering the parameters recorded, treatments 1.5 mg/L and 2.0 mg/L BAP supplemented with 6% sucrose should be employed for the development of elite planting material. After successful hardening and acclimatization, the platelets were transferred to a field with a survival rate of 90%. The medium composition observed in the present study could be used for developing superior-quality plants of small cardamom through in vitro regeneration.



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sciforum-105103: Genotype × Environment Interaction for summer dormancy and productivity in cocksfoot hybrids over three contrasted environments

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Climate change is projected to amplify existing climate-related risks and create new risks for natural and human systems. Perennial forage species may represent a valuable alternative to annual forage crops by improving the environmental and economic sustainability of Mediterranean agro-pastoral farming systems through a reduction in soil erosion and the conservation of soil water. Under climate variability, a multi-environment experiment was conducted in Morocco under three contrasting environments—Annocer, Guich, and Tassaout—over three consecutive years (2013/214, 2014/2015, and 2015/2016). Measurements for productivity traits and summer dormancy were taken for 21 genotypes, 18 of which were (F1 hybrids) generated between two varieties of cocksfoot—*Dactylis glomerata* ssp *glomerata* and *Dactylis glomerata* ssp *hispanica*—with different ranges of senescence, parents, and Ludac values (temperate control). An evaluation of the stability and adaptability of the cocksfoot genotypes was established by AMMI (Additive Main Effects and Multiplicative Interaction) using some productivity traits (plant height, annual dry-matter production, and spring biomass) and summer dormancy to determine differences between genotypes across environments. The present study aimed to identify the effect of environmental control on the induction of summer dormancy and identify genotypes with both mean performance and high stability. The results indicated a large variability among genotypes from year to year and location to location. The Analysis of Variance (ANOVA) showed highly significant differences ($P < 0.0001$), which were recorded between genotypes for all measured traits, mainly due to changes in genotype rankings. Significant effects of genotype, environment, and G×E were noted. Moreover, significant correlations ($P < 0.0001$) were obtained between environments. Env2 and Env3 achieved the highest mean annual dry matter.



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sciforum-103000: Harnessing Artificial Intelligence for Next-Generation Plant Breeding: A Systematic Review of the Breeding 5.0 Paradigm

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The integration of artificial intelligence (AI) and machine learning into plant breeding, known as the Breeding 5.0 paradigm, represents a significant leap forward in agricultural innovation. This systematic review explores how AI-driven approaches enhance precision, efficiency, and scalability in plant breeding by combining AI algorithms with big data analytics, high-throughput phenotyping, genomic selection, and environmental modeling. These advancements reduce time and costs, identify genetic traits, optimize breeding strategies, and predict plant performance. AI techniques such as image analysis and reinforcement learning accelerate breeding cycles and facilitate the development of resilient genes and climate-adaptive crops. Empirical evidence demonstrates substantial improvements, including up to a 25% increase in yield and a 30% improvement in disease resistance, for crops like wheat and rice. Breeding 5.0 also enhances accessibility for a broader range of farmers, bolstering food security and promoting sustainable agricultural practices. However, challenges persist, particularly in data integration and accessibility. This review examines the core components of Breeding 5.0, including the role of AI in high-throughput phenotyping, smart breeding platforms, and deep learning for genomic prediction. It also addresses ethical considerations and potential challenges associated with the use of AI in plant breeding. Synergy between AI and plant breeding is paving the way for a new era of agricultural innovation, aiming to improve sustainable crop production and address global food security challenges.



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sciforum-106963: Identification of Novel Bacterial Blight Resistance in Wild *Punica granatum* L. from North-Western Himalayas using SSR Markers and Hybridization for Developing Resistant F₁ Hybrids

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Pomegranate (*Punica granatum* L.) cultivation is increasingly threatened by bacterial blight caused by *Xanthomonas axonopodis* pv. *punicae* (Xap), highlighting the need for resistant cultivars. This study aimed to identify bacterial-blight-resistant sources from indigenous wild Daru populations and assess their potential through hybridization. Wild Daru germplasm was surveyed, collected, and screened using artificial challenge inoculation, with attached leaf assays providing insights into resistance under more realistic conditions. This study identified genotypes SH-14 and SH-16 as having the lowest disease severity (13.30%) and longest incubation periods (9.50 days). SSR marker analysis of 20 primers across 23 genotypes revealed 1119 scorable bands with a high polymorphism ratio of 92.58%. Phylogenetic analysis and clustering highlighted significant genetic diversity and unique alleles in resistant wild genotypes. Hybridization studies with commercial cultivars showed the Bhagwa × SH-16 cross achieving the highest fruit set (88.90%), while the Kandhari Kabuli × SL-23 cross had the lowest (11.0%). Fruit retention varied, with Bhagwa × SL-23 and Kandhari Kabuli × SR-11 having the highest retention percentages. These findings underscore the potential of Himalayan wild germplasm in developing bacterial-blight-resistant pomegranates and emphasize the integration of molecular markers and hybridization in breeding efforts. The research also provides valuable insights for the development of new pomegranate cultivars with enhanced resistance and improved yield potential. Future research will focus on evaluating hybrid progenies, constructing genetic linkage maps, and identifying specific genes associated with bacterial blight resistance in pomegranate.



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sciforum-107315: Impact of Auxin and Cytokinin Concentrations on the Induction of Callus and the Regeneration of in vitro Plantlets in Aromatic Rice Katarivogh (*Oryza sativa* L.)

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Population expansion is driving up the prerequisite demand for rice farming, although productivity is steadily falling. Plant growth hormones in excess can cause somaclonal variations and impede the ability of regeneration in tissue culture systems. The two main objectives of the current project were to determine the ideal dosage of plant growth hormones for the in vitro regeneration of the aromatic rice katarivogh (*Oryza sativa* L.) and to identify the times at which somaclonal variation occurred in the transformed plantlets. Mature seedlings were employed as the initial substance for callus induction, with various concentrations of 2,4-D and NAA. The callus induction probability was approximately 93% on the MS medium including 2,4-D (2.0 mg L⁻¹) and NAA (0.5 mg L⁻¹) after six weeks of treatment. Several concentrations of BAP and Kn were employed to induce embryogenic calli to promote regeneration. The results revealed that within four weeks, the highest regeneration frequency (98%) was attained on the half-strength hormone-free MS medium incorporating BAP (3.0 mg L⁻¹) and Kn (1.0 mg L⁻¹), and the produced shoots were effectively rooted in this medium. Two weeks later, the container harboring the healthy and vigorous plantlets was refilled with soil, coco dust, and vermicompost to allow for acclimatization. The plantlets were assessed for a positive response to regeneration once they adequately appeared and were given time to harden. This developed a sizable number of shoots that could potentially be employed for upcoming genetic investigations.



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sciforum-100967: Improving Crops Using Genomic and Biotechnological Resources

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Plant breeding has significantly increased the yield, quality, and disease resistance of crops. Advances in genomic resources have revolutionized this field, allowing for the precise identification of genes and the application of marker-assisted selection (MAS) through molecular breeding techniques. These advancements are supported by various powerful tools, including genomic sequences, molecular markers, genetic transformation, and genome editing methods, all utilized to improve crops such as tomatoes. Tomatoes represent a major global agriculture commodity, with an estimated value of USD 1.4 billion. In North Carolina alone, tomato cultivation contributes approximately USD 35 million annually, spanning 3,200 acres of cultivated land. This presentation will focus on the genomic and biotechnological resources employed in crop improvement, using North Carolina (NC), USA, as a representative case study. The NC State Tomato Breeding Program enhances tomato varieties by improving their disease resistance and fruit quality. Substantial progress has been made by integrating conventional and molecular breeding approaches. However, new challenges, particularly from evolving pests and diseases, require ongoing research and development efforts. Fruit quality is a multifaceted trait assessed based on various parameters such as shape, size, smoothness, lycopene content, and flavor. The NC State Tomato Breeding Program strives to optimize these attributes to meet market demands and consumer preferences. The program's efforts include the development of new tomato varieties that exhibit superior qualities in these areas. This presentation will outline the ongoing breeding initiatives aimed at addressing the challenges that are faced by tomato cultivation. It will delve into the methodologies employed, encompassing conventional breeding techniques and cutting-edge molecular approaches. Through this comprehensive overview, the audience will gain a deeper understanding of the critical role that genomic and biotechnological resources play in modern crop improvement efforts.



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sciforum-105693: Influence of Sucrose Levels and LED Light Spectra on In Vitro Propagation of Cornelian cherry (*Cornus mas* 'Podolski')

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Cornelian cherry or *Cornus mas* is well known for its nutritional, medicinal, and ornamental uses. The cultivar *Cornus mas* 'Podolski' is particularly valued for its larger fruit size, high yield, and adaptability, making it a promising candidate for commercial cultivation and landscape use. However, conventional propagation methods are limited, necessitating the development of efficient in vitro techniques. Light-emitting diodes (LEDs) are currently being used as a light source for in vitro regeneration or the growth of plants in a controlled environment. The objective of the present work was to investigate the influence of varying sucrose concentrations (10 g·L⁻¹, 15 g·L⁻¹, 20 g·L⁻¹) and different dominating LED light spectra; White (Control); Blue (B); Blue-Red (BR); and Red (R) on the in vitro growth and morphogenesis of *C. mas* 'Podolski'. The parameters measured included the number of shoots, the shoot length, the number of leaves, callus induction, and regeneration rate. It was observed that both sucrose concentration and light spectrum significantly influence the in vitro growth and morphogenesis of *Cornus mas* 'Podolski'. Higher sucrose levels, particularly 20 g·L⁻¹ with white spectra, promote greater shoot production, while red spectra with varying sucrose concentrations enhance shoot elongation and leaf formation. Furthermore, 100% regeneration was observed in several treatments, indicating a high potential for successful plant regeneration under specific sucrose and light spectrum combinations. The lack of significant differences in callus formation across treatments suggests that callus induction is largely independent of sucrose concentration and light quality under the tested conditions. Collectively, Blue-Red spectra with varying sucrose levels are most effective for overall plant regeneration. This optimized protocol is considered for enhancing the large-scale propagation of this valuable cultivar, supporting both commercial production and conservation efforts.



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sciforum-107010: Response of a boron-tolerant *Triticum dicoccum* genotype under high boron concentrations

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Approximately 10000 years ago, wild emmer wheat was domesticated to develop cultivated emmer wheat, *Triticum dicoccum*, with the AB genome. It is considered as a potential candidate for durum wheat breeding programs due to its compatibility with modern tetraploid wheat. Along with a high protein content and productive tillers, it has also been reported to be a crucial source of different stresses such as yellow rust, common bunt and drought stress. However, the information about its boron toxicity tolerance is limited. Here, we discuss different responses of a boron-tolerant *T. dicoccum* genotype towards boron toxic growth conditions. The genotype was hydroponically grown under three different boron treatments, Control, 1 mM and 10 mM, in triplicate. The differential expression of several genes under stress conditions was found to be associated with the physiological and biochemical responses of plants. Several transporters including transmembrane proteins, aquaporins and ABC transporters have been determined as potential candidate genes for developing B toxicity tolerance. Not only were caffeine metabolism and photosynthesis-antenna protein pathways highly enriched under high boron, but also oxidative phosphorylation, biosynthesis of secondary metabolites and metabolic pathways showed the maximum number of DEGs. The studied boron-tolerant genotype and the identified significant DEGs can be further used by researchers to introduce B toxicity tolerance in modern wheat accessions.

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sciforum-104084: Response of Neglected Hexaploid Wheat Species towards Combined Drought and Salinity Stress

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Combined drought and salinity stress, prevalent in arid and semi-arid regions of the world, is known to have more damaging effects on wheat crops as compared to the individual drought and salinity stress conditions. Different hexaploid *Triticum aestivum* subspecies including *ssp. compactum*, *ssp. spelta*, and *ssp. sphaerococcum* have not been well explored for abiotic stress tolerance. While *ssp. compactum* and *ssp. sphaerococcum* are free threshing, *ssp. spelta* is a hulled type. All these subspecies are autogamous and can be crossed with *ssp. aestivum* to produce fertile offsprings. Hence, it will be useful to identify and utilize the potential genotypes of these subspecies to develop stress tolerant wheat cultivars. Thus, more than 20 genotypes of these species have been screened in hydroponic system under controlled, drought stressed, salinity stressed, and combined drought and salinity stressed growth conditions. The tolerance level of these genotypes was estimated in terms of growth parameters, photosynthetic rates, relative water content and electrical conductivity under different stress conditions. A huge genetic variation in stress tolerance was observed within and among all the studied species. A significant correlation was identified between the stress tolerance and different parameters. The obtained results directed that these neglected hexaploid wheat subspecies can be a potential source of combined drought and salinity stress tolerance.

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sciforum-104066: Stability Analysis of Egyptian Faba Bean Varieties and their Resilience to Variable Environmental Conditions and *Orobanche* Parasitic Weed Infestations

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Broomrape (*Orobanche crenata* Forsk.) is an obligatory parasitic weed negatively affecting faba bean hosts grown in the Mediterranean countries. Breeding resistant/tolerant varieties may provide a reliable measure for proper production under infestation. The acceleration of climate change is represented in drastic fluctuations of the elements, greatly impacting the performance of new varieties, particularly in the case of faba reactions to broomrape, which are identified by quantitative genetics.

The results of ten field trials conducted under naturally broomrape-infested soils in the Faculty of Agriculture, Cairo University, Giza, Egypt, during the 2018/2019 and 2019/2020 seasons were used in stability analyses. During each season, five trials were carried out at five planting dates starting at the end of October. In each trial, ten faba bean varieties from different genetic backgrounds and with degrees of reaction to *Orobanche* infestation were randomly distributed as main plots in RCBD with three replications.

The stability analyses of performance across the twenty environments were performed using three parametric measures: two dynamic (S^2d_i and b_i) and one static ($CV_i\%$) stability parameter.

The investigated faba bean cultivars varied significantly in mean performance and stability as measured by all parameters. Based on the ranking of performance by using the centroid method for seed yield plot⁻¹ or host plant⁻¹, podded host% and the number of broomrapes, the varieties identified as broomrape-tolerant, particularly the synthetic ones, seemed to be more adaptable across wide environmental conditions and levels of infestation. The seed production of these varieties seems not to be affected across the studied environments in spite of the variable broomrape levels recorded. Thus, for breeding promising and resilient faba bean varieties, lines should be screened under several environmental conditions and those showing reliable performance could be synthesized according to their general combining ability tests.



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sciforum-103792: Stimulation of Spring Wheat Growth by Various Combinations of Spectral Compositions of Led Light

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Additional lighting is required to cultivate crops in northern latitudes and in greenhouse conditions. In the present study, the effect of two light-emitting diode sources on the growth and yield of the spring wheat cv. Zlata was studied. Plants were cultivated under complete isolation from sunlight. We employed two light spectra established by commercially available LED lamps, provided by Uniel, China (prevalence of red light), and Agroaspect, Russia (prevalence of blue light). The growth conditions, including the temperature, humidity, watering, fertilization and length of the photoperiod, were the same for all plants.

Cultivation under red light resulted in faster plant development, earlier heading, flowering and ripening of cv. Zlata. Under blue light, the time from sowing to harvesting was 107 days, while the application of the red spectral range reduced the growth time to 79 days. This led to a 2-fold decrease in the number of ears per plant, a shortening of the flag leaf and a 2-fold decrease in the total number of seeds per plant. Under blue light, the average weight of 1000 seeds of cv. Zlata was 41.75 g, and the protein content reached 17.65%. In contrast, plant growing under red light led to a decrease in the average seed weight to 30.1 g, and the protein content reduced to 16.75%.

Although the red spectral range leads to a decrease in the yield and quality of wheat seeds, this technical approach makes it possible to shorten the growth time and achieve four cycles of growing wheat plants per year in well-controlled installations. The use of the blue spectral range can be used for the production of sufficient number of high-quality seeds to speed up wheat breeding.



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sciforum-104935: The *Jatropha curcas* as a substitute for *Ricinus communis* in biodiesel production in the semi-arid region of Brazil

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In Brazil, public policies have been promoting the use of renewable energies, with a particular emphasis on biofuels, as well as research for the replacement of fossil fuels, among which biodiesel stands out. The primary species used for biodiesel production is castor bean (*Ricinus communis*), widely disseminated in the semi-arid region due to its resistance to long dry periods and its requirement for highly fertile soils. However, another crop is emerging in this process: the *Jatropha curcas* L. This species, native to Brazil and belonging to the Euphorbiaceae family, the same as castor bean, requires strong sunlight and is also highly drought-resistant. Additionally, it can tolerate increased rainfall and soils with poor chemical characteristics. This study presents the results of three years of cultivation of *Jatropha curcas* and castor bean at the Rio Seco Experimental Station (Amélia Rodrigues, Bahia, Brazil), a region located on the marginal zone of the semi-arid area, which is also hot but has a higher rainfall index and chemically poor soils, comparing their productivity and respective edaphoclimatic aptitudes. It was observed that castor bean has a significant restriction concerning humidity, as its cultivation and development showed low production, frequently associated with fungal action due to humidity and low yield due to the type of soil, resulting in non-viability for biofuel production in this region. However, *Jatropha curcas* showed better results, indicating greater adaptability. Nevertheless, *Jatropha curcas* is still a little-known plant, both in its productive cycle and productivity, requiring further studies to efficiently monitor its phenological cycle and the duration of its productive cycle.



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sciforum-106888: The Effect of Abiotic Stress on the Production of alkaloids from the callus tissue of *Datura* and *Solanum* species

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Medicinal plants have increasing worldwide potential in pharmacological therapies, and their secondary metabolites are effective, with no adverse effects on the body. Technologies for plant cell culture have proven to be useful for both researching and generating plant secondary metabolites in vitro, and phytochemicals are reported to defend against abiotic stresses. This study employed four different types of abiotic elicitors (UV, NaCl, GA3, and Pt) to examine the relationship between abiotic stresses and the generation of secondary metabolites from *Datura stramonium*, *D. innoxia*, *Solanum nigrum*, and *S. dubium*. After breaking seed dormancy, Callus tissues were derived from two organs: the seeds and leaves of all the four species. In callus tissue, the high mean total alkaloid recorded for leaves was observed with values in *S. dubium* < *D. stramonium* < *D. innoxia* < *S. nigrum*, while the seed values were scored as *S. dubium* < *D. innoxia* < *S. nigrum* < *D. stramonium*. The resulting alkaloids from the callus treated with different elicitors showed that high alkaloid levels obtained from *S. nigrum* seeds treated with GA3 (1082.02 µg/ml) and the lowest alkaloid levels (58.17 µg/ml) were observed in leaves treated with platinum and in controlled *D. stramonium* seeds. Seed explants had more alkaloid production than leaves in all species. Atropine, a tropane alkaloid, was detected in 13 samples using GC/MS. *D. innoxia* seeds treated with NaCl, and had the highest atropine concentration (18.82ppm).



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sciforum-105479: Unravelling the breeding potential of cytolines of Indian cauliflower

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Among the cole vegetables (*Brassica oleracea* L.) , Indian cauliflower holds a predominant position in India in terms of area and production. cauliflower and other cole vegetables like cabbage, broccoli, brussels sprout, kale and knolkhol are reservoir of nutrients, vitamins, antioxidant compounds and secondary metabolites like glucosinolates. Thus, enhancing the productivity of cole vegetables is of utmost value to combat the hunger and malnutrition globally. Development of hybrids is one of the effective way to increase the productivity of vegetable crops. In this context, Cytoplasmic male sterility (CMS) has been proved instrumental in accelerating the breeding programmes of cole vegetables. In the past decades, large number of cytolines of cauliflower consisting of Ogura cytoplasm has been developed at ICAR-Indian Agricultural Research Institute, New Delhi, through repeated backcrossing. to unravel the true genetic and breeding potential of these cytolines, the appraisal of morphological, reproductive and seed traits of these lines is essential. The present investigation indicated that some of the CMS lines proved promising and can be exploited in developing high yielding early hybrids. The results also confirmed the reduction in nectar volume and flower size in cytolines as compared to their male fertile counterpart, which is attributed to introgression of sterile cytoplasm. High heritability estimates also indicated the role of selection in the present germplasm. The introgression of cytoplasm also resulted changes in alteration in petal size and sepal size. The results of current study are instrumental in formulating a effective breeding strategy for exploitation of these cytolines in accelerating breeding of cauliflower.



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Session 3. Sustainable Soil Management and Farming Systems

sciforum-102475: Assessing the Efficacy of Citronella and Oregano Biochar for Soil Enhancement

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Organic waste constitutes the majority of waste in Lebanon, over 52%. This study aims to valorize organic waste and turn it into an environmental benefit by investigating the use of citronella (*Cymbopogon Winterianus*) and oregano (*Origanum Syriacum*) residues as biochar. These plants are known for their aromatic compounds and produce substantial waste during cultivation and processing. The biochar was produced through pyrolysis at 400°C in a muffle furnace under an atmosphere devoid of oxygen, for one hour. The efficiency of oregano and citronella biochars as soil amendments (1% of soil mass 100 g) was evaluated by studying oregano plant germination and soil analysis and as adsorbant for methylene blue. Oregano biochar demonstrated the best performance, with significant improvements in plant height of 24 cm, leaf dimensions 1.5 cm width and 1.7 cm length, chlorophyll concentrations 62.22% chlorophyll b and 37.36% chlorophyll a, and soil nutrient levels. Citronella biochar effectively removed 88.8% of methylene blue dye. After cultivation, the results show that the amendment of biochar offers an appropriate alternative strategy to achieve higher essential oil yield (higher in 30% than the other groups) in oregano plants without compromising the aroma quality of the soil. This study highlights the potential of using agricultural residues to create biochar and add it strategically as a fertilizer which has the concomitant advantage of enriching soil fertility for long-term sustainable agriculture with potential to reduce chemical fertilizer inputs, contributing to a circular bioeconomy and offering regional economic benefits.



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sciforum-106919: Assessment of soil fertility for sugar beet in the irrigated area of Doukkala (Faregh)

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Soil, being a resource that is not very renewable, its reasonable management, protection and maintenance of its fertility and productive potential are essential to ensure food security and sustainability. This work aims to study the properties and fertility of soils in the Faregh area, which is the first to be equipped with irrigation in the Doukkala area. The physicochemical characterization of the soils was carried out by laboratory analyses and the assessment of their fertility was done on the basis of recognized standards and using statistical methods. Soil samples were taken at the 0-30 cm level, on 80 sites. The physicochemical parameters retained are: clay (A), silt (L), sand (S), exchangeable potassium (K), assimilable phosphorus (P), pH, organic matter (OM) and boron (B). The results obtained show that the soils have a balanced sandy texture (A = 15.43, L = 14.35, S = 70.22%) with a high variability (CV > 35%) for A and L and average (20.29%) for S. The soils studied are poor in OM (average = 1.05%) with an average variability (CV = 34.4%), while the pH has a neutral tendency (average = 7.43) in 76.3% of the cases, it presents a low variability (CV = 6.96%). The soils are rich in K (135.41 ppm) for 63.7% of the soils and P (73.79 ppm) for 82.6% of the soils. However, the majority of the soils (82.5%) are poor in boron (average = 0.42 ppm). These three parameters have a high variability (CV > 35%). The texture and pH of the soils are suitable for sugar beet cultivation. The contributions of K and P depend on the yield to be achieved and those of boron must be added to avoid yield losses. The recovery of organic matter must be done by contributions of manure and good management of residues.



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sciforum-105936: Development of a Simplified Library for Over-The-Air (OTA) Firmware Updates on ESP32/ESP8266 Devices with a Secure Web Interface

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The present work is aimed at the development of a simplified library for remote firmware updates (Over-The-Air—OTA) on ESP32/ESP8266 devices. The library seeks to facilitate the integration of OTA systems with a secure and ergonomic web interface, providing a practical solution for embedded systems developers. The local interface is developed using HyperText Markup Language (HTML), Cascading Style Sheets (CSSs), and JavaScript, while the solution for external networks also utilizes the Django framework to host and manage new binaries. The primary objective of this library is to reduce the complexity of OTA implementation, allowing it to be configured with just a few lines of code, without compromising the project's functionality. The solution is especially useful in Internet of Things (IoT) applications, where remote firmware maintenance and updates are crucial requirements and, in some cases, are very laborious to carry out. The library is designed to be lightweight, enabling integration across different development environments, from local networks to external network systems. This work contributes to the advancement of remote maintenance techniques in embedded systems and represents a valuable tool for the developer community, promoting the scalability and longevity of microcontroller-based projects. The library will be made available on GitHub, a open source code-hosting platform.



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sciforum-106885: Exploring the potential of soybean as an intercrop in maize-based cropping systems

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Traditional maize farming practices in Pakistan are labor-intensive and add to the depletion of soil fertility. Soybeans, being a leguminous crop, have the competence to restore soil health, making maize–soybean intercropping an effective pathway to ameliorate maize production. A field experiment was designed and conducted in the autumn of 2019 at the Agronomic Research Farm, University of Agriculture, Faisalabad, to evaluate the impact of soybean intercropping on maize yield. The experiment followed a factorial arrangement in a randomized complete block design (RCBD) with three replications. Factor A involved two maize planting geometries (MPG): alternate single-row maize planting on 75 cm spaced ridges, and alternate double-row planting on 75 cm ridges. Factor B included four soybean intercropping techniques (SIT): no intercropping for brown manuring at 30 days after sowing (DAS), as a fodder crop at 60 DAS, and as a grain crop at maturity. Standard methods were used to record parameters related to soil health, growth, and the yield of both crops. Results indicated that maize planted in alternate single rows with soybean as a grain crop achieved higher values in terms of plant height (205.17 cm), 1000-grain weight (372.97 g), biological yield (19.10 tons/ha), grain yield (8.65 tons/ha), and harvest index (2.9). Soybean growth, however, was generally superior when intercropped on alternate double rows. Both MPG and SIT significantly influenced the performance of maize and soybean, with alternate single-row maize and soybean grain crop intercropping found to be the most economical under Faisalabad's agro-ecological conditions.



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sciforum-106966: Agroforestry as a mitigatory tool for land degradation: Effect of organic manures on soil physicochemical properties in a newly established wild pomegranate based agroforestry system

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Land is a non-renewable resource essential for human development, supporting our need for food, shelter, and growth. However, since the 20th century, land degradation has rapidly increased due to environmental damage, population growth, urbanization, industrial expansion, and unsustainable land use. This degradation has become a critical environmental, social, and economic problem worldwide. Sustainable land management practices, such as agroforestry, are promising solutions for restoring degraded lands and maintaining soil health. Therefore this study was conducted with the aim to evaluate the effects of organic manures on soil physicochemical properties within a newly established wild pomegranate-based agroforestry system on land that had been abandoned for several years. This research was conducted at Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, during the year 2020-21. Four treatments studied during the experiment were: T1—Recommended Dose of Fertilizers (RDF), T2—Farm Yard Manure (FYM), T3—Goat Manure, and T4—Control. Additionally, two varieties of *Pisum sativum* i.e. Pusa Pragati and JK-124 Hybrid, were included to assess their performance. Soil physicochemical properties were tested before the start of the experiment and at the end of the experiment. The results showed that soil properties improved significantly by the end of the experiment. Improvements were observed particularly under the application of T3: Goat Manure producing the best results for soil physicochemical properties. These enhancements contribute to a more favorable environment for plant growth and overall soil health. The model can be a potential land use system economically as well as ecologically for the region but needs more elaborative studies over the longer period of time



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sciforum-104072: Assessing the Influence of No-Till and Cover Crop Practices on Soil Organic Carbon in a Tunisian Sandy Olive Orchard

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The integration of cover crops and no-tillage practices is gaining attention due to its potential to improve soil health and sustainability in agricultural systems. This study investigated the impact of cover crops and no tillage on soil organic carbon (SOC) in sandy soils, which are typically low in organic matter and prone to erosion. A field experiment was conducted over two growing seasons in a traditional olive orchard located in a semi-arid region in central eastern Tunisia. Legume-seeded (faba bean, vetch, and fenugreek) and non-tilled plots were compared with conventionally plowed plots.

The results demonstrated that cover crops and no tillage significantly increased SOC levels in the 0-30 cm soil depth and exhibited significantly higher enzymatic and microbial activity than the control plots. This increase in SOC was attributed to the aggregation of organic residues from cover crops and reduced soil disturbance, which enhanced microbial activity and carbon sequestration. Cover crops and no tillage also improved soil structure, reduced erosion, and increased water retention, contributing to overall soil health.

Consequently, the integration of cover crops and no tillage in sandy soils can effectively enhance SOC levels, promote sustainable agricultural practices, and mitigate climate change. Future research should focus on the long-term impacts and optimization of cover crop species and management practices for different soil types and climatic conditions



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sciforum-102371: Association cultivation of *Ceratonia siliqua* L. and *Spergularia salina* J.Prest. A sustainable strategy for mitigating salt stress in agriculture

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Soil salinization represents a major challenge for agriculture, severely limiting plant growth. At present, over 1,000 million hectares are threatened by this phenomenon, aggravated by climate change and human practices such as excessive irrigation. This problem leads to a drop in agricultural yields and threatens food security. It is crucial to develop sustainable agricultural strategies, including adapted management practices and innovative solutions to mitigate the effects of salinization. This study explores the potential of combined cultivation of *Ceratonia siliqua* L. (carob) and *Spergularia salina* J.Prest/ as a strategy for enhancing growth in a saline environment. Four levels of NaCl concentration were applied, ranging from 0 mM/L to 257 mM/L. Key parameters assessed included soil electrical conductivity, morphological parameters, as well as various physiological and biochemical indicators of stress. The results show that the combination of *Ceratonia siliqua* and *Spergularia salina* significantly improves the salt tolerance of carob plants compared with monoculture, as evidenced by the marked difference in the parameters measured. The findings of the study suggest that the associated cultivation of *Ceratonia siliqua* and *Spergularia salina* could represent a sustainable solution for maintaining agricultural productivity in saline environments. Indeed, this method not only proves to be effective in improving crop resilience to salt stress, but also offers significant benefits for sustainable soil management.



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sciforum-103751: Circular and agroecological practices to improve integrated systems

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Conventional agriculture encompasses agricultural and livestock systems that are highly specialized and often associated with a negative environmental impact and external input dependency. Integrated systems are a sustainable alternative for production, where, in addition to increased diversity, nutrient recycling is promoted under a circularity approach. This research evaluated the effect of circular and agroecological practices on the yield and soil properties of an integrated corn+sheep+forage system. Four treatments were tested in a completely randomized design with three replications: maize+vetch association without fertilization (MV), maize fertilized with sheep manure (MM), maize+vetch association fertilized with sheep manure (MVM), and maize with chemical fertilization (CFM). The response variables were grain and forage yield (maize stover+vetch), soil bulk density, soil organic matter, and soil nutrient content (nitrogen, phosphorus, and potassium). The results revealed significant statistical differences ($P=0.003$) in forage yield and soil potassium content. The combination of animal fertilizer and crop association practices (MVM) increased the grain and forage yield compared to the chemically fertilized monoculture (CFM) by 2.3 and 5.8 Mg ha⁻¹, respectively. In the soil, the MVM treatment increased potassium content ($P=0.027$), organic matter, and ammoniacal nitrogen and decreased bulk density. In conclusion, implementing circular and agroecological practices allows for a sustainable improvement in integrated systems, as production costs for fertilization and animal feed are reduced, crop yield per unit area is increased, soil quality is improved, diversity in the production unit is favored, and the environmental impact is reduced by promoting nutrient recycling.



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sciforum-101342: Conservation Agriculture as Integrated and Regenerative Farming Systems for Environment Sustainability in Drylands

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Combining Conservation Agriculture (CA) and Integrated Farming Systems (IFSs) can be both a powerful approach and tool for promoting and regenerating environmental sustainability in drylands. Such a combination can include (i) the integration of various agricultural activities like crops, livestock, and trees within a single CA farm; (ii) the creation of a closed-loop system where waste from one component becomes an input for another; and (iii) the promotion of circularity practices like using livestock manure as fertilizer for CA crops. The most relevant benefits for drylands are (i) increased nutrient cycling and reduced reliance on external inputs; (ii) improved farm biodiversity and resilience; and (iii) potential for additional income streams from livestock or trees. When combined, CA and IFSs offer even greater benefits: i) excess crop residues from CA can be used as feed or bedding for livestock in IFSs; (ii) manure from livestock in IFS can be composted and used as fertilizer for crops in CA, reducing reliance on synthetic fertilizers; and (iii) the improved soil health from CA benefits both crops and trees in IFS. For successful integration, challenges to consider are private and public investments for simultaneously adopting CA and IFSs, thorough changes in traditional practices and mental settings, the development of research and extension efforts, increased and continuous support and motivation to farmers, and strengthening and downscaling government policies that can play a role in incentivizing the adoption of CA and IFS for sustainable agriculture and food security.



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sciforum-104069: Dual Benefits of Soil Zinc Application: Enhancing Wheat Resilience and Zinc Content While Mitigating Cadmium Toxicity

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Cadmium (Cd) contamination in agricultural soils poses a significant risk to crop productivity and food safety, highlighting the need for effective mitigation strategies. This study introduces a novel approach to alleviate Cd-induced stress in wheat (*Triticum aestivum* L.) by applying zinc (Zn) to the soil, aiming to enhance both crop resilience and grain Zn content. Conducted at the University of Agriculture Faisalabad during the winter season of 2022-23, the experiment utilized a Completely Randomized Design (CRD) with a factorial arrangement and three replicates. Treatments included combinations of three Cd levels (0 mg/kg, 5 mg/kg, and 15 mg/kg) and three Zn levels (0 mg/kg, 30 mg/kg, and 60 mg/kg).

The findings reveal that Cd stress markedly inhibited wheat growth, with the most severe impacts on plant height, biomass, grain yield, chlorophyll content, and photosynthetic rate observed at 15 mg/kg Cd. Remarkably, Zn application effectively counteracted these effects, particularly at high Cd levels. Specifically, Zn improved plant height by 24%, shoot biomass by 10%, chlorophyll content and photosynthetic rate by 6.4% and 80%, respectively, and grain yield by 41%, while increasing biological yield by 11%. Notably, Zn application at 60 mg/kg not only elevated grain Zn content by 20% and protein content by 9% but also reduced grain Cd content by up to 38% compared to the control with 15 mg/kg Cd.

This study underscores the innovative use of Zn to simultaneously mitigate Cd-induced stress and improve the nutritional quality of wheat grains. The significant improvement in both growth parameters and grain quality with Zn application highlights its potential as a dual-purpose strategy for enhancing crop resilience and nutritional value, offering new insights into sustainable soil management and biofortification practices.



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sciforum-105557: Eco-Friendly Fertilizer Solutions: Production and Optimization of Biochars from Vineyard Prunings

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Biochar is a carbon rich material, produced through the thermal conversion of a wide range of feedstocks at elevated temperatures and under oxygen-deprived conditions¹. Considering its positive physical and chemical effects on soil properties, and due to its extensive pore structure, large surface area, and high adsorption capacity, significant research has been conducted on biochar use as controlled-release fertilizers (CRFs)^{2,3}. In the present work vineyard pruning's were used to produce different biochars: (1) at industrial ovens from Ibero Massa Florestal (BIMF); (2) using a flow of CO₂ (BCO₂) in a laboratorial furnace; (3) and by pre-treating milled vineyard pruning's with AlCl₃ and MgCl₂ solutions, and afterwards pyrolyzing in a laboratorial furnace. Following, the biochars capacity to adsorb nitrogen (N), phosphorous (P) and potassium (K) in function of the pH was investigated. The most promising biochar and most adequate pH value for N and P adsorption were selected for further optimizations, namely effect of adsorbent dosage, kinetic assays and adsorption isotherms. In contrast, K adsorption results across all biochars and pH values were not favourable, so no further optimizations were pursued. Langmuir model showed the best fit for the adsorption isotherms and the maximum Langmuir adsorption capacities corresponded to 10.4 mg N/g biochar for BIMF biochar and 12.7 mg P/g biochar for BMgCl₂. These results suggest that vineyard pruning's, presently considered an undervalued residue, could be used for the production of an economically valuable product, following the principles of circular economy. Additionally, this study also suggests that CRFs prepared from vineyard pruning's and possibly from other cellulosic agro-industrial residues could be used as a substitute for conventional fertilizers, which are associated with many environmental issues.



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sciforum-107156: Effect of ammonium-clinoptilolite zeolite as a slow-release fertilizer on the growth of bell pepper seedlings (*Capsicum annuum* L.)

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Excessive nitrate in groundwater, caused by fertilizer overuse and poor wastewater management, poses a significant threat to its quality and long-term sustainability. Zeolite, a low-cost mineral, has positive effects on agricultural soil, plant growth, and groundwater. This study evaluated ammonium-clinoptilolite zeolite as a slow-release nitrogen fertilizer for agriculture. The clinoptilolite zeolite (NCC) was prepared in chip (NH₄-ICC) and powder (NH₄-ICP) forms using an impregnation method and microwave reactor treatment (NH₄-ECC). The additional treatment was used as the control (T4) using just natural zeolite as the growing substrate. The zeolite-clinoptilolite/natural zeolite ratio levels for treatments T1, T2, and T3 were 5, 15, and 25%, respectively in terms of volume. The effectiveness of these zeolites in promoting the germination and growth of bell pepper seedlings (*Capsicum annuum* L.) was assessed under greenhouse conditions for 23 days. The data were analyzed with the statistical software R v4.2. The experiment had a completely randomized design based on the combination of two factors: the type of zeolite and the level of zeolite-clinoptilolite/natural zeolite proportion. All the treatments were irrigated using just water without any fertilizer. Several parameters were analyzed, including plant growth, root length, chlorophyll, leaf number, and dried plant weight. The results showed significantly higher plant growth, leaf number, and dried plant weight. T1C, T1P, and T2P had high leaf area. There was no statistically significant difference in chlorophyll. However, there was a trend towards increased stem thickness, plant height, and dried plant weight compared to the control. This research highlights the important potential of zeolites as a component of ammonium-based fertilizers. Their ability to minimize nutrient loss and control release makes them a valuable tool for sustainable agriculture.



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sciforum-104365: Effect of coal char concentrations on soil bulk density and soil water-holding capacity

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Coal char (CC) is a porous carbon material prepared from the pyrolysis of coal, which burns off the volatile matter of coal, leaving behind a high-carbon solid material. Adding porous material to the soil will directly affect the soil's physical properties. This study aimed to determine the effect of CC concentrations on soil bulk density (Db) and water-holding capacity (WHC) on sandy loam and sandy clay loam soils with CC concentrations of 0 (control), 2.5, 5, 10, 20, and 40% by soil weight (w/w) in a greenhouse pot experiment. Results indicate that soil Db is significantly different ($p < 0.01$) in CC-treated soils compared to non-treated soil. Regression analysis results suggest that an increase in CC concentration reduced soil bulk density in both soils (Figure 2b), and there was a high correlation between the CC concentrations and soil Db with R^2 values of 0.8171 and 0.9050 on sandy loam and sandy clay loam soils, respectively. Soil WHC on both soils was significantly different ($p < 0.01$) after 5% CC treatments compared to the control treatment. There was a linear response between WHC and CC concentrations and a greater correlation between soil WHC and CC application rates with R^2 values of 0.9871 and 0.9472 on sandy loam and sandy clay loam soils, respectively. Micro pores of CC can have contributed to higher water holding in both soils.



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sciforum-103617: Effects of Aloe Vera-Based Hydrochar on Cherry Tomato and Soil Microbial Activities: Immediate and Six-Month Aged Amendments

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Hydrochar, a carbon-based material, is synthesized through hydrothermal carbonization (HTC) at temperatures ranging from 180 to 250 °C. In this study, aloe vera residues were utilized as the feedstock for the HTC process. The impacts of untreated aloe-based hydrochar were assessed at various application rates (0.5%, 1%, and 3%) in agricultural soil and at different residence times in the soil (immediately after application and after six months of weathering). Two successive sowings of tomato (*Lycopersicon esculentum* var. cerasiforme) were conducted in pots, five months apart. The investigation focused on the effects of hydrochar addition on seed germination, plant growth, photosynthetic pigment concentrations, and oxidative stress biomarkers in 35-day-old tomato plant leaves. Additionally, changes in soil pH, electrical conductivity, and soil functions mediated by microorganisms were examined. Most effects of fresh added hydrochar were dose-dependent. Notably, a reduction in germination rate and an increase in soil salinity at 3% hydrochar loading were the most concerning outcomes. The parameters most sensitive to hydrochar application were carotenoid levels and soil enzymatic activities (dehydrogenase, phosphatase, and ammonium oxidase) across all concentrations studied. Elevated levels of antioxidant enzymes, proteins, and malondialdehyde in the leaves were observed only at the highest dose. The most significant finding was the increase in guaiacol peroxidase activity. Over time, except for photosynthetic parameters and soil phosphatase activity, most effects, vanished (germination, protein and malondialdehyde levels, and antioxidant enzymes) or were significantly reduced (notably guaiacol peroxidase, catalase, and dehydrogenase activities). This reduction is consistent with the degradation of more labile toxic components of hydrochar in the soil. These findings underscore the necessity of rigorously testing materials derived from hydrothermal carbonization prior to their application on an agricultural scale. At the highest application rate, a safety period post-application appears essential to mitigate adverse effects on soil biota.



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sciforum-093496: Electronic structure of cobalt iodide-filled single-walled carbon nanotubes to control toxicity in plants

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The toxicity of nanomaterials for plants is an important issue in the agricultural field. Single-walled carbon nanotubes (SWCNTs) have a small diameter of about 2 nm, and they are toxic for single cells of plants. To reduce the toxicity of SWCNTs, there is a method of filling of SWCNTs. The filling of SWCNTs encompasses the loading of their the inner spaces with different substances. The physics of filled SWCNTs defines their toxicity. First, the microstructure of the filled SWCNT is an important point. Second, the electronic properties of the filled SWCNT is also a significant point. The microstructure and electronic properties of the filled substances are different from the bulk. They should be studied in order to reveal their differences and to model the properties of the filled nanomaterials. It is known that the band structures of the encapsulated substances with one-dimensional atomic structures are very different from three-dimensional band structures. These differences lead to new electronic structures with doping and Fermi-level variations. Here, cobalt iodide (CoI_2) was loaded in SWCNTs with diameter of 1.4 nm. The transmission electron microscopy showed the loading of cobalt iodide in the SWCNTs, and crystal formation. Raman spectroscopy, and X-ray photoelectron spectroscopy, proved the p-doping of the SWCNTs with cobalt iodide. The obtained information is needed to reduce the toxicity of nanomaterials for plants and reduce grass growing with nanomaterials in the agricultural field.



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sciforum-103047: Evaluating the Effects of Myco-Vermicompost on the Growth Performance of Pak Choi (*Brassica rapa* var. *chinensis*)

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This study evaluates the effects of Myco-Vermicompost, produced by African Night Crawlers (ANCs) from mushroom waste, on the growth performance of Pak Choi (*Brassica rapa* var. *chinensis*). Myco-Vermicompost is a high-value organic fertilizer enriched with macro- and micronutrients, vitamins, enzymes, and growth hormones, offering a promising alternative to inorganic fertilizers. The experiment was designed to investigate the effects of Myco-Vermicompost in combination with biochar and topsoil on the growth and productivity of Pak Choi. The Pak Choi was planted with different growing media combinations mixed with Myco-Vermicompost approximately for six (6) treatments. Six treatments were tested, which included Myco-Vermicompost (T1), rice husk (T2), and topsoil (T3), and the combinations Myco-Vermicompost+rice husk (T4), Myco-Vermicompost+topsoil (T5), and Myco-Vermicompost+topsoil+rice husk (T6). At the end of the experimental trial, the fresh weight, the dry weight of the leaves and roots, and the total fresh and dry weight of Pak Choi were recorded to assess growth performance. The results indicated that the highest fresh weight was recorded in plants treated with T4, with values of 83.58g for leaves, 16.98g for roots, and 97.48g for total fresh weight. In contrast, the lowest fresh weight was observed in plants treated with biochar only (T2), for which we recorded 20.08g for leaves, 5.58g for roots, and 25.65g for total fresh weight. For dry weight, Pak Choi planted with topsoil (T3) showed the highest readings, with 8.54g for leaves, 1.52g for roots, and 10.06g for total weight, while the lowest was recorded in biochar treatment (T2), with 1.80g for leaves, 0.50g for roots, and 2.30g for total weight. All treatments showed significant differences ($P < 0.05$). The findings demonstrate that using Myco-Vermicompost significantly enhances growth performance, including plant dry weight, height, and leaf area, compared to normal soil treatment. Therefore, combining Myco-Vermicompost with soil presents a significant positive impact on Pak Choi's growth performance.



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sciforum-107053: Examining the correlation between the consolidation coefficient and impact value of dry humus-rich surface soils

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Humus-rich soils are vital to arable farming, particularly in regions like Central and Eastern Europe, where they dominate the uppermost soil layers. These soils are characterised by their loose structure, which supports crop growth, but they are also vulnerable to degradation due to soil mechanics such as the consolidation coefficient (CV) and impact value (IV). These factors affect soil particle firmness, structure, and nutrient availability. Despite their importance, the correlation between CV and IV has not been sufficiently studied. This research aimed to investigate the relationship between these two variables. An experiment was conducted at Látókép Experimental Station (Debrecen, Hungary) using a calibrated EM38 sensor mounted on a metal-free sledge. The sensor was towed across a dry, non-irrigated plot, recording 1,443 soil conductivity readings at a depth of 0.5 m. The plot's elevation averaged 118 m, with coordinates of 21.44681° longitude and 47.55311° latitude. The collected data were analysed using Excel, Past4.11, and MedCal Statistical Software, with a predetermined null hypothesis significance level of $p \geq 0.05$. The results revealed a skewness range from -0.747 to 0.185 and a p-value of 0.0001, indicating a strong correlation between CV and IV. The p-value suggested that the null hypothesis could be rejected, supporting the existence of a significant relationship. Conclusively, CV and IV are closely related in humus-rich soils, and their concurrent measurement is essential when using EM38 sensors. This will help improve the understanding of soil consolidation, providing valuable insights for maintaining soil health and optimising agricultural productivity.



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sciforum-104124: Exploring the Nexus of Ecosystem Dynamics, Environmental Sustainability, and Climate Change in Agriculture

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This study contributes to the existing body of knowledge by examining the interplay between ecosystems, environment, and climate change, specifically in agriculture within the Ejura-Sekyedumase District of Ghana. Unlike previous studies covering various regions, this research focuses on a district known for its diverse ecosystems, including both savanna and forest vegetation. By narrowing the geographical scope, the study provides a localized perspective on farmers' views in the district.

The research employs a comprehensive approach with structured questionnaires and in-depth interviews, offering a holistic understanding of farmers' perspectives, their understanding of climate change, and their adaptation strategies. Using purposive sampling, the study ensures representation from different sub-districts and farming practices, enhancing the robustness and generalizability of the findings. The sample consisted of 40 farmers, with 30 males and 10 females, representing 75% and 25%, respectively. Key findings highlight significant shifts in local ecosystems and the direct impact of climate change on farming practices and crop yields. The study reveals farmers' appreciation for the interconnectedness of ecosystems and agriculture, along with their commitment to sustainable practices. Notably, 69% of farmers (45% males and 24% females) were dedicated to adopting sustainable agricultural practices. The emphasis on agroecological approaches, such as agroforestry and integrated pest management, reflects their innovative strategies for resilience and mitigating climate change effects. The study underscores the importance of government intervention, suggesting policy support, financial aid, and technical knowledge dissemination to facilitate the broader adoption of sustainable practices. Although focused on the Ejura-Sekyedumase District, the insights are relevant to other regions with similar challenges. Policymakers and agricultural extension services can use these findings to design strategies that enhance climate resilience, environmental sustainability, and socio-economic well-being.



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sciforum-107331: Exploring using Google Earth Engine and GIS to assess the impacts of climate change and land use change on the Haouzia forest (Morocco)

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Climate change and land use change are recognized as major global challenges owing to their direct impact on water resources and natural ecosystems. The deforestation process leads to the conversion of forest areas into other land uses, intensifying climate change through increased atmospheric CO₂ and modified weather patterns while contributing to soil erosion and biodiversity loss. In this context, effective measures against deforestation require a thorough understanding of the spatiotemporal evolution of forest areas to mitigate its environmental impacts at different scales. Therefore, this study focuses on the Haouzia forest, located north of the city of El Jadida in Morocco, where rapid urban growth has exerted increased pressure on forests and agricultural land. Urban sprawl results in the significant conversion of forest land into urban areas, threatening local biodiversity and disrupting natural ecosystems. To assess and monitor these changes, we adopted an integrated approach combining the Google Earth Engine (GEE), geographic information systems (GIS) and field observations. GEE enables processing large quantities of high-resolution satellite images, facilitating the mapping and monitoring of deforestation over time. Simultaneously, field observations allowed us to understand the local dynamics of land use change better. As a result, we can confirm that the degradation of the Haouzia forest effectively reflects the impact of climate change on land use dynamics and urban expansion in this area. These results underline the importance of this multidisciplinary approach to understanding forest degradation processes and developing more effective and sustainable policies and management practices. Based on accurate and timely data on the state of forest lands and the pressures exerted by urbanization, this study aims to provide policymakers, managers, and local stakeholders with a useful database for preserving local forest ecosystems while promoting sustainable urban development.



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sciforum-106600: Foliar Spraying with Tryptophan Significantly Alleviates Waterlogging Stress In Young Peach Seedlings

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Introduction

Waterlogging is one of the major abiotic factors that negatively impact the growth and productivity of peach seedlings, because the peach plant is the least tolerant to low oxygen due to a shallow root system. One important amino acid that has been linked to improving plant stress tolerance is tryptophan. The purpose of this study was to examine how the foliar application of 20 mM of tryptophan affects young peach seedlings under waterlogging conditions.

Methodology

An experiment was conducted for 12 days, with data collected at 0-, 4-, 8-, and 12-day intervals. Three treatments were established: control (CK), waterlogged (WL), and waterlogged with tryptophan (WL+Tryp.). We assessed selected physiological parameters including plant height, chlorophyll content (SPAD), and root scanning (root length, root average diameter, root surface area, root volume, root tips, and root forks) using biochemical and antioxidant analyses.

Results

The results showed that waterlogging affected the plant height and chlorophyll levels, with significant reductions in the waterlogged group compared to the controls. However, the use of tryptophan mitigated these effects, resulting in increased plant height and SPAD values. The root scanning indicated that tryptophan-treated seedlings had increased root biomass and structure, suggesting improved root resilience under stress. Biochemical analyses showed increased antioxidant enzyme activity (SOD, POD, CAT) in the tryptophan-treated group, indicating a successful response to oxidative stress caused by waterlogging.

Conclusion

Foliar application of 20mM of tryptophan improves the physiological and biochemical resilience of young peach seedlings exposed to waterlogging stress. This study demonstrates the potential of tryptophan as a beneficial treatment for improving stress tolerance in fruit crops, providing insights into future agricultural practices in waterlogged conditions.



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sciforum-103970: Genomic Exploration of *Enterobacter hormaechei* OYAS29: A Potential Ally for Sustainable Plant Growth

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There is insufficient information showing that *Enterobacter* species that promote plant development are important for improving plants' vegetative growth. *Enterobacter hormaechei*, in contrast to *Enterobacter cloacae*, has received little research attention while having enormous promise for promoting plant development. This study conducts a thorough genomic exploration of *Enterobacter hormaechei* OYAS29, a potential plant growth-promoting rhizobacterium (PGPR) isolated from an undisturbed and uncontaminated farmland at the Federal University Oye Ekiti, Ekiti State, Nigeria. Through the application of cutting-edge sequencing technologies and bioinformatics evaluations, we decipher *Enterobacter hormaechei* OYAS29's genomic characteristics, highlighting its genetic makeup that promotes sustainable plant growth. The genome falls within the superkingdom Bacteria and contains 2 ribosomal RNA (rRNA) genes, 71 transfer RNA (tRNA) genes, and 4,083 protein-coding sequences (CDS). The annotation included 3,657 proteins with assigned functions, alongside 426 hypothetical proteins. Among the functional proteins, 851 were associated with KEGG pathways, 979 had Gene Ontology (GO) assignments, and 1,203 possessed Enzyme Commission (EC) numbers. Additionally, We found several genes, including *trpABCFDRS*, *lfdc*, *patB/malY*, *trps*, and *mtr*, which are linked to the synthesis of IAA and tryptophan synthase, the *nar* and *nir* gene cluster (*narHLKX*, *nirDB*, and *nasR*) linked to nitrate reduction and nitrite oxidation. Given its pristine environmental origin and distinct genomic makeup, *Enterobacter hormaechei* OYAS29 is a promising ally for ecologically friendly and successful plant growth promotion in agricultural contexts. This study advances sustainable agriculture techniques that are adapted to regional ecosystems and contribute to the increasing body of knowledge on indigenous PGPRs.



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sciforum-106588: Impact of Phosphorus Solubilizers on Soil Organic Matter in Soybean Crops

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Soybean is a globally relevant agricultural crop, essential for food production and industrial applications. The efficient management of phosphorus in the soil is crucial for root development and biomass formation. However, the efficiency of phosphorus use in soils with variable fertility remains a challenge for countries with tropical soils. In this context, BiomaPhos, an inoculant developed by EMBRAPA in Brazil, registered for use in corn and soybeans, contains phosphate-solubilizing microorganisms, specifically *Bacillus subtilis* and *Bacillus megaterium*, which aims to improve phosphorus availability in tropical soils, where this nutrient is often immobilized. BiomaPhos is widely used in Brazil and also has a potential impact on global agriculture. This study aimed to evaluate the effect of different doses of phosphorus, with and without BiomaPhos, on soil organic matter in soybean crops. The experiment was conducted in a field with a split-plot design and by considering two factors: inoculation with BiomaPhos and phosphorus doses (0%, 50%, and 100%). Soil samples were collected after harvest and analyzed to measure organic matter. Statistical analyses included the calculation of means, standard deviations, and comparisons using t-test to identify significant differences. Soil organic matter means were consistently higher without BiomaPhos at all phosphorus doses. The mean organic matter was 73.75% and 73.00% for the 0% and 50% doses without BiomaPhos, respectively, compared to 69.00% and 62.75% with BiomaPhos. At the 100% dose, the means were 67.50% without BiomaPhos and 64.75% with BiomaPhos. The results show that although BiomaPhos increases phosphorus availability, it also reduces the percentage of organic matter in the soil, regardless of the dose applied. This reduction suggests that BiomaPhos may be affecting soil dynamics in a way that is not conducive to the conservation of organic matter. Since organic matter is essential for soil fertility and structure, this change may have implications for long-term soil health.



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sciforum-104076: In vitro growth and sporulation inhibition of the phytopathogenic fungus *Cylindrocladium* sp. by oregano and peppermint essential oils

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The genus *Cylindrocladium* includes phytopathogenic species that affect many crops around the world. In Argentina, it has been found to cause the black spot of yerba mate (YM) (*Ilex paraguariensis*), producing defoliation and large crop yield losses. *I. paraguariensis*, a small tree native to South America, has economic and social importance since its leaves and branches are used to prepare a popular infusion called “mate”. In search of natural strategies to control the black YM spot, the objective of this work was to evaluate the use of peppermint (*Mentha x piperita*), oregano (*Origanum vulgare* ssp. *hirtum*) and marigold (*Tagetes minuta*) essential oils for *Cylindrocladium* sp. (*Cy*) control. The essential oils (EOs) were characterized by GC-MS. *Cy* 14-day culture grown in YM agar medium was used as inoculum; a 4 mm disc was placed at the center of the Petri dish. For each EO treatment, two EO-embedded paper discs were placed near the edge of the Petri dish. Discs with sterile water were used as control. The fungus colony diameter was measured on days 5, 7, 10 and 15. Conidium production was analyzed on day 15. The assays were made in three replicates and the results analyzed using the Kruskal–Wallis test. Oregano EO (OEO) was composed mainly of trans-sabinene hydrate and thymol, marigold EO (MEO) of dihydrotageton and verbenone, and peppermint EO (PEO) of menthol and menthone. OEO and PEO inhibited fungal growth, showing significant differences with the control from day 5 to 10. However, on day 15, only OEO showed statistical differences ($p=0.0188$), suggesting that PEO could reduce the inhibition effectiveness with time. MEO showed no fungal growth inhibition. Conidium production resulted in 7.27×10^6 conidia in the control while no conidia were observed in the OEO and PEO treatments. These results demonstrate the effectiveness of OEO and PEO as natural control agents against *Cy*.



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sciforum-104617: Integrated weed management in aerobic rice enhanced weed control efficiency and reduced herbicide retention in soil

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Aerobic rice production is a newly evolved concept used to obtain higher yields with less water, with a substantial reduction in greenhouse gas emissions. Aerobic rice without standing water has a higher density of weeds compared to the conventional method, posing a stronger threat for crop growth, yield and sustainability. Among the different weed management practices, herbicides had gained wider acceptance as they ensure better weed control and lesser labour work and even reduce the cost of cultivation significantly compared to other methods. However, the herbicide residues left in the field had a significant negative impact on the succeeding crop, soil microbiota and overall surrounding environment. Integrated weed management practices, including hand weeding (HW) and mechanical weeding (MW), along with herbicides, were tested for effective weed control and herbicide residues in aerobic rice. Pre-emergent (PE) herbicide pyrazosulfuron ethyl and early post-emergent herbicide (EPoE) bispyribac sodium were combined with HW and MW methods and evaluated against the common practices of using only HW, MW or weedy check. Among the nine treatments, PE pyrazosulfuron ethyl (at 3 DAS) fb EPoE bispyribac sodium (at 12 DAS) fb one round of MW (at 45 DAS) led to a higher weed control efficiency (WCE) of 91.19% and grain yield of 3544 kg ha⁻¹, which increased the net returns to INR 29,244 ha⁻¹. Additionally, the integration of HW and MW methods increased herbicide degradation in all the plots with herbicide applied, thus reducing their levels below the detectable limit in soil, at 30 DAS, except pendimethalin (0.11 mg kg⁻¹). However, even with reduced retention periods, the integration of different methods was found to be successful in controlling weed issues, especially during the critical crop-weed competition period. Therefore, this method ensured a competition-free environment for aerobic rice growth. Overall, the integration of weed management practices could reduce the dependency on labour and the chemical load on the ecosystem and simultaneously enhance WCE, making aerobic rice cultivation an eco-friendly and sustainable approach.



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sciforum-106934: Ion leaching patterns in agricultural soils: insights from ion chromatographic data

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The content and behavior of inorganic ions in soil play a critical role in determining soil quality, fertility, and suitability for agricultural applications. Nutrient leaching from agricultural soils is a major environmental concern, as it affects both soil fertility and groundwater quality. Accurate assessment of these components requires reliable and precise analytical methods, with ion chromatography emerging as a highly sensitive, selective, and precise technique for ion analysis in complex soil matrices. This study aimed to evaluate the leaching patterns of major inorganic ions in agricultural soils using ion chromatography. Experiments were conducted with soil samples from the University of Agricultural Sciences and Veterinary Medicine, and leachate samples were collected after rainfall events. Ion chromatographic analysis was performed using a Shimadzu two-channel instrument with non-suppressed conductivity detection, employing Allsep Anion 7u and Universal Cation 7u columns; this configuration enabled the simultaneous determination of five major anions (chloride, nitrite, nitrate, phosphate, and sulfate) and five major cations (potassium, sodium, ammonium, calcium, and magnesium) in under 20 minutes. The proposed method significantly enhances laboratory efficiency by minimizing both sample preparation and analysis time while allowing for the efficient, simultaneous analysis of multiple ions in a single run. This simple and rapid approach is well suited not only for soil quality assessments but also for broader environmental monitoring efforts, supporting the effective management of diffuse pollution sources.



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sciforum-107420: Lessons of Innovative Sustainable Farming for Corn/Legume Production under WEFE Nexus in Egypt

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Climate change, water scarcity and smallholder farms are the most important challenges facing Egyptian agriculture and food security. Egypt is considered a water-stressed region, with about 150 mm of rain falling only on the northern coast and a 50% shortage of the Nile's water resource. The proper handling of water, energy, food and ecosystem (WEFE nexus) may alleviate these conflicts among limited resources.

The objectives of the present studies were to elucidate the proper cropping pattern/s and cultural practices that may be used to maximize agricultural productions, land equivalent ratio (LER), and irrigation water use efficiency (IWUE) of corn as a major summer crop. The intercropping farming systems of soybean/mung bean as legume crops with corn accompanying to lower inputs than traditional/recommended ones were investigated in upper and northern Egypt.

Three field trials were carried out using Split-split plot arrangements of RCBD in Al-Minia (2021 and 2022 seasons) and Nubaria (2022 season), representing the upper and northern locations. respectively.

The main plots were assigned to two irrigation regimes as recommended ($7860 \text{ m}^3 \text{ ha}^{-1}$) vs. saving regime ($5895 \text{ m}^3 \text{ ha}^{-1}$ as 75% of recommendation), as well as traditional ridges (distanced 70 cm) vs. bed ones (140 cm wide). First, split plots were occupied by cropping systems (intercropping vs. solid of each corn or soybean and mung bean). Foliar application and rhizobium inoculation were adopted for compensating the lower applied N fertilizers.

The intercropped corn/legumes reflected in higher land equivalent ratios (LERs) ranged from 1.32 to 2.287 (= 32.0- 128.7% progress). Nutrient foliar was reflected on the higher LERs than those of soil applications which were pronounced under the normal watering regime rather than the water saving one. Cropping patterns in wider ridges (Bed) were found in either solid or intercropping upgraded irrigation water use efficiency (IWUE), for which we recorded 2.993 and 3.558 of solid farming and intercropping, respectively, compared to the 0.318 of narrow ridges.



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sciforum-103894: MSW-COMPOST and Mycorrhizae Interaction in Grapevine Roots

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Introduction

Tree crops are facing increasing challenges due to biotic and abiotic stresses. Climate change exacerbates these issues, especially in Mediterranean regions such as Southern Italy. To address these issues, it is beneficial to design agricultural systems that maximize resilience, meaning the ability to withstand and recover from traumatic events or periods of difficulty. In this regard, both compost (rich in organic matter and nutrients) and mycorrhizae (symbiotic fungi with plants) can be valuable tools. The aim of this study was to evaluate the interactions between these two potential strategies.

Methods

Twenty-four grapevine plants were divided into four groups treated as follows: inoculation with mycorrhizae, fertilization with compost, inoculation with commercial mycorrhizae and fertilization with compost, with no additions. The compost used was derived from the organic fraction of municipal solid waste (MSW-compost). Leaf pigmentation analyses were performed using reflectance spectrophotometry, and the percentage of mycorrhization in the roots was analyzed using methyl blue root staining and microscopy.

Results

The compost, regardless of mycorrhizal inoculation, caused a delay in leaf senescence and a higher presence of photosynthetic pigments even at the end of the growing season. The compost significantly stimulated the symbiosis with the native mycorrhizae in the soil used, with effects comparable to those under the addition of a commercial mycorrhizal inoculum.

Conclusions

The addition of MSW-compost improves the health of grapevine plants and stimulates symbiosis with native mycorrhizae. Therefore, it can be used in vineyards both as an organic fertilizer and to implement management strategies aimed at enhancing ecological interactions with beneficial soil microorganisms.



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sciforum-105973: Nano-fertilizers in agriculture: a patent overview

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Introduction

The application of nano-fertilizers (NFs) represents a nascent area of research within the field of agriculture. These are materials in the size range of 1-100 nm that facilitate the provision of nutrients to plants, enhancing crop growth and productivity. Nano-fertilizers (NFs) are composed of nutrients and may serve as carriers for nutrients, releasing them in low amounts and in a slow and sustainable manner.

The essential nutrients required for optimal crop growth are nitrogen, phosphorus, and potassium.

The objective of this paper is to present a comprehensive overview of the patent activity pertaining to nano-fertilizers.

Materials and methods

In the course of this investigation, data were retrieved from a number of patent databases, including Patentscope, Espacenet, Orbit Intelligence, The Lens, and Amplified.

A search was conducted using precise keywords in the Title/Abstract/Claims search fields. In addition, the full text was employed in conjunction with keywords and classification symbols.

Results

The majority of inventions in this field were filed in China, with the United States and India representing the next most prolific sources.

The number of filings has been on the rise since 2017, indicating a growing trend.

The main IPC classification symbols pertain to a mixture of one or more fertilizers with additives that lack a specifically fertilizing activity (C05G 3/00), inorganic fertilizers containing trace elements (C05D 9/02), and biocides or plant growth regulators containing heavy metals or compounds thereof (A01N 59/16).

With regard to the elements present in nano-fertilizers, the most frequently claimed in patent applications are potassium, calcium, and nitrogen.

Conclusions

The findings of this study corroborate the importance of academic and industrial research on nano-fertilizers. China has been identified as the foremost nation in this technical domain.



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sciforum-103758: Optimizing Energetics in Aerobic Rice: Comparative Analysis of Tillage Practices and Nitrogen Fertilizer Schedules

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A field experiment conducted at the Indian Institute of Rice Research, Hyderabad, Telanagana, India, during the *rabi* season (November–April) of 2022 and 2023 assessed the impact of tillage practices and nitrogen fertilizer schedules on aerobic rice energetics. The study employed three tillage treatments (T) and five nitrogen fertilizer schedules (N) in a strip plot design with three replications. The data were analyzed using two-way ANOVA with R software. The Bartlett test was performed to assess homogeneity before conducting the combined (pooled) analysis. The results revealed that conventional tillage (T1) showed higher energy input (53899 MJ ha⁻¹), whereas zero tillage (T3) showed lower energy input (51846 MJ ha⁻¹). Higher gross energy output (GEO), net energy output (NEU) (143114, 89257 MJ ha⁻¹), energy use efficiency (EUE) (2.65%), and energy productivity (EP) (0.0832 kg MJ⁻¹) obtained under T1, which is statistically comparable with minimum tillage with residue retention (T2), and significantly higher over T3. Treatment T3 resulted in the highest physical energy intensity (EIP) (5.89 MJ kg⁻¹). Energy intensity in economic terms (EIE) was not significantly influenced by tillage practices. Among nitrogen fertilizer treatments, the treatment 100% RDN + foliar spray of 2.5 ml l⁻¹ nano urea at tillering and before the panicle initiation stage (N2) generally yielded the highest energy metrics, including GEO and NEO (144278, 90759 MJ ha⁻¹), EUE (2.69%), EP (0.0841 kg MJ⁻¹) and EIP (3.55 MJ kg⁻¹). The treatment involving 75% RDN + foliar spray of 2.5 ml l⁻¹ nano DAP at tillering and before panicle initiation stage (N5) showed a higher EIE (6.11 MJ kg⁻¹) with the lowest energy input (51728 MJ ha⁻¹). Treatments T1 and N2 demonstrated superior performance across various energetics, emphasizing their effectiveness in enhancing the energetic efficiency of aerobic rice cultivation. Treatment T2 showed comparable results with T1, so conservation tillage was performed similarly with conventional tillage.



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sciforum-103891: Potential Application of Municipal Solid Waste (MSW) Compost from Organic Waste as an Herbicide in Viticulture

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Introduction

Soil degradation and climate change are highlighting the need for sustainable weed management practices that reduce the use of synthetic herbicides and subsequent environmental pollution. Using MSW compost derived from organic waste could represent an interesting opportunity, especially within a circular economy perspective. It is well known that MSW compost contains chemical molecules that inhibit seed germination. This antigerminative property suggests potential applications for weed control in perennial crops. The goal of this work is to develop a method to evaluate the antigerminative effect of MSW compost through germination tests under controlled conditions and to hypothesize possible applications in viticulture.

Methods

During the fall of 2023, seeds of two wild species were collected: chicory (*Cichorium intybus*) and fennel (*Foeniculum vulgare*). Also, other two commercial species were used in this test: urye (*Secale cereale*), and fava bean (*Vicia minor*). To assess the antigerminative effect of MSW compost, five treatments with varying compost extract concentrations were applied: 0%, 10%, 30%, 50%, and 100%. For each treatment, three replicates consisting of 10 seeds each were used. The tests were conducted under controlled growth conditions to ensure consistency and reliability of the results. To evaluate the antigerminative effect of the MSW compost, the average number of germinated seeds was measured and analyzed.

Results

The MSW compost demonstrated antigerminative effects on the small-seeded species (wild fennel, chicory, and rye), which were correlated with the concentration of the MSW compost extract. Generally, significant effects were observed starting at the 30% concentration level. In contrast, the germination of fava bean, which is used as an artificial cover crop, was not inhibited. This lack of inhibition is likely due to the large size of the seeds.

Conclusions

Soil is a fundamental component of the vineyard system, and its management requires attention and awareness. Proper weed management helps preserve soil fertility by reducing competition for limited resources (water and nutrients) in the Mediterranean environment.



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sciforum-104609: Potential of *Elaeis guineensis* as An Agroforestry Tree and its Compatibility with Maize (*Zea mays*)

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The global population including Nigeria is growing at alarming rate and to meet the demand for food, production must be increased. One of the veritable means of improving the production capacity is agroforestry. Proposition of any tree for agroforestry purpose requires the assessment of its compatibility with a test crop. This study assessed the allelopathic effect of *Elaeis guineensis* on germination and growth of *Zea mays* with a view to recommending it for agroforestry. This study took place in David Okali Laboratory in the department of Forest Production and Products, University of Ibadan, Nigeria. The study was carried out in a Completely Randomized Design by preparing the leachate from the leaf extract of *E. guineensis* in 5%, 10% and 20% concentrations and control with four replications. A petri dish within which 5 maize seeds were sown served as a replicate while 2ml of the leachate was administered every 2 days for 9 days and distilled water was added to the control experiment. Germination and growth variables such as shoot length, root length, shoot and root fresh and dry weight were assessed. The data analysis was done using one-way ANOVA, correlation and Descriptive statistics. Control treatment had the lowest germination percentage of 60% while both the 5% and 10% leachate concentration had the highest but equal germination of 85%. Shoot length varied from 5.71cm (control) to 8.66cm (10% leachate). The effect of the leachate was significant ($p < 0.05$) on all the growth variables except for the shoot length. Correlation coefficient between Seed Vigor Index and Mean Germination Percentage, Days of First Seed Germination was highest with coefficient value of 0.428 and 0.424 respectively compared to other growth and germination variables. It was concluded that *E. guineensis* has a positive allelopathic with maize, but field test experiment is recommended to affirm this claim.



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sciforum-104085: Reinforcing ecosystem health and biodiversity in smallholder farming systems through agroecological principles

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Ensuring a sufficient food supply while preserving ecosystem health is crucial for researchers and agricultural stakeholders. Agroecology offers a framework for developing biodiverse agroecosystems that sustain their functionality. This study investigates how agroecological practices such as crop diversification, agroforestry, and intercropping can improve the sustainability of food systems. Through a systematic literature review, this research assesses the impact of these practices on soil productivity, water use, pollution reduction, and economic viability for farmers. It also explores how agroecology can promote social equity by supporting small-scale farmers, integrating indigenous knowledge, and fostering participatory decision-making, thereby advancing food sovereignty and community resilience. Furthermore, by combining a literature review with data analysis from major academic databases, this review aims to identify current knowledge gaps and suggest future research directions. The findings will highlight agroecology's potential as a transdisciplinary principle to transform agricultural practices and address critical issues such as food sovereignty, nutrition quality, hunger, environmental degradation, climate change, soil erosion, biodiversity loss, water scarcity, rural poverty, the viability of small-scale farming, social inequalities, and the erosion of traditional agricultural knowledge, among others.



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sciforum-107197: Reviving Ancient Practices: Modern Perspectives on Rice-Fish Culture

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Rice-fish culture, an ancient agronomic practice, integrates aquaculture with rice farming, a sustainable solution for enhancing food security and agricultural productivity. The recent advancements and historical perspectives on rice-fish culture have increased its ecological, economic, and social impacts. The practice, which spans over 2,000 years, has seen significant technological improvements, especially in regions like China, Thailand, and Bangladesh [1]. Implementations of modernized rice-fish systems demonstrate increased rice yields, reduced pest and weed prevalence, improvements on soil quality, and higher profits for farmers [2]. For example, in China it was reported that a rice-fishing system produced 6 000-7 000 kg of rice and 1 500-7 500 kg of fish per hectare per year [3]. Furthermore, the fish reduce herbivore insect abundance, as well as reduced weed abundance, effectively eliminating the need for pesticides [2].

Despite its advantages, challenges such as water management, the availability of quality fish seed, and socio-economic barriers remain [2]. By synthesizing findings from various studies, we will highlight the potential of rice-fish culture to contribute to sustainable agriculture and rural development, recommending strategies for optimizing its adoption and addressing existing constraints.

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sciforum-103761: Sewage Sludge as a Valuable Resource of Nitrogen and Phosphorus: Long-Term Monitoring Data from a Wastewater Treatment Plant

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Sewage sludge (SS) derived from Wastewater Treatment Plants (WWTPs) represents a valuable resource rich in organic matter and nutrients, including nitrogen (N) and phosphorus (P). These elements are major components of mineral fertilizers, i.e., essential macronutrients used in agri-food production. In addition, P is recognized as a non-renewable resource, mostly as a component of P-based rocks distributed in specific global regions. Therefore, recycling and recovering N and P from SS could generate value-added products such as (organo)mineral fertilizers, fuel, energy, etc., contributing to sustainable waste management practices and environmental protection. In this study, we studied, for the first time, long-term monitoring data spanning 18 years (2007–2024), focusing on the monthly dynamics of N and P concentrations in SS generated at the WWTP Zagreb, Croatia. It was confirmed that the long-term monitoring data provide valuable insights into the dynamics of N and P in SS, emphasizing the importance of continuous improvement in waste management practices to enhance nutrient recovery and environmental sustainability. Specifically, an analysis of variance revealed significant concentration heterogeneity ($p < 0.001$) for both elements over the studied years: N concentrations ranged from 0.07% to 9.57%, with a mean value of 2.59% followed by a positive linear trend ($y = 0.003x + 2.557$), while P concentrations varied even more, from 0.03% to 20.3%, with a mean value of 2.01% and a negative linear trend ($y = -0.081x + 2.784$). The significant heterogeneity and opposite trends of N and P concentrations in municipal sludge highlighted that the recovery and recycling processes of those elements need to be optimized. Technological upgrades of the current secondary and tertiary phases of wastewater treatment technology could additionally enhance SS management, maximizing the recovery of valuable nutrients, strengthening water resource conservation (e.g., preventing water eutrophication), and reducing reliance on non-renewable P.



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sciforum-107421: Sociodemographic Profile of Persian Lime (*Citrus latifolia* Tanaka) Producers and the Use of Organic Fertilizers in the Central Citrus Region of Veracruz State, Mexico

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The production of citrus, particularly Persian lime (*Citrus latifolia* Tanaka), is crucial for Mexico's economy, standing out due to its high demand in both local and international markets. Mexico is the second-largest producer of lime globally, with the state of Veracruz being the national leader in production. Although conventional cultivation relies on chemical fertilizers, organic production has gained significance due to its environmental and health benefits.

The study was conducted in the central region of Veracruz between January 2022 and March 2023, covering the municipalities of Cuitláhuac, Cotaxtla, Carrillo Puerto, Tlalixcoyan, and Tierra Blanca. A total of 119 producers participated, located through a citrus cooperative. A structured questionnaire was applied to gather data on the producers' profiles, orchard characteristics, and the use of organic fertilizers. Statistical analysis was performed using R software, employing Chi-squared tests to assess the relationship between sociodemographic variables and the use of organic fertilizers.

The producers' profile indicates that 83% are men, predominantly between 31 and 60 years old, with the majority having a high school education (45%). Additionally, 22% of producers implement technological packages. Most orchards are small, with 76% ranging from 1 to 5 hectares, and the plantations are young (71% being 1 to 3 years old). Regarding organic fertilization practices, 66% use sulfocalcic broth and supermagro, while 61% employ bovine compost. Producers with higher educational levels and access to technical assistance showed a greater tendency to apply organic fertilizers.

Persian lime production in Veracruz is primarily in the hands of small producers with young orchards. Although conventional methods dominate, there is a growing inclination towards more sustainable practices, which could promote greater sustainability in Persian lime production in Veracruz, Mexico.



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sciforum-095773: Soilless farming: a key tool of precision agriculture for reducing environmental footprints, increasing water-use efficiency and crop yield under climate change

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The present study discusses the currently accessible modern farming system under changing climate scenarios. Traditionally, plants are grown in open farming methods but climate change, urbanization, industrialization, and population growth have raised concerns about global food insecurity issues. Studies have reported that it would be difficult to provide enough food supply to the growing population using open-field farming systems. Therefore, we should change the farming pattern by introducing precision agriculture tools in traditional agriculture. Soilless farming is the modern practice of crop growing exclusive of the support of soil by providing water and solid particles as a rooting medium in an artificial supporting system. It is mainly practiced with two methods including solid media and water culture. Solid media is described as the growing of plants in a solid organic or inorganic media such as woodchips, barks, fleece, peat moss, sawdust, marc, and coco peat. The inorganic substrate includes zeolite, vermiculite, gravel, rock wool, sand, glass wool, etc. The water culture is different than solid media, where crops are grown in a water-rich solution. In the system, the plant's roots are continually or interval soaked or flooded with/ in the solution. The upper parts of plants are put above supporting trays of growth boxes. Hydroponics, aquaponics, and aeroponics are the three types of water culture. This study found that soilless farming is cost-effective, higher yields, and quicker harvests from smaller areas of land than soil-based farming. Furthermore, it can provide many benefits; including it can deal with growing food issues and rapid climate variations for competent consumption of existing natural sources. Also, the method is suggested to be practiced in those regions having less arable land, rapid environmental changes, and increasing food challenges with the indigenous population.



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sciforum-096907: Studies on Phosphorus Nutrition through Band Placement and Seed Coating in Maize

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Poor phosphorus use efficiency of applied fertilizers due to low phosphorus availability is a considerable factor contributing to low maize productivity in Pakistan. Phosphorus use efficiency can be enhanced by phosphorus application through band placement and phosphorus seed coating to increase phosphorus uptake. Thus, keeping in view this fact, an experiment was performed at the Agronomic Research Area, University of Agriculture Faisalabad, to evaluate the effect of different sources and application methods of phosphoric fertilizers on autumn planted maize, in 2017. The performance of Di-ammonium Phosphate (DAP) and Single Super Phosphate (SSP) was evaluated under two application methods (Seed Coating and Band Placement) alone and in combination. Experiment was arranged in a randomized complete block design and replicated three times with a plot size of 3 m × 6 m. Results revealed that the application of phosphorus through seed coating and band placement significantly increased the maize yield. Maximum grain yield (7.72 t ha⁻¹), biological yield (19.33 t ha⁻¹), cob length (18.80 cm), number of grains per cob (382.9), plant height at maturity (230.0 cm), 1000-grain weight (260.3 g) and grain protein contents (9.55%) were recorded where phosphorus was applied through Single Super Phosphate seed coating and Single Super Phosphate band placement. Therefore, it is concluded that seed coating with Single Super Phosphate + band placement of Single Super Phosphate would be a better phosphorus use efficiency management strategy for the farming community in order to enhance maize production.



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sciforum-098230: Sunn hemp management after termination: effects on soil microbiological diversity

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Soils with greater microbial diversity are generally considered healthier. Cover crops are used to diversify the cropping system, providing various benefits to the agricultural system. After cutting, these crops are sometimes incorporated into the soil and other times left on the surface. This study aimed to evaluate the effects of deposition methods (left on the soil surface or incorporated into the soil) for sunn hemp *Crotalaria juncea* (CJ) after cutting on soil microbial diversity. A field experiment was conducted with the following treatments in three replications: CJ incorporated (INC), CJ left on the soil surface (SUP), and a control with spontaneous vegetation (CTL). Later, the plots were sown with grain sorghum (MG2220). Soil samples from the 0-10 cm layer were collected 19, 52, and 80 days after CJ cutting and analyzed for microbial diversity. In the first sampling collection, the bacterial diversity in the INC and SUP groups was significantly higher than in the CTL group, likely due to the input of carbon and nitrogen from CJ, stimulating bacterial growth and diversity. However, there was no initial effect on soil fungal diversity. In the second sampling collection, the bacterial diversity in the INC group, the only treatment group that did not receive topdressing with urea ($\text{CO}(\text{NH}_2)_2$), was approximately double that of the other treatments, while the fungal diversity remained without significant differences between treatments. Finally, in the third sampling collection, there was no difference between treatments for bacterial or fungal diversity. It was concluded that, for up to 19 days, CJ residues stimulated bacterial diversity. Urea nitrogen topdressing negatively influenced bacterial diversity. At 80 days after CJ cutting, the bacterial diversity decreased compared to the first sampling round, and the fungal diversity was not significantly affected by the treatments evaluated.



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sciforum-106996: Sustainable management of pests and improved yield in Chinese cabbage (*Brassica rapa subsp. chinensis*) by Black soldier fly frass and Desmodium under Wonder multistorey gardens

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Intensive use of inorganic fertilizers and pesticides in farming to improve productivity has globally destroyed soil fertility, interfered with biodiversity, and negatively affected both human and the environment. To overcome these problems, it is very important to shift our attention towards eco-friendly alternatives like insect-based black soldier fly frass (BSFF) and Desmodium that have the potential to increase crop growth and yield as well as control or suppress pests sustainably. Black soldier fly frass fertilizer with its rich plant growth nutrient not only improves the growth and yield of crops but also offers protection to pests through the provision of nutrients; also, the chitin present helps control pests. Desmodium also has tremendous potential to protect plants from pests when used as a companion crop as it increases the diversity and activity of natural enemies, which helps to suppress pests. In this study, we examined the potential of Desmodium and BSFF in the management of common brassica pests and improved growth under low-cost vertical gardens suitable for urban settings. A Randomized Complete Block design trial on wonder multistorey gardens with eight treatments was laid out as sole cabbage (T0), Powdered black soldier fly frass (T1), liquid black soldier fly frass, (T2), Desmodium (T3), NPK (T4), combined powdered black soldier fly frass with Desmodium (T5), combined liquid black soldier fly frass with Desmodium (T6)) and combined NPK with Desmodium (T7), each of which was replicated three times. Data collected on pests' numbers, growth parameters, damage score and yield showed significant differences when subjected to ANOVA. Gardens where BSFF and Desmodium were used showed a high growth rate and yield, and reduced pest damage. This indicated the potential of BSFF and Desmodium as an alternative source of plant nutrients and as a pest control strategy in vertical vegetable production systems.



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sciforum-103644: Tea Bag Index: Assessing Soil Microbial Activity Under Different Compost Management Practices in Vineyards

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Introduction

The Tea Bag Index (TBI) is a standardized, simple, and accessible method for assessing soil microbial activity by estimating the rate of organic matter decomposition. Compost is an organic-rich fertilizer produced through decomposition processes facilitated by microorganisms. When added to soil, compost improves nutrient content, enhances chemical and physical properties, and boosts fertility, also contributing to soil biodiversity by introducing microbial species.

Methods

We used the Tea Bag Index (TBI) method to assess the effect of compost on the soil microbial activity under different vineyard soil management practices: tilled compost, mulched compost, and tillage without compost (control). Two types of tea were used: green tea, which contains a higher fraction of degradable organic compounds, and rooibos tea, which has a higher amount of recalcitrant compounds. A tea bag of each type was weighed and then buried, midway between two vine plants, at a depth of approximately 12 cm in at least three replicates of each different soil management practice. After a 3-month burial period, the bags were retrieved, dried at 65°C for 48 hours, and then reweighed to calculate mass loss. An ANOVA was used to assess statistical differences among the different soil management practices.

Results

The use of the Tea Bag Index (TBI) according to the original method (Keuskamp et al., 2013; <https://doi.org/10.1111/2041-210X.12097>) was ineffective due to the apparent incompatibility of the calculation formula. Therefore, as a valid technique for determining soil microbial decomposition activity, we measured the percentage of organic matter degradation in the tea bags: $[1 - (\text{final tea weight} / \text{initial tea weight})] \times 100$. This approach has been used in other studies as well.

Conclusions

In the two years of compost application, the response of the soil biological activity differed. Particularly in the second year, both the tilled and the mulched compost significantly increased the soil biological activity.



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sciforum-106803: The effect of plant growth-promoting rhizobacteria (PGPR) on the growth and yield of cucumber (*Cucumis sativus*) in differently colored polyethylene greenhouses

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Cucumber cultivation in greenhouses is a common practice for effective pest control and the maintenance of optimal growing conditions to ensure consistent productivity. The choice of greenhouse covering material is crucial as it affects both the quality and quantity of light that enters the greenhouse. Using unsuitable materials can block essential light needed for crop growth, resulting in reduced yields. Biofertilizers such as plant growth-promoting rhizobacteria (PGPR) offer a sustainable alternative to chemical fertilizers by enhancing nutrient uptake, conserving water, reducing pesticide use, and lowering carbon emissions. This study aimed to investigate the spectral characteristics of two types of polyethylene (PE) films used as greenhouse covering materials and their effect, individually or when combined with PGPR, on cucumber vegetative growth and fruit production. The assessment of spectral properties revealed that the purple PE film provided higher light transmission, greater total photosynthetic photon flux density (PPFD), and a higher fraction of red light compared to white PE films. Growing plants in this altered lighting condition in the purple PE greenhouses gave rise to more fruits, higher yields, and a greater proportion of marketable fruits. Furthermore, the application of PGPR strains, particularly *Staphylococcus sciuri*(E2) and *Bacillus* sp. (P1), significantly boosted yields and fruit quality; this growth promotion was more effective when used in conjunction with purple PE films. The synergistic effect of combining PGPR with purple PE film demonstrated the potential of integrating biological and engineering approaches to achieve sustainable and productive cucumber cultivation.



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sciforum-102819: The Efficacy of Organic Farming Practices in Mitigating Climate Change: A Systematic Review

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Organic farming practices are increasingly being recognized for their potential to mitigate climate change by enhancing soil health, reducing greenhouse gas (GHG) emissions, and promoting biodiversity. This systematic review evaluates the efficacy of organic farming in climate change mitigation, focusing on carbon sequestration, nitrous oxide (N₂O) emission reduction, and soil organic carbon (SOC) enhancement. Organic farming techniques, such as crop rotation, cover cropping, and organic amendments, can sequester up to 0.9 tons of carbon per hectare annually, compared to 0.3 tons in conventional systems. In Ethiopia's Tigray Province, organic practices have doubled agricultural productivity across over 1 million hectares by improving soil fertility and SOC. Additionally, organic farming reduces GHG emissions by minimizing synthetic fertilizer use and enhancing soil health, resulting in up to a 40% reduction in N₂O emissions. Prohibiting biomass burning further reduces methane (CH₄) emissions, which constitute 12% of agricultural GHG emissions. In Europe, organic farming has led to a 20% reduction in overall agricultural GHG emissions. These findings highlight the practical implications of organic farming. It aids climate change mitigation while enhancing farm resilience and sustainability. Improved soil health increases water retention and nutrient cycling, reduces the need for chemical inputs, and promotes biodiversity. Moreover, organic farming bolsters rural livelihoods by enhancing food security and providing economic benefits through higher market prices for organic products. In conclusion, organic farming practices offer a robust strategy for mitigating climate change. They provide significant benefits in carbon sequestration, GHG emission reduction, and soil health improvement, making them crucial for sustainable agricultural development and addressing global climate challenges.



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sciforum-095065: The environmental-friendly and sustainable solutions for fully utilizing the tobacco wastes

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Tobacco is one of the most important economic crops worldwide for mainly producing cigarettes, accompanying with millions of tons of tobacco wastes in agricultural fields every year. Owing to the increasing concerns for human health and agricultural ecology, tobacco wastes containing the bioactive compounds such as nicotine are commonly recognized to be hazardous and urgently required to be handled carefully. Therefore, the full utilization of tobacco wastes seems to be an ideal goal for not only avoiding their negative effects but also providing the sustainable resources. The microwave-assisted hydrothermal treatment is proposed to be the first solution for extracting the carbohydrate from the wasted leaves and stalks. A high efficiency more than 90% and solid content higher than 50 g/L could be achieved at 120-130 °C in only 20 min. The preliminary economic analysis shows 10 times benefit of the crude carbohydrate output compared with the consumption of energy input. Specifically, the carbohydrate could be also used as the coating material for promoting the germination of wheat seeds. Then pyrolysis is proposed to be the second solution for transforming the residual biomass solid into high-value aromatic compounds and by-products biochar. A relatively high level of phenols and even some benzenes that are difficult to generate could be obtained after the hydrothermal treatment of tobacco wastes. More interestingly, the introduction of seawater would result in the preferred production of benzenes and phenols in all identified compounds, which may be attributed to the facilitation of chloride element. These products should be separated by distillation technology for further industrial usage. The by-product biochar could be also employed in adsorbing environmental contaminant and other applications. These solutions may pave the way for sustainable agricultural development.



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sciforum-104538: The impact of poultry manure and rock phosphate in heavy metal and nutrients concentrations on ryegrass grown in two Cambisols

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Ecofriendly amendments are willing to maintain crops productivity because they are a good source of organic carbon for promoting soil biology. However, there are some counteractions led might by inputs of ecotoxicological elements to soil-plant environments. This study evaluated the effects of poultry manure (PM), rock phosphate (RP), and their combination (PMRP) on the growth, nutrient uptake, and heavy metal (HM) accumulation in ryegrass grown in two soil types: moderately acid and alkaline. A growth chamber experiment was conducted over seven weeks to assess the impact of these amendments on nutrient and heavy metals concentrations in soil, shoots, and roots. Results indicated significant increases in potassium concentrations in both shoots and roots with the PMRP treatment, particularly in moderately acid soil. In alkaline soil, PM treatment led to substantial increased in copper, manganese, nickel, lead, and zinc concentrations, raising concerns about heavy metal accumulation. The principal component analysis further highlighted the enhanced nutrient availability and potential risks of heavy metal accumulation with PM and PMRP treatments. The findings underscore the importance of balanced fertilization strategies that optimize nutrient uptake while minimizing environmental risks. This study contributes to the understanding of integrated fertilization strategies, emphasizing the need for careful management to ensure sustainable and safe agricultural practices.



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sciforum-106930: The impact of vermicompost on the quality of lettuce (*Lactuca sativa*) seedlings and plant productivity

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Lettuce is the most widely consumed leafy vegetable in the world. Its quality and yield are highly dependent on the growing conditions, including the growing substrate. Peat is commonly used as a growing substrate, but there is a growing interest in finding alternatives to reduce peat usage. One potential alternative is vermicompost, and this study aims to investigate the impact of vermicompost as an additive to peat substrate on the quality and yield of lettuce seedlings. The research was carried out in a greenhouse covered with a polymer film at the Institute of Horticulture and Horticulture of the Lithuanian Agricultural and Forestry Research Center. Lettuce seedlings were grown in peat with varying amounts of vermicompost (0%, 10%, 20%, 30%, 40%, or 50% vermicompost). Various parameters such as lettuce growth, biometric data, the amount of pigments in the leaves, and the accumulation of elements (N, P, K, Ca, and Mg) were evaluated. The addition of vermicompost, regardless of its amount, significantly increased plant height (from 7.5 cm in control up to 10.9 – 11.3 cm with vermicompost), number of leaves (up to 4.2 – 4.6), leaf area (up to 107 – 131 cm²), and the percentage of dry matter accumulation (up to 6.4 – 7.5 %). Vermicompost also had a positive effect on photosynthesis, resulting in higher yields and better quality of lettuce. The summarized research results demonstrate the potential of using vermicompost in the production of high-quality lettuce.



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sciforum-107257: Towards geospatial recommendations for restoring site-specific depletion of soil organic matter in a Moroccan semi-arid region

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This study was conducted in the Doukkala plain (western of Morocco), which has a semi-arid climate, to assess SOM levels and provide scenarios for remediating SOM depletion by rationally adding an organic amendment (manure or compost). Therefore, we exploited the potential of GIS and remote sensing techniques to calculate the recommended organic amendment requirement for each soil. SOM prediction was performed using a 15 m resolution pan-sharpened Landsat-8 image and an artificial neural network model. Furthermore, we estimated the organic amendments using an approach for a three-year crop rotation (3YCR). In addition, we set a target SOM level content of 1.5%, suitable for the main crops in the study area. The organic amendment was determined at 10% of organic matter over the 3YCR. The produced digital maps were aggregated into homogeneous areas to facilitate interpretation and use by local agricultural advisors. The findings demonstrate that vertisols, isohumic, immature, and fersiallitic soils lose an average of 0.59, 0.77, 1.04, and 1.09 t/ha/year, respectively. Fersiallitic and immature soils lose the most SOM due to their high mineralizing capacity, while vertisols and isohumic soils lose the least due to their low mineralizing potential. The global loss was estimated at an average of 0.80 t/ha/year. To restore the soils to 1.5% of SOM, the results indicate an average amendment of about 31 and 14 t/ha per 3YCR (with returning crop residue) and 47 and 21 t/ha per 3YCR (without returning) for manure and compost application, respectively. Returning crop residue to soil was expected to contribute 4.72 t/ha of SOM per 3YCR on average. Finally, aggregating the results into homogeneous areas could simplify the communication of recommendations while keeping roughly the same results as detailed maps. The adopted method and obtained results highlight the important role of geospatial tools in developing appropriate fertility plans and recommendations for other regions.



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sciforum-103820: What Effect Does Potato Production Have on Human Health?

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In 2022, global potato production reached approximately 376 million tons. The leading producers include China, India, Russia, Ukraine, and the United States. In Africa, potato cultivation produced 20 million tons, with Morocco ranking as the third-largest producer in the Maghreb region with 2.2 million tons. Annual production can vary depending on climatic conditions, agricultural practices, and other economic factors.

This study evaluated the impacts on human health in relation to potato production in northern Morocco, using life cycle assessment (LCA) with the USEtox method. The three categories (human toxicity – carcinogenic, human toxicity – non-carcinogenic, and ecotoxicity) were assessed to identify the main hot spots and characterize the production process. To do so, the openLCA 2.1.1 software was used. Additionally, to identify the main hot spots and characterize the manufacturing process, this work gathered comprehensive data on potato production. The functional unit considered is one ton of cultivated potatoes. The results obtained are as follows: human toxicity – non-carcinogenic is 0.01171 CTU, human toxicity – carcinogenic is 1.39568×10^6 CTU, and ecotoxicity is 1.82540×10^4 CTU. Machinery and diesel, nitrogen have been identified as the main hot spots during the production period. This study suggests that future research should include the replacement or reduction of the machinery, diesel, nitrogen used in the production process.



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Session 4. Precision and Digital Agriculture

sciforum-105297: Advancements in Precision Agriculture and Digital farming in India: A Strategic Analysis

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Since the 1990s, precision farming has introduced a revolution in agricultural practices and has evolved significantly in terms of the application of GPS, GIS, and yield monitors. Such technologies have substantially contributed to the Indian agriculture sector over the past two decades by increasing productivity, resource management, and decision-making along with reducing environmental impact. The current global precision farming market was valued at USD 10.50 billion in 2023, and is expected to grow at a compound annual growth rate (CAGR) of 12.8% between 2024 and 2030. The analysis of data that has already been acquired by others is referred to as secondary data analysis. Developing advanced technologies such as AI, ML, IoT, and agricultural robotics plays a crucial role in data-driven digital farming by improving efficiency and sustainability. Precision seeding, utilizing variable-rate technologies, has shown 10% to 30% greater efficiency compared to conventional methods. IoT has increased agricultural productivity by 70%, aligning with the future scope for 2050. The Digital Agriculture Mission 2021–2025 and the 'India Digital Ecosystem of Agriculture,' centered on 'AgriStack,' are pivotal in driving sector digitalization and increasing farmers' income. Several modern applications, including Soil Health Card, Plantix, Meghdoot, and mKisan, are enhancing areas like soil health, fertilizer recommendations, irrigation scheduling, and pest management. Future developments like Deep Leaf, which uses deep learning to enhance measurement accuracy with average errors as low as 4.6% for leaf length and 5.7% for leaf width, will further streamline agricultural processes. However, the adoption rate of precision agriculture is expected to stabilize post-2030. Continuous advancements in AI, ML, and IoT are anticipated to further propel productivity, profitability, and sustainability in agriculture, ensuring effective land resource protection and minimizing environmental impact.



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sciforum-104391: Analysis of the Working Efficiency of Telematics Data of Combine Harvesters

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Telemetry systems are widely used in the latest agricultural machinery, both in tractors and combines. There is still a problem with managing the data recorded and stored in the telemetry systems and their purposeful use. Ways to correctly interpret, analyze, and use as much as possible of the information obtained during various agricultural technological processes has been studied.

The purpose of this work is to analyze the harvesting data collected and stored in the telematics system in order to optimize labor costs. The research was carried out during grain harvesting using a CLAAS Lexion combine harvester. By using the data of the telematics system, the working time structure and fuel consumption of the technological processes of spring wheat harvesting for one year were analyzed. During this study, the components of the harvesting time, which have an influence on the harvesting speed and the performance of the harvester, were examined. The results showed that 10% more time was spent when grain unloading stopped when harvesting smaller fields than larger fields (more than 50 ha). Fuel consumption when unloading grain after the harvester stopped amounted to 2% of the total fuel used for harvesting one ton of grain. After analyzing the efficiency of the use of the harvester, it was found that a considerable part of the working time and fuel consumption is devoted to the inevitable inefficient technological processes.



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sciforum-102356: Assessing Dendrometric Parameters Using GIS and LiDAR Flight Data: A Tree-by-Tree Study in Mont Avic Regional Park, Aosta Valley, NW Italy

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The application of LiDAR (Light Detection and Ranging) technology in forestry has been steadily increasing, revolutionizing how forest ecosystems are monitored and managed.

This study leverages GIS and LiDAR flight data to assess dendrometric parameters on a tree-by-tree basis in Mont Avic Regional Park, located in the Autonomous Aosta Valley Region (NW Italy). The LiDAR data, collected during 2020-2021, was processed to derive Digital Terrain Models (DTM) and Digital Surface Models (DSM), enabling the computation of a Canopy Height Model (CHM) with a Ground Sampling Distance (GSD) of 0.5 m. Although an optimal CHM for forestry dendrometric assessments typically has a GSD of around 0.15-0.25 m, the high number of LiDAR returns, exceeding 12 per square meter, compensated for this issue. The CHM was segmented using a local maxima algorithm to delineate individual tree crowns. This study specifically focused on vertical biomass (VB) assessment, utilizing the 0.5 m resolution CHM to segment canopies and calculate species-specific incidence areas and related diameters through empirical formulas. These formulas, derived from similar regions and documented in literature, correlated tree crown measurements from GIS with diameters at 1.30 m for each species. Dendrometric formulas were applied to estimate tree volume, with validation performed using ground measurement data from randomly selected, evenly distributed areas within the study site. For each tree, the following parameters were obtained: height (H), crown area (C), diameter (D), volume (V), altitude (A), coordinates (X and Y in ED50 UTM 32N), tree species, and forestry category from species maps.

In conclusion, this integrated approach combining advanced remote sensing technologies with GIS underscores the potential for comprehensive forest ecosystem monitoring and management as well as in agro-forestry. Future perspectives include monitoring fire vulnerability through the Vegetation Health Index (VHI) and analyzing trends to support agro-forestry planning and management.



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sciforum-105445: Comparative Analysis of Precision and Digital Agriculture Adoption in Romania and Western Europe

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This study offers a **comparative analysis** of how Romania and Western European countries are adopting precision and digital agriculture, focusing on regional trends, challenges faced, and specific outcomes for farming practices. The **dataset** used in this research includes responses from structured surveys and in-depth interviews with farmers, industry experts, and policymakers from Romania and several European countries. These responses provide diverse perspectives on the socio-economic and structural factors that influence the use of digital tools and precision technologies. **Data collection methods** involved quantitative surveys to assess adoption rates and qualitative interviews to gather insights on how socio-economic differences and farm structures impact technology use. This dataset is complemented by a review of recent literature and case studies, offering a comprehensive view of digital agriculture's effects on efficiency, sustainability, and food security. Among the **main findings**, the study highlights a significant contrast: Western European farms, typically larger and benefiting from advanced infrastructure and supportive policies, show widespread adoption of precision agriculture. In contrast, Romania faces considerable challenges due to the high number of small-scale farms, limited financial resources, and a shortage of technical expertise. However, Romania's extensive high-speed internet infrastructure presents a unique advantage, enabling quicker adoption of digital tools where other barriers can be effectively managed. Farms in Romania that have embraced these technologies report substantial improvements in crop yields, resource efficiency, and environmental impact. The study concludes that to close Romania's adoption gap, tailored financial incentives, dedicated educational programs, and infrastructure support are essential to better align with broader European trends, fostering competitiveness, sustainability, and resilience in Romanian agriculture.



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sciforum-104001: Drone-based Multispectral Imaging for Precision Monitoring of Crop Growth Variables

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Drone-assisted crop growth monitoring has significantly boosted the demand for precision agriculture in recent years. Different vegetation spectral indices derived from drone-based multispectral images could be found more appropriate, as well as near-real-time monitoring tools over traditional methods and satellite remote sensing. The present study was conducted to estimate the leaf area index (LAI) and leaf nitrogen content (LNC) of wheat crops from drone-image-derived NDVI. Drone-based multispectral imaging of a wheat field with three wheat varieties (DBW-187, HD-3086, PBW-826) under eight nitrogen treatments (N0, N30, N60, N90, N120, N150, N180, N210) was completed at the flowering (90 DAS) and grain-filling stages (108 DAS), respectively. Multiple correlation analysis revealed that the squared Pearson's correlation (R^2) values of NDVI with LAI and LNC during the flowering stage were 0.78, 0.86, and 0.80 for DBW-187, HD-3086, and PBW-826, respectively, and improved to 0.89, 0.88, and 0.90 during the grain-filling stage. These results indicate a strong, positive relationship between NDVI, LAI, and LNC, which becomes stronger as the crop matures. Thus, drone remote sensing can effectively assess the biophysical variables of crops, potentially reducing the need for labor-intensive conventional methods of estimation. This study demonstrated that drone-assisted approaches can greatly enhance crop growth monitoring efficiency, offering a viable alternative to traditional methods.



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sciforum-104280: EfficientNet Network, Mish Activation Function and Ranger Optimizer Implementation for Plant Leaf Disease Classification

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Plants account for over 80% of the human diet, being essential for food security and worldwide feeding. In this context, it is important to maintain high productivity, avoid crop losses and preserve the environment. Plant leaf diseases are a drawback in this reality, where they are responsible for depreciation in food quality, directly causing economic losses in agricultural production and great environmental impact if pesticides are used indiscriminately. Therefore, the classification of diseases is of fundamental importance and is a great challenge since many leaf diseases present similarities, inducing misidentification. Also, manual classification is an exhaustive task and gives subjective results, causing misidentification in addition to being economically unfeasible. To solve this problem, a new arrangement of deep convolutional neural networks, activation functions and optimizers for plant leaf disease classification is proposed. In the proposed method, we tested different EfficientNet Convolutional Neural Network models, scaling the model size and number of parameters alongside with the Mish activation function and Ranger Optimizer in the task of plant leaf disease classification. Compared with previous work applied into the same dataset, the proposed arrangement achieved better performance with 94,0% accuracy for EfficientNetB0, achieving state-of-the-art results for the tested dataset. The model with best performance also has less parameters, therefore being effective and demonstrating potential for portability.



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sciforum-103951: Estimating Leaf Area Index of Wheat using UAV Hyperspectral Remote Sensing and Machine Learning

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Hyperspectral remote sensing using Unmanned Aerial Vehicles (UAVs) provides accurate, near-real-time, and large-scale spatial estimation of leaf area index (LAI), a very important crop variable used for monitoring crop growth. In the present study, the LAI of wheat crops was estimated using high-resolution UAV-borne hyperspectral data with a spectral range of 400-1000nm and a spatial resolution of 4cm. A total of twenty-seven hyperspectral vegetation indices were computed. The PLS (Partial Least Squares) regression combined with the VIP (Variable Importance in the Projection) scores were used for selecting the optimum indices as feature vectors for the Extreme Gradient Boosting (Xgboost) model for predicting LAI. The twelve optimal vegetation indices with VIP scores above 1 were selected to develop the prediction model. Once validated against the in situ-measured LAI values, the prediction model showed good accuracy, with R^2 of 0.71, RMSE of 0.52, and MAE of 0.44. The model was used to generate a spatial map showing the variability in the LAI of wheat fields. Accurate mapping of LAI for wheat crops was achieved by integrating high-resolution UAV data and machine learning models. The results can be up-scaled to farmers' fields for the operational delivery of LAI of crops to monitor crop growth and predict yield.



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sciforum-106940: Normalized Difference Vegetation Index and Normalized Difference Red Edge could be useful tools for optimising grazing management in mixed pastures.

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Pasture growth and quality are optimised when pasture is grazed at the point at which it achieves 95% light interception (LI), that is, when the canopy is capable of intercepting 95% of the incident solar radiation with its leaves. Thus, measurements of LI provide a good indicator of the ideal time to graze a pasture. However, measurements of LI are difficult since they require sensors to be placed in and above a pasture canopy throughout a pasture regrowth period and are affected by daily weather patterns. Therefore, an alternative tool for predicting pasture LI is desired. The Normalized Difference Vegetation Index (NDVI) and Normalized Difference Red Edge (NDRE) may provide useful alternatives to LI, since their measurement is less labour-intensive and is not affected by weather. In a mixed perennial ryegrass (*Lolium perenne* L.) + plantain (*Plantago lanceolata* L.) pasture at Massey University, New Zealand, the relationship between NDVI, NDRE and LI was investigated between early spring and late summer. NDVI and NDRE were measured by scanning eight plots (182m²) with a Rapid Scan(R) CS-45 canopy analyser (~300 readings), while LI was measured with a Spectrosense 2+(R) device, at three fixed locations within each plot. Positive logarithmic relationships were found between NDVI and LI ($R^2 = 0.35$) and NDRE and LI ($R^2 = 0.30$). These results suggest that NDVI and NDRE may be useful tools for predicting pasture LI, therefore indicating the most effective time to graze a pasture. However, future research is required to determine the limitations of their use for predicting optimal grazing times for different pasture species.



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sciforum-101804: Novel IoT Solution Using Smart Sensors for Precision Irrigation Agriculture: Design, Applications, Algorithms and Pilot Testing of IoT-Based System for Agricultural Water Management

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Rice is a staple crop for ensuring global food security, although it requires a lot of water, up to 2500 L, to produce 1 Kg of rice. Rice farming is expanding in East Africa, with up to 90% production on smallholder farms using traditional flooding and rain-fed methods vulnerable to climate change and variability. Alternate wetting and drying (AWD) and rice intensification (SRI) systems are climate-smart irrigation practices that increase yields and water management, although practised at a micro-research scale. Some of the challenges to adopting these techniques among farmers and large schemes in East Africa include poor government policies, limited awareness, technical knowledge, changes in soil structure that influence irrigation water application, and frequent manual water level (WL) monitoring. This study presents the pilot test of the i) self-developed Internet of Things (IoT)-based smart solution, ii) compared with conventional AWD practice to address AWD challenges and improve water management for smallholder farmers in Africa. The pilot test was carried out at the Tokyo University of Agriculture and Technology with pot rice cultivation in greenhouse conditions between Dec 2024 and Feb 2024. The preliminary results indicated that the IoT system had 16% water savings twice that of conventional AWD and higher compared to conventional AWD and CF. Since there is ongoing field research development in Uganda, we have yet to understand the effects of the IoT AWD system on water use efficiency, labour savings, yields, soil hydraulic conditions, economic projection for adoption by smallholder farmers, and promotion in Africa.



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sciforum-104118: Patenting Trends in AI Applications for Agriculture: A Comprehensive Analysis

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Innovative agricultural technologies encompass a wide range of tools and techniques aimed at improving efficiency, sustainability, and productivity in farming. This study analyzes patents related to the use of artificial intelligence (AI) in agriculture. Various patent databases were utilized, employing keywords and terms such as “AI in agriculture”, “deep learning in agriculture”, “machine learning in agriculture”, “AI applications in crop yield optimization”, “crop monitoring with AI”, and “pest and disease detection using AI.” Searches were carried out using patent titles, abstracts, and claims to ensure thorough coverage and the retrieval of pertinent data. The search results were then refined based on publication year, patent classifications, applicants, and jurisdictions. As a result, 1514 patent documents were identified. The origins of AI use in agriculture patenting can be traced back to the earliest priority date, marking 1989 as the inaugural year. Significantly, the peak of patent document activity occurred in 2023. The analysis reveals that the United States and China are the most prolific nations in patenting AI applications in agriculture. The majority of inventions involve information and communication technology tailored for agriculture, fishing, and mining. Additionally, patents in this area are related to computing arrangements based on specific computational models, particularly focusing on machine learning and neural networks inspired by biological models. This study provides a patent analysis and competitive analysis covering AI usage trends in agriculture and presents recommendations to guide the development of innovative research strategies.



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sciforum-106969: Use of Convolution Neural Networks for classification of time series of Sentinel-1 chronological data

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Satellite data is crucial for monitoring soil conditions, with applications in agriculture and environmental management. This study assesses soil moisture in a semi-arid region of Tunisia using Sentinel-1 satellite imagery and CNN-based classifiers developed for time-series data classification. The training database was validated with Sentinel-2 imagery and ground-truth data to enhance classification accuracy.

The study area, in central Tunisia's Kairouan governorate, spans the eastern Tunisian Atlas (9°30'E to 10°15'E, 35°N to 35°45'N). Measurements were taken during a 2019 field campaign. The region's land use includes cereals, orchards, olive groves, bare soils, fallows, vegetables, urban areas, and dams. Sentinel-1 and Sentinel-2 images from June to October 2019 were downloaded from the Copernicus platform. Sentinel-1 data was preprocessed using ESA's SNAP software, involving terrain correction, noise reduction, and radiometric calibration, and then segmented in QGIS using GPS field reference data. Statistical analysis in R revealed correlations between VH backscattering, land uses, and NDVI with rainfall. Sentinel-1 (VH polarization) and Sentinel-2 NDVI images informed sampling hypotheses for CNN training, considering soil moisture and biomass variations.

The CNN classifiers, implemented in MATLAB R2018a, were evaluated through cross-validation, selecting models that minimized errors and maximized accuracy. The CNN achieved the best results with a learning time of 503 seconds, accuracy of 99.36%, and a loss of 6.76%. The training phase used 9x9 sampling windows, 15,000 samples (2/3 for training, 1/3 for testing), 5 classes, 50 filters (5x5), Maxpooling (window size = 4, stride = 2), and the activation function 'gradient descent with momentum.' The learning rate was 0.005, with 1 fully connected layer, 30 epochs, and 50 iterations. The CNN outperformed the Random Forest (RF) method applied to Sentinel-2 data in handling data complexity such as moisture, biodiversity, and biomass.



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Session 5. Biostimulation and Biocontrol Microbial-Based Strategies

sciforum-107075: *Lotus creticus* response to abiotic stress: role of plant density and soil microorganisms

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Coastal ecosystems are exposed to extreme abiotic conditions, primarily water deficit and salt stress, as well as resource availability, which exacerbates interspecific competition. In this context, soil microbial communities may provide an advantage in coping with abiotic and biotic stresses.

This study investigates the effects of both soil microbiota and plant density on *L. creticus* performance under salt and water stresses. We applied two saline treatments (100 mM and 200 mM NaCl), and water deficit (complete withholding of irrigation), to plants grown either individually or in groups of three, in coastal dune soil (with the natural soil microbial community) or sterile soil. When the plants started to wilt, we measured the morphometric traits, mycorrhizal structures, and biochemical markers indicative of plant responses to abiotic stress. The latter were photosynthetic pigments (chlorophylls and carotenoids), ion content in leaves and roots, osmolytes (proline, total soluble sugars, and glycine betaine), and oxidative stress markers (malondialdehyde and hydrogen peroxide). We also analysed antioxidant mechanisms, both enzymatic (catalase, glutathione reductase, superoxide dismutase and ascorbate peroxidase activities) and non-enzymatic (total phenolic compounds and flavonoids).

Plants grown in coastal soils exhibited greater biomass compared to plants grown in sterile soils (leaf dry weights were 0.52 ± 0.07 g vs 0.28 ± 0.02 g, respectively). Plants cultivated in groups showed higher levels of osmolytes than those cultivated individually (e.g., proline concentrations were 12.70 ± 2.73 μ mol/g DW vs 1.60 ± 0.41 μ mol/g DW, respectively). Salt and water stresses had a negative effect on morphological development (e.g., average leaves produced in 0.2 M NaCl: 34.72 ± 9.98 ; in water stress: 37.71 ± 12.70 ; in control plants: 82.39 ± 17.45) and triggered some stress markers (e.g., total soluble sugars, control plants: 18.49 ± 3.16 mg eq. G /g DW; 0.2 M NaCl: 46.90 ± 11.72 mg eq. G /g DW; water stress: 55.35 ± 19.85 mg eq. G /g DW). These findings support the positive effects of local soil microbial communities on plant performance under abiotic stresses and population density conditions.



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sciforum-104113: Evaluation of the microbiological quality of *Trichoderma asperellum* produced in an on-farm system in Curitiba – SC

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In Brazil there has been a large increase in the use of products based on microorganisms, used for biological control. Due to this increased demand for biological products, some companies have been selling a technology called “on farm” production system, also known as “biofabrics” which consists of producing microorganisms for biological control within the property using commercial products as inoculum source. However, it occurs without any rigorous supervision and the multiplication occurs in open spaces such as water tanks, bioreactors, and milk coolers. With the lack of control over the multiplying microorganisms, published articles report the presence of several contaminants, including antibiotic-resistant bacteria. The present work aimed to evaluate the microbiological quality of two multiplied *Trichoderma* products in Curitiba – SC, Brazil. Samples were collected on rural properties and taken to the laboratory for quantification processes by serial dilution and morphological analysis of colonies. One of them was the commercial product Trippel, with a labeled concentration of 1×10^5 UFC ml⁻¹ of *Trichoderma asperellum*, and the other was a product of its “on farm” multiplication. We observed no contaminants in Trippel, and a concentration of 1×10^7 UFC ml⁻¹. On the other hand, the multiplied product did not present *Trichoderma asperellum*, and the concentration of contaminants was 4×10^9 CFU ml⁻¹ (mostly bacterial colonies). The on-farm multiplication of the microorganism *Trichoderma asperellum* was not efficient, once that only contaminants were multiplied, and the agricultural use of this multiplication will not result in the benefits expected from a commercial product. Furthermore, contaminants may be pathogenic and even antibiotic-resistant groups of microorganisms, which represents a serious health risk to farmers and can contaminate soil and water resources.



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sciforum-103962: Isolation and Characterization of Multi-Trait Plant Growth-Promoting Rhizobacteria to Improve Phosphorous Nutrient And Maize Growth Optimization

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The increasing global need for food necessitates a shift towards more profitable and efficient farming methods since chemical fertilizers pose hazards to both human health and the planet's ecosystem. Microorganisms that may serve as PGPRs (plant growth-promoting rhizobacteria) for Zea mays optimization were the focus of this study's isolation and identification efforts. A preliminary screening of five isolates was conducted using growth stimulation, nutrient solubilization, and enzyme synthesis in vitro from indigenous soil at the Federal University Oye Ekiti field. By comparing each trait's maximum and minimum, the strain pool was reduced to two. The 16S rDNA sequencing method was used to confirm the identification of two promising isolates, Enterobacter hormaechei OYA S29 and Acinetobacter sp. OYA S30. The effect of Enterobacter hormaechei OYA S29 on soil phosphorus and maize development was examined in a pot experiment. The findings showed that soil phosphorus solubilization was increased from 0.4905ppm (Control group) to 0.4934ppm by (Enterobacter hormaechei OYA S29), and Zea mays development much improved, with greater plant height (45.722cm) and plant girth (4.20cm), longer leaves (35.500cm), longer roots (23.433cm), and higher biomass (7.4850g), when compared to the control group (36.250cm, 3.225cm, 28.450cm, 16.750cm and 4.7220g). These results demonstrate the discovered strains' potential as efficient PGPRs for maximizing maize growth and nutrient availability.



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sciforum-094934: Strategies for the Integrated Pest Management of Fruit Fly, *Bactrocera zonata* (Tephritidae: Diptera), using various approaches

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Guava (*Psidium guajava*) is a vital crop in tropical agriculture, renowned for its rich antioxidant and dietary fiber content. However, its cultivation faces significant challenges from the Peach Fruit Fly (PFF), *Bactrocera zonata*, which threatens various fruit crops, including guava. Integrated Pest Management (IPM) strategies, such as the Male Annihilation Technique (MAT), Bait Application Technique (BAT), and the use of botanical compounds, are employed to control this pest. This study, conducted in the fields of the University of the Punjab, Lahore, aimed to evaluate the efficacy of the MAT, BAT, and botanical methods by measuring mortality rates at 24-, 48-, 72-, and 96-hour intervals. For the BAT and botanicals method, the study tested extracts from Neem, Moringa, Citrus, and Parthenium at concentrations of 100%, 50%, and 25%. The results showed that the highest mortality occurred at 100% concentration, with effectiveness decreasing over time but still providing adequate control after 24 and 48 hours. Neem extract at 100% concentration achieved the highest mortality rate of 65.71% after 24 hours, while Parthenium at 25% showed the lowest mortality rate at 23.8%. Moringa and Citrus extracts exhibited moderate effectiveness. The MAT involved nine traps set with three different concentrations (100%, 20%, and 10%) of Polytrin-C and methyl eugenol, each replicated three times. The 100% concentration produced the highest mortality rate within 24 hours, whereas the 10% concentration resulted in the lowest mortality rate. Overall, the MAT proved to be the most effective method, while botanical treatments were the least effective. This study concluded that all IPM strategies tested provided satisfactory control of *Bactrocera zonata*, with the MAT being the most efficient approach. Among the botanicals, Neem extract was the most effective, and Parthenium the least. The BAT showed moderate effectiveness in managing the pest.



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sciforum-100165: Antagonistic and nematocide activity of carboxylic acids of microbial origin

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Introduction

The field of experimental microbiology allows for the creation of new avenues of biotechnology with the aim of facilitating the extensive utilization of microbial synthesis products in agriculture as plant protection agents. The most prevalent biological substances are antibiotics, alkaloids, peptides, phenolic compounds, lipids, terpenoids, polysaccharides, organic acids, and others. The objective of this study was to assess the fungicidal, bactericidal, and nematocidal activity of carboxylic acids produced by the yeast *Yarrowia lipolytica*.

Methods

Succinic acid (SA), isocitric acid monopotassium salt (ICA), and α -ketoglutaric acid monopotassium salt (KGA) were synthesized under specific conditions using *Y. lipolytica*, and subsequently isolated from the culture liquid in crystalline form with 99.9% purity. The fungicidal and bactericidal activities of carboxylic acids were determined by the agar diffusion method. The phytopathogenic bacteria *Erwinia carotovora* and the fungi *Trichothecium roseum*, *Cylindrocarpon*, *Aspergillus flavus*, *Fusarium oxysporum*, *F. napiforme*, and *Penicillium casei* were employed as test microorganisms. The nematocidal activity of carboxylic acids was investigated against the phytoparasitic stem nematode *Ditylenchus destructor*.

Results

The selective antimicrobial activity of carboxylic acids produced by *Y. lipolytica* has been demonstrated. The acids were subjected to testing against six test microorganisms, with four being inhibited. Moreover, it was demonstrated that all acids were capable of inactivating the nematode *D. destructor*. The nematostatic activity ranged from 13 to 37.6%, while the nematocidal activity ranged from 22.4 to 58.3%. The highest nematocidal activity was observed with SA.

Conclusions

The utilization of SA, ICA, and KGA produced by *Y. lipolytica* for the purpose of plant protection may be regarded as a highly promising avenue of research, given that pests have not yet developed resistance to these acids. Furthermore, the acids produced by microorganisms are of a higher purity than those that are chemically synthesized.



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sciforum-100743: Antifungal activity of *Achilléa millefólium* extract against pathogens of plant root rot

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Introduction

Phytopathogens affect all types of agricultural plants in all regions of the world. The annual losses from these pathogens in the global economy amount to tens of billions of dollars. All over the world, great importance is attached to environmentally friendly means of protecting plants from pathogens, so a promising direction is the use of green technologies for the development of biological products based on plant extracts and their natural compounds. The purpose of this study was to evaluate the antifungal activity of *Achilléa millefólium* extract of the *Compósitae* family against pathogens that cause plant root rot and to determine their component composition.

Methods

An aqueous-alcoholic extract of the plant *Achilléa millefólium* was obtained by grinding the leaves, washing with running water and then with sterile water, drying, grinding into powder, and extraction with 70% ethanol, followed by settling and filtering. The antifungal activity of the extract was determined by the agar diffusion method. *Fusarium oxysporum*, *F. solani*, and *Penicillium notatum*, previously isolated from soybean plants affected by root rot, were used as test microorganisms. The component composition was determined using HPLC and gas chromatographic analysis.

Results

The *Achilléa millefólium* extract was shown to have high antifungal activity; the growth inhibition zones of *F. oxysporum*, *F. solani*, and *P. notatum* were 36.3 mm, 39.6 mm, and 31.0 mm, respectively. The component composition of the extract revealed derivatives of flavones, quercetin, kaempferol, phenolic acids, decanoic acid, etc.

Conclusions

The *Achilléa millefólium* plant extract and the complex of its natural compounds can be further used as a basis for the development of environmentally friendly drugs against plant root rot pathogens.



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sciforum-106939: Aromadendrane Sesquiterpenoids from *Santolina chamaecyparissus* L. Flowers: Chemical Profiling and Antifungal Activity Against *Neocosmospora* Species

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Santolina chamaecyparissus L. (cotton-lavender; family Asteraceae), traditionally valued in medicine and cosmetics for its bioactive compounds, was evaluated for its phytochemical profile and antifungal properties against two emerging plant pathogens. Flower extracts were prepared using methanol/water (1:17 v/v) with ultrasonication and characterized through gas chromatography-mass spectrometry (GC-MS) and Fourier-transform infrared (FTIR) spectroscopy. The extract's antifungal efficacy against *Neocosmospora falciformis* and *N. keratoplastica* was assessed through both *in vitro* assays and *in planta* experiments on zucchini (cv. Diamant F1) and tomato (cv. Optima F1) using root-dipping treatments. GC-MS analysis revealed a diverse sesquiterpenoid profile, with nuciferol (17.7%), 2,1,3-benzothiadiazole (10.3%), and 8-cedren-13-ol (5.9%) as major components, alongside aromadendrane derivatives including spathulenol, viridiflorol, and ledol. The extract exhibited potent antifungal activity with minimum inhibitory concentrations (MICs) of 1500 and 1000 µg/mL against *N. falciformis* and *N. keratoplastica*, respectively. In greenhouse trials, treatment with 3000 µg/mL extract (2×MIC) effectively suppressed *N. falciformis*-induced wilt and root rot in both crops without phytotoxic effects. These results indicate an antimicrobial activity comparable to that of fosetyl-Al and higher than that of azoxystrobin conventional fungicides, and demonstrate the potential of *S. chamaecyparissus* flower extract as a sustainable, biorational alternative for managing *Neocosmospora* species and related pathogens in agricultural disease control.



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sciforum-103963: Beyond a Pathogen: *Chromobacterium violaceum*, a Rhizobacterium with Plant Growth-Promoting Potential

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Current global climate change and its challenges have led to a search for green approaches to ensuring sustainable agriculture. Microbe-based fertilizers have been reported as potent eco-friendly alternatives to chemical fertilizers owing to their plant growth-promoting potential. This research identified an often scientifically reported pathogen as a rhizobacterium with plant growth-promoting potential. The rhizobacterium was isolated from the rhizosphere of *Leersia oryzoides* (L.) Sw. growing in waterlogged soil and screened for plant growth-promoting traits: indole-3-acetic acid (IAA) production and phosphate solubilization. It was further tested for plant growth-promoting activity via a maize seed germination bioassay for five days. The rhizobacterium was identified phenotypically and via biochemical tests. The rhizobacterium was negative for IAA production and phosphate solubilization. After five days of incubation during the seed germination bioassay, the radicle and hypocotyl length of the maize seeds inoculated with the rhizobacterium (RS PUR) were 6.6 cm and 0.7 cm, respectively, while those of the control (maize seeds + sterile distilled water only) were 5.7 cm and 0.3 cm, respectively. Student's t-test statistical analysis showed $P < 0.05$, indicating that there was a significant difference between the rhizobacterium-treated seeds and the control. The rhizobacterium was tentatively identified as *Chromobacterium violaceum*. This research thus shows the significance of bioprospecting studies and the plant growth potential of this unidentified strain of *Chromobacterium violaceum* beyond it being a pathogenic strain. Screening for more plant growth-promoting traits and the strain-level identification (16s rDNA sequencing) of this rhizobacterium are therefore recommended.



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sciforum-104938: Bio-Potential Activity of *Bacillus* sp. from Tomato Rhizosphere Soil against Fungal Growth of *Pythium aphanidermatum* and *Fusarium oxysporum*

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Tomato is a significant vegetable crop in India, but it faces substantial losses due to diseases like damping-off (caused by *Pythium aphanidermatum*) and wilt (caused by *Fusarium* sp.). To address these issues, a study was conducted to isolate *Bacillus* sp. from rhizosphere soil to manage the pathogens of *P. aphanidermatum* and *Fusarium* sp. Virulent isolates of *P. aphanidermatum* and *Fusarium* sp. were isolated from infected tomato plants and were identified morphologically and molecularly as *P. aphanidermatum* and *Fusarium oxysporum*. A total of 12 *Bacillus* sp. were isolated from the rhizosphere soil of tomato field. In vitro, a screening of the *Bacillus* isolates against the damping-off and wilt pathogens revealed that strains BS1, BS2, and BS5 were effective against *P. aphanidermatum*, while BS1, BS4, BS7, BS9, and BS11 were effective against *F. oxysporum*. Notably, strain BS1 was effective against both *P. aphanidermatum* and *F. oxysporum*. Volatile GC-MS analysis of the crude extract from *Bacillus* sp. BS1 revealed the presence of several antimicrobial compounds, including hexanone, benzoic acid, methyl butanol, furan, proline, xylene, dodecane, benserazide, pentanoic acid, and cartap, all with significant area percentages. The result of the volatile analysis showed that benzoic acid was predominantly expressed at high peak values with a higher area percentage (79.2 %), which was found to suppress the pathogenic growth in vitro. A glasshouse trial assessing the efficacy of *Bacillus* sp. (BS1) demonstrated that treating tomato seeds with 5 g/kg as a basal application and applying 2.0 kg/ha to the soil as a top dressing on days 25 and 35 after sowing resulted in substantial reductions in damping-off (1.29%) and wilt (5.26%) pathogen incidences. Furthermore, the bipartite interaction of plant-defense-related enzymes such as peroxidase, polyphenol oxidase, phenylalanine ammonia lyase, and total phenol content potentially expressed higher activities. This study concluded that *Bacillus* sp. from the tomato rhizosphere soil exhibits significant potential to inhibit soil-borne plant pathogens.



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sciforum-102735: Biochemical responses induced by SiO₂-ZnO nanoparticles in Zea mays plants under water deficit conditions

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Nanotechnology (NT) holds promise as a tool to improve crop yields and address current and future limitations in agricultural production by enhancing plant tolerance to abiotic stresses, such as droughts. Silicon nanoparticles (NPSi) are beneficial in mitigating biotic and abiotic stresses. However, the impact of the combined synthesis of NPSi with metals (SiZnONP) under drought stress conditions is poorly understood. An experiment was conducted to investigate the effect of Si NPs on the growth of maize (*Zea mays*) under water deficit conditions in a greenhouse. Four levels of SiNP and SiZnONP (0, 50, 100, and 200 mg/L) were applied weekly as a foliar spray after maize sowing. Two water levels (100% and 35% of soil water-holding capacity) were introduced 50 days after sowing for the remaining growth period. The lowest biomass, stem diameter, leave number, and height were observed in the plants under drought stress (control). The SiNP treatments improved plant growth indicators and photosynthesis, especially in drought stress grains. The improvement in maize growth was consistent across different levels of Si NPs, with the highest effect seen with NPSi-ZnO at 50 mg/L (81.05±1.2 cm). In plants treated with SiZnONPs, the levels of proline, peroxidase (POD), superoxide dismutase (SOD), and catalase (CAT) [771.97 µg/mg, 4.48 ± 0.2 UI/mg; 19.28 ± 0.11 UI/mg, and 0.27 ± 0.06 UI/mg] were higher compared to plants under drought stress conditions [650 ± 31.44 µg/mg, 2.93 ± 0.61 UI/mg; 14.58 ± 0.21 UI/mg, and 0.17 ± 0.03 UI/mg]. However, the levels of H₂O₂ showed an opposite trend. The application of SiNPs notably enhanced the histological features of roots under drought conditions.



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sciforum-106709: Biofortification and Increased Heat Stress Resistance of Pea Microgreens through Selenium Seed Priming

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Selenium (Se) is an essential micronutrient for human health, playing a crucial role as a component of various enzymes and proteins involved in antioxidant defense and immune regulation. In small quantities, Se can improve plant yield and quality and modulate stress-responsive genes [1-3]. However, plant foods grown in Se-deficient soils inevitably contain low levels of this micronutrient. This study aimed to address this issue by biofortifying pea microgreens (*Pisum sativum* L.) under heat stress through seed priming with Se. Seed priming is a cost-effective and environmentally friendly method for biofortifying edible crops, promoting uniform germination and fast emergence, even under stressed environments. In this experiment, seeds were submitted to nutri-priming treatments using 25–100 µM Se solutions for 6 and 12 h, with sodium selenate as the Se source. Hydroprimed and unprimed seeds served as controls. After treatment, one batch of seeds was tested for electrolyte leakage, while another was grown in a high-temperature greenhouse to produce pea microgreens. Emergence rate and morphological parameters were monitored daily. Upon harvest, biomass was measured, and the Se content was analyzed by atomic absorption spectrometry. Additionally, chlorophyll levels, soluble sugars, organic acids, total phenolics, and antioxidant activity were quantified using different analytical methods [4]. The seed treatment significantly influenced the emergence and growth of pea microgreens. The 6 h treatment resulted in superior agronomic performance and greater biomass accumulation compared to the 12 h treatment. However, the unprimed control exhibited the highest emergence rate. Despite this, Se priming significantly increased the Se concentrations in the microgreens' aerial parts, confirming the effectiveness of this biofortification strategy. These findings highlight the need to balance biomass production with Se accumulation to optimize production protocols under heat stress, contributing to the development of Se-biofortified foods in the context of rising global temperatures.



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sciforum-107072: Biostimulant Application as a Strategy to Sustain Reproductive Development and Fruit Set in Eggplant Under Heat Stress

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Climate change is a source of stress for crops and reduces agricultural yields worldwide, and the Mediterranean area is a hotspot where these effects are exacerbated. With a growing global population, agriculture must not only mitigate the adverse effects of climate change but also meet increasing food demands. One important challenge in eggplant (*Solanum melongena*) cultivation is the disruption of reproductive development under high temperatures, leading to an increase in functionally-male flowers and reduced fruit set—a response aimed at conserving plant resources but resulting in yield reduction for farmers.

In this study, we investigated the impact of heat stress on the production of hermaphrodite and male flowers in the experimental eggplant variety “Micromel”, developed in our laboratory, and commercial varieties from Valencia, Spain, grown in the field. Furthermore, we assessed whether biostimulants derived from plant organic matter and enriched with aminoacids, applied during the vegetative phase could improve plant resilience, maintaining fruit set under heat stress conditions.

Climate change introduces severe stress to crops, with the Mediterranean region experiencing some of the most intense impacts. As the global population grows, agriculture faces the dual challenge of mitigating climate-related stress while meeting increasing food demands. One challenge in eggplant (*Solanum melongena*) cultivation is the disruption of reproductive development under high temperatures. Eggplant exhibits andromonoecy, a sexual system where hermaphrodite and male flowers coexist on the same plant. Specifically, eggplant displays functional andromonoecy, where male flowers retain a non-functional pistil. Different eggplant varieties display different proportions of hermaphrodite and male flowers, but it's been shown that the proportion of male flowers always increases under heat stress conditions. It has been suggested that the balance between male and hermaphrodite flowers is linked to stress and resource allocation. Therefore, under stressful conditions, eggplants are thought to produce more male flowers, because they require fewer resources and avoid the metabolic cost of fruit development. Nevertheless, this hypothesis has not been systematically tested so far.

This study explored this hypothesis by testing the effect of the application of a biostimulant on flower sex and fruit set. For this, we used a dwarf eggplant variety (“Micromel”), developed in our laboratory. Micromel plants treated with the biostimulant during the vegetative phase produced significantly more hermaphrodite flowers and higher fruit yields than control plants, supporting the idea that andromonoecy strength is controlled by resource availability.

To assess the impact of heat stress on andromonoecy, a subset of plants was exposed to heat stress (35°C day / 30°C night). While control plants under heat stress ceased producing hermaphrodite flowers, biostimulant-treated plants continued to produce them. Although fruit set was limited in biostimulant-treated plants due to reduced pollen viability at high temperatures, these plants showed greater resilience to stress, suggesting a faster recovery post-stress. Additionally, when subjected to secondary stresses like drought, biostimulant-treated plants exhibited enhanced tolerance.

Overall, these results support the idea that the strength of andromonoecy is linked to resource allocation in eggplant and that biostimulant application may support eggplant yield by promoting flower fertility and fruit set and improving stress tolerance. This approach offers a promising strategy for crop management in the face of climate change.



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sciforum-106944: Brewing Sustainability: Transforming Coffee Waste into Powerful Crop Protectors—A Circular Economy Approach

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The coffee industry generates substantial waste, which is often discarded, creating environmental and economic challenges. However, these residues can be a valuable source of bioactive compounds with antimicrobial properties, presenting an opportunity for their use in crop protection, both pre- and post-harvest. Following circular economy principles, this study proposes the extraction and characterization of bioactive products from coffee byproducts and evaluates their antifungal activity against pathogens affecting coffee plants and/or stored coffee beans. The proposed method for recovering coffee residues (extraction in aqueous ammonia medium followed by freeze-drying) has proven cost-effective for caffeine production and competitive with current methods. In vitro activity assays demonstrated the high antimicrobial activity of the extracts against *Fusarium xylarioides*, *Aspergillus flavus*, *A. niger*, and *Penicillium verrucosum*. The minimum inhibitory concentrations ranged from 15.6 to 375, 31.2 to 1000, 62.5 to 1000, and 62.5 to 1500 µg/mL, respectively, depending on the residue used. The extract with the highest activity, derived from silver skin, was tested for the pre-harvest protection of coffee plants and the post-harvest protection of coffee beans. At a concentration of 62.5 µg/mL, it demonstrated complete control of tracheomycosis caused by *F. xylarioides* in coffee plants and full protection of coffee beans against *A. flavus*, *A. niger*, and *P. verrucosum*. These findings suggest that aqueous ammonia extracts of coffee byproducts represent a promising alternative to conventional synthetic phytosanitary products, with the potential to improve the sustainability of the coffee industry.



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sciforum-100685: Comparative Yield Response of Two Alfalfa Cultivars to Biostimulant Supply

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Improving alfalfa biomass yield production through an eco-friendly approach is crucial for sustainable agriculture productivity. A study was conducted at the University of Debrecen, Hungary, to examine the effect of biostimulant application on two alfalfa biomass yield performances and identify potential cultivar-specific responses to the biostimulant treatment. Two alfalfa cultivars, (i) Magor and (ii) Hunor, were subjected to biostimulant supply under field conditions, and biomass yield was harvested four times on a plot basis. The experiment was arranged in a randomised complete block design (RCBD) with four treatment combinations consisting of T0 = control, T1 Biostimulant containing MTU®, pidolic acid, and Si (2.5L/ha); T2 = Tricho Immun + Ino Green (foliar fertilizer) (3+3L/ha); and T3 = Tricho Immun (3L/ha) replicated three times. Our findings show significant differences in yield responses between the two cultivars following the application of biostimulant treatments with or without foliar fertilizer. Hunor exhibited a significant increase in biomass yield of 8.73% compared to 6.27% Magor across all the harvested periods. The application of biostimulants with or without foliar fertilizer significantly increases biomass yield production, highlighting differential responses based on cultivar genetics. The treatment applied attained biomass yield in the range of 17959 kg/ha to 19983.75 kg/ha, which contributed a yield increase of 1.10% to 11.27% for Magor, while 15534 kg/ha to 17347 kg/ha was observed for Hunor, contributing a yield increase in the range of 8.11% to 11.67%. Our results indicate that Hunor had a better yield response to biostimulant application compared to Magor. The study contributes valuable insights to optimizing alfalfa production strategies, focusing on the potential of biostimulants in enhancing alfalfa crop yield performances and agricultural sustainability.



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sciforum-104086: Effect of silica spraying on physiological performance of *Cucumis sativus* and *Capsicum annum* under heat stress

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The foliar application of sunscreen formulations containing silicon dioxide (SiO₂) may be relevant to overcome heat burn in vegetable crops. The authors tested a Si-containing product on cucumber (*Cucumis sativus*) and pepper (*Capsicum annum*) potted plants to assess its protective properties against heat stress. Two-week-old plants were either sprayed (S+) or not sprayed (S-) with a 0.05% Si solution and were either exposed (H+) or not exposed (H-) to heat stress; greenhouse conditions were used and there was a total of four treatments (S-H-, S-H+, S+H-, and S+H+). The H+ treatment consisted of exposing plants, for 6 hours on two consecutive days, to mild heat stress (air temperature around 42°C) and one week later to severe heat stress (air temperature around 48°C). Also, H- plants received 25% less solar radiation than H+ plants.

Pepper plants exposed to heat burn (H+) showed a 1% decrease in their water percentage compared to H- plants. The leaf temperature was 7% lower ($p < 0.01$) in the S+H+ treatment group and around 5% lower in S+H- plants of both species, compared to plants not sprayed with Si (S-). In addition, plants sprayed with Si (S+H+ and S+H-) showed a 20% lower ($p = 0.04$) stomatal conductance (g_s). The chlorophyll content of leaves not exposed to heat-stress (H-) was almost 50% higher in S+ plants of either species, on average, of the two heat-stress treatments (mild and severe). Heat stress decreased by an average of 4% in relation to the quantum efficiency (Fv/Fm) of plants of either species. Also, Si improved the Fv/Fm of all plants that were not exposed to heat stress (i.e., S+H-) and plants after exposure to severe heat stress (48°C), but not after mild heat stress (42°C). The number of flowers produced by cucumber plants was 60% higher in Si+H+ than in Si-H+ plants. These results suggest a beneficial effect of silica spraying but should be confirmed in the field.



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sciforum-103613: Enhancing Almond Seed Germination and Growth Through Microbial Priming: A Biostimulation Strategy for Sustainable Agriculture

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Microbial priming is an emerging strategy in sustainable agriculture that involves the use of beneficial microorganisms to enhance agricultural productivity and sustainability. This innovative approach leverages the natural interactions between plants and microorganisms to promote plant growth and improve soil health. This study explores the application of microbial priming on almond seeds, focusing on the biostimulant effect of a soil-based microbial extract to enhance almond seed germination and seedling growth. Methods: Almond seeds were subjected to microbial priming using a microbial wash extracted from a rhizospheric native soil sample of *Pistacia lentiscus*. The experiment evaluated germination rates, seedling growth parameters, and conducted comprehensive physico-chemical and microbial soil analyses. AMF (Arbuscular Mycorrhizal Fungi) colonization was also measured. Results: Microbial priming significantly improved germination rates and enhanced seedling growth compared to untreated controls. Soil analysis revealed increased nutrient availability and a higher population of beneficial microorganisms. The AMF colonization was notably higher in treated plants. Conclusions: Microbial priming effectively enhances almond seed germination and seedling growth, demonstrating its potential as a sustainable biostimulation strategy in agriculture. This practice not only boosts crop productivity, but also promotes soil health by enriching microbial communities and improving nutrient cycling. Integrating microbial priming into almond cultivation can lead to more sustainable and resilient agricultural systems, reducing dependency on chemical inputs and enhancing overall crop performance.



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sciforum-103958: Evaluation of Coco Peat-Based, Plant Growth-Promoting Rhizobacteria Formulation for Drought Stress Management and Sustainable Agriculture

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This research studies the formulation of a biofertilizer using coco peat as a carrier agent along with plant growth-promoting rhizobacteria (PGPR) on the growth enhancement of Zea mays (maize) under drought stress. Rhizobacteria were isolated from Phyllanthus amarus growing around a waste-dump site and screened for plant growth-promoting (PGP) traits: indole-3-acetic acid (IAA) production and phosphate solubilization. Rhizobacteria were further tested for PGP activity via a seed germination bioassay. The formulations were prepared by homogenizing 20ml of each PGPR standardized inoculum with 2g of oven-dried coco peat. The PGP potential of the formulations was evaluated in a pot experiment by measuring the wet weight (WW), plant height (PH), and shoot and root lengths (SL and RL) of the treated maize seeds weekly, for 14 days. Drought stress was simulated by not watering maize plants during the pot experiment. Ten (10) rhizobacteria were isolated; only two were positive for IAA production and phosphate solubilization. Four rhizobacteria (CE, PP, LP and DYE) expressed superior growth performance during the seed germination bioassay and were further used for the formulation (2g coco peat+20 ml CE) and pot experiment. On Day 14, the SL, RL, PH, and WW of maize seeds cultivated with the formulations ranged between 2.2 and 6.3cm, 2.5 and 15.1cm, 27 and 41.1cm, and 1 and 2g, respectively, while the corresponding values for the control (maize seeds + coco peat only) were 7cm (SL), 3.5cm (RL), 30cm (PH), and 1g (WW). On day 16, all plants withered except for those treated with 2g coco peat+20 ml CE and 2g coco peat+20 ml DYE. These PGPR were further identified by 16s rDNA sequencing and biochemical tests as Priestia flexa strain PG61 and Staphylococcus aureus, respectively. This study therefore shows the potential of carrier-based rhizobacteria fertilizers in managing drought stress and enhancing plant growth, thus effectively achieving Sustainable Development Goal 2.



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sciforum-106967: From Ornamental to Defender: *Camellia japonica* Flower Extracts Control *Erwinia amylovora* in Pear Orchards

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Camellia japonica (common camellia or Japanese camellia) has long been valued in Eastern medicine and cosmetics for its rich bioactive compounds, known for their antioxidant, antimicrobial, anti-inflammatory, and anticancer properties. This study investigated the antibacterial potential of hydromethanolic extracts from leaves and flowers of the 'Lipstick' cultivar against two significant phytopathogens: *Erwinia amylovora* (EA) and *Xanthomonas campestris* pv. *campestris* (Xcc). Gas chromatography-mass spectrometry analysis revealed the primary constituents in the leaf extract to include *D*-fucose, dihydroxyacetone, methoxy-phenyl-oxime (MPO), 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one (DDMP), and 1-(4-hydroxy-3,5-dimethoxy phenyl)-ethanone. The flower extract shared MPO and DDMP as main phytochemicals, along with diethoxyacetic acid ethyl ester, nonanoic acid, 1,2-cyclopentanedione, and eicosane. *In vitro* assays demonstrated low activity for the leaf extract and minimum inhibitory concentration (MIC) values of 1000 and 1250 µg/mL against Xcc and EA, respectively, for the flower extract. At these concentrations, the flower extract achieved complete inhibition of biofilm formation and, in the case of EA, substantial reduction in amylovoran production. Moreover, *in vivo* tests on artificially-infected *Pyrus communis* L. branches showed effective control of fire blight at a concentration of 1250 µg/mL. These findings highlight the potential of *C. japonica* flower extracts as eco-friendly biorationals for protecting crops against bacterial phytopathogens, particularly in the management of fire blight in pear trees.



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sciforum-102469: Green Synthesis of Silver Nanoparticles by Using *Phyllanthus emblica* and *Adhatoda vasica* Leaf Extract and their comparative study on microbes

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Introduction

In ancient time silver played an important role of novel metal ion ,to fight against many infections.Now silver is used as a AgNPs for targeting many biomedical,physio-chemical reaction to fulfill research goal .But there are many drawbacks also reported in AgNPs reaction like allergy and environmental risk , so avoiding these all side-effect plant based AgNPs are synthesized.In our research ,we have used silver nano-particle of Indian gooseberry (*Phyllanthus emblica*) and Malabar nut(*Adhatoda vasica*)Leaf Extract and their comparative study on microbes.

Methods

Leaves were first collected, then crushed into a powder. Next, we made a water-based extract solution by heating the mixture to 80 degrees Celsius for three to four hours using a magnetic stirrer. Leaf extract was combined with 1M silver nitrate solution, which was made by dissolving 1.7 grams of silver nitrate in 100 milliliters of water. Finally, the mixture of amla and adusa silver nitrate was centrifuged at 12000 rpm for 30 minutes, discarding the supernatant and collecting the dark pellet to form AgNPs of leaf extract. Finally, the leaf extract was collected in the form of a powder and dried for two to three days in a dark place.Using the disc diffusion and well diffusion methods, we investigated the effects of these AgNPs powders at varying concentrations against bacteria that cause disease, such as *E. coli*, *S. aureus*, *Mucor*, and *Aspergillus* strains.Additionally, we utilized the commercial antibiotic streptomycin to complete comparative study.

Result

AgNPs of *Phyllanthus emblica* and *Adhatoda vasica* leaf extracts comparative study on microbes explored positive results as compared to commercial antibiotic streptomycin to kill microbes ,that un clearly shown by zone of inhibition formation in petridish

Conclusions

Secondary metabolites in plant leaves makes plant based drug system and AgNPs molecules more effective and eco-friendly as compare to chemical based AgNPS.



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sciforum-106936: Harnessing Nanotechnology for Eco-Friendly Viticulture: Combating *Botrytis cinerea* in the Ribera de Duero

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Botrytis cinerea, the primary cause of gray mold in vineyards, significantly impacts the wine industry by reducing both yield and quality. While chemical fungicides remain the primary control method, their use has led to pathogen resistance and raised concerns about toxicity to human health and the environment. The demand for zero-residue wines necessitates alternative approaches. Natural bioactive products (NBPs) offer a promising solution by inhibiting pathogen growth and reproduction. However, their field application is challenging due to instability, solubility issues, and lack of specificity. Nanoencapsulation can enhance NBP efficacy, but the development and application of nanocarriers (NCs) require a multidisciplinary approach to overcome scientific and technical hurdles. This study presents the results of in vitro, ex-situ, and field application tests against *B. cinerea* using *Rubia tinctorum* and *Uncaria tomentosa* extracts encapsulated in chitosan-based NCs. Laboratory tests revealed high efficacies, with minimum inhibitory concentrations (MICs) of 250–375 µg/mL in range and complete protection of artificially inoculated 'Tempranillo' grapes at MIC doses. Field trials conducted in a D.O. Ribera de Duero vineyard during the 2024 growing season showed promising results, with no signs of phytotoxicity and no adverse effects on grape must quality parameters. These findings suggest that biopolymeric NCs offer a non-toxic and eco-friendly platform for delivering NBPs without compromising wine quality.



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sciforum-106857: Improved growth, yield and quality of rice (*Oryza sativa* L.) with foliar application of protein hydrolysates biostimulant

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An investigation was conducted using protein hydrolysates (PHs), obtained from the enzymatic breakdown of animal and plant wastes, which contain active compounds showcasing biostimulant effects that can help in increasing growth, yield and quality. The study location of the field experiment was the Agricultural Research Farm, Banaras Hindu University, during the kharif season, n 2021–22. The treatments consisted of 0.5, 0.625, 0.75, 1 and 1.5 L/ha PH applied at 15 and 50 days after transplanting (DAT), along with an untreated control. Various treatments significantly influenced the growth parameters, including plant height, no. of tillers, and dry matter accumulation, and the yield parameters, including the number of panicles, the panicle length and weight, the number of filled grains per panicle, fertility percentage, and grain and straw yield. PH at 1.5 L/ha yielded the highest values, followed by PH at 0.875 L/ha, when compared to the untreated control, and the percentage increase in yield over untreated control increased linearly with a range of 4.1% to 15%. Similarly, the protein hydrolysates at 1.5 L/ha showed higher nutrient content and a higher uptake of nitrogen, phosphorus, and potassium in the grains. The analysis of the provided results indicates that the most successful method for enhancing rice yield and quality in Varanasi's India agroclimatic conditions was to incorporate protein hydrolysates at a rate of 1.5 L/ha at 15 and 50 DAT.



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sciforum-104041: Inoculation of cotton improves plant growth under reduced nitrogen fertilization

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The environmental impacts caused by the use of mineral fertilizers contribute significantly to the loss of quality of soil, water resources and the atmosphere. At a global level, there are increasing investments in the search for alternatives that reduce the use of chemical inputs in agriculture and contribute to sustainable production. In this sense, the use of growth-promoting microorganisms is one of the most promising techniques. In soybean cultivation, for example, inoculation makes it possible to eliminate the use of nitrogen fertilizers. The objective of the present work was to evaluate the effects of inoculating cotton plants with *Azospirillum brasilense* and *Pseudomonas fluorescens*. The experiment was conducted under greenhouse conditions in a completely randomized design, with five treatments and five replications, as follows: T1: 100% N; T2: 75% N; T3: 75% N + *Azospirillum brasilense*; T4: 75% N + *Pseudomonas fluorescens*; T5: 75% N + *Azospirillum brasilense* + *Pseudomonas fluorescens*. Inoculation was performed at the time of transplanting. After five months, the growth and mass production of roots and shoots were evaluated. The data were submitted to analysis of variance and the means were separated by the Scott-Knott test at 5% probability of error. The use of *Pseudomonas fluorescens* with 75% nitrogen fertilization increased the mass of fresh roots by 150% and the volume of roots by 167% in relation to 100% fertilization. Inoculation with *P. fluorescens* appears to be a promising tool for better rooting of cotton seedlings and reducing fertilization costs, and should be better explored to understand its benefits in field conditions, as well its effects on the productivity of this crop.



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sciforum-103653: Intraspecific variability in nematocidal response of *Arthrobotrys oligospora*, a natural enemy of plant-parasitic nematodes, and how it is affected by availability of prey.

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The nematophagous fungus *Arthrobotrys oligospora* (Leotiomyces: Heliales) has for a long time incited interest in its potential as a biological control agent of plant-parasitic nematodes in agriculture. However, efforts to materialise these aspirations have been hindered by inconsistent results. Many research papers on the subject deal with one particular strain of *A. oligospora*, but their conclusions are often assumed to be valid for the whole species. We hypothesize that one of the causes for the inconsistencies is that the natural variation in the nematocidal response between different strains of *A. oligospora*, as well as how prey availability in the experimental design can affect results, is often overlooked. In this work, we evaluate the in vitro nematocidal response of 11 strains of *A. oligospora* over the first 12 hours of contact with the model nematode *Panagrellus redivivus*. Strain INTA10 had significantly higher and faster nematocidal activity than the rest (LT₅₀ after 247 minutes, Mean=0.55 n=6 SD=0.24 Tukey post-hoc: F=13.20, p0.0001; LT₁₀₀ after 719 minutes, Mean=1 n=6 SD=0 Tukey post-hoc: F=18.29, p0.0001). Additionally, we studied how in vitro nematocidal activity is affected by the availability of prey, using strain INTA10 with four prey densities, 75, 25, 10, and 3 *P. redivivus*/cm², over the first 11 hours of contact. Although mortality over time curves followed a similar pattern across treatments, we found significant differences between them, with intermediate prey densities eliciting a faster response, and higher final mortalities. Our results stress the importance of evaluating *A. oligospora* as individual strains, show how different experimental designs can affect results, and highlight the risks of assuming that results obtained in one strain in certain particular conditions apply to the whole species.



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sciforum-103927: Isolation and characterization of a *Bacillus thuringiensis* strain with potential for epizootics in *Plodia interpunctella*

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Bacillus thuringiensis is a Gram-positive bacterium known for its insecticidal activity against various insect species, making it an excellent biocontrol agent. Although *B. thuringiensis* is regarded as an opportunistic entomopathogen due to the naturally low incidence of epizootics, certain strains, such as *B. thuringiensis* serovar *aizawai*, have shown the potential to induce epizootics in *Plodia interpunctella* (Lepidoptera: Pyralidae). In this study, we isolated the strain INTA L404-1 from the hemolymph of a dead *P. interpunctella* larva collected from artificial rearing at CEPAVE (La Plata, Argentina), where a high mortality rate was observed. DNA was extracted from the purified bacterium using a commercial kit, and Illumina sequencing was performed for strain identification. Nine insecticidal protein genes were identified, including *cry1Aa*, *cry1Ab*, *cry1Ca*, *cry1Da*, *cry1Ia*, *cry2Ab*, *cry9Ea*, *spp1Aa*, and *vip3Aa*, with amino acid sequence identities ranging from 80% to 100%. Additionally, the proteins from the genes, similar to *cry9Ec*, *mpp3Aa*, and *tpp80Aa*, exhibited sequence identities below 34%. These results suggest the potential of INTA L404-1 as a biocontrol agent. Bipyramidal crystals were observed in INTA L404-1, and an SDS-PAGE analysis of parasporal crystals revealed a unique *ca.* 130 kDa protein. This strain demonstrated significant insecticidal activity, causing 100% mortality in *Cydia pomonella* (Lepidoptera: Tortricidae) when incorporated into the larvae's diet. *B. thuringiensis* INTA L404-1 may induce epizootics in the artificial rearing of *P. interpunctella*, as evidenced by the observed spread of infection among pest offspring. To confirm this, it is necessary to assess the strain INTA L404-1 in bioassays with *P. interpunctella* to demonstrate that it causes mortality like that observed in the original host. The insecticidal protein gene profile of INTA L404-1 is comparable to that of other *B. thuringiensis* serovar *aizawai* strains.



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sciforum-106768: Mitigating water stress impacts on corn plants using microbial-based biostimulants and organic amendments

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Water stress is one of the main factors limiting crop productivity in arid and semi-arid Mediterranean regions. The aim of this study is to assess the effect of using organic amendments (C) alone or combined with biostimulants based on arbuscular mycorrhizal fungi (F) and plant growth-promoting bacteria (B) on *Zea mays* L. in alleviating the effects of water stress. Two factors were studied in this work: the water regime (25% and 75% of field capacity) and the single, double and triple application of F, B and C. Shoot and root dry biomass, osmolyte content (proline and total soluble sugars), antioxidant system (Polyphenol oxidase), stress marker content (malondialdehyde and hydrogen peroxide) and mycorrhization intensity and frequency were assessed. The results showed that drought stress negatively affected plant biomass, biochemistry, and root colonization by arbuscular mycorrhizal fungi. In addition, combined applications, particularly mycorrhizae and compost, improved shoot and root dry biomass by 179 and 275%, respectively, compared with untreated drought-stressed plants. Mycorrhization intensity and frequency were higher when the soil contained plant growth-promoting bacteria and reduced when amended with compost alone under water stress. The single or combined application of F, B and C enhanced proline and total soluble sugar content and polyphenol oxidase activity in leaves in comparison with untreated plants. On the other hand, malondialdehyde and hydrogen peroxide content were minimized (67% and 18%, respectively) by applying the triple combination of F, B and C. In conclusion, the strategy of combining organic amendments and microbial-based biostimulants may offer an environmentally friendly solution in arid and semi-arid regions where soils are degraded to provide drought protection for corn crops.



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sciforum-106937: Nanoengineered Plant Protection: *Cercospora beticola* Control in Sugar Beet with Encapsulated Phytoextracts

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Nanotechnology offers promising applications in agriculture, aiming 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. Recently, NCs have been proposed as a key technology for applying agrochemicals via unmanned aerial vehicles (UAVs). This study presents the results of using chitosan-based NCs to deliver and release natural compounds in a controlled manner, specifically extracts of *Rubia tinctorum* and *Uncaria tomentosa*, for the effective and sustainable control of phytopathogens in horticultural crops. The efficacy of NC-based treatments was demonstrated in vitro and ex situ against horticultural pathogens *Botrytis cinerea*, *Cercospora beticola*, *Rhizoctonia solani*, and *Sclerotinia sclerotiorum*. Mycelial growth inhibition values ranged from 187.5 to 375 µg/mL for NCs loaded with *R. tinctorum* extracts and 187.5–500 µg/mL for those with *U. tomentosa* extracts. Complete plant protection of artificially inoculated sugar beet and carrot plants was achieved at doses ranging from 187.5 to 500 µg/mL, depending on the pathogen. Field tests conducted on sugar beet during the 2024 growing season yielded promising results for *Cercospora beticola* control. The absence of phytotoxicity and clogging problems during spray application represents a significant step towards optimizing the UAV field application of these treatments.



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sciforum-106964: Plant metabolite role in developing abiotic stress resilience in plants: Evaluating the Effects of Melatonin and Myoinositol on the photosynthetic efficiency of apple rootstocks in the western Himalayan region.

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Abiotic stress, primarily drought, is a major threat to crop production and food security. Plant metabolites like melatonin and myoinositol enhance stress resistance, improve growth, and promote sustainability without harming biodiversity or human health. Apple farming is crucial to the Himalayan region's economy in India. Despite using High-Density Planting (HDP) with dwarf rootstocks for better yields, these rootstocks are still sensitive to drought, impacting fruit quality and production. To address these challenges, the experiment applied exogenous melatonin (100 μ M) and myoinositol (20 μ M, 50 μ M, 100 μ M, 150 μ M, 200 μ M) to determine optimal doses for biochemical, morphological, and molecular studies. Five apple rootstocks were grown under polycarbonate conditions at 100% and 50% field capacities. Five treatment combinations were tested at 50% F.C., with one control at 100% F.C. Data were collected on the 5th, 10th, and 15th days of drought. The best treatment was melatonin (100 μ M) + myoinositol (150 μ M) (T4) at 50% F.C., showing the highest net photosynthetic rate (Pn), transpiration rate (Tr), stomatal conductance (Gs) and intercellular CO₂ (Ci) at the 5th, 10th and 15th day of drought for rootstock M111 (15.55, 14.44, 12.65 Pn), (0.21, 0.18, 0.16 Gs), (267, 278, 287 Ci), M106 (12.81, 11.96, 10.86 Pn), (0.17, 0.15, 0.14 Gs), (280, 298, 310 Ci), M9 (10.45, 9.87, 8.56 Pn), (0.17, 0.15, 0.13 Gs), (327, 332, 339 Ci), Bud 118 (16.78, 14.15, 13.98 Pn), (.26, .24, .23 Gs), (279, 282, 287 Ci), and M116 (13.23, 12.55, 11.53 Pn), (.21, .19, .18 Gs), (299, 308, 318 Ci). Hence, the best treatment combination effectively counteracts drought-related photosynthesis inhibition.



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sciforum-107029: Synergistic effect of Lead-Resistant Bacteria and *Lysinibacillus fusiformis* US3 biostimulant in ecorestoration of lead-stressed soil

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Lead pollution poses a formidable threat to agriculture, bioaccumulating in crops and ultimately harming human health. Even low-level exposure can significantly reduce crop yields, diminish their nutritional value, and precipitate economic losses and food insecurity. To combat this threat, we investigated the efficacy of a novel biostimulant, *Lysinibacillus fusiformis* US3, which was previously isolated from the rhizosphere of a plant with enhanced plant growth attributes to promote ecorestoration of a lead-remediated soil. Four lead-resistant bacterial (LRB) strains, *Bacillus infantis* K66, *Halopseudomonas xiamenensis* B13, *Lysinibacillus fusiformis* KAF67, and *Pseudomonas* spp. A27, harbouring the gene cluster *PbrABCT* were employed in the treatment of lead-contaminated soil. The treatment efficacy was remarkable, with final lead removal percentages of 85%, 82%, 83%, and 83%, respectively, while the control achieved a 41% removal rate. To achieve ecorestoration and facilitate the agricultural reuse of soil, maize seeds from the Agricultural Development Program, Nigeria, were planted in the treated soil, and 10% w/v of the US3 biostimulant was introduced as liquid culture into the pots except in the control pot. The inoculum concentration was determined according to the McFarland standard and plant growth parameters such as shoot length, root length, and fresh and dry root weight, which were monitored for 28 days under greenhouse conditions. The post-cultivation analysis revealed enhanced plant growth and biomass yield in US3-inoculated pots; a 48% lead uptake by the maize in control pots, while lead was not detected in the inoculated pots; and 53% residual lead in the control soil, while lead was not detected in the inoculated soil. The synergistic application of lead-resistant bacteria and the US3 biostimulant effectively ecorestored lead-stressed soil, demonstrating a promising approach for sustainable lead mitigation. This study highlights the potential of microbial solutions for environmental remediation and agricultural sustainability.



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sciforum-103802: The role of *Opuntia ficus-indica* in mitigating climate change impacts on vineyards: a physiological and molecular approach

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Grapevine (*Vitis vinifera* L.) is one of the most widely cultivated species globally, due to its role in the wine industry. Production loss in vineyards is partly due to the high radiation levels associated with extreme temperatures. To mitigate this problem, various techniques have been adopted to enhance plant resilience, such as the application of natural substances. These substances are compounds, microorganisms or an amalgamation of both that, when applied to plants, could improve tolerance under environmental stresses and increase nutrient uptake and plant growth, without being classified as pesticides or fertilizers.

The application of natural substances derived from cactus species to agricultural crops has proven effective in increasing tolerance to both biotic and abiotic stress. In this study, an aqueous extract prepared from the cladodes of prickly pear (*Opuntia ficus-indica*) was applied to *V. vinifera* cv. 'Aragonês' plants under heat stress (42°C) to explore its potential for protecting vines from heat stress. The effect of extract application was assessed by measuring various physiological parameters (stomatal conductance, relative water content, chlorophyll content, water potential and leaf temperature) and by analysing the whole proteome profile through the two-dimensional electrophoresis technique. Parameters were evaluated in leaves collected prior to extract application, and at 2, 7 and 15 days post-application.

The analysis of physiological parameters did not indicate a positive effect of the extract application in mitigating the effects of heat stress in grapevine. The protein spots detected as differentially expressed between vines submitted to heat stress with and without application of the extract suggest a probable involvement of proteins related to abiotic stress response, revealing an effect of *Opuntia ficus-indica* extract on grapevines. To our knowledge, this study is the first to employ *Opuntia ficus-indica* extract as a natural substance to mitigate sunburn effects on grapevines, providing strategies for future field applications.



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sciforum-104518: Understanding the role of vermicompost microbial diversity in agriculture

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Soils act as a major reservoir of microbes belonging to different groups, namely bacteria, fungi, and actinomycetes. Organic matter decomposed by microbial diversity play a significant role in the growth development and yield of plants. Earthworm, which is well known as a farmer's friend, has a great symbiotic relationship with the microbial flora present in the soil. The presence of earthworms in the soil influences the microbial community and density, which helps in accelerating and improving soil fertility. Microbes, together with earthworms, are more effective in mineralising and humifying organic matter, which is further responsible for a highly fertile soil. A clear picture about the actual microbial diversity in vermicompost is yet to be uncovered. Deciphering the native microflora of vermicompost and its specific role in the productivity of crop plants could be the enticing phenomenon. This work was started to figure out the major microbial diversity involved in vermicomposting compared with natural compost and simple soil microflora. The isolation of some specific microbes has been done through plate culture technique. Enumeration, comparative colony phenotyping, and microscopic studies were carried out. The present work provides strong evidence about the involvement of some specific bacteria/microflora with unique characteristics in the process of the decomposition of organic waste during the vermicomposting mechanism. Furthermore, work will be carried forward for the biochemical and genomic analysis of the microbial isolates followed by determining their role in enhancing the productivity of crop plants.



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Session 6. Plant–Crop Biology and Biochemistry

sciforum-103394: Activités antioxydantes et anti-inflammatoires in vitro d'extraits bruts et criblage phytochimique actif de noyaux de palmier dattier (*Phoenix dactylifera* L.)

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Date seeds, considered a major waste product of the date industry, represent a valuable economic resource. Currently, they are often discarded or used as animal feed, despite their rich chemical composition, including high levels of phenolic compounds, flavonoids, and antioxidants. This study aimed to evaluate the phytoconstituents present in the extract of *Phoenix dactylifera* L. (*Takerboucht*) seeds for their antioxidant and anti-inflammatory properties.

The seeds were extracted using the Soxhlet method with a polar solvent mixture, then subjected to antioxidant tests (DPPH and ABTS). The phytochemical composition of the extract was also determined. The anti-inflammatory activity in vitro was evaluated using the denaturation test on bovine serum albumin (BSA), with diclofenac as the standard.

The crude extract exhibited strong antioxidant activity, with an IC₅₀ value of 2.7 µg/ml for DPPH, comparable to the standards BHT and BHA. This correlated with the phytochemical analysis, which revealed the presence of tannins, flavonoids, terpenoids, phenols, and saponins. Regarding anti-denaturation activity, the crude extract inhibited BSA by 92.05% at the highest concentration.

These findings suggest that date by-products, particularly seeds, are a promising source of phenolic compounds with antioxidant activity. They could serve as cost-effective natural antioxidants for food and non-food applications and provide an alternative remedy for managing inflammatory disorders.



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sciforum-103760: Comparative anatomical and biochemical studies of in vitro and in vivo plants of ginger

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In vitro propagation offers disease-free material in ginger (*Zingiber officinale* Rosc.), a plant of significant medicinal and commercial value. This study aims to investigate the anatomical and biochemical characteristics of in vitro and in vivo plants of ginger. Fifty-day-old in vitro (developed from tissue culture lab maintained at $25 \pm 2^\circ\text{C}$ and 90-92% RH over 14 h photoperiod at 3000 lx) and in vivo plants (pro-tray plants grown in polyhouse maintained at $25 \pm 2^\circ\text{C}$ and 60-70% RH) of the ginger variety IISR Varada were taken to be studied at the ICAR–Indian Institute of Spices Research, Kerala, India. Transverse sections of leaves, the pseudo-stem, and the rhizomes of the in vitro and in vivo ginger plants were taken and visualized under light microscopy. In vitro and in vivo ginger possess similar leaf structures but differ in their spongy parenchyma thickness, the number of stomata, oil cells, and air canals, and their vascular bundle distribution. The in vitro pseudo-stems had a closely bound leaf sheath and epidermis unlike their in vivo counterparts. Rhizome analysis revealed larger vascular bundles in the in vivo ginger (normal rhizomes produced at farm) and higher starch and sugar content in the in vitro rhizomes (micro-rhizomes developed at tissue culture lab). Biochemical analysis revealed that the total chlorophyll and carotenoid content was significantly higher in the in vivo ginger (1.1989 mg/g and 67.24 mg/g) compared to the in vitro ginger (0.7173 mg/g and 50.87 mg/g, respectively). Furthermore, the enzyme activities of peroxidase (0.063 mg/g), catalase (108.248 U/g), and superoxide dismutase (0.367 U/g); the starch content (22.84%); and the total soluble sugars (0.093%) were higher in the in vitro ginger plants. Hence, the anatomical and biochemical variations observed in the different parts of the in vitro and in vivo ginger plants may be due to the differences in the growing conditions and the media used in the in vitro conditions.



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sciforum-107078: Gene expression and microbial interactions in *Plantago* spp under salt stress

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Salinity is considered the most limiting abiotic stress affecting both ecosystems and global agriculture by hampering plant growth and development, thus seriously limiting plant productivity and survival. Therefore, investigating the response to salt stress in plants is pivotal to understanding how ecosystems will face the effects of climate change. Salt stress is a very likely event in coastal ecosystems. The Mediterranean coastal ecosystems, such as salt marshes, host valuable plant species with heterogeneous degrees of tolerance to salt. La Albufera Natural Park in Valencia, Spain, is home to several species of *Plantago* known for their ability to withstand salt stress, such as *P. coronopus* and *P. crassifolia*, which are more tolerant than species like *P. lanceolata* or *P. major*. Moreover, some *Plantago* species are known to host diverse microbial endophyte species with potential beneficial effects.

The main objective of this research is to understand the molecular dynamics of salt stress gene expression when exposing *Plantago* species with different ecological strategies (glycophyte or halophyte) to 400 mM NaCl salt stress. Additionally, we will investigate the potential role of local soil microbiota on the plants' response. RNA expression of salt-tolerant genes will be quantified at times 0, 2, 4, 8, 24 h, and when plants start to wilt. Morphological, physiological, and molecular stress markers will be recorded for each plant.

We found a heterogeneous response of the biochemical markers of stress depending on the treatment or the *Plantago* species. Moreover, we found several fungal endophytes associated with the roots and leaves from wild *P. crassifolia*. We further discuss the different levels of gene expression.



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sciforum-103746: Hilling promotes flooding stress recovery by prompting photosynthesis resumption and biomass gain in tomato plants

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The ability of tomato plants to withstand flooding depends on how quickly they recover after the stress ends. Flooding causes damage to the plants' primary roots and replacing the damaged root system with new roots after the floodwaters recede is crucial. We looked at how promoting the growth of new roots through hilling affects growth and photosynthesis resumption in tomato plants after flooding. After a period of partial submersion, we drained the water and allowed plants to recover with or without hilling treatment. Hilling treatment consisted of applying moistened soil to the base of a group of plants immediately after water drainage to prevent new roots from drying out. Another group of plants was left with their stems exposed to the air. Control plants were kept under the same conditions but were watered regularly. We measured various parameters, including biomass allocation, nitrogen concentration in leaves, transpiration rate, stomatal conductance, net CO₂ assimilation rate, intercellular CO₂ concentration, and chlorophyll fluorescence, throughout the post-flooding period in control, hilled, and non-hilled plants over a six-day recovery period. Flooding stress significantly reduced plant biomass, but root growth resumed faster in hilled plants, reaching normal levels three days after the stress. Nitrogen content in leaves also recovered more quickly in hilled plants, showing that their root absorbing capacity resumed faster. Additionally, leaf gas exchange, carbon assimilation, and photochemical efficiency were restored in a shorter time in hilled plants. Our findings suggest that promoting root regeneration is crucial to aid recovery from flooding in tomato plants, as promoting stem-borne new root growth speeds up photosynthesis and biomass gain.



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sciforum-107089: Intra- and Intermolecular Coevolution of Plant Ion Homeostasis and Compartmentalisation Proteins

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The coevolution process has shaped the diversity and complexity of life on Earth. Coevolution involves the interaction between two entities in a highly specific process because selective pressures in one of the entities drive the evolution of the other. Moreover, coevolution is reciprocal and simultaneous, as evolution occurs in both entities at the same time. At the molecular level, molecular coevolution occurs in systems where molecules interact closely (e.g., enzymes and their substrates, proteins and their binding partners, transcription factors and their specific binding motifs on DNA, etc.). Many factors play a pivotal role in shaping molecular coevolution, such as drift intensities, selection, and mutation rates. Intramolecular coevolution occurs between sites within a single molecule, while intermolecular coevolution takes place between sites of two interacting molecules. Identifying coevolving sites is crucial for understanding protein-protein interactions, drug resistance, the evolutionary arms races between hosts and pathogens, and for enhancing molecular activity.

Plant response mechanisms to salinity stress are diverse and complex. Among them, those involved in ion homeostasis and compartmentalisation play a key role in isolating and eliminating toxic ions. The main strategies are the expression of Salt Overly Sensitive (SOS) genes, the High-Affinity Potassium Transporters (HKTs), the Na^+/H^+ Antiporter (NHX), and the proton pumps. The aim of this work is, first, to identify coevolving amino acids within these proteins and, second, to find if there exist any coevolving sites between them. We used CAPS, a software to identify co-evolution between amino acid sites by measuring the correlated evolutionary variation at those sites, which further removes the phylogenetic and stochastic dependencies between sites. The software uses a reference sequence for which the 3D protein structure is available. NHX1, SOS1, SOS2, and HKT1 were analysed, and we found pairs of sites under strong intramolecular co-evolution as well as intermolecular interactions.



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sciforum-107018: Post-Harvest Sweet Pepper Plants as a Potential Source of Antioxidant and Antidiabetic Ingredients for Food and Dietary Supplements

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Oxidative stress plays a pivotal role in the onset and progression of chronic and metabolic diseases, including diabetes, obesity, and cancer, due to the excessive production of reactive oxygen species, which cause damage to essential biomolecules and impair critical cellular functions [1]. Antioxidants such as polyphenols can mitigate or delay this damage, driving growing interest in the use of polyphenol-rich extracts as natural functional food ingredients. Notably, polyphenols can be obtained from the massive amounts of undervalued plant biomass generated after crop harvesting [2]. Therefore, this study was carried out to valorize sweet pepper (*Capsicum annuum* L.) agricultural by-products as a source of bioactive polyphenols, in line with United Nations' 2030 Sustainable Development Goals. Hydroethanolic extracts were prepared from these plant by-products [2], and their phenolic profile was characterized using HPLC-DAD-ESI/MS. Additionally, the extracts' antioxidant, antidiabetic, anti-obesity, anti-inflammatory, and cytotoxic properties were assessed through *in vitro* cell-based and enzyme inhibition assays. Chromatographic analysis revealed a phenolic profile consisting mainly of phenolic acids, such as chlorogenic acid, and *O*-glycosylated flavones, specifically luteolin and apigenin. The extracts showed notable antioxidant and anti-diabetic properties, along with cytotoxicity against certain tumor cell lines. In conclusion, sweet pepper crop by-products are a promising source of bioactive compounds that can provide functional properties to foods and related products. Furthermore, this approach to resource circularity is crucial for promoting sustainable production and consumption patterns, contributing to a more eco-friendly and efficient use of agricultural resources. However, ensuring that the final products are free from pesticide residues and other contaminants will be essential for guaranteeing food safety.



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sciforum-107095: Allelopathy and plant gene expressions under Climate Change and Arid Conditions in Africa: A Systematic Review

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Climate change, marked by rising temperatures and fluctuating precipitation, threatens agricultural systems globally, with arid regions in Africa being particularly vulnerable. Climate change has significant implications for the biology and biochemistry of plants and crops, which impacts the allelopathic interactions between crops and weeds. Allelopathy is a potential natural solution for enhancing crop resilience and weed management. This systematic review explores the intersection of plant–crop biology, biochemistry, and allelopathy under climate change conditions, emphasizing species-specific responses and the effects of temperature and precipitation changes. Species such as sorghum, millet, and invasive weeds like *Striga* respond to allelopathy when subjected to drought and heat stress, with some plants showing enhanced allelopathic activity as a defense mechanism. This study evaluates how these gene expression changes can be harnessed in agronomic practices to improve crop performance and sustainability. For example, breeding programs could integrate allelopathic traits with drought tolerance, leading to the development of plant varieties that are naturally competitive against weeds and resilient to water scarcity. Such strategies could reduce the dependence on chemical herbicides, promote sustainable agriculture, and enhance food security in arid African regions. This systematic review compares how different crops and weeds, particularly those found in arid African environments, respond to climate-induced stress. The paper concludes by discussing the potential benefits for African agriculture, particularly in terms of yield stability, environmental sustainability, and resource conservation. This integration of allelopathic gene expression with agronomic practices offers a promising avenue for mitigating the impacts of climate change while promoting agriculture in arid regions of Africa.



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sciforum-103598: An in silico approach for the comparative characterization of imidazolonepropionase from *Agrobacterium fabrum* and *Bacillus subtilis*: an imperative enzyme for histidine degradation

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Introduction

The third step in histidine degradation is catalysed by imidazolonepropionase. It catalyses the conversion of 4-imidazolone-5-propionic acid to produce N-formimino-L-glutamic acid by hydrolyzing carbon–nitrogen bonds. The histidine is a very expensive amino acid inside the cell and its degradation is a very conserved process. To date, very few reports exist regarding the structure of bacterial imidazolonepropionase, but no reports have been published regarding the comparative structure and sequence analysis of this enzyme from bacterial sources.

Methods

An in silico study has been conducted to characterize imidazolonepropionase from gram-positive *Bacillus subtilis* and gram-negative *Agrobacterium fabrum*.

Results

The sequence analysis revealed that more charged residues are present in *Bacillus subtilis*. These charged residues help in the increment of the polarity and hydrophilicity of *Bacillus subtilis*. The formation of intra-protein interactions was also high in gram-positive species. Interestingly, both species have an almost equal abundance of aromatic amino acids in their sequences, but the formation of aromatic–aromatic interactions was high in *Bacillus subtilis*. Finally, the molecular dynamics simulation study revealed that imidazolonepropionase from *Bacillus subtilis* was more stable and compact than *Agrobacterium fabrum*.

Conclusion

The imidazolonepropionase from *Bacillus subtilis* was more stable than *Agrobacterium fabrum*. Due to the presence of higher stable imidazolonepropionase in *Bacillus subtilis*, it can use histidine more efficiently.



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sciforum-103635: Antioxidant enzymatic activity of extracts from hairy roots of root lesion nematode-susceptible and -resistant *Medicago sativa*

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Diseases caused by plant parasitic nematodes (PPNs) are still a heavy constraint on modern farming. They can cause losses in crop yield and increase production costs, mainly due to pest management activities. The root lesion nematodes (RLNs), *Pratylenchus* (Nematoda: Pratylenchidae), are soil-dwelling migratory endoparasites that infect the roots of many crop species. Affected plants develop necrotic spots where the RLNs feed and reproduce in the cortical cells. Injury to plant tissue results in weakened plants that become more prone to attack from opportunistic pathogenic microorganisms. In alfalfa, (*Medicago sativa* L.), resistance to *Pratylenchus penetrans* has been linked to an increase in transcripts of key enzymes in the biosynthesis of isoflavonoid phytoalexins; however, the mechanisms of resistance are still unknown. The present work analyzed the activity of antioxidant enzymes of extracts from transgenic roots of susceptible (cv. Baker) and resistant (cv. MNGRN-16) alfalfa. Transgenic roots were obtained after infection of aseptic germinants with *Rhizobium rhizogenes* and maintained in Schenk and Hildebrandt culture medium. The activity of guaiacol peroxidase (GPX) was ca. 3x higher on extracts of susceptible alfalfa in comparison with those of resistant alfalfa transgenic roots. This suggests that resistance response is not solely dependent on the antioxidant enzymatic activity of GPX. Future work will focus on the metabolomic characterization of these varieties in contact with the RLN.



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sciforum-100445: Antioxidant Potential and Analysis of Phytochemical Compounds of Algerian Medicinal Plants

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Medicinal plants constitute an inexhaustible reservoir of the most effective folk remedies thanks to the valuable bioactive compounds they contain. The present work is based on the phytochemical study and the dosage of some phenolic compounds (flavonoids, polyphenols) as well as the evaluation of the antioxidant activity (anti-radical activity DPPH, anti-radical activity ABTS) of the three Saharan and Mediterranean plants *Matricaria pubescens*, *Salvia verbenaca* and *Santolina africana*. They are used in traditional Algerian medicine. The phytochemical screening made it possible to highlight the presence of flavonoids and tannins in all the extracts of the three plants. These compounds are well known for their beneficial health properties, particularly due to their anti-inflammatory, antimicrobial and antioxidant effects. The total phenolic and flavonoid contents were estimated using the Folin-Ciocalteu reagent and the aluminum chloride reagent respectively. The antioxidant and free radical scavenging activity was determined by several standard methods using a spectrophotometer (DPPH• anti-radical activity, ABTS•+ anti-radical activity). Evaluation of the content of phenolic compounds shows the richness of *S.verbanaca* in flavonoids and polyphenols with contents 25.17 ± 0.02 mg EQ/g of extract, 72.80 ± 0.02 mg EAG/g of extract respectively. The results of this study highlight the importance of phenolic compounds, in particular flavonoids, in the antioxidant properties of the Saharan and Mediterranean plants studied. *Salvia verbenaca*, with its high levels of flavonoids and polyphenols, stands out particularly for its high antioxidant potential. Statistical analysis reveals the existence of a correlation between the content of antioxidants (flavonoids, polyphenols) and antioxidant activity. These results confirm the traditional use of these plants in Algerian folk medicine and suggest their potential for the development of new natural therapeutics based on their bioactive extracts.



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sciforum-103654: Assessing the Impact of Mulching techniques on Broccoli (*Brassica oleracea* var. *italica*) Growth and productivity: A Comparative Analysis

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Broccoli (*Brassica oleracea* var. *italica*) is a commonly grown vegetable valued for both its economic and nutritional value. Sustainable farming methods, which maximize productivity while reducing environmental effects, have gained popularity in recent years. A field study was carried out to evaluate the effects of locally accessible mulching materials on the growth and yield of broccoli in comparison to black plastic mulch, straw mulch, and no mulch. Three treatments (T₀: no mulch; T₁: black plastic mulch; and T₂: straw mulch) and five replications made up the Randomized Complete Block Design (RCBD) of the field layout. All growth and yield parameters showed significant differences, with the exception of stem diameter and chlorophyll. Treatment T₂ lead to the highest plant height (25.6cm), head diameter (15.8cm), leaf area breadth (17.7cm), head dry weight (140.24g), and stem diameter (3cm,) seen in the study. In Treatment T₁, the following parameters reached their maximum: the number of leaves, head fresh weight, root fresh weight, root dry weight, and root length. All other parameters had minimal values in Treatment T₀, with the exception of head fresh weight. All things considered, the control treatment performed the worst. The results of this experiment indicate that black plastic mulch is the best mulch in terms of broccoli growth and productivity.



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sciforum-103259: Biochemical and Phytochemical Response of two Mediterranean Aromatic Species (Lamiaceae) to Abiotic Stress Conditions

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One significant challenge that plants, including those used in medicine and aromatics, face is their capacity to survive in unfavorable climatic conditions, particularly those associated with climate change. The main goal of this study was to assess the influence of temperature (15 and 30 °C for a period of two weeks) and UV-B radiation (4 hours per day and 4 hours every four days) on the biochemical and phytochemical responses of *Lavandula viridis* L'Hér and *Thymus lotocephalus* López and Morales. Following exposure to stress conditions, an evaluation was conducted of the photosynthetic pigments, oxidative stress level (H₂O₂ and MDA contents), soluble sugars, and phenolic profile and associated antioxidant activity. Plants cultivated under standard non-stressful conditions served as the control group. It was observed that both temperature treatments resulted in the highest oxidative stress in the plants, as evidenced by the H₂O₂ and MDA concentrations, which had a direct negative impact on the total chlorophylls and carotenoids. The data demonstrate that soluble sugars, phenolic compounds, and the related antioxidant activity play an important role in protecting both species from the oxidative stress caused by temperature and UV-B treatments. The highest content of the major phenolic compound of both species, rosmarinic acid, was produced in *L. viridis* exposed to 30 °C (68.9 g/kg, representing a 68% increase over the control) and in *T. lotocephalus* following exposure to UV-B radiation for 4 h/4 days (26.6 g/kg, representing a 9.1% increase over the control). The findings of this study provide new insights into the responses of soluble sugars and phenolic compounds to unfavorable environmental conditions in *L. viridis* and *T. lotocephalus* plants. Furthermore, the findings contribute to the development of appropriate cultivation techniques for these plants, which may be employed for industrial or other purposes.



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sciforum-099954: Biomonitoring lanthanum in tree bark samples from urban and rural areas across Leicestershire (UK)

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Background

The presence of lanthanum (La) in Leicestershire's (UK) topsoils and wild edible mushrooms exceeded the established soil screening level and could contribute to the maximum level of intake of lanthanides for vegetables. Tree bark was used to gain a better understanding of the environmental presence of this metal.

Methods

Bark samples (thickness of 2–6 mm) were collected from 96 trees from Leicester (n=55) and surrounding rural/suburban areas (41) at 1.50–1.80 metres from the ground to limit contamination from topsoil/dust. La was monitored by ICP-MS in cleaned/ground/homogenised samples mineralised with HNO₃/H₂O₂ [LoD=0.00068 ng/g dry weight (dw)]. The results were compared with previous studies performed on 106 mushrooms and 850 topsoils collected in the same areas.

Results

Higher levels were found in bark samples collected in the urban area (median and ranges, in ng/g dw): 9.679 (2.128–150.769) vs. 8.344 (1.815–59.801), which is in line with our previous observations performed on wild mushrooms and topsoils. Thus, our results could suggest a higher presence of sources of La in urban areas, attributed to the technological uses of this metal, for example, in catalytic converters and phosphors. The content of La varied between bark samples collected across the four cardinal subareas in which Leicester city was divided (median values, in ng/g): 38.664 (SE) > 17.104 (SW) > 9.128 (NE) > 6.707 (NW). A similar pattern was detected in mushrooms and topsoils, although higher levels were found in the southwest quadrant for both samples, respectively (1.286 and 19.621; both in µg/g).

Conclusions

The presence of La in Leicestershire could be related to traffic volumes, which are much higher in the city. In general, this presence is estimated to be similar or lower to those described in similar studies, *e.g.*, in oak tree bark from Genoa, Italy (0.1–1.7 µg/g), which might indicate a lower airborne contamination by La in Leicester.



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sciforum-099991: Biomonitoring the heavy rare-earth element ytterbium in tree bark samples across Leicester, England

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Background

Although the presence of ytterbium (Yb) in topsoils from Leicester city (UK) could represent some risks for the population, consuming wild edible mushrooms species would not represent a risk. The aim of this study was to elucidate past air contamination with Yb using tree bark.

Methods

Thin layers of bark were collected from 96 trees in Leicester (n=55) and surrounding rural/suburban areas (41) at 1.50–1.80 metres from the ground. Yb was monitored by ICP-MS in cleaned/ground/homogenised samples mineralised with HNO₃/H₂O₂ [LoD=0.075 ng/g dry weight (dw)].

Results

The levels of Yb in the tree bark samples were similar when comparing both main areas, i.e., urban versus rural (median and ranges, in ng/g dw): 1.205 (0.375–12.146) vs. 1.206 (0.672–4.731). However, some samples collected from trees monitored across the urban area showed the highest content of Yb. The trees that grow in these locations might indicate areas of pollution within the city, which should be further investigated for levels of atmospheric particulate matter and their Yb composition. These results correlate with previous studies performed on 106 wild mushrooms and 850 topsoils collected from the same areas; thus, although the levels of Yb were slightly higher in mushrooms and topsoils collected in the rural areas, these were non-significant (p-value=0.723), suggesting similar potential sources of Yb throughout Leicestershire. Levels were slightly higher than the range reported in bark samples from *Pinus ponderosa* trees growing in an area with an inactive open-pit uranium mine in eastern Washington (US; 0.37–3.85 ng/g dw), suggesting some atmospheric contamination of Yb in Leicester city and surrounding areas.

Conclusions

Although Yb is described as having low toxicity, the levels found in the trees monitored suggest some anthropic pollution of Yb in Leicester city that should be further investigated to identify potential risks to human health.



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sciforum-104068: Comparison of osmotic stress tolerance in two durum wheat (*Triticum durum* Desf) cultivars during germination

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Drought represents a significant abiotic stress affecting crops, particularly cereals, with severe impacts in arid and semi-arid regions. To mitigate the effects of rainfall deficiency and a poor spatio-temporal rainfall distribution, it is crucial to manage available water resources efficiently and utilize drought-tolerant plant varieties.

This study aimed to compare the impact of osmotic water stress, induced by polyethylene glycol (PEG₆₀₀₀), on the germination of two durum wheat (*Triticum durum* Desf) cultivars: Mohamed Ben Bachir and Oued El Bared. Two concentrations of PEG₆₀₀₀ (10% and 20%) corresponding to osmotic potentials of -1.37 bars and -4.64 bars, respectively, were employed to evaluate the tolerance of these varieties to water stress. The seeds were germinated at 25°C in the dark for seven days.

The results showed that osmotic water stress significantly reduced the germination parameters (germination rate and speed, germination index, and vitality index) and the initial growth parameters (fresh biomass, seedling length, roots, and coleoptiles) for both varieties, with variations in tolerance depending on the stress intensity. At a moderate concentration of PEG₆₀₀₀ (10%), both varieties showed a similar reduction in their germination and growth parameters. However, at a higher concentration of PEG₆₀₀₀ (20%), the Oued El Bared variety exhibited a more marked reduction in the parameters studied, indicating greater sensitivity compared to the Mohamed Ben Bachir variety, which demonstrated greater tolerance to severe water stress.

In conclusion, the durum wheat variety Mohamed Ben Bachir shows remarkable tolerance to severe osmotic stress, whereas the Oued El Bared variety is particularly sensitive. These findings highlight the importance of selecting varieties adapted to water stress conditions to optimize cereal production in drought-prone areas.



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sciforum-103729: Effect of drought on germination and seedling of *Vigna radiata* L.

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In Algeria, agricultural production is severely limited by several abiotic constraints, the main one being drought. In light of this limiting factor, any attempt to improve and select criteria involved in plant adaptation to water deficit becomes essential. Germination is the most critical stage in the plant life cycle. This process is the basis of plant success and development, and determines uniformity and crop stand density. Successful germination establishes the seedling, which is crucial for the plant's survival and future growth. The aim of the present work is to study the effect of osmotic and water stress on two crucial developmental stages of *Vigna radiata*.

Osmotic stress at the germination stage was induced by increasing concentrations of polyethylene glycol (PEG₆₀₀₀) (0, -0.50, -10.27, -13.68, and -17.57bars), while water stress was applied at the seedling stage. All pots were normally watered for three weeks before the application of drought stress, at which point watering ceased.

The results showed that *Vigna radiata* had a high germination ability, with the germination rate exceeding 90% under an osmotic potential of -10.75 bar, indicating that mung bean seeds are resistant to water deficiency. However, germination was inhibited at -17.57 bar. Applying water stress to seedlings resulted in a gradual decrease in relative water content, accompanied by a slowdown in stem length and leaves number. The root dry biomass/stem dry biomass ratio and root fresh biomass/stem fresh biomass ratio increased in stressed seedlings, indicating that resources were allocated to root elongation at the expense of stem growth in stressed leaves.

The germination of mung bean seeds shows strong resistance to water deficiency, which is a major advantage for the establishment of this species under unfavorable conditions. Water stress leads to morphological changes from the first week of drought stress application.



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sciforum-106910: Effect of drought stress on different organs of Pineapple using destructive and non-destructive indicators

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Plants of *Ananas comosus* (cultivar Smooth Cayenne) were grown in pots filled with a commercial substrate and exposed to different water content treatments: 100% field capacity (FC), 50% FC, and 25% FC. The experiment was conducted under controlled greenhouse conditions for three months. Every month, relative water content (RWC), NDVI, proteolytic activity (PA), and protein content (PC) were measured in the "D" leaves. Additionally, proteolytic activity and protein content were measured monthly in the stem and leaves. RWC showed no significant differences during the first month. However, by the second month, the 50% and 100% FC treatments had significantly higher values than the 25% FC treatment. By the third month, all three treatments were statistically different, with the 100% FC treatment having the highest RWC. In the first month, the 100% treatment showed statically higher NDVI values than the 50% and 25% FC treatments. By the second and third months, the three treatments were statistically different, with average NDVI values of 0.57, 0.67, and 0.72 for the 25%, 50%, and 100% FC treatments, respectively. PA and PC increased in both the leaves and stems as drought stress intensified, with a significant increase from 100% to 25% FC over the course of the experiment. The non-destructive indicator (NDVI) showed differences in the first month, while the destructive indicators (RWC, PA, and PC) in both organs exhibited statistical differences by the second month of the experiment. The NDVI proved to be a highly sensitive indicator of drought stress in pineapple plants and did not require the destruction of the plant.



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sciforum-106097: Effects of Fertilization on Phenolic and Glucosinolate Levels in *Diplotaxis Tenuifolia* (L.) Dc Hybrid Venere

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Diplotaxis tenuifolia (L.) DC, known as wild rocket, is a perennial herb that features the hybrid Venere, which offers enhanced resilience to lower temperatures, and improved flavor and texture. Rich in phenolics, and glucosinolates (GLSs), this variety is highly valued for its peppery, nutty leaves, making it a popular choice in gastronomy. This study aimed to assess the impact of the biostimulant Kelpak, along with iron and potassium-enriched foliar fertilizers, on the levels of phenolics and GLSs in the leaves of this hybrid, compared to an untreated control group. To achieve this, twenty-three plant phenolics and four glucosinolates were quantified in 70% methanol extracts using an ultra-high-performance liquid chromatography (UHPLC) system coupled with quadrupole time-of-flight mass spectrometry (Q-ToF-MS). The results revealed that quercetin derivatives were the dominant phenolics. Notably, quercetin-3,4'-di-*O*-hexoside-3'-*O*-(6"-sinapoyl)-hexoside ranged from 505.9 to 700.6 mg/kg FW across treatments, and quercetin 3,7,4'-tri-*O*-hexoside ranged from 424.8 to 653.7 mg/kg FW, with both compounds being more abundant in the control group compared to the treated samples. This trend was mirrored in the total phenolic content, which was higher in the control (3681.9 mg/kg FW) compared to the treated leaves. Conversely, the fertilized plants exhibited increased relative content of the dominant GLSs, glucosativin, which reached its highest concentration in potassium-treated plants (89.5%). Other GLSs, such as glucoerucin, neoglucobrassicin, and DMB-GLS, also showed variations, with untreated samples generally having higher relative content. The exception was neoglucobrassicin, which exhibited a slight increase in leaves treated with Kelpak. Ultimately, fertilization practices were effective in modifying the phytochemical content and enhancing specific compound levels of wild rocket leaves.



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sciforum-103987: Enhancing Walnut (*Juglans regia* L.) Quality Control: High-Resolution Melting Analysis for Accurate and Cost-Effective Variety Identification

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The accurate identification of walnut (*Juglans regia* L.) varieties is crucial for nurseries to detect any mistakes that might occur during vegetative propagation, enabling them to certify their plant material. It is also essential for farmers to resolve any uncertainties about the plant material used in orchard plantations. The availability of a practical, accurate, and reliable tool for walnut genotyping will be of obvious interest. Traditional genotyping methods, such as microsatellite (Simple Sequence Repeats – SSR) analysis, are often too time-consuming and expensive for routine use. This study introduces High-Resolution Melting (HRM) analysis as an innovative, cost-effective, and rapid technique for effective walnut variety genotyping.

HRM analysis utilizes real-time PCR to amplify variable genomic regions, followed by melting curve analysis to distinguish between different varieties. This method streamlines the genotyping process, making it both accessible and practical for routine applications. PCR conditions were optimized to improve the accuracy and efficiency of HRM analysis, and its effectiveness was demonstrated by comparing the results with those obtained through SSR analysis.

Leaves collected from four *J. regia* varieties (Tulare, Lara, Howard, and Chandler), grown in different orchards in the Alentejo region of Portugal, were used as plant material to establish the methodology. Polymorphic regions corresponding to thirteen SSR *loci* were examined, and three proved to be effective in differentiating the varieties (*WGA202*, *WGA321*, and *WGA376*).

Validation via conventional microsatellite analysis substantiated the reliability of the HRM-based method. The implementation of HRM analysis can mitigate the risk of varietal mixing, thereby ensuring superior quality control and compliance with market standards. Furthermore, future studies could extend this technique to the identification of walnut varieties at the fruit level, facilitating the correct identification of market-bound fruits and ensuring higher quality for consumers.



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sciforum-103896: Genome-wide identification, structural characterization and expression profile of AUX/LAX genes during the development of adventitious roots in *Juglans regia* L.

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The phytohormone auxin plays a key role in most processes of plant development and growth, including *de novo* morphogenic events like the formation of adventitious roots. Nevertheless, the molecular mechanisms behind adventitious rooting (AR) remain not completely understood, and many plants species, like the walnut tree (*Juglans regia* L.), exhibit a recalcitrant behaviour towards stem cuttings propagation. *AUX/LAX* genes encode a family of auxin influx transporters involved in the transport of indole-3-acetic acid (IAA), directly synthesized by plant cells or derived from the conversion of indole-3-butyric acid (IBA), with a leading role in the induction phase of the AR process. The present study aimed to identify and characterize the members of the *AUX/LAX* family in *J. regia* through diverse *in silico* methods. An analysis of promoter sequences was also performed to provide insights into the regulation of *JrAUX/LAX* expression. Eight *JrAUX/LAX* genes were identified, and all demonstrated highly conserved structural characteristics, with all members comprising eight exons showing conserved length, interrupted by seven length-variable introns. To analyse the involvement of *JrAUX/LAX* in AR, an *in vitro* rooting trial was established. Basal region of microcuttings of 'Paradox', the first-generation hybrid between two *Juglans* species (*J. hindsii* X *J. regia*), were immersed in an IBA solution, and further inoculated in rooting medium. Sections of the basal region of microcuttings from both IBA-treated and non-treated samples were collected at different timepoints post-immersion: 0h, 6h, 72h, 5 days and 7 days. *JrAUX/LAX* exhibited differential expression patterns between IBA and control samples and amongst timepoints during the experiment, indicating the involvement of these genes in the induction phase of the AR process. Further investigation considering genotypes behaving differently to the AR stimulus should be performed to better comprehend the role of the *JrAUX/LAX* family in this morphogenic process.



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sciforum-108016: Germinability and electrical conductivity of seeds of groundnut varieties

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Seed quality affects crop establishment and productivity. In addition, the use of good-quality seed is an essential prerequisite for sustainable crop production including groundnuts. Assessing germinability and electrical conductivity provides early evidence of the production potential of a given crop variety or genotype. Therefore, this study assessed the germinability and electrical conductivity of seeds of three groundnut varieties. A laboratory experiment arranged in a Completely Randomized Design (CRD), replicated three times, was conducted at the Faculty of Agriculture, Kyambogo University, in 2020. Seeds of groundnut varieties Igola, Serenut 1, and Serenut 2 were tested, and data were collected on germination percentage and electrical conductivity. Analysis of variance (ANOVA) was performed using Genstat and means were separated using the least significance test at a 5% probability level. Germination percentage and electrical conductivity significantly ($p < 0.05$) differed among the groundnut varieties, with Igola recording the highest germination percentage, followed by Serenut 1, and the lowest was in Serenut 2. The highest electrical conductivity was recorded in Serenut 1 and the lowest in Igola. Since Igola had one of the lowest electrical conductivities and the highest germination percentage, it was concluded that Igola was the most promising variety from the studied ones. This study recommends Igola to be evaluated further for growth and yield performance.



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sciforum-107093: Impact of Salinity on Reproductive Development in *Cakile maritima*: A Focus on Male Gametophyte Biology

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Halophytes have evolved a variety of strategies to tolerate elevated salinity levels. *Cakile maritima*, a succulent annual halophyte from the *Brassicaceae* family, is widely distributed across global coastal environments, primarily thriving in foreshores. This species exhibits optimal growth under moderate saline conditions and is capable of completing its life cycle in environments with salt concentrations reaching up to 500 mM NaCl. The response of *Cakile maritima* to salinity during its vegetative development has been extensively documented, with various mechanisms identified, including anatomical and morphological adaptations, ion transport regulation, osmolyte biosynthesis, and activation of antioxidative mechanisms. However, there is limited knowledge regarding the effects of salt stress on its reproductive development. Preliminary results indicated a pronounced negative impact of salinity on flowering and fruit production in *Cakile maritima*. To elucidate the detrimental effects of salinity on the plants' reproductive capacity, we conducted a histological analysis of anther anatomy at various developmental stages, along with assessments of pollen viability and germination potential. These analyses were performed on plants irrigated with either freshwater or saline water with increasing concentrations of NaCl. The gametophyte development in halophytes, and particularly in *Cakile maritima*, remains an underexplored research area. This study aims to provide new insights into the reproductive adaptations of halophytes by examining the impact of salinity on the biology of male gametophytes, thus contributing to our understanding of their survival in extreme environments.



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sciforum-103732: Impact of Various Scarification Methods and Osmotic Stress on *Gleditsia triacanthos* L. Seeds

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Desertification is considered one of the most concerning environmental issues of the 21st century; it is a real problem for arid and semi-arid environments, where precipitation is variable and plants are subjected to more or less prolonged periods of drought. To combat desertification in Algeria, the selection of tree species for reforestation is based on specific criteria, including their tolerance to the water stress. Germination is the starting point of a plant's life cycle. It initiates the growth process. Successful germination is especially crucial in drought conditions to ensure the growth and survival of plants.

The germination of *Gleditsia triacanthos* L. seeds requires scarification to enhance water absorption. The seeds are divided into two lots: non-scarified seeds (control lot) and scarified seeds. The scarified seeds are further separated into different lots according to the types of scarification used: manual, microwave, boiling water, and sulfuric acid scarification. Osmotic stress is induced using polyethylene glycol 6000 (PEG₆₀₀₀), an inert substance used as an osmoticum.

Our findings indicate that the most effective scarification method for this species is manual scarification followed by exposure to a microwave (360 watts) for 90 seconds.

The addition of PEG₆₀₀₀ reduces the osmotic pressure of imbibition solutions, leading to a decline in germination rates, which are observed to be 22% and 64% at -0.55 and -1.59 bars of pressure, respectively. *G. triacanthos* seeds do not germinate under pressures below -3.13 bars.

Our study reveals a significant variation in the effectiveness of pre-treatments for breaking the dormancy of *G. triacanthos* seeds. Germination is completely inhibited at -5.17 bars, suggesting that these seeds are poorly tolerant to osmotic stress.



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sciforum-101768: Leaf characteristics of ‘Harumanis’ mango (*Mangifera Indica* L.) trees planted under open-area and greenhouse conditions

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Information on the physiological mechanisms of the development organs, such as leaf, of fruit tree crops is still limited, especially in tropical mangoes. Therefore, the leaf morphological characteristics of the mango cultivar named ‘Harumanis’ that have been planted under different conditions (i.e. open-area and greenhouse) were evaluated. Various sizes of leaves from selected Harumanis mango trees were randomly collected and analysed. Data on the leaf area (LA) (cm²), leaf width (LW) (cm), leaf length (LL) (cm), as well as fresh (FW) (g) and dry weight (DW) (g) including leaf moisture content (LMC), were measured and compared between these two growing conditions. Results indicate that the LA, LL and LMC were significantly different (*P*0.05) between both growing conditions. The LA of Harumanis mango trees planted in the greenhouse was approximately 25% larger compared with the trees planted in the open area. Similarly, Harumanis trees planted in a greenhouse had 11% longer LL and contained higher LMC than the trees in open areas. However, no significant differences were recorded on LW, FW, and DW between both growing conditions. Our results, therefore, suggest that different growing conditions may have affected the characteristics of tree organs, such as leaves, that may contribute to the environmental adaptation and tree productivity of this high-value mango crop.



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sciforum-106925: Microbial Growth Kinetics of Fermenting Botanicals Used as Gluten-Free Flour Blends

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Introduction

The fragmentary and whole substitution of wheat flour with flour blends is an alternative approach for producing cheaper, nutrient-rich, and comparatively advantageous gluten-free foods through fermentation.

Methods

Dry samples of sweet potato, pigeon pea, and maize botanicals were purchased from local vendors, and authenticated and processed before spontaneous fermentation at room temperature. The pH and microbiological patterns of the fermenting botanicals were evaluated every 12 hours for 72 hours, using standard test protocols.

Results

It revealed that the rates of growth of isolated microorganisms were affected by pH; all the botanicals fermented had a reduction in their pH values. Acids were produced during fermentation, leading to a reduction in pH. Bacteria growth on the fermenting samples on nutrient agar reveals that the bacterial load increased with fermentation time, from 7.52 Log₁₀ CFU/g to 10.6 Log₁₀ CFU/g (sweet potato); 6.3 Log₁₀ CFU/g to 10.54 Log₁₀ CFU/g (pigeon pea), and 6.3 Log₁₀ CFU/g to 10.54 Log₁₀ CFU/g (maize). On MacConkey agar, the bacterial load on all samples started after 24 hours of fermentation, peaked at 48 hours, and reduced gradually towards 72 hours of fermentation. There was increase in fungal growth with time from 0 to 36 hours across all samples. The microorganisms isolated can be categorized into lactic acid bacteria, spore formers, Enterobacteriaceae, Staphylococcace, yeast, and moulds.

Conclusion

Fermentation of botanicals over 72 hours results in organic acid formation, which lowers pH; this attribute helps in checkmating undesirable microorganisms capable of affecting the production of gluten-free flours with good keeping qualities.



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sciforum-103980: Phenolic Compounds, Evaluation of Alpha-Amylase Inhibitory Activity, and Antioxidant Effects of *Phoenix dactylifera* L. Date Seeds

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Recent research trends emphasize the valorization of food industry waste to enhance economic gain, food security, environmental safety, and sustainable development. Among the significant wastes from the date industry are date seeds, which represent substantial economic resources. Typically discarded or used as animal feed, date seeds possess a valuable chemical composition, particularly high levels of phenolic compounds, making them suitable for various applications. This study focuses on the valorization of date seeds from the *Takerboucht* variety in the Adrar region. The objective was to evaluate the in vitro antioxidant and antidiabetic properties of the crude seed extract. The phenolic and flavonoid contents of the extract were determined using the Folin–Ciocalteu and aluminum chloride colorimetric methods, respectively. Antioxidant activity was assessed through DPPH, FRAP, and ABTS assays, while antidiabetic activity was evaluated by examining the inhibitory effect of the extract on the key diabetes enzyme, α -amylase. The date seed extract demonstrated significant antioxidant activity, reducing both DPPH and ABTS radicals in a dose-dependent manner, with IC₅₀ values of 2.7 μ g/ml and 42.9 μ g/ml, respectively. The extract also exhibited considerable potential in the FRAP assay (0.114 mg/ml), comparable to standards BHT and BHA. This antioxidant activity was well correlated with the total phenolic content (100.20 mg GAE/g DW) and flavonoid content (44.618 mg CE/g DW). Moreover, the extract showed strong inhibitory activity against α -amylase, with an IC₅₀ of 0.24 mg/ml, compared to the positive control, acarbose (0.17 mg/ml). These findings suggest that date by-products, particularly Takerboucht seeds, are a rich source of phenolics with significant antioxidant and antidiabetic properties. Consequently, they could be considered inexpensive sources of natural antioxidants for use in food and non-food applications and in preventing metabolic disorders such as hyperglycemia.



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sciforum-103517: Phytochemical characterization of various extracts types of three Tunisian plant species: *Quercus ilex*, *Quercus coccifera* and *Pinus pinea*

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Tunisia presents a very rich potential in flora because its geological and climatic characteristics. For this reason, continuous efforts are exerted to more explore the species known for their medicinal virtues. Our study aims to determine and compare the phytochemical content and biological activity of various extracts types issued from three Tunisian species: *Quercus ilex* and *Quercus coccifera* (harvested from El KEF Governorate), and *Pinus pinea* (harvested from Nabeul Governorate) at February 2021.

Estimation of the yields of different types of phenolic compounds extraction by aqueous and methanolic macerations is realised. It appears that methanolic extraction is the best technique for extracting total polyphenols compounds and flavonoids, while aqueous one is more effective for condensed tannins extraction.

Data reveals that *Quercus ilex* specie contains the largest amounts of total polyphenols compounds and flavonoids. Whereas, *Pinus pinea* presents the highest content of condensed tannins. More that, the large amounts of organic osmolytes (total soluble sugars and proline) is detected in *Pinus pinea* specie. Evaluation of anti-radical activities by DPPH and ABTS tests of the different extracts and essential oils, shows that the different species are endowed with antioxidant activity. Nevertheless, it should be noted that the foliar extract also the essential oils of *Pinus pinea* show the highest antioxidant activity compared to *Quercus ilex* and *Quercus coccifera*.

It is concluded that the different Tunisian species subjected to our study, show very important phytochemical characteristics as well as biological activities.



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sciforum-099955: Tree bark as a bioindicator of yttrium in urban and suburban areas from Leicestershire, England

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Background

Picking wild edible mushrooms from Leicestershire (England) is not recommended owing to their content of yttrium (Y). To monitor the air quality for this element, samples from tree bark were assessed, as they are considered suitable bioindicators.

Methods

Bark samples were collected from 55 trees from Leicester city and 41 surrounding suburban areas at a height of 1.50–1.80 metres to reduce potential effects of dust from the soil. Samples were cleaned, ground, homogenised and mineralised with HNO₃/H₂O₂ to monitor Y by ICP-MS [LoD=0.00073 ng/g dry weight (dw)].

Results

Slightly higher levels were found in bark samples collected from trees across the suburban and rural areas (median and range, in ng/g dw), specifically 6.339 (1.514–48.705) vs. 6.118 (1.832–126.027), suggesting similar airborne contamination by Y in both areas. Levels of Y were slightly higher in wild mushrooms collected from urban parks and green spaces across Leicester city, although mushrooms were only collected from a nature park situated NW of Leicester city, which might explain the differences. Thus, although the content of Y also varied between tree barks collected across the four cardinal subareas in which Leicester city was divided [NW (4.967) NE (5.946) SW (11.677) SE (32.974)], the distribution found matched the same pattern described in the wild mushrooms collected within the city. Levels of Y in the tree bark were lower than the range reported in bark samples collected from Genoa (Italy; 60–1290 ng/g), which could indicate a lower airborne contamination by Y in Leicester city.

Conclusions

Although our results should be considered as preliminary, in general, lower atmospheric contamination by Y was determined across Leicestershire. However, the high presence of Y detected in edible mushrooms recommends a continuous monitoring of this metal in Leicestershire; this could be easily carried out using tree bark as a bioindicator instead of operating automated monitoring stations, which are more expensive.



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sciforum-103633: Two-Dimensional Electrophoresis Highlights Proteomic Shifts in Grapevines (*Vitis vinifera* L.) Exposed to Drought Under Field Conditions

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The grapevine (*Vitis vinifera* L.) is one of the oldest and most economically significant fruit crops in the world. The grapevine's ability to adjust the expression pattern of specific genes in response to stress causes alterations in its cellular proteome, with metabolic and physiological consequences, resulting in efficient adaptation to environmental stresses. Proteomic studies are crucial to understand the mechanisms by which plants adapt to adverse conditions, identifying stress-response proteins and elucidating their specific role in metabolic pathways.

In this study, the two-dimensional electrophoresis (2-DE) technique was applied to evaluate the protein profile of *V. vinifera* cv. 'Touriga Nacional' grown in field conditions under two water availability settings (irrigated and non-irrigated vines). Grapevine leaves were collected and homogenized with liquid nitrogen. Total proteins were extracted following a methanol/chloroform precipitation protocol and then separated by 2-DE.

The analysis of the resulting proteomic profiles uncovered differences in protein expression. Out of 47 protein spots considered for analysis, 10 were identified as differentially expressed: 9 spots showed significantly higher expression in non-irrigated vines, while 1 spot showed a significantly higher expression in vines under irrigation.

By comparing the apparent molecular weight of the differentially expressed spots with published data, it was possible to find potential correspondences with proteins previously identified in other studies of drought stress in grapevines, including proteins related to defense responses against stress, such as heat shock proteins or antioxidant enzymes, proteins related to carbohydrate and energy metabolism, such as ATP synthase CF1 beta subunit or glyceraldehyde-3-phosphate dehydrogenase, and photosynthesis-related proteins, such as RuBisCO large subunit or LHC chlorophyll-binding proteins. The involvement of these proteins in grapevine's adaptation to drought are validated by including other Portuguese traditional cultivars with different plasticities under this environmental constraint. Differentially expressed protein spots common among genotypes are further identified by LC-MS/MS.



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sciforum-106859: Unravelling the mystery of the roles of tryptamine and serotonin in *Solanum lycopersicum*

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Plants produce a vast array of small molecules, called specialized metabolites, in response to various physiological and ecological stimuli. Despite the rich arsenal of techniques available, the biological roles of many plant metabolites still remain uncovered, and, in this context, several efforts have been made to unravel the functions of two indolamines, i.e., tryptamine (TAM) and serotonin (SER).

The biosynthetic pathway involving TAM and SER in plants starts with the decarboxylation of tryptophan by tryptophan decarboxylase (TDC) to produce TAM, which is, in turn, converted into SER by tryptamine 5-hydroxylase (T5H). TAM and SER have been declared as intermediates in the biosynthesis of melatonin. However, the very high values of TAM and SER in plants (µg/g of fresh weight), especially in the edible fruits and seeds of important crops, for example, tomato, suggest that they have specific biological roles in reproductive organs.

To study the biological roles of TAM and SER in *Solanum lycopersicum*, we previously characterized a three-member *TDC* gene family and a single *T5H* gene. Moreover, after combining gene expression levels with indolamine contents in tomato tissues and organs, we proposed a model where *SITDC1* and *SITDC2* promote TAM accumulation in fruits and in aerial vegetative organs, respectively. *SITDC3* drives TAM synthesis in roots and seeds, and *SIT5H* catalyzes the conversion of TAM to SER throughout the plant.

A metabolic engineering approach involving both conventional transgenesis and CRISPR/Cas9-mediated gene knockout was followed to generate tomato lines with altered TAM and SER levels. Phenotypic analysis of *SITDC1*-overexpressing and knockout lines revealed notable changes in fruit size and number compared to the wild-type line. Additionally, seeds from the *SITDC1*-knockout lines exhibited altered seed coat pigmentation and reduced germination rates. These observations suggest that TAM and SER may play critical roles in the reproductive development of tomato plants.



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Session 7. Water Use and Irrigation

sciforum-100696: Seawater Desalination for Agricultural Watering

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In recent years, escalating concerns regarding food security, the effects of climate change, and the strain on conventional water resources have compelled agriculture to investigate alternative water sources. Desalinated seawater (DSW) has emerged as a viable method for enhancing irrigation resources, especially in arid regions such as Spain and Israel, where it is increasingly embraced by farmers. Nonetheless, initial experiences in these domains demonstrate the intricate agronomic, economic, and environmental issues linked to the utilization of DSW in agriculture. The use of DSW can modify the soil salinity and nutrient availability, requiring customized crop management strategies to maintain yields. The substantial initial investment and continuous operational expenses of desalination facilities necessitate thorough evaluation in relation to the prospective long-term advantages and cost reductions in water-scarce areas. Environmental issues are centered around the energy-intensive characteristics of desalination and the disposal of brine leftovers, which could adversely affect adjacent ecosystems if not managed sustainably. Confronting these difficulties requires novel research approaches and a comprehensive strategy for water management, incorporating sophisticated water treatment technology, optimal irrigation systems, and sustainable agricultural practices. By employing these tactics, DSW could substantially impact agriculture; however, it must be used with meticulous attention to agronomic, economic, and environmental concerns to guarantee long-term sustainability.



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sciforum-106706: Drip Irrigation and Nitrogen Management Effects on Rice Yield, Nitrogen Use Efficiency, and Water Productivity Under Varied Irrigation

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Rice, a high-water-consuming cereal crop that provides essential carbohydrates to nearly half of the world's population, faces significant challenges in sustainable production due to irrigation water deficits, climate change, and excessive groundwater extraction, all threatening global rice production and food security. Technologies such as drip irrigation and fertigation are effective in improving water and nutrient use efficiency, thereby enhancing productivity compared to traditional methods. In eastern India's subtropical climate, a cereal-based cropping system features rice as the primary crop during the wet season, with vegetables grown in the dry season to boost food security and farmer income. Research on the combined effects of drip irrigation and nitrogen management in rice is limited. To address this gap, our study investigated the impact of various water stress levels following drip irrigation and different nitrogen fertilizer applications on rice growth, yield, and water productivity. Field experiments were conducted at the Indian Institute of Technology Kharagpur in 2018 and 2019. This study investigated two nitrogen levels (50% and 100% of the recommended dose) and four water management conditions (rainfed, flooded, and drip irrigation at -0.6 bar and -0.8 bar soil water potentials) in a strip-plot design. The results showed that water stress beyond 0.6 bar during reproductive stages significantly reduced yield, with notable decreases under 0.7 bar stress around flowering. Limited irrigation at 0.6 bar improved water productivity to 1.0 kg/m³ compared to 0.58 kg/m³ under flooding. Nitrogen use efficiency (NUE) was higher at 50% nitrogen application, with apparent nitrogen recovery (ANR) decreasing from 55% to 33% as nitrogen levels increased. Drip irrigation required only 7% of the water needed for flooding while maintaining similar yields. This study highlights the importance of water-efficient technologies for mitigating climate-induced challenges and ensuring food security in subtropical India.



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sciforum-104659: Greywater treatment using agro-industrial biochar: A novel water reuse approach

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The European Union (EU) Blue Deal has dealt with the preservation of vulnerable freshwater supplies and recommended water reclamation and reuse applications. The use of biochar is a promising technique for water treatment and reclamation. From this point of view, malt dust, which is an agro-industrial by-product of the brewery industry, was used as the feedstock of biochar for the treatment of the greywater originating from a kitchen sink and a laundry rinse cycle to obtain the reclaimed water quality. This paper mainly aimed to determine the quality of reclaimed water using biochar application. Turbidity, Biological Oxygen Demand (BOD₅), Total Suspended Solid (TSS), and E. coli analyses were performed to determine the effluent quality. According to the EU Wastewater Reclamation and Reuse Legislation, Class-A-quality reclaimed water can be used for the irrigation of all kinds of agricultural crops. Otherwise, Class-B-quality reclaimed water can be used for the irrigation of above-low-ground and high-ground crops such as tomatoes, peppers, or fruit trees. At the end of treatment, the reclaimed water met the requirement of the Class B quality according to EU legislation, considering all parameters. E. coli values met both Class A and Class B qualities for each season. Only TSS in winter met the Class A quality requirements, while the others met in the range of Class B quality. Turbidity and BOD₅ met the Class B quality criteria. In the results of the overall assessment, the effluent met the Class B reclaimed water quality considering the minimum criterion requirement. This study has verified that malt dust-derived biochar is an efficient and low-cost adsorbent to obtain reclaimed water quality. The reclaimed water was used for the green area irrigation of Osmanbey Campus in Turkey.



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sciforum-105723: Utilization of Citronella and Origanum syriacum in Wastewater Treatment

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Due to their general accessibility, affordability, environmental friendliness, and reduced side effects as compared to chemical treatments, herbal plants are becoming increasingly popular as a substitute for wastewater treatment. The purpose of this study was to assess the antibacterial capabilities of essential oils derived from *Origanum syriacum*, citronella (*Cymbopogon winterianus*), and their combination with a selection of bacteria present in wastewater.

Hydrodistillation techniques were used to extract the essential oils, and gas chromatography-mass spectrometry (GC-MS) was used to determine the chemical composition of the oils.

The essential oils' chemical profiles varied, according to a preliminary examination. Citronella oil was mainly made up of geraniol (2.9%) and citronellal (32.6%), whereas *Origanum syriacum* oil had a significant concentration of carvacrol (79.2%) among its constituents. Antioxidant activity was measured for their ethanolic extracts; citronella showed better antioxidant activity with a lower half-maximal inhibitory concentration (IC₅₀) of 131.7 µg/ml, while the IC₅₀ for oregano was 180.9 µg/ml. Regarding the antibacterial effect, oregano oil showed minimum inhibitory concentrations (MICs) of 2.5% against all the tested bacteria except for *C. freundii*, which had an MIC of 5%. In contrast, citronella oil revealed an MIC of 1.25% for all the bacteria except *E. coli*, which had an MIC of 2.5%. This indicates that *Origanum syriacum* essential oil has a stronger antibacterial effect than java citronella essential oil.

The ability of *Origanum syriacum* and Java citronella essential oils to display antibacterial properties makes them suitable natural agents for wastewater treatment, as highlighted in this study. Additional research, including the clarification of their mechanisms of action, should be carried out to confirm their usefulness in wastewater treatment systems.



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sciforum-103909: Advancements in Irrigation Technologies and Their Effects on Plant Physiology and Crop Productivity: A Systematic Review

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Advances in irrigation technologies are crucial in addressing water scarcity and enhancing agricultural productivity. This systematic review evaluates the effects of precision irrigation systems, such as variable-rate irrigation (VRI) and smart irrigation systems, on plant physiology and crop yields. VRI, which adjusts water application based on spatial variability in soil and crop conditions, has been shown to improve water use efficiency by up to 27% and increase crop yields by 10-15%, especially in semi-arid regions. However, high installation costs, estimated at USD 50-100 per acre, and the need for specialized knowledge limit its large-scale adoption in developing regions. Smart irrigation systems, leveraging AI and IoT technologies, optimize irrigation schedules using real-time data from soil moisture sensors, weather forecasts, and crop growth models. Studies have demonstrated a reduction in water consumption by up to 35% while maintaining or increasing yields by 8-12%. Despite these advantages, the reliance on uninterrupted internet connectivity and the complexity of system management pose significant barriers, particularly in rural areas. Both systems have been shown to enhance root development, nutrient uptake, and overall plant health, leading to improved crop resilience to environmental stressors. On the downside, their implementation requires substantial initial investments, regular maintenance, and skilled labor, which can deter small-scale farmers. In conclusion, while modern irrigation technologies significantly contribute to sustainable water use and improved crop performance, widespread adoption remains a challenge due to economic and technical constraints. Future research and policy support should focus on making these technologies more accessible and scalable, particularly for resource-constrained regions facing the dual challenges of climate change and food security.



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sciforum-107096: Assessing the impact of irrigation-based agricultural intensification in Tunisian olive-growing systems from a water–energy–food–environment nexus perspective

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This study utilized a Water–Energy–Food (WEF) nexus approach to evaluate the sustainability performance of various olive cultivation systems in Tunisia, contrasting traditional cultivation (TCIF) with several intensive methods (ICIF 1, ICIF 2, and SICIF). Key indicators included crop yield, water usage and footprint, energy performance indicators (efficiency, productivity, specific energy, and net energy gain), twenty-two environmental impacts, gross farm income, and the eco-efficiency index. Results revealed that intensive systems yield 4.9 times more olives than traditional practices (10,600 kg/ha vs. 2,159 kg/ha), but this productivity comes at a cost: intensive systems require up to 6.5 times more water, consuming 3,600 m³/ha compared to 550 m³/ha for traditional methods. Despite the higher yields, traditional systems show superior water use efficiency, producing 3.93 kg of product per cubic meter of water, raising concerns about the sustainability of intensive methods in arid regions like Tunisia due to their larger water footprint. This study also found that energy input, specific energy consumption, and energy output significantly increase with intensification, but energy use efficiency and productivity fluctuate, suggesting an inconsistent relationship between energy input and output. A multi-indicator Life Cycle Assessment (LCA) using the ReCiPe 2016 method quantified intensity (impact per hectare) and efficiency (impact per ton of product), revealing that emission intensity rises with intensification while production efficiency varies. An aggregated single-score indicator demonstrated that, regardless of the adopted functional unit (mass- or land-based), intensive systems exhibit higher environmental impacts despite their greater economic returns (EUR 3,871 to EUR 5,862 per hectare) compared to traditional systems, which generate EUR 1,193.90 per hectare. An eco-efficiency index indicates that traditional olive production methods outperform intensive systems regarding resource use relative to environmental impact. Overall, while irrigation-based intensification enhances productivity, it raises significant concerns about water use, energy consumption, and sustainability, emphasizing the need for balanced management strategies that optimize productivity and resource efficiency.



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sciforum-107263: Evaluation of different scenarios to optimize the delineation of Daya surfaces using the multi-band water index (MBWI)

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The inland water bodies in the Doukkala plain are mainly water surface bodies locally known as Dayas. These Dayas are of vital socioeconomic and ecological significance. Several years of drought have resulted in a water shortage in this area. The current management of water resources lacks relevance. Sustainable water management has become a necessity and therefore must involve monitoring and mapping these Dayas. Remote sensing technologies play an important role in completing this task. In this study, we calibrated the multi-band water index (MBWI) to our study area using three weighting factors ($w = 2, 3$, and 4) with thresholds selected iteratively using two distinct step values (0.1 and 0.01). To make it easier to apply the indices to different situations, we utilized the average of the ideal thresholds as the single index threshold for each coefficient. The computation was carried out using Landsat images on the Google Earth Engine (GEE) platform, and then validation was carried out by collecting ground data with Google Earth Pro from very-high-resolution images. The comparison was conducted for five Landsat scenes. To assess the accuracy performance of the method, we calculated the overall accuracy (OA) and the Kappa coefficient (Kappa). The results show that the weighting coefficient ($w = 4$) and the threshold (-0.008) yielded better performances, with a Kappa between 0.92 and 0.97 , in the five scenes.



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sciforum-107107: Expansion of Agricultural Irrigation in the State of Bahia, Brazil, from 1985 to 2023

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Climate change has caused various impacts on our planet, presenting an escalating challenge that threatens water and food security, as it directly affects agriculture and livestock production, sectors highly vulnerable to these changes. Therefore, it is crucial to adopt strategies that promote the safe advancement of agriculture. Irrigated agriculture is vital for addressing issues arising from water scarcity, utilizing diverse technologies and methods. In Brazil and worldwide, this practice accounts for the majority of water consumption. In addition to ensuring agricultural production, irrigation significantly contributes to the economic development of these sectors, mitigating the impacts of climate variability. This study focused on analyzing the expansion of irrigated areas in the Brazilian state of Bahia from 1985 to 2023, utilizing irrigation data from MapBiomas Collection 9. The results indicated a significant increase in irrigated area, reflecting the growth and development of agricultural production in the state, with a temporal variation of 90% over the analyzed period. There was a 97% increase in irrigation using center pivots and an 83% increase in the use of other irrigation systems. The substantial rise in the adoption of irrigation techniques is attributed to the expansion of agricultural areas. In conclusion, there is clear evidence of the growth of agricultural production areas in the state, leading to the expansion of irrigation techniques and increased water demand. While irrigation offers benefits, its implementation requires rigorous oversight by responsible authorities due to high water consumption and associated losses. Therefore, it is essential to monitor irrigation systems to maximize their efficiency while minimizing losses from evaporation, leaching, and other adverse impacts.



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sciforum-107333: Importance of remote sensing data in investigating potential groundwater zones in semi-arid areas

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The Tagragra-Akka region, located in the Moroccan Anti-Atlas, is mainly composed of crystalline and crystallophyllian rocks. In this area, agricultural activities are primarily based on oasis cropping, which is essentially irrigated by surface water resources. This area belongs to an arid/semi-arid climate and has been living, over the last few decades, with a very severe drought. This has led to a water irrigation shortage and made groundwater a unique alternative source. However, investigating potential groundwater zones is financially demanding and time-consuming. Hence, remote sensing data and GISs are essential tools for precisely determining these zones. We used these tools to study fracturing and its spatial relationship with potential groundwater zones. Therefore, a Landsat-8 image was acquired and processed to extract three pieces of information, namely a fracturing map using the Sobel filtering technique, the fracturing density, and a lithology Support Vector Machine classifier. The main concept of using fracturing network mapping is of fundamental importance in hydrogeological investigations since they represent the preferred route for the infiltration and circulation of groundwater. Additionally, we used an image from a digital elevation model (DEM) to generate the slope, hydrological network, and drainage density maps. The resulting raster maps were integrated into a GIS workflow to identify places with high-potential groundwater resources. This approach made it possible to identify the most promising zones for establishing wells to provide sufficient water irrigation. The produced maps could be used for future hydrogeological investigation campaigns. This study also highlights interest in remote sensing and GISs to aid in resolving problems related to drought and water irrigation management in zones exposed to climate change effects. This approach could also be used in areas suffering from similar issues.



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sciforum-103834: Investigating the potential of reducing food losses and waste within the agricultural value chain to improve food security and resource efficiency

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Food security remains a major global challenge, with roughly one-third of all food produced for human use being lost or squandered each year. The essential issue of food loss and waste throughout the agricultural value chain, as well as its effects on resource efficiency and food security, are discussed in this study. This study's goal is to investigate how reducing food losses and waste could improve food security while making the best use of available resources. The study examines the entire agricultural value chain, from growing to consuming, to identify key events and factors that cause food losses and waste. The research examines social, environmental, and nutritional issues using empirical data, case studies, and theoretical frameworks. It explores how lowering food losses and waste might boost food availability for disadvantaged groups, enhance resource allocation, and lessen environmental impacts. The results of this study help us better comprehend the complex interaction between food security, waste reduction, and food loss. The study emphasizes the possibility of significant gains by reducing losses within the agricultural value chain, particularly in terms of boosting global food security and preserving priceless resources. This research helps policymakers, academics, and stakeholders achieve a more sustainable and secure food future by emphasizing effective measures and areas for improvement.



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sciforum-106954: Irrigation water resources in the Moroccan urban environment: diagnosis, challenges and sustainable prospects (the case of the city of Marrakech)

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Water resources are the fundamental pillar of every nation, as they represent the essential vital element for survival and are a determining factor in the development process, given their importance in all important sectors (agriculture, tourism, etc.). This proves particularly true following the global warning about the severe shortage of reserves of this resource, due to various constraints and factors, especially in the countries of the South. This could potentially lead to tensions and armed conflicts over these resources.

This article focuses on managing irrigation water resources in urban areas of Morocco, with a particular emphasis on the city of Marrakech. Marrakech has long been known for its ideal water system (*Khettaras, Sequaya...*), especially its irrigation system, which has contributed to its international reputation and established it as a historic metropolis and a green city (garden city). This research adopts a mixed methodology (qualitative and quantitative), as well as historical, analytical-descriptive, and systemic approaches. The study's results emphasize that the city faces a significant deficit in irrigation water, with an annual shortage of 184 million cubic meters. This deficit is attributed to the excessive consumption of surface and groundwater for irrigating agricultural lands (knowing that 47% of agricultural lands are irrigated) and the watering of public and private green spaces (which consume 26.5 million cubic meters). A deterioration has also been observed in several water resources considered heritage assets (80% have been destroyed), due to the interaction of various factors, including natural impacts such as climate change, low precipitation, etc., and human factors like population growth, the expansion of human activities, and urbanization with a more technical than patrimonial dimension. This study proposes innovative and sustainable solutions for rational water management, aiming to enhance the city's resilience and ensure the sustainability of its hydraulic and cultural heritage.



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sciforum-106299: Optimizing Water Use Efficiency in Precision Agriculture for Enhanced Crop Productivity

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The increasing global food demand and dwindling water resources necessitate a paradigm shift towards water-efficient agricultural technologies. This study explores the integration of drip irrigation and hydroponics to optimize water use efficiency in precision agriculture. Both techniques offer viable alternatives for sustaining agricultural yields while conserving water. This research employs a comprehensive methodology that includes modeling, data analysis, and field trials. Three experimental setups were established: a control group using traditional soil-based farming, a hydroponic system, and a hybrid system combining hydroponics with drip irrigation. Each group experiences varying water regimes, enabling the quantification of water usage, crop growth, and yield. To assess the effectiveness of each system in maintaining optimal growing conditions, we employed soil moisture sensors and climate monitoring devices. The preliminary results indicate that both the hydroponic and hybrid systems utilize significantly less water than conventional soil-based methods. Additionally, these systems demonstrate higher crop production and accelerated plant growth, attributed to enhanced nutrient uptake and improved root development. Economic analyses and life-cycle assessments were conducted to evaluate the cost-effectiveness and environmental impacts of the proposed systems. The initial findings suggest that while the upfront investment is higher, the long-term benefits of reduced water consumption and improved crop yields render these systems both environmentally and financially sustainable. This study provides practical insights into the combination of drip irrigation and hydroponics in precision agriculture, offering a roadmap for increasing crop productivity and water use efficiency. The implications of these findings are particularly relevant for sustainable farming practices in regions facing water scarcity and rising agricultural demand.



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sciforum-104048: Thermotolerant coliforms and their resistance to antibiotics in water from rivers used for agricultural purposes

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The consumption of river water for agricultural purposes relies, among other aspects, on its microbiological quality, which is determined based on the concentration of thermotolerant coliforms it contains. The presence of antibiotic-resistant coliforms, despite not being a criterion considered by federal or state laws, is a serious concern. These bacteria cause difficult-to-treat illnesses and deaths if directly ingested by animals through water or if indirectly ingested through contaminated vegetables and grains. The present study evaluated the concentration of thermotolerant coliforms, and their resistance to ampicillin, ciprofloxacin, and tetracycline, in four rivers in rural areas of Santa Catarina, Brazil, that are used for animal consumption and crop irrigation. Analyses were carried out bimonthly for one year, between 2022 and 2023. Data were subjected to an analysis of variance and means were separated by the Tukey test. The average number of thermotolerant coliforms in all rivers was $709 \cdot 100 \text{ mL}^{-1}$, which corresponds to Water Class 2 according to Brazilian legislation. Therefore, this water can be used for animal consumption and irrigation, in accordance with the way this water is used by the local population. However, 41% of coliform isolates were resistant to ampicillin, while 10% were resistant to tetracycline and ciprofloxacin. Resistant isolates were found in all rivers and on all sampling dates, which indicates the high frequency and abundant spread of these microorganisms. The presence of antibiotic-resistant bacteria in water can cause serious human and animal health problems if this water consumed without treatment. Considering the environment, the irrigation of vegetables and crops with resistant bacteria may also cause negative impacts on plant and soil microbial communities, leading to compromised ecosystem functions. We highlight the importance of monitoring the resistant bacteria in water, the need for environmental conservation programs, and the rational and correct use of antibiotics in order to minimize the occurrence of microbial resistance.



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sciforum-102778: Wheat Crops Protection from Salinity Stress with kitchen waste derived Biochar

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Our research explores the potential of using highly saline water for agricultural irrigation, a pressing issue made increasingly critical by climate change and pollution impacts on water resources. In this study, we examine the effects of biochar application, at dosages of 1% and 3%, on wheat crops irrigated with water at two distinct salinity levels (0.63 and 10 dS/m). The goal is to determine whether biochar can mitigate the negative effects of salinity on plant growth, potentially making saline water resources viable for agricultural use, particularly in arid and semi-arid regions where freshwater availability is scarce.

The results indicate promising outcomes, particularly for wheat plants treated with 1% biochar under low salinity conditions (0.63 dS/m), where they reached an average height of 26.6 cm, while plants in the control group, without biochar, showed a significantly shorter average height of 17 cm. Biochar-treated plants also exhibited notably higher chlorophyll levels, critical for photosynthesis and plant health. Specifically, chlorophyll a concentrations ranged from 29.8 to 20.9 $\mu\text{g/ml}$, and chlorophyll b from 54 to 23 $\mu\text{g/ml}$, in biochar-treated plants, exceeding the levels observed in untreated plants at both salinity levels.

Moreover, both 1% and 3% biochar applications resulted in higher chlorophyll concentrations compared to the control, indicating biochar's effectiveness in mitigating the physiological stresses imposed by salinity. The study highlights that while lower salinity promoted higher chlorophyll a levels, untreated plants exposed to high salinity suffered significant chlorophyll reduction. These findings suggest that biochar application could serve as an effective strategy for enhancing crop resilience in saline conditions, ultimately supporting sustainable agriculture by enabling the productive use of saline water resources. Biochar's role in reducing salinity stress may offer a transformative approach for regions challenged by limited freshwater supplies, promoting both food security and environmental sustainability.



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