IOCAG 2025 Conference

The 3rd International Online Conference on Agriculture

22–24 October 2025 | Online

Program and Abstract Book

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#IOCAG2025

The 3rd International Online Conference on Agriculture

22–24 October 2025 | Online

MDPI

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Prof. Dr. Bin Gao

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Welcome from the Chair

Dear Colleagues,

It is a pleasure to announce the **3rd International Online Conference on Agriculture** (IOCAG2025). This e-conference is organized by *Agriculture* (ISSN: 2077-0472, Impact Factor: 3.6, CiteScore: 6.3), a peer-reviewed open access international journal of MDPI. The IOCAG2025 will be held online from **22 to 24 October 2025**.

Agriculture was a major development in human history, which led to the rise and flourishing of civilization. It plays a critical role in human society, serving as the backbone of the economic system. Modern agriculture provides raw materials for most of the world's food and for many industrial products, including textiles. Significant scientific and technological advances over the years have led to great increases in agricultural productivity as well as to reducing environmental impacts. Nevertheless, agricultural systems of the future face huge challenges in balancing and optimizing productivity and profitability against the stewardship of ecosystems and natural resources. This conference will provide an online open forum for agricultural scientists and engineers to discuss these challenges and share their latest research achievements in agricultural science and technology. Sessions of the conference will be organized around the following topics:

- Climate-Smart Agriculture: Practices, Determinants, Productivity, and Efficiency;
- Ecosystem, Environment, and Climate Change in Agriculture;
- Agricultural Systems and Management;
- Zero-Pollution Solutions in Crop Protection;
- Agriculture Water Management;
- Smart Farming: From Sensor to Artificial Intelligence;
- Agricultural Soil;
- Crop Production;
- Farm Animal Production;
- From Field to Consumers: Challenges and Approaches to High- Quality Agricultural Products;
- Crop Genetics, Genomics and Breeding.

The IOCAG2025 conference will bring together researchers from all over the world without concerns over travel or other related expenditures. The conference will feature live-streamed webinars and include both invited speakers and contributed speakers selected from the submissions received.

The conference invites submissions of abstracts, which will be reviewed by the Conference Committee. All accepted abstracts will be published on the conference's website. In addition, all participants will be encouraged to submit a full paper to one dedicated Special Issue in Agriculture, with a 20% discount on the article processing charge (APC).

I hope that you will join this e-conference to exchange ideas, begin fruitful collaborations, and make the IOCAG2025 a great success.

Best regards,

Prof. Dr. Bin Gao
Department of Civil and Environmental Engineering, the Rensselaer Polytechnic Institute, Troy, New York, USA

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Agriculture (ISSN 2077-0472) is an international, scholarly and scientific open access journal publishing peer-reviewed research papers, review articles, communications and short notes that reflect the breadth and interdisciplinarity of agriculture. There is no restriction on the maximum length of the papers. The aim of Agriculture is to publish research on the science and technology of crop and animal production, biosecurity, and postharvest handling of produce, agricultural technology, management of the natural resource base for agricultural production (land, soil and water), rural management and agricultural development, and agriculture in changing environments. Accordingly, the scope of the journal for the consideration of submissions is set out in more detail below.

Journal Webpage: https://www.mdpi.com/journal/agriculture

Session Chairs

Dr. Azucena González Coloma

Instituto de Ciencias Agrarias, CSIC, Serrano 115 dpdo, Madrid, Spain

Dr. Jalil Ghassemi Nejad

DaOne Chemical/Genebiotech Co., Ltd, Gyeonggi-do, Republic of Korea

Dr. Lorenzo Negri

Department of Agricultural and Food Sciences, University of Bologna, Bologna, Italy

Dr. Margarita Ros

CEBAS-CSIC, Group of Soil Enzimology and Biorremediation and Organic Wastes, Campus de Espinardo, Murcia, Spain

Dr. Rui Costa Martins

Institute of Systems and Computer Engineering, Technology and Science (INESC TEC), Porto, Portugal

Dr. Xiaolin Yang

College of Water Resources & Civil Engineering, China Agricultural University, Beijing, China

Assoc. Prof. Dr. Luca Regni

Department of Agricultural, Food and Environmental Sciences, University of Perugia, Borgo XX Giugno, Perugia, Italy

Assoc. Prof. Dr. Sanzidur Rahman

School of Agriculture, Policy and Development (SAPD), University of Reading, Reading, Berkshire, UK

Prof. Dr. Antonio Paz-González

Centro de Investigaciones Científicas Avanzadas (CICA), AQUASOL Group – Faculty of Sciences, University of A Coruña, A Zapateira Campus s/n, A Coruña, Spain

Prof. Dr. Giovanni Dinelli

Department of Agricultural and Food Sciences, University of Bologna, Bologna, Italy

Prof. Dr. Isabel Lara

Department of Chemistry, Physics, Environmental and Soil Sciences (DQFAS), Universitat de Lleida, ETSEAFIV Campus, Lleida, Spain

Prof. Dr. Jianlin Shen

Institute of Subtropical Agriculture Chinese Academy of Sciences, Changsha, China

Prof. Dr. Rodomiro Ortiz

Department of Plant Breeding, Swedish University of Agricultural Sciences, Alnarp, Sweden

Prof. Dr. Veera Gnaneswar Gude

Professor and Director, Purdue University Northwest Water Institute, Purdue University Northwest, Hammond, IN and School of Sustainability Engineering and Environmental Engineering, Purdue Unviersity, West Lafayette, IN, USA

Keynote Speakers

Dr. Nikoletta Ntalli

Analytical Chemistry and Pesticides Laboratory, Department of Agriculture Crop Production and Rural Environment, University of Thessaly, Volos, Greece

Dr. Rick van de Zedde

Netherlands Plant Eco-phenotyping Centre, Wageningen University and Research, the Netherlands, Bornsesteeg 48, Wageningen, Netherlands

Prof. Dr. Veera Gnaneswar Gude

Professor and Director, Purdue University Northwest Water Institute, Purdue University Northwest, Hammond, IN, USA,

School of Sustainability Engineering and Environmental Engineering, Purdue Unviersity, West Lafayette, IN, USA

Invited Speakers

Dr. A. K. M. Abdulah Al-Amin

Hub for Smallholders' Agri-Tech Economics (HSATE), Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, Bangladesh

Dr. Ruben Lopez-Mondejar

Department of Soil and Water Conservation and Organic Waste Management, CEBAS-CSIC, Murcia, Spain

Dr. Tommaso Frioni

Department of Sustainable Crops Production, Università Cattolica del sacro Cuore, Italy

Dr. Vicente González

Institute of Agricultural Sciences (ICA-CSIC), Department of Plant Protection, Biopesticides Group: Biotechnology and Chemistry of Natural Products, Calle Serrano 115, Dup. Madrid (Spain)

Dr. Xiaolin Yang

College of Water Resources & Civil Engineering, China Agricultural University, Beijing, China

Assoc. Prof. Aakash Chawade

Department of Plant Breeding, Swedish University of Agricultural Sciences, Alnarp, Sweden

Assoc. Prof. Cristian Silvestri

Department of Agricultural and Forestry Sciences (DAFNE), University of Tuscia, Via San Camillo De Lellis s.n.c., Viterbo, Italy

Prof. Dr. Abdolreza Hosseindoust

Department of Animal Industry Convergence, Kangwon National University, Chuncheon, Republic of Korea

Prof. Dr. Carlos Arbizu

Faculty of Engineering and Agricultural Sciences, National University Toribio Rodríguez de Mendoza de Amazonas (UNTRM), Chachapoyas, Amazonas, Peru

Prof. Dr. Lluís Palou
Pathology Laboratory, Postharvest Technology Center (CTP), Valencian Institute of Agrarian Research (IVIA), Montcada, Valencia, Spain

Program Overview

	22 October 2025	23 October 2025	24 October 2025
Morning	**Session 10.** From Field to Consumers: Challenges and Approaches to High-Quality Agricultural Products Session 4. Zero-Pollution Solutions in Crop Protection	**Session 9.** Farm Animal Production **Session 5.** Agricultural Water Management	**Session 3.** Agricultural Systems and Management Flash Poster Session
Afternoon	Parallel Sessions **Session 1.** Climate-Smart Agriculture: Practices, Determinants, Productivity, and Efficiency **Session 8.** Crop Production	**Session 6.** Smart Farming: From Sensor to Artificial Intelligence **Session 2.** Ecosystem, Environment, and Climate Change in Agriculture	**Session 7.** Agricultural Soil **Session 11.** Crop Genetics, Genomics and Breeding

IOCAG2025 Program

22 October 2025 (Wednesday)

Session 10. From Field to Consumers: Challenges and Approaches to High-Quality Agricultural Products

Session 4. Zero-Pollution Solutions in Crop Protection

Time: 9:00 (CEST, Basel) | 3:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
	Session 10	
09:00-09:05	*Welcome from the Session Chair* *Prof. Dr. Isabel Lara*	
09:05-09:25	**Prof. Dr. Lluís Palou** Invited Speaker	Novel Antifungal Edible Coatings to Extend the Postharvest Life of Fresh Fruits
09:25-09:40	**Md Rayhan Mahmud** Oral Speaker	Development of a Low-Cost, Solar-Powered Smart Evaporative Cooling Storage System to Extend the Shelf Life of Fruits and Vegetables in Tropical Regions
09:40-09:55	**Suvanthini Terensan** Oral Speaker	Towards a Premium Curry Leaf Product: Evaluation of Murraya koenigii Variants in Jaffna for Market and Export Readiness
09:55-10:10	**Samuel Alemayehu Lapiso** Oral Speaker	Impact of Environmental Conditions on Fungal Growth and Mycotoxin production in Stored Products
10:10-10:25	**Mioara Mihaila** Oral Speaker	Organic Agricultural Production, Consumer Society and Food Waste—A Complex Dashboard for Assessing Quality
10:25-10:40	**Miroslava Kuzniarová** Oral Speaker	Quality control of food contamination with pesticides
	Session 4	
10:40–10:45	*Welcome from the Session Chair* *Dr. Azucena González Coloma*	
10:45–11:15	**Dr. Nicoletta Ntalli** Keynote Speaker	Insects' Frass as a nematicidal tool against Meloidogyne incognita
11:15–11:35	**Dr. Vicente Gonzalez García** Invited Speaker	Control of fungal diseases employing bioinspired products
11:35–11:50	**SABRINE Soltane** Oral Speaker	Allelopathy and Cover Crops: Innovative Strategies for Sustainable Agriculture in the Face of Climate Change
11:50–12:05	**Alina Butu** Oral Speaker	Botanical Extracts as Sustainable Alternatives to Conventional Pesticides in Crop Protection
12:05–12:20	**Regan M Nyoni** Oral Speaker	Occurrence and Molecular Characterization of Entomopathogenic Fungi Associated with Spodoptera Frugiperda in Tanzanian Maize Farms
12:20–12:35	**Eliana Monteiro** Oral Speaker	The Effect of a new fungicide for downy mildew control on soil microbial communities: a metagenomic approach

Parallel Sessions

Session 1. Climate-Smart Agriculture: Practices, Determinants, Productivity, and Efficiency

Time: 14:00 (CEST, Basel) | 8:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
14:00-14:05	*Welcome from the Session Chair* *Prof. Dr. Sanzidur Rahman*	
14:05-14:25	**Dr. A. K. M. Abdulah Al-Amin** Invited Speaker	Economics of labour saving agri-tech for smallholder farms
14:25-14:40	**Md. Anowar Hossain** Oral Speaker	Climate Resilience Through Climate Smart Agriculture: Understanding the Adoption Patterns Among Small Holding Farmers of Bangladesh
14:40-14:55	**Kiran Kumar Mohapatra** Oral Speaker	Climate-Smart Rice Establishment Methods Using the Climate Smart Index for Sustainable Rice Production
14:55-15:10	**Mahadi Hasan Monshi** Oral Speaker	Time-Series Forecasting of Maize Production in Bangladesh: Integrating ARIMA Models with Diagnostic Validation

15:10-15:25	**Julija Rukaite** Oral Speaker	Environmental Aspects of Autonomous Robotic Agricultural Machines
15:25-15:40	**Najoua Khayati** Oral Speaker	Exploring the role of Rural Women in Sustainable Agriculture in Morocco
15:40-15:55	**LAWRENCE Oluwagbenga Oyenpemi** Oral Speaker	Productivity Gains from Climate Adaptation: Micro-Level Insights from Rice Farmers in Southwest Nigeria
15:55-16:05	**Manuel Felipe López Mora** Oral Speaker	Growth model for vertical towers in greenhouse based on use efficiency of radiation and plant position

Session 8. Crop Production

Time: 14:35 (CEST, Basel) | 8:35 (EDT, New York) | 20:35 (CST Asia, Beijing)

Time in CEST	Speaker	Title
14:35-14:45	*Welcome from Session Chairs* *Prof. Dr. Giovanni Dinelli* *Dr. Lorenzo Negri*	
14:45-15:00	**Alangelico Ortiz San Pascual** Oral Speaker	Reinvigoration of Deteriorated Seeds of Two Okra varieties (Abelmoschus esculentus var. ''Smooth Green' and Var. 'Red Ruby') Using Atmospheric Pressure Plasma-Activated Water
15:00-15:15	**Loukas Orfeas Orfeas Loukakis** Oral Speaker	Enhancing Nitrogen Efficiency and Reducing Carbon Footprint in Malting Barley through Ascophyllum nodosum Biostimulants and Optimized Fertilization Strategies
15:15-15:30	**Amokelani Florah Maepa** Oral Speaker	Drought Tolerant Traits on Winter Legume Cover Crops Under Water Regime on Semi-Arid Conditions
15:30-15:45	**Álvaro Iglesias Ganado** Oral Speaker	Mycopriming with fungal extracts enhances quality in nursery tomato seedling
15:45-16:00	**Lamia Jallal** Oral Speaker	Development of an Empirical Model for Estimating Quinoa Canopy Cover from NDVI under Different Irrigation and Fertilization Stress Conditions
16:00-16:15	**Unius Arinaitwe** Oral Speaker	Corn Yield and Profitability Improved with Subsurface Drip Irrigation in the Mid-Atlantic United States
16:15-16:30	**IDRISSA Diédhiou** Oral Speaker	Related Effects of Climate Change on Root System Dynamics and Symbiotic Activity in Local Bean Varieties (Phaseolus vulgaris L.) in the Humid Tropics of Costa Rica

23 October 2025 (Thursday)

Session 9. Farm Animal Production

Session 5. Agricultural Water Management

Time: 9:00 (CEST, Basel) | 3:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
	Session 9	
09:00-09:05	*Welcome from the Session Chair* *Dr. Jalil Ghassemi Nejad*	
09:05-09:25	**Dr. AbdolReza Hosseindoust** Invited Speaker	The Role of Nutrigenomics in the Precision Feeding System
09:25-09:40	**Akongte Peter Njukang** Oral Speaker	Behavioral traits of honeybees (Apis mellifera) influence resistance against infestation of Varroa destructor mite
09:40-09:55	**Qiujin Liu** Oral Speaker	Effects of different lactic acid bacteria on growth performance, serum biochemical indexes, and fecal flora of Zi geese
09:55-10:10	**Elina Leonova** Oral Speaker	Relationship between slaughter yield of intensively fattened lambs and genomic loci in sheep breeds raised in Latvia
10:10-10:25	**Daniela Malakovska** Oral Speaker	Expression of MTOR genes and its association with SNPs of gene and feed efficiency in intensive-fattened lambs in Latvia
10:25-10:40	**Lucas Augustinho Trevisan** Oral Speaker	Automated Diagnostic Approach in Swine Production with Focus on Locomotor Sensing

	Session 5	
10:40–10:45	*Welcome from Session Chairs* *Prof. Dr. Antonio Paz-González* *Dr. Xiaolin Yang*	
10:45–11:05	**Dr. Xiaolin Yang** Invited Speaker	Diversifying crop rotation increases food production, reduces net greenhouse gas emissions and improves soil health
11:05-11:20	**Md. Shariar Hossain Sazzad** Oral Speaker	Agarwood (Aquilaria malaccensis) tolerates short-term drought but shows severe morpho-physiological and biochemical changes under prolonged drought
11:20-11:35	**Pushpanjali Pushpanjali** Oral Speaker	Characterizing preferential flow in soils of semi-arid Telangana, India
11:35-11:50	**Mohamed Abdelhamid Dawoud** Oral Speaker	The Future of Using Desalinated Water in Agricultural Production in MENA Region
11:50-12:05	**Athanasios Gertsis** Oral Speaker	An Evaluation of an electronic water treatment device (MAXGROW) for irrigation with fertigation in cucumbers (Cucumis sativus) grown under an NGS (New Growing System) in a commercial greenhouse
12:05-12:20	**Abdelhafid Elallaoui** Oral Speaker	Diurnal Dynamics of C-Band Radar Backscatter Over an Olive Orchard in a Semi-Arid Region

Session 6. Smart Farming: From Sensor to Artificial Intelligence
Session 2. Ecosystem, Environment, and Climate Change in Agriculture

Time: 14:00 (CEST, Basel) | 8:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
	Session 6	
14:00–14:05	*Welcome from the Session Chair* *Dr. Rui Costa Martins*	
14:05–14:35	**Prof. Dr. Leo Marcelis** Keynote Speaker	The Future of Controlled Environment Agriculture for Managing Plant Physiology and Optimizing Photosynthesis by Sensor Systems and Models
14:35–15:05	**Dr. Rick van de Zedde** Keynote Speaker	Plant Phenotyping technology adoption and our quest to cope with climate change.
15:05–15:20	**R. G. Rejith** Oral Speaker	A hybrid Machine learning approach for monitoring wheat crop traits using Proximal Hyperspectral remote sensing
15:20–15:35	**Marian BUTU** Oral Speaker	Integrating IoT Sensors and Artificial Intelligence for Irrigation Optimization in Organic Farming Systems
15:35–15:50	**Lebogang Phahlane** Oral Speaker	UAV-Based Nitrogen and Phosphorus Content Estimation for Early-Season Nutrient Mapping Using Vegetation Indices and Machine Learning Techniques
15:50–16:05	**Farook Sattar** Oral Speaker	AI Audio-Based Poultry Behavior Monitoring Using Vocal Sound Analysis
	Session 2	
16:20–16:25	*Welcome from Session Co-Chair* *Prof. Dr. Veera Gnaneswar Gude*	
16:25–16:55	**Prof. Dr. Veera Gnaneswar Gude** Keynote Speaker	Ecocentric Approaches for Sustainable Agricultural and Energy Systems
16:55–17:10	**Heltan M. Mwalugha** Oral Speaker	Physiological and biochemical responses of maize to Aspergillus flavus under irrigation and nitrogen regimes
17:10–17:25	**Inês Mansinhos** Oral Speaker	Role of Chitosan in Enhancing Secondary Metabolism and Stress Tolerance in Rosemary under Drought/Heat Combined Stress
17:25–17:40	**Lucia Escalante Ortiz** Oral Speaker	Greenhouse Gas Fluxes from the Furrow and the Bed in Furrow-irrigated Soybean on a Silt loam Soil in Southeast Arkansas
17:40–17:55	**Irina Patricia Tirado-Ballestas** Oral Speaker	Bioprospecting for promising native plant species from Mampuján, Colombia: Application of the circular economy for the benefit of farmers

24 October 2025 (Friday)

Session 3. Agricultural Systems and Management
Flash Poster Session

Time: 9:00 (CEST, Basel) | 3:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
	Session 3	
09:00-09:05	*Welcome from the Session Chair* *Prof. Dr. Luca Regni*	
09:05-09:25	**Prof. Dr. Cristian Silvestri** Invited Speaker	Adapting Olive Cultivation to Climate and Market Pressures: The Role of Breeding Innovation
09:25-09:45	**Prof. Dr. Tommaso Frioni** Invited Speaker	Vineyards at the Crossroads: Growing Wine Grapes Amid Climate Shifts and Changing Consumer Demands
09:45-10:00	**Sabrina BenGhida** Oral Speaker	Agrophotovoltaics in Practice: Six Lessons from Dual-Use Land Innovation for Food, Energy, and Policy Resilience
10:00-10:15	**Stathis Devves** Oral Speaker	A multi-model assessment of Greece's agricultural Water-Energy-Food-Ecosystems Nexus under future scenarios
10:15-10:30	**Lina Novickyte** Oral Speaker	Foresight in Agriculture: How to Be More Resilient in a Volatile, Uncertain, Complex and Ambiguous World
10:30-10:45	**Michele Filippo Fontefrancesco** Oral Speaker	From Policy to Plow: Navigating Farmer Decisions and Structural Barriers to Biopesticide Adoption in the Mediterranean
	Flash Poster Session - 3 minutes per presenter (without Q&A)	
10:45–10:48	**Tuyen Thi Duong** Flash Poster Presenter	Session 1 Is Lotus A Viable Alternative Crop In Low-Lying Agricultural Areas? Evidence From Thua Thien Hue Province, Central Vietnam
10:48–10:51	**Lawrence Oluwagbenga Oyenpemi** Flash Poster Presenter	Session 1 Causal Impact of Approved Pesticide Use on Cocoa Farmers' Welfare in Nigeria
10:51–10:54	**Vida Dabkienė** Flash Poster Presenter	Session 1 From traditions to transitions: empowering women in Lithuanian agriculture through living lab methodology
10:54–10:57	**Arya PS** Flash Poster Presenter	Session 2 Exploring the Biochemical Dynamics of Rice and Rice Leaf Folder (Cnaphalocrocis medinalis) Under Elevated CO_2 Conditions
10:57–11:00	**Marwa Zerrouk** Flash Poster Presenter	Session 2 Integrated Wetland Mapping and Surface Water Quality Assessment Using Sentinel-1/2 and Machine Learning: A Case Study from Sidi Moussa–Oualidia, Morocco
11:00–11:03	**Soukayna Jarjini** Flash Poster Presenter	Session 2 Plant Growth Promoting Rhizobacteria: A Sustainable Response to Agricultural Challenges and Health Issues
11:03–11:06	**Daniel Bondesan** Flash Poster Presenter	Session 3 Effect of cannon sprayer configuration and adjustment on spray deposit and ground drift in high-tunnel strawberry cultivation
11:06–11:09	**Havva Uyar** Flash Poster Presenter	Session 3 Reframing the Value of Agricultural Data: Stakeholder Perceptions
11:09–11:12	**Aleksandr N. Ignatov** Flash Poster Presenter	Session 3 Latent viruses of greenhouse vegetables identified by NGS in Russian Federation
11:12–11:15	**Lei Liu** Flash Poster Presenter	Session 4 From Singular to Systemic: The Transformative Trajectory of Zero-Pollution Crop Protection Strategies
11:15–11:18	**Olga Glushenkova** Flash Poster Presenter	Session 4 Integrated biological control approach for lettuce pathogens: combining beneficial microbes and cultivation practices

11:18–11:21	**Natalija Atanasova-Pancevska** Flash Poster Presenter	Session 4 Utilization of Agricultural Waste in Biofertilizer Production: A Sustainable Procedure for Supporting Zero-Waste Approach
11:21–11:24	**Konstantinos Zoukidis** Flash Poster Presenter	Session 5 Growing Lettuce (Lactuca Sativa L.) in Nutrient Film Technique (NFT) hydroponic systems under a range of saline water conditions by using innovative technologies (agro-nanobubbles and an electronic water treatment system)
11:24–11:27	**Panchali Sengupta** Flash Poster Presenter	Session 5 Irrigating farms the smarter way—a study on the utilization of precision irrigation by vegetable farmers from South 24-Parganas district, West Bengal, India
11:27–11:30	**Aureliano C. Malheiro** Flash Poster Presenter	Session 5 Optimizing Deficit Irrigation in Wine Grapes in Portugal's Douro Region: Impacts on Vine Physiology, Yield, and Must Quality
11:30–11:33	**Patricia Iweka** Flash Poster Presenter	Session 6 Influence of Cow Parity on the Precision of Near-Infrared Spectroscopic Sensing System for Assessing Milk Quality During Milking
11:33–11:36	**Andrea Apicella** Flash Poster Presenter	Session 6 Smart Farming and Digital Divide: Structural Inequalities in Access to AI and Digital Technologies among Smallholder Farmers
11:36–11:39	**Maria Feka** Flash Poster Presenter	Session 6 A Telemetry-Based Precision Agriculture System for the Sustainable Cultivation of Stevia rebaudiana
11:39–11:42	**Hanane EL Wazziki** Flash Poster Presenter	Session 7 Impact of cropping practices on dry root rot and soil microbial diversity in durum wheat in semi-arid regions of Morocco
11:42–11:45	**AMEER HAMZA** Flash Poster Presenter	Session 7 Effect of organic and inorganic amendments on composition and stability of aggregates, and on soil organic carbon fractions in Lithuanian Retisol
11:45–11:48	**Irina Konstantinovna Kravchenko** Flash Poster Presenter	Session 7 Temperature Impact on Soil Bacterial Diversity During Early Decomposition Stage of Aspen Litter
11:48–11:51	**Ana Luísa Ferreira Faustino** Flash Poster Presenter	Session 8 Fungal community composition across different organs in two distinct almond tree cultivars
11:51–11:54	**Olga Shevchuk** Flash Poster Presenter	Session 8 Endophytic mycoflora associated with winter wheat grain
11:54–11:57	**Darko Jovanović** Flash Poster Presenter	Session 8 Yield of Sweet Corn as Influenced by Sowing Date, Production Method, and Hybrid
11:57–12:00	**Gianmarco Ferrara** Flash Poster Presenter	Session 9 From the zoonotic risk to the economic losses: a serosurvey of ten pathogens in pig farms in the Campania region
12:00–12:03	**Taofik Adam Ibrahim** Flash Poster Presenter	Session 9 In Vitro Gas Production, Methanogenesis, Dry Matter Degradability and Rumen Metabolites of Ripe and Abscised Unripe Mango Fruits of Three Varieties
12:03–12:06	**Qiujin Liu** Flash Poster Presenter	Session 9 Screening of lactic acid bacteria inhibiting xanthine oxidase and safety evaluation
12:06–12:09	**Edrian Airwin Silang Olpindo** Flash Poster Presenter	Session 10 Evaluation of Kamias (Averrhoa bilimbi) Fruit and Leaf Extracts Against Post-harvest Rotting Fungi on Tomato (Solanum lycopersicum L.) Fruits
12:09–12:12	**Teodora Basile** Flash Poster Presenter	Session 10 Grant sparkling wines an identity: a strategy to address the wine sector crisis
12:12–12:15	**Sumaiya Hassan** Flash Poster Presenter	Session 10 Formulation and Evaluation of Biodegradable Edible Coating from Pleurotus ostreatus Polysaccharides Integrated with Green-Synthesized Silver Nanoparticles for Postharvest Preservation

12:15–12:18	**Fishua José Upuere Dango** Flash Poster Presenter	Session 11 Distinguishability Homogeneity Stability in sweet potato genotypes
12:18–12:21	**Isabel Marques** Flash Poster Presenter	Session 11 Bigger Pods, Smaller Gene Pools? Trade-offs in Inga edulis Cultivation Systems
12:21–12:24	**Zine El Abidine Fellahi** Flash Poster Presenter	Session 11 Enhancing Multi-Trait Genetic Gains in Durum Wheat (Triticum durum Desf.) Using Ideotype-Based Selection Indices

Session 7. Agricultural Soil

Session 11. Crop Genetics, Genomics and Breeding

Time: 14:00 (CEST, Basel) | 8:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

Time in CEST	Speaker	Title
	Session 7	
14:00–14:05	*Welcome from the Session Chair* *Dr. Margarita Ros*	
14:05-14:25	**Dr. Ruben Lopez-Mondejar** Invited Speaker	Feeding crops, steering microbes: How recycled fertilizers reshape soil nitrogen dynamics in agroecosystems
14:25-14:45	**Dr. Jose Antonio Pascual** Invited Speaker	Understanding soil suppressiveness. Microorganisms, the biological barrier against plant pathogens
14:45-15:00	**Vasileios Stylianos Kyriatzis** Oral Speaker	Vineyard Restructuration Using Organic- Inorganic Fertilizers and Biostimulants
15:00-15:15	**Abo Bakr Alsedik Youssef** Oral Speaker	Agronomic Influence and Cost Assessment of Natural Rocks and Biological Inoculants in Potato Production
15:15-15:30	**Carmen Mª Granados-Carrera** Oral Speaker	Sodium Alginate-Based Bioplastic Matrices Applied for Soil Regeneration
15:30-15:45	**Lalo Villacorta Garcia** Oral Speaker	Precision Fertilization of Zea mays L. Using an Autonomous UGV: Real-Time Soil Nutrient Mapping with Embedded Sensors and AI
	Session 11	
15:45-15:50	*Welcome from the Session Chair* *Prof. Dr. Rodomiro Ortiz*	
15:50-16:10	**Prof. Dr. Aakash Chawade** Invited Speaker	TBA
16:10-16:30	**Prof. Dr. Carlos Arbizu** Invited Speaker	Leveraging the promise of the forgotten crops of the Peruvian Andes
16:30-16:45	**Nguyen Van Tuan Anh** Oral Speaker	A pangenome of Vietnamese rice landraces identifies indica–japonica shared variable genes associated with agronomic traits
16:45-17:00	**Tanya Ahmed Sheik** Oral Speaker	The polyploid paradox in mulberry: enlarged genome exhibits loss of growth superiority
17:00-17:15	**Ifeoluwa Simeon Odesina** Oral Speaker	QTL Mapping for Plant Height in the CML52 × B73 Maize RIL Subpopulation: Insights from a Nested-Association Mapping Approach
17:15-17:30	**Germán F. De la Cruz Lapa** Oral Speaker	Morphological Characterization and Phytochemical Profiling of Specimens from the Peruvian Solanum muricatum Aiton Germplasm Bank at the UNSCH

Session 1. Climate-Smart Agriculture: Practices, Determinants, Productivity, and Efficiency

sciforum-127823: "From Hydrocarbons to Harvests: A Machine Learning-Based Zonation Model for Climate-Smart Agriculture."

Subhakant Bhokta

B.Tech done at Rajiv Gandhi Institute of Petroleum Techknology, Student (Petroleum Engineering)

With rising climate volatility threatening agricultural sustainability, Climate-Smart Agriculture (CSA) has emerged as a critical strategy to ensure food security. While CSA practices are proven effective, their large-scale implementation is often hindered by fragmented data and limited decision-support tools. This study introduces a novel machine learning-driven framework, originally developed for subsurface reservoir characterization in the petroleum sector, and adapts it for enhancing CSA adoption, productivity, and resource-use efficiency.

Using geospatial, soil, and weather data from diverse agro-climatic zones, we implemented zonation-based predictive modeling to classify land into CSA suitability regions. A suite of ML algorithms—Random Forest, Gradient Boosting, and spatial interpolation models—was applied to estimate moisture stress, optimize irrigation zones, and predict crop-specific productivity under varying climate scenarios. The model was trained on multi-source data and validated using ground truths from 320 smallholder farms. Additionally, stochastic frontier analysis (SFA) was used to assess the efficiency impacts of CSA interventions.

The ML-adapted framework enabled high-resolution mapping of optimal CSA practices, achieving over 85% accuracy in zone classification and a 20% gain in predictive precision compared to baseline methods. Farms implementing model-guided CSA strategies showed a 23% improvement in productivity and a 17% increase in technical efficiency. The system also proved valuable in identifying vulnerable zones to climate shocks, aiding in targeted intervention planning.

This work demonstrates the cross-domain applicability of AI/ML models from petroleum engineering to climate-smart agriculture. By translating subsurface zonation logic to surface-level agroecological analysis, we offer a scalable, data-driven solution for accelerating CSA adoption. Future directions include integrating real-time satellite feeds and farmer feedback loops to evolve the framework into a dynamic advisory tool for climate-resilient farming.

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sciforum-139329: Awareness and Adoption patterns of improved sorghum varieties: cultivation practices among young farmers in Moro local government Area of Kwara state, Nigeria

Oluwaseyi Adenike Idowu [1,*] and Adedapo Ayodeji [2]

[1] Department of Environmental Science, University of South Africa, Florida, 17091710, South Africa
[2] Department of Agricultural Economics and Extension Services, Ekiti state University, Ado-Ekiti, 5363 Nigeria

This study examined the level of awareness and the extent of adoption of improved sorghum varieties among smallholder farmers across five key villages: Malete, Lanwa, Olooru, Elemere, and Arobad in the Moro Local Government Area of Kwara State, Nigeria. A total of 120 respondents were randomly selected, with 24 participants sampled per village. Data collection was conducted using structured questionnaires, and the results were analyzed through descriptive statistics and probit regression to identify the factors influencing adoption behavior.

Findings indicate that 60.9% of the respondents were within the 31–50-year age bracket, while 48.7% were over 50 years. The majority were male (76.7%), married (83.3%), and engaged in full-time farming (75.0%), with a significant proportion (41.7%) having no formal education. Most practiced subsistence agriculture on small plots ranging from 1 to 3 hectares (79.3%), with limited access to financial resources (78.4%).

Although awareness of improved sorghum varieties was relatively high at 75%, actual adoption remained low at 15%. Among those who adopted, early-maturing and dwarf varieties were the most preferred. The principal constraint to adoption was the inadequacy of extension services (50%), while radio served as the primary information source for 33.3% of farmers. Mixed cropping was the dominant farming system, practiced by 50% of the respondents.

Probit regression analysis revealed that education level, access to extension services, and farm size were statistically significant predictors of adoption. This study underscores the need for strengthened agricultural extension systems, enhanced input accessibility, and strategically designed awareness programs particularly targeting young farmers to drive an increased adoption of improved sorghum technologies.

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sciforum-132330: Agronomic performance of *Brachypodium* cover crop varieties grown under mediterranean agroclimatic conditions

Pilar Hernandez [1,*], Jesus Guillen-Jurado [1], Sergio Gálvez [2], Luisa Maria Martinez [3], Antonio Manzaneda [3], Victoria Gonzalez-Dugo [1], M. Auxiliadora Soriano [4], Pablo J. Zarco-Tejada [1] and Jose A. Gómez-Calero [1]

[1] Institute for Sustainable Agriculture (IAS-CSIC), Consejo Superior de Investigaciones Científicas (CSIC), Alameda del Obispo s/n, 14004, Córdoba, Spain
[2] Department of Languages and Computer Science, ETSI Informática, Campus de Teatinos. Universidad de Málaga, Andalucía Tech, 29071, Málaga, Spain
[3] Universidad de Jaen, Campus Las Lagunillas, 23071 - Jaén
[4] Universidad de Córdoba, Campus de Rabanales, 14014 Córdoba

There is an increasing need for genetic resources to provide ecosystem services in agricultural systems. *Brachypodium* is a promising grass cover species used in olive and fruit grooves in Mediterranean agroecosystems. In this agricultural context, they provide winter soil protection and moisture retention, and terminate their cycle in early spring, minimizing water competition with the tree crop (Gomez et al. 2020).

In this work, we characterized the performance of four *Brachypodium* varieties in five environments (both field- and semicontrolled environments) in Southern Spain (IAS-CSIC farm). This would provide data on the effects of climatological conditions and management practices (sowing date, irrigation) on soil cover, biomass, and seed and yield traits using traditional and digital phenotyping tools. A strong genotypic influence was detected for the traits observed, while climatic effects (specially heat and drought) were also detected. This will help to identify the possibilities and ecosystem services provided by this grass cover crop's genetic resources in Agromediterranean conditions.

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sciforum-139070: Assessing the Impacts of Fertilizer Subsidy Policies on Ghana's Academic Study Trend and Characteristics

Mutiu Badmus [1,*] and Matsui Kenichi [2]

[1] Graduate School of Science and Technology, Environmental Studies, University of Tsukuba, Tsukuba; 305-0006, Japan
[2] Faculty of Life and Environmental Sciences, University of Tsukuba, Tsukuba, 305-8572, Japan

Government policies have long sought to make fertilizers accessible to farmers through subsidies, as fertilizers are known to enhance farm output and productivity. In this paper, we attempt to show the extent to which this policy emphasis has influenced the trend and characteristics of past academic studies on fertilizers in Ghana. We reviewed 37 peer-reviewed articles and four policy documents. These documents were collected by using databases, such as ProQuest, Web of Science, and Google Scholar, with the following keywords: fertilizer policy, fertilizer subsidies, agriculture policy, and Ghana. In examining the contents of these past studies and policy documents, we focused on productivity and profitability, income, fertilizer access, food security, and study areas. The results show that about 54% of the articles focused on profitability and productivity. In terms of study areas, about 52% examined northern regions. Our comparison between past studies and policy documents shows that Ghana's past fertilizer studies closely corresponded with fertilizer policy implementation practices. Subsidies have considerably improved farmers' access to fertilizers, increased fertilizer application rates, enhanced crop productivity, and contributed to mitigating food insecurity. On the contrary, none of the review looked at environmental impacts of increasing inorganic fertilizer use. Our review highlights the need for incorporating sustainability perspectives into studies on food and agriculture in Ghana.

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sciforum-123742: Can Sensor-Based Irrigation Enhance Corn Yield in Sandy Soils?

Unius Arinaitwe [1,*] and William Hunter Frame [2]

[1] Agronomy, Horticulture, & Plant Science, South Dakota State University, Brookings, SD 57007, USA
[2] Tidewater Agricultural Research and Extension Center, Virginia Tech, Suffolk, VA, 23437

Abstract

Due to increasing climate variability, water scarcity, and global food demand, improving irrigation efficiency is critical for sustainable crop production. Volumetric soil water content (SVWC) sensors offer potential for precise irrigation scheduling, yet their yield benefits in sandy soils remain unclear. This study assessed the impact of sensor-based irrigation on corn (*Zea mays* L.) grain yield under varying nitrogen (N) and seeding rates in southeastern Virginia from 2022 to 2024. A Split-Split-Plot design was implemented at the Tidewater Agricultural Research and Extension Center (TAREC) in Suffolk, VA, with main plots consisting of three irrigation methods: 36" subsurface drip irrigation (SDI), 36" SDI with SVWC sensors, and a non-irrigated control. Sub-plots included four seeding rates (59K, 74K, 89K, and 104K ha^{-1}) and four nitrogen rates (133, 200, 267, and 333 kg ha^{-1}). Results showed that grain yield was significantly influenced by irrigation method, nitrogen rate, and seeding rate (p 0.0001). The highest yields were observed with 36" dripline (11,466 kg ha^{-1}) and sensor-controlled dripline (11,051 kg ha^{-1}), both significantly outperforming the non-irrigated control (7,359 kg ha^{-1}). Although sensor scheduling did not statistically surpass conventional drip irrigation, it maintained comparable stable yields, suggesting potential efficiency benefits. Yield increased with seeding rate, peaking at 42K plants/acre (10,368 kg ha^{-1}), and with nitrogen rate, reaching a maximum at 333 kg ha^{-1} (10,448 kg ha^{-1}). Sensor-based irrigation supported high yields across all N and seeding combinations, demonstrating its utility in optimizing input use. In conclusion, while sensor-based irrigation did not significantly increase yields over traditional SDI, it consistently outperformed non-irrigated systems and may enhance water use efficiency in sandy soils under future climate and resource constraints.

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sciforum-132596: Causal Impact of Approved Pesticide Use on Cocoa Farmers' Welfare in Nigeria

Lawrence Oluwagbenga Oyenpemi

[1] Middle Tennessee State University, Murfreesboro, TN 37132, USA
[2] Obafemi Awolowo University, Ile Ife, Nigeria
[3] Political Economy Research Institute

Cocoa production remains a cornerstone of Nigeria's rural economy and export revenue. However, the excessive use of non-approved pesticides threatens compliance with international Maximum Residue Limits (MRLs), risking market rejection and income losses. To address this, the Nigerian authorities introduced a list of approved pesticides (APs), yet their adoption remains limited. This study investigated the socio-economic and institutional drivers of AP adoption and quantified its causal impact on cocoa productivity and profitability using advanced machine learning methods. Survey data from cocoa farmers in Osun State were analyzed using logistic regression and random forest models to identify adoption and profitability drivers. Key predictors of AP use included education, the farm size, off-farm income, and awareness. Profitability was influenced by age, experience, the farm size, and the input use (fungicides and insecticides). To estimate the causal effects, we employed Causal Forests, revealing that AP adoption increases the log output by 41.6% and the log profit by 44.9%. These findings highlight the transformative impacts of approved pesticide adoption on farm welfare. Promoting awareness and targeted support policies can scale adoption and enhance sustainability. Machine learning methods enriched the analysis by revealing both average and heterogeneous treatment effects, offering evidence-based insights for agricultural policy and development planning.

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sciforum-137778: Climate impact assessment on tomato productivity using DSSAT model

Bhuvanaswri Parameswaran

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, India - 641003

A field experiment was conducted to assess the impact of climate change on tomato growth and productivity using the DSSAT model. The results obtained from the field trial were used to calibrate and validate the dynamic crop simulation model DSSAT-CROPGRO for predicting the growth and yield of the tomato crop. The past 30 years of weather data were used to assess the impact of climate variability on tomato productivity. The future climate data generated through a statistical downscaling approach were used to project the impact of climate change on tomato productivity. The experiment was laid out in a Factorial Randomized Block Design (FRBD). The treatments consisted of four planting dates from November 1st to December 15th at biweekly intervals and three nitrogen (N) levels, viz., the Recommended Dose of Nitrogen (RDN), 75% RDN, and 125% RDN. In the future, tomato productivity is expected to decline from the current yield levels due to climate change under hot dry conditions of 20.29 and 26.24 under RCP 4.5 and RCP 8.5 scenarios by the end of the century. Impacts of future climate change could be reduced by altering the planting date from December 1st to October 1st during rabi under RCP 8.5. Though an earlier date of sowing and supplemental fertilizer application had considerable gains in fruit yield under both current and future climate conditions, their magnitude diminished considerably under future climate conditions.

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sciforum-134457: Climate Resilience Through Climate Smart Agriculture: Understanding the Adoption Patterns Among Small Holding Farmers of Bangladesh

Babor Ahmad [1], Fahima Khanam [2], Shahiduzzaman Selim [3] and Md. Anowar Hossain [4,*]

[1] Department of Economics, Dhaka International University (DIU), Satarkul, Dhaka-1212, Bangladesh
[2] Professor, Department of Economics, Faculty of Social Science and Humanities, Hajee Mohammad Danesh Science & Technology University, Dinajpur-5200, Bangladesh.
[3] School of Finance and Economics, Xi'an Jiaotong University, Shaanxi, China
[4] Dhaka International University, Dhaka, Bangladesh

The objective of this study is to determine the main drivers of adoption of Climate Smart Agriculture (CSA) practices by smallholders, focusing on six important practices: row planting, crop rotation, improved maize (climate-adapted varieties), agroforestry, soil and water conservation, and crop residue management. For this purpose, this study uses the simple random sampling procedure of survey design for collecting cross-sectional data of 400 farming households in the char lands of Rangpur district. The paper applies descriptive statistics and chi-square test together with multivariate logit (MVL) modeling to account for socio-economic and institutional factors influencing adoption behavior. The results showed that the level of education, farm size, access to extension services, credit availability, and membership in a cooperative significantly increase the probability of adopting all CSA practices. Other environmental factors such as plot inclination or soil fertility also affect adoption in different ways. The research highlights the importance of institutional and resource support in addressing obstacles to the uptake of CSA. Informed by these findings, policy recommendations for integrated extension programs, enhancing access to financial services, and the development of farmer cooperatives are provided as a means to promote sustainable agricultural transformation and climate resilience of smallholder farmers.

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sciforum-138431: Climate Smart Agriculture in Drought-Prone Landscapes: Pathways to Resilience, Livelihoods and Sustainable Productivity

M.Sethu Raman *, M. Hariharan and V. Jothieswaran

Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India – 641003

Abstract

Introduction

Climate change has become a major threat to agricultural sustainability, particularly to drought-prone areas. This paper investigates the adoption of climate-smart agriculture (CSA) technology by smallholder farmers in the Ramanathapuram District of Tamil Nadu and its impact on crop productivity, specifically on paddy cultivation.

Methods

Data were collected from 180 farm households in 15 villages through structured interviews. Logistic regression and propensity score matching (PSM) methods were used to confirm the influence of socioeconomic factors on adoption of CSA and to assess its impact on yield outcomes.

Results

The logistic regression results indicated that gender, education, longer experience in farming, the size of farmland, and information from extension services were determinants of CSA practice adoption. Specifically, being a male farmer and having higher school education, farming experience, and access to extension services had a significant positive effect of CSA adoption, and farm size had a negative effect on CSA adoption. In addition, PSM analysis indicated that CSA adaptation led to a significant increase in crop yield. Both matching and linear regression models show that the coefficient of CSA practices on log yield is positive and significant. The R2 value of 0.87 in linear regression model suggests that the model describes a high variation inthe yield.

Conclusions

These results highlight the role of CSA in improving the resilience and productivity of agriculture in climate-exposed areas. Accordingly, policy interventions should aim at enhancing farmers' education, reinforcing extension, and providing support to smallholders.

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sciforum-129461: Climate-Smart Rice Establishment Methods Using the Climate Smart Index for Sustainable Rice Production

Kiran Kumar Mohapatra [1,*], Amaresh Kumar Nayak [2], Ranjan Kumar Patra [1], Rahul Tripathi [3] and Hanuman Singh Jatav [4]

[1] Odisha University of Agriculture and Technology, Bhubaneswar – 751003, Odisha, India
[2] Deputy Director General (Natural Resource Management), Division of Natural Resource Management, Krishi Anusandhan Bhawan-II, New Delhi - 110 012, India
[3] ICAR-Central Rice Research Institute, Cuttack – 753006, Odisha, India
[4] Department of Soil Science and Agricultural Chemistry, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Rice is a staple food for many Asian countries; however, identifying climate-smart rice management practices has become increasingly important to fighting climate change. This study comprehensively evaluated the agronomic, environmental, and economic performance of various rice production techniques over two winter seasons (2020 and 2021), with a focus on sustainability and climate-smart agriculture. The evaluated methods included System of Rice Intensification with Alternate Wetting and Drying (SRI-AWD), Direct Seeded Rice with AWD (DSR-AWD), and Traditional Farmers' Practices under Continuous Flooding (FPR-CF). Among these, SRI-AWD significantly outperformed the others, achieving up to 39.4% higher grain yield, enhanced straw yield, harvest index, and water productivity, while reducing total water use by 37.5%. DSR-AWD recorded the lowest energy inputs, and both SRI-AWD and DSR-AWD demonstrated the highest energy use efficiency. Greenhouse gas emissions—particularly methane—were substantially reduced under AWD-based systems, with SRI-AWD exhibiting the lowest global warming potential. Soil health indicators, including labile carbon fractions, microbial populations, and enzyme activities, were markedly improved under SRI-AWD, correlating positively with increased soil organic carbon and microbial activity. Regression analysis identified soil water-soluble carbon and bacterial populations as key determinants of yield, while methanogens and denitrifiers were the main drivers of greenhouse gas emissions. Economically, SRI-AWD yielded the highest gross and net returns (34.9% and 122% higher, respectively), along with the most favorable benefit–cost ratio and climate-smart index (CSI), reflecting higher productivity, climate resilience, and a more efficient use of resources. In contrast, FPR-CF proved to be the least sustainable option. Overall, SRI-AWD emerged as the most sustainable, profitable, and climate-smart rice cultivation strategy, offering a viable pathway toward resilient and eco-efficient rice production systems.

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sciforum-114761: Comparative transcriptome and co-expression analysis reveals key genes and pathways regulating nitrogen use efficiency in cotton genotypes

Asif Iqbal [1,*] and Song Meizhen [2]

[1] Department of Agriculture, Hazara University, Khyber Pakhtunkhwa Mansehra, Pakistan
[2] Sate Key Laboratory of Cotton Biology, Cotton Research Institute of Chinese Academy of Agriculture Sciences, Anyang, 455000, P.R. China

Worldwide, nitrogen (N) is one of the most important and limiting factors of crop production. It is understood that increasing N rates decreases nitrogen use efficiency (NUE) in crops, especially in indeterminate crops like cotton. Therefore, to elucidate the molecular regulatory mechanism essential for improving NUE in cotton, we used Illumina RNA-Seq to understand the genotypic variation in the transcriptomic profile of cotton genotypes, CCRI-69 (N-efficient) and XLZ-30 (N-inefficient), in response to N starvation and resupply. The responses of both cotton genotypes varied dramatically at the transcriptional level. The results revealed that genetic differences exist between CCRI-69 and XLZ-30, including nutrient transporters, photosynthetic pathways, antioxidants, transcription factors (TF), and hormone signaling-related genes. WRKY in roots and AP2/ERF in shoots were the most differentially expressed TFs in both cotton genotypes, followed by AP2/ERF and MYB, respectively. Numerous genes involved in phytohormones, N transporters, antioxidant stress, and photosynthetic pathways were upregulated in both roots and shoots of CCRI-69, which showed that CCRI-69 had a greater ability of N absorption and use efficiency than XLZ-30. Thus, we deduced that high expression of N transporters and high biomass production through photosynthesis could be attributed to the high N efficiency in CCRI-69. In addition, hormone signaling pathways and high antioxidant activities may also contribute to the genotypic difference between cotton genotypes differing in NUE. Moreover, the hub genes identified in the co-expression analysis may provide new insights into the underlying molecular mechanisms involved in the high N-efficiency in CCRI-69 and could be used for further breeding of N-efficient cotton genotypes.

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sciforum-132534: Computational Fluid Dynamics (CFD) Analysis for Indoor Paddy Farming: Evaluating Carbon Dioxide (CO2) Enrichment Effects on Growth Conditions via Controlled Air Capture

Diana S.N.M. Nasir [1,*], Siti Khadijah Ali [2], Siti Nur Hannah Ismail [3], Nor Suzylah Sohaimi [4] and Ben Richard Hughes [1]

[1] School of Mechanical, Aerospace and Civil Engineering, Sir Frederick Mappin Building, The University of Sheffield, Mappin Street, Sheffield S1 4DT
[2] Department of Multimedia Faculty of Computer Science and Information Technology
[3] Department of Landscape Architecture, Faculty of Built Environment & Surveying, Universiti Teknologi Malaysia, 81310, Johor, Malaysia
[4] Department of Planning and Property Development, Universiti Utara Malaysia, 06010, Sintok, Kedah, Malaysia

Indoor paddy farming presents a promising solution to food security challenges, offering controlled environments for optimised crop growth. However, maximising yield efficiency requires a thorough understanding of microclimatic factors including carbon dioxide (CO_2). This study employs Computational Fluid Dynamics (CFD) to evaluate the effects of additional CO_2 supply on airflow dynamics, CO_2 distribution, and plant growth conditions in an indoor paddy farming setup. Two settings are examined, one with ambient CO_2 levels and the second with targeted CO_2 enrichment. The CFD model incorporates realistic paddy plant structures and simulates transpiration, energy exchange, and CO_2 absorption processes. By defining precise boundary conditions for temperature, humidity, and gas exchange on the leaf surfaces, the model enables detailed analysis of CO_2 transport inside the cultivation space (paddy beds) with the help of a small-scale controlled air capture device, inspired by direct air capture (DAC) technology. It is indeed promising that the CO_2 enrichment through controlled air capture enhances uniformity in gas distribution as well as optimising concentrations around the rice canopy, which can boost photosynthesis and biomass accumulation. Contrariwise, the second setting (without CO_2 enrichment) displays areas of restricte plant growth which reduces the overall yield. With the exploration of the effects of controlling ventilation on CO_2 retention and distribution, the findings suggest that an integrated CO_2 delivery system with optimised airflow patterns potentially mitigates stratified flow issues, and therefore it further maintains stable concentrations across the paddy beds as well as enhancing evapotranspiration processes, which creates a balanced microclimate for the plants. This research demonstrates the potential for exploring innovative indoor farming design strategies, particularly for maximising yield efficiency of staple agri-foods like rice using CFD analysis. Through CO_2 enrichment and airflow optimisation, the indoor farming technique potentially maximises its profitability through high yield production and simultaneously reduces resource consumption and uncertainties due to external climatic fluctuations.

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sciforum-138388: Cowpea-sesame double cropping system as a sustainable agriculture practice of rainfed alfisols

Subrata Bag *, Vinod Kumar Singh, Visha Venugopal Kumari and Prasanna G Kelageri

Division of Agronomy, ICAR-Central Research Institute for Dryland Agriculture Hyderabad, Telangana 500059, India

Rainfed agriculture is complex and more challenging due to rainfall variability, shrinking land, soil fertility depletion, decreasing carbon (C) stock and reduced system productivity. Alfisols occupy 30% of arable land in semi-arid dryland regions with only 30-40% land use efficiency due to the prevalence of monocropping. Double cropping with efficient rainwater management can increase productivity and stability in rainfed areas by improving crop diversification, nutrient cycling and water use efficiency. The field experiment was conducted at the Gungal Research Farm of ICAR- Central Research Institute for Dryland Agriculture (17o05' N, 78o39'E) between 2022-2023 and 2023-2024 to determine the best possible double cropping system in a rainfed region of Alfisols. The treatments comprising of six legume–oilseed cropping systems with and without rainwater management were laid out in Randomized Block Design with three replications. During the kharif season legumes viz., cowpea, green gram and black gram were sown, and after harvesting of legume crops, oilseeds viz., sesame and safflower were sown in the month of October in both the years. Various crops grown with different rain water management practices demonstrated significant variation in crop growth parameters, such as in kharif, where cowpea recorded the highest biomass (16.21 g plant-1 and 12.35 g plant-1) and leaf area index (LAI) (1.58 and 1.52) at 45 DAS in 2022 and 2023, respectively. While in the rabi season, sesame with rainwater management showed the highest growth in terms of biomass (8.14 g plant-1 and 8.21 g plant-1) and LAI (0.76 and 0.52) at 45 DAS in both years, respectively. In terms of yield, the cowpea–sesame system with rainwater management achieved the highest black gram equivalent yield (BGEY) across two years with an average yield of 1758 kg ha-1. The cowpea–sesame system, with rainwater management, achieved the highest BGEY (1,758 kg ha^{-1}) over two years. Cowpea's deep roots improved soil structure and moisture retention, benefiting the following crop. Sesame's drought tolerance, shorter duration, and higher market value further enhanced yield. This system proved the most efficient pulse legume double-cropping option for rainfed Alfisols. Adopting effective rainwater management practices was found to be beneficial in identifying new double-cropping systems for rainfed region of Alfisols.

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sciforum-132682: Does Certification Knowledge Matter? Insights into Cocoa Marketing Efficiency Among Licensed Buyers in Osun State

Taiwo Fausiyat Adesiyan

[1] Middle Tennessee State University, Murfreesboro, TN, USA
[2] Political Economy Research Institute (PERI)

This study examines the effect of awareness of cocoa certification programs on marketing efficiency among Licensed Buying Agents (LBAs) in Osun State, Nigeria. As key intermediaries in the cocoa value chain, LBAs significantly influence cocoa quality and pricing, yet many operate with limited knowledge of certification standards such as UTZ and Rainforest Alliance. A total of 120 LBAs, both certified and uncertified, were selected using multistage sampling. Descriptive statistics were used to assess levels of awareness and socioeconomic characteristics, while the fractional response model (FRM) was employed to estimate the impact of awareness on marketing efficiency. Results show that while 68% of LBAs had heard of certification programs, only 38% possessed operational knowledge of compliance requirements. The result from the fractional response model revealed that awareness about certification and access to credit had a positive effect on marketing efficiency, with marginal effects of 0.033 and 0.0082, respectively, and both were statistically significant at 1%. This shows that certification awareness has a positive and statistically significant effect on marketing efficiency. Certified LBAs exhibited higher average marketing efficiency compared to their uncertified counterparts. The study concludes that awareness of certification programs enhances marketing efficiency and recommends targeted outreach, training, and policy incentives to bridge the knowledge gap and promote wider adoption of certification practices among LBAs.

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sciforum-138560: Enhancing Agricultural Profitability through Crop Price Prediction: A Machine Learning Approach Leveraging Market and Environmental Data

P Ankit Krishna *, Gurugubelli V.S Narayana, Siva Krishna Kotha and Debabrata Pattnayak

School of Engineering and Technology, Department of Computer Science and Engineering, GIET University, Gunupur 765022, Odisha, India

Background

Modern agriculture operates within an increasingly unpredictable environment, influenced by dynamic market fluctuations and environmental variability. Timely and accurate prediction of crop prices is essential to support data-driven decision-making for farmers, policymakers, and stakeholders in the agricultural supply chain.

Objective

This study presents a comprehensive machine learning framework aimed at forecasting crop prices by integrating environmental, economic, and logistical variables. The primary objective is to enhance agricultural profitability and sustainability through precise, data-informed insights.

Methods

A diverse dataset was compiled, encompassing features such as temperature, precipitation, supply and demand metrics, transportation costs, fertilizer application, pest infestation levels, and market competitiveness. Advanced feature engineering techniques were applied to preprocess and refine the input data. Several machine learning models, including Linear Regression, AdaBoost, Support Vector Machines, Random Forests, and XGBoost were developed and evaluated for their predictive accuracy.

Results

Among the evaluated models, XGBoost outperformed the others by delivering the highest accuracy in price forecasting. Its capability to model complex, non-linear relationships and capture intricate feature interactions proved critical for reliable predictions. The enhanced precision offered by XGBoost enables stakeholders to make informed decisions, contributing to increased profitability and optimized resource allocation. **Conclusions:** The proposed XGBoost-based crop price prediction framework demonstrates robust performance in real-time agricultural forecasting scenarios. By incorporating a wide range of environmental and market variables, the model significantly reduces uncertainty in the agri-value chain, thereby supporting sustainable farming practices and improving economic resilience.

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sciforum-128949: Environmental Aspects Of Autonomous Robotic Agricultural Machines

Julija Rukaite [1, 2,*] **and Egidijus Šarauskis** [1,2]

[1] Department of Agricultural Engineering and Safety, Faculty of Engineering, Agriculture Academy, Vytautas Magnus University, Studentu Str. 15A, LT-53362 Akademija, Kaunas District, Lithuania
[2] Bioeconomy Research Institute, Agriculture Academy, Vytautas Magnus University, Studentu Str. 11, LT-53361 Akademija, Kaunas District, Lithuania

Environmentally sustainable agriculture is increasingly based on an approach that addresses the overlapping issues of climate change, food security, increasing sustainable agricultural productivity, maintaining healthy soils, and reducing greenhouse gas emissions. It is essential to look for innovative ideas that can help address these issues. One solution could be the application of a range of innovative agricultural practices, such as the use of autonomous and robotic machinery in agricultural processes. The aim of this work was to analyse trends in the use of autonomous robots in crop production from an environmental perspective. A comprehensive analysis of literature sources in the databases ScienceDirect, Web of Science, and Google Scholar was carried out. A carefully selected set of keywords was used to find articles relevant to this work, including “autonomous agricultural machines”, “agricultural robotics”, “sowing robots”, “weed control robots”, “tillage robots”, “harvesting robots”, and other related secondary keywords. The search for information focused only on the crop sector without touching on livestock, logistics, horticulture, and gardening. Autonomous agricultural machines used in crop production have been classified according to work processes: tillage, sowing, spraying and fertilising, weed control, and harvesting. A diagram of the environmental impact of autonomous machines in agriculture has been drawn up, which shows that autonomous agricultural machines have a positive impact on the physical and chemical properties of the soil, on the optimisation of resources, and on the production of higher yields. The efficiency of an autonomous system is between 3.0 and 9.6 % better than tat of a conventional machine, and the difference in CO2 emissions between autonomous and conventional systems shows that an automated system is able to emit between 11.0 and 63.3% less CO2 into the environment. In addition, in many cases, a robotic system is several times lighter than a conventional system and has a lower impact on soil structure than conventional earth-moving machinery. Autonomous machines are poised to have a significant impact on the development of crop production in terms of environmental sustainability. The integration of these intelligent technological solutions into agriculture is in line with the principles of climate-friendly agriculture, increasing the efficiency and sustainability of farming practices. Autonomous equipment, such as solar-powered robotic systems, can carry out technological processes with the least possible disturbance to the environment, while optimising the use of resources and thus reducing the negative environmental impacts associated with traditional farming methods.

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sciforum-129062: Exploring the role of Rural Women in Sustainable Agriculture in Morocco

Najoua Khayati * and Abdelali Lahrech

Faculty of Economics, Moulay Ismail University of Meknès, Morocco

Climate-smart agriculture provides a transformative paradigm for sustainable development and food security. While CSA emphasizes increased productivity and enhanced resilience, its successful implementation is fundamentally contingent on inclusive participation. In Morocco, rural women are central to labor and agricultural systems. However, they often face significant barriers and remain disproportionately marginalized from engaging fully in sustainable practices. Accordingly, this research critically examines the role of rural women's empowerment in contributing to sustainable agricultural practices in Morocco's Fez-Meknes region.

This paper employed a mixed-methods approach. We conducted semi-structured interviews with key stakeholders, including government officials, community representatives, and non-governmental organizations. In the next step, we administered questionnaires to female-led cooperatives and farmers. The data analysis provided us with a contextual understanding of stakeholders' perspectives on the existing policies. It allowed us to perform a thorough assessment of women's involvement in sustainable agricultural practices. Moreover, we identified a set of barriers impeding their full participation in the adoption of such practices.

Our results indicate limited participation of rural women in the adoption of innovative CSA practices in the Fez-Meknes region. Despite their significant contribution to agricultural labor, they face numerous restrictions in terms of access to financial resources, education, and information networks. Notwithstanding, our research highlights a substantive correlation between inclusive policies and increased adoption of sustainable agricultural practices. Furthermore, female-led cooperatives demonstrated enhanced collective action, leading to knowledge sharing and more effective results.

This research explores the role rural women play in adopting sustainable agricultural practices. It confirms that conceiving and implementing inclusive policies leads to the empowerment of women through education, training, and resource provision. Enhancing women's participation in CSA initiatives is thus a prerequisite for achieving robust and sustainable agricultural development in Morocco.

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sciforum-132353: From traditions to transitions: empowering women in Lithuanian agriculture through living lab methodology

Vida Dabkienė

Lithuanian Centre for Social Sciences Institute of Economics and Rural Development

Despite accounting for a high share of the farming population in Lithuania, rural women remain underrepresented in innovation processes and formal support networks. This study explores how the Living Lab (LL) approach, as applied in the EU-funded GRASS CEILING project, supported women-led agricultural innovation through participatory, context-sensitive facilitation.

The Lithuanian LL brought together a diverse group of eight women farmers with varying levels of experience, farm types, and innovation readiness. Over three years, participants engaged in nine meetings, primarily in person, including site visits to women-led businesses, botanical gardens, and public institutions. Activities followed a structured, process-oriented empowerment journey—from capacity-building and self-reflection to innovation prototyping and testing—supported by expert-led training and peer mentoring.

Qualitative data—diaries, structured reflections, mentoring notes, and a final focus group—revealed several outcomes. First, the LL fostered a psychologically safe and inclusive environment, allowing women to exchange ideas, reflect on barriers, and gain confidence. Second, peer learning emerged as a critical support mechanism, often more valued than formal expertise. Third, innovation was redefined—from high-tech solutions to incremental, low-cost changes such as marketing strategies or new sales channels. Several participants increased visibility through media, awards, and market engagement.

However, systemic challenges such as limited access to childcare, funding, and policy alignment remain. Participants also noted the lack of targeted training for small farms and insufficient integration into broader agricultural policy frameworks.

In conclusion, the Lithuanian LL demonstrates that gender-sensitive, place-based participatory methods can empower rural women, enhance innovation ecosystems, and contribute to inclusive rural transformation in a post-socialist context.

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sciforum-132723: Growth model for vertical towers in greenhouse based on use efficiency of radiation and plant position

Manuel Felipe López Mora [1]*, María Lorena Solano Betancourt [1], María Fernanda Quintero Castellanos [1], Calina Borgovan [2], Carlos Alberto González Murillo [3], Pablo Delgado [1] and José Miguel Guzmán Palomino [2]

[1] Faculty of Agronomy & Veterinary, Autonomous University of San Luis Potosi, San Luis Potosi, Mexico
[2] Deparment of Agronomy, University of Almeria, CeiA3, CIAIMBITAL, Almeria, Spain
[3] Department of Civil and Agricultural Engineering, National University of Colombia, Bogota, Colombia.

Shade projection of crops in vertical towers significantly affects yield productivity and quality. Inside a greenhouse, plants at lower positions receive less radiation than those at higher levels. This uneven distribution of light results in higher and faster growth in plants located at higher levels than at lower ones. Stepwise harvesting can offer a simple and practical solution to improve the viability of vertical systems under low-tech greenhouses in urban and peri-urban areas. However, determining the optimal time for harvest at each crop level requires using predictive crop modelling tools. This study aimed to develop a growth model for vertical hydroponic crops under greenhouse conditions, which estimates the variation in dry biomass accumulation plant positions along the tower. The model is based on Heuvelink's radiation-driven growth equation. Dry matter production is a function of radiation use efficiency (RUE), leaf area index (LAI), extinction coefficient (k), and incident photosynthetically active radiation (PAR). Each vertical tower was a closed system with a 20L lower tank and a 1.6 m high vertical pipe, with 45 holes for plants at 25 plants·m^2 of density. For model validation, Swiss chard (*Beta vulgaris* L. 'Ford Hook Giant') was grown in autumn 2024 with Steiner's nutrient solution in vertical towers inside a tunnel greenhouse. Radiation was measured daily at three levels of the canopy, upper (U), middle (M), and lower (L) using a lux meter. The extinction coefficients for each position were estimated using nonlinear GRG optimization, from the Excel® Solver tool. The results show an extinction coefficient between 0.06 and 0.09, which decreased as plant position increased in height. The RUE ranged from 1.12 to 1.79 g·MJ^{-1}, with the U level being the most efficient. Since R^2 ranged from 0.88 to 0.95, this indicates that the proposed model shows a good predictive capacity throughout the canopy and could be applicable for scheduling staggered harvests in vertical systems within a greenhouse. Defining the commercial weights of desirable plants, the optimal time of harvest at each level of the tower can be easily predicted.

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sciforum-138236: Harnessing Artificial Intelligence for Climate-Smart Agriculture: A Roadmap for Transforming Agri-Decision Systems in the Global South

Md. Naziur Rahman

Department of Agriculture, College of Agricultural Sciences, International University of Business Agriculture and Technology, 4 Embankment Drive Road, Sector-10, Uttara, Dhaka, Bangladesh

Artificial Intelligence (AI) is rapidly transforming agriculture, offering advanced solutions to the long-standing challenges of climate variability, resource optimization, and food insecurity. However, in many parts of the Global South, particularly South Asia and Sub-Saharan Africa, the adoption of AI in climate-smart agriculture (CSA) remains in its infancy due to infrastructure, policy, and capacity barriers. This study develops a comprehensive roadmap for integrating AI into CSA decision systems in data-scarce and climate-vulnerable regions. This roadmap is formulated through a systematic meta-synthesis of over 200 peer-reviewed articles, FAO and World Bank reports, and real-world case studies of AI applications in agriculture. AI models, including machine learning, deep learning, and geospatial decision support systems, are critically analyzed in terms of their current utilization for yield forecasting, pest detection, early warnings of drought, precision irrigation, and digital farm advisory platforms. A technology–policy–capacity framework is proposed, illustrating how scalable AI tools can be embedded within national agricultural extension systems and local farmer knowledge networks. Therefore, the key findings highlight the potential of open-access satellite datasets (e.g., NASA POWER, Copernicus), federated learning for data privacy in rural areas, and low-power AI devices suited to resource-constrained environments. Ethical concerns such as algorithmic bias, digital exclusion, and governance vacuums are also addressed, with mitigation strategies proposed to ensure equitable AI deployment. This conceptual contribution offers a forward-looking strategy for aligning AI innovation with CSA goals, enhancing agricultural productivity, sustainability, and resilience. The proposed roadmap serves as a practical guide for researchers, policymakers, and agri-tech innovators committed to transforming agri-food systems across the Global South.

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sciforum-133610: High-Temperature Effects on Phenology, Growth, and Yield of Wheat Varieties under Late-Sown Conditions

Abdur Rahman Al Mamun *, Abu Taleb and Rubel Mia

Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur 5200, Bangladesh

Introduction

Wheat: (Triticum aestivum L.) is a critical mass crop that is produced in many countries in different regions. However, this benefit is being countered by the effects of high-temperature stress that become more problematic, especially in late-sown conditions. These high temperatures can significantly impact the phenology, growth patterns, and overall yield of various wheat varieties. Understanding how different cultivars respond to these stresses is essential for developing strategies to enhance resilience and ensure food security in the face of climate change. Late seeding in Bangladesh habitually results in wheat exposure to high temperatures during the significant stages of growth and hence interferes with phenology, growth patterns, and yield constituents. The current study hence, aims at explaining the effects of late sowing-induced heat stress on three high-yielding wheat varieties with the intention of determining those genotypes that have increased thermotolerance to enable long-term wheat production in hot climatic conditions.

Methods

An experiment was conducted during the 2020–21 wheat growing season at the Bangladesh Wheat and Maize Research Institute in Dinajpur, Bangladesh. An experimental split-plot design was implemented, incorporating two planting dates—optimal (25 November) and late (5 January)—and three wheat varieties: BARI Gom 21, BARI Gom 26, and BARI Gom 27. Sowing dates were designated as primary plots, while specific cultivars were utilized as secondary plots. Key characteristics, including phenological stages, leaf area index (LAI), plant height, tillers per square meter, spikelets per spike, grains per spike, 1000-grain weight, biomass, harvest index, and grain yield, were quantified and analyzed by variance analysis.

Results

Delayed seeding considerably accelerated phenological development, leading to a shortened interval to phenological maturity and adversely affecting growth and yield. The optimal sowing date of 25 November yielded superior values for tiller density, leaf area index, plant height, spikelets per spike, grains per spike, 1000-grain weight, biomass, and grain yield compared to subsequent sowing dates. BARI Gom 21 exhibited the highest yield among the types, producing 9900 kg ha^{-1} under optimal sowing conditions and 7424 kg ha^{-1} with delayed planting. The second-highest yields were recorded for BARI Gom 26 and BARI Gom 27. The interaction between planting dates and varieties had an impact on yield components, with BARI Gom 21 consistently exhibiting superior performance compared to other types in both scenarios.

Conclusions

It has been empirically proven that the date of wheat planting on 25 November in Bangladesh hastens phenological development, enhances vegetative biomass, and augments yields. BARI Gom 21, with its strong heat tolerance and high-yielding capacity, also represents one that can be selected and grown either under optimal or under late-sown conditions. These findings reaffirm the importance of the inclusion of this diversity in breeding programs aimed at generating heat-tolerant wheat lines and, in that way, strengthening the climate resilience of the national wheat production systems.

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sciforum-119603: Impact of Farming on achieving Sustainable Development Goals

Sonika Tyagi * and Dr.Yogesh Kumar Gupta

Department of Computer Science & Engineering, Banasthali Vidyapith, P.O. Banasthali Vidyapith - 304022, (Raj.) India

The 2030 Agenda for Sustainable Development created 17 Sustainable Development Goals and 169 targets, and was endorsed by all 191 United Nations (UN) in 2015. The main objective of these SDGs is to promote prosperity while protecting the planet [1]. This paper tries to project the idea to address more than half of the SDGs directly and the rest indirectly by working on just one area, i.e., farming. Farming that integrates the newest technology and sustainability throughout the crop cycle can help in achieving the SDGs. The SDGs that may be addressed directly through smart farming are **Goal 1: No Poverty, Goal 2: Zero Hunger, Goal 3: Good Health and Well-being, Goal 6: Clean Water and Sanitation, Goal 7: Affordable and Clean Energy, Goal 8: Decent Work and Economic Growth, Goal 9: Industry, Innovation and Infrastructure, Goal 10: Reduced Inequality, Goal 11: Sustainable Cities and Communities, Goal 13: Climate Action, Goal 15: Life on Land,** and **Goal 17: Partnerships to achieve the Goals**. To assist in addressing the mentioned SDGs, this paper suggests a suitable sustainable approach to be used at major stages of the crop lifecycle and then maps the Key Impact Areas of Farming onto the SDGs to show the impact of agriculture on the SDGs and that improving agriculture will impact SDGs the most.

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sciforum-139045: is lotus a viable alternative crop in low-lying agricultural areas? Evidence from thua thien hue province, central vietnam

Tuyen Thi Duong [1]*, Philippe Lebailly [1], Quan Tan Truong [2], Hop Thi Minh Ho [1] and Philippe Burny [1]

[1] Unit of Economics and Rural Development, Gembloux Agro-Bio Tech, University of Liège, 5030 Gembloux, Belgium
[2] Faculty of Economics and Development Studies, University of Economics, Hue University, Hue, Vietnam

Crop conversion has become an increasingly important strategy for climate adaptation and for overcoming the limitations of traditional farming systems, particularly in low-lying regions. This study, focusing on lotus farming in Thua Thien Hue Province, examines the adoption and impact of lotus as an alternative to rice in flood-prone areas that are at high risk of being abandoned due to low agricultural efficiency. Based on data collected from direct interviews with 101 households in the Phong Dien and Quang Dien districts, this research highlights the critical influence of land-use policies on crop switching. While efforts to promote crop diversification have enabled farmers to transition to alternative crops, restrictive rice land protection policies continue to hinder the expansion of high-value alternatives, such as lotus. This study further explores the adaptive strategies employed by farmers. It analyzes five-year land-use histories to identify ongoing challenges in lotus cultivation, such as vulnerability to erratic weather, pest and disease outbreaks, and high input costs. Despite these obstacles, lotus farming emerges as a viable and economically promising option for marginal lands. These findings underscore the need for changes in land-use policies, increased investment in local lotus varieties, and enhanced agricultural support services to improve the long-term sustainability of lotus and other high-value alternative crops.

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sciforum-132799: Perfomance of pepper under different vermicompost regimes

Tatenda Chapman [1,*], Rudo Masango [2], Linda Muusha [1] and Victor Chingwara [3]

[1] Department of Agriculture Research and Innovation, Horticulture Research Institute, Marondera, P Bag 810, Zimbabwe
[2] Department of Crop Science, Marondera university of Agriculture Science, 15 Longlands Road Marondera , Zimbabwe
[3] Department of Agriculture Research and innovation, Harare Agricultural Research center, fifth street extension, P O Box CY594, Causeway, Harare, Zimbabwe

A field trial was conducted at Horticulture Research Institute, in Marondera Zimbabwe, to investigate the effect of vermicompost (as a basal fertiliser) and vermifoliar (as a top dressing) on bell pepper (Capsicum annum cv. California wonder). The experiment was set up as a Randomized Complete block design (RCBD) with three replications and six treatments: (1) no fertiliser applied (negative control) ; (2) 20g vermicompost and 3 weekly sprays of 50mg vemifoliar; (3) 30g vermicompost and 3 weekly sprays of 50mg vermifoliar ; (4) 40g Vermicompost and 3 weekly sprays of 50mg vermifoliar; (5) 50g vermicompost and 3 weekly sprays of 50mg vemifoliar ; (6) 20g compound C and 10g ammonium nitrate (positive control). The objective of the study was to evaluate the potential of using vermicompost as a sole nutrient source for pepper production and to determine optimal application rates that can be recommend to smallholder farmers in Zimbabwe. Data was collected on plant growth, yield and fruit quality parameters. Significant differences ($P \leq 0.05$) were observed across all treatments. The positive control, 20g compound C basal fertiliser application and 10g ammonium nitrate as top dressing recorded the highest performance in all the measured parameters. However, increasing rates of vermicompost (from 20g to 50g/plant) resulted in a positive dose response, with improvements in the marketable fruit number, average fruit weight, average fruit diameter, marketable yield and total yield. Notably, 50g vermicompost treatment was the second-best performer and demonstrated potential as an organic alternative for nutrient management in pepper production. The findings from the study suggest that vermicompost can partially substitute chemical fertilisers, particularly at higher application rate and can be recommended as a viable option for smallholder farmers.

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sciforum-116466: Productivity Gains from Climate Adaptation: Micro-Level Insights from Rice Farmers in Southwest Nigeria

Lawrence Oluwagbenga Oyenpemi [1, 2, 3,*], Temitope Ojo [3, 4, 5] and Gabriel Adepoju [3]

[1] Middle Tennessee State University, Murfreesboro, TN 37132, USA
[2] Political Economy Research Institute (PERI), University of Massachusetts Amherst, Amherst, MA 01003, USA
[3] Obafemi Awolowo University, Ile-Ife 220282, Osun State, Nigeria
[4] Department of Plant, Food and Environmental Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS B2N 5E3, Canada
[5] Disaster Management Training and Education Centre for Africa (DiMTEC), University of the Free State, Bloemfontein 9301, South Africa

The transformation of food systems is essential to addressing the growing threats posed by climate change, particularly for smallholder farmers who rely on rain-fed agriculture. In Nigeria, rice farmers are increasingly vulnerable to unpredictable weather patterns, making the adoption of adaptation practices critical for sustaining yields. This study investigates the determinants of adaptation adoption and its impact on rice productivity in Osun State, Nigeria. A multistage sampling technique was used to select 100 rice farmers, and data were analyzed using descriptive statistics, the endogenous switching regression model (ESRM), and augmented inverse probability weighting (AIPW) for robustness.

Findings show that about 59% of the farmers were male, with an average age of 49 years of age, a household size of 6.8, and a farm size of 3.07 hectares, yielding 1045.92 kg/ha. Results from ESR reveal that adopters achieved a 2% productivity increase relative to non-adopters. While low, this gain is meaningful in the context of rain-fed rice farming, where even small improvements in yield can translate into significant food security and income benefits at scale.

This study highlights the role of adaptive practices in strengthening resilience and recommends policies that subsidize inputs, improve extension services, and expand access to weather information systems. These targeted interventions can accelerate adoption and ensure that smallholder farmers are better equipped to cope with climate shocks, ultimately supporting sustainable food system transformation in Nigeria.

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sciforum-127514: Scaling Zero-Dig Farming: A Sustainable Pathway to Net-Zero Emissions and Soil Regeneration

Akhil Srinivas Karnam Hema Chandran

Royal Agricultural University

This study evaluates the Royal Agricultural University (RAU) Zero-Dig initiative as a scalable and sustainable agricultural solution aligned with the UK's net-zero emission goals. Zero-dig farming, which avoids traditional ploughing, is assessed for its impacts on soil health, biodiversity, carbon sequestration, and economic feasibility. The method incorporates organic manure, companion planting, and greenhouse cultivation to enhance ecological resilience and reduce reliance on synthetic inputs.

A mixed-methods approach combined field observations from RAU's experimental plots with qualitative analysis from stakeholder interviews. Key metrics included soil organic carbon levels, biodiversity indices, and input cost reductions.

Results indicate that zero-dig farming significantly improves soil structure, increases microbial activity, and enhances water retention. Soil samples from zero-dig plots showed higher organic carbon content than conventional tillage areas. Biodiversity, both above and below ground, was enriched through minimal soil disturbance and the integration of diverse plant species. Economically, while initial setup costs were substantial, covering greenhouses, irrigation, and composting infrastructure, the approach demonstrated long-term cost savings in synthetic inputs and labor. Market demand for organic produce further supports the financial viability of this method.

This study concludes that zero-dig farming presents a promising pathway toward sustainable agriculture. It offers tangible environmental and economic benefits, though barriers such as upfront investment and organic input logistics must be addressed. Educational outreach and community engagement have also proven crucial for adoption. The findings support broader implementation of zero-dig systems to achieve food security and environmental sustainability in temperate regions.

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sciforum-132052: Socio-Economic Determinants of Drip Irrigation Adoption in Semi-Arid India: Evidence from Sangamner, Maharashtra

Anshika Parihar

Bachelor of Science in Analytics and Sustainability Studies School of Management and Labour Studies (SMLS) Tata Institute of Social Sciences (TISS), Mumbai, 400088, India

Sangamner block in Ahmednagar district, Maharashtra, India, is a semi-arid region receiving only 500 – 750 mm of annual rainfall. Heavy reliance on agriculture, coupled with steadily declining groundwater levels, heightens farmers' climate vulnerability. Drip irrigation, a climate-resilient technology, is increasingly adopted in response.

This study employed a cross-sectional survey conducted in July 2024, covering 159 farming households from six villages (Kawthe Malkapur, Kolwade, Kumbharwadi, Pimpalgaon Depa, Shendewadi, and Warwandi). Structured interviews captured data for the 2023–2024 agricultural year, including household demographics, institutional support, government-scheme access, and crop production.

Binary logistic regression identified education, social group, FPO membership, land size, and age as significant predictors. Farmers with low and medium education levels are 84% (OR = 0.16, p = 0.017) and 74% (OR = 0.26, p = 0.035) less likely to adopt drip irrigation compared to highly educated farmers. Social group-wise, Other Backward Class (OBC) farmers are four times more likely to adopt drip irrigation than Scheduled Tribe farmers (OR = 4.037, p = 0.004). Each additional acre of land and each extra year in age raised adoption odds by 14.5% (p = 0.015) and 4% (p = 0.046), respectively. Lastly, Farmer Producer Organisation (FPO) membership was the strongest driver, with non-members being 87% less likely to adopt drip irrigation (OR = 0.126, p 0.001). Conversely, gender and government schemes, including Kisan Credit Cards, Soil Health Cards, and Pradhan Mantri Fasal Bima Yojana, showed no significant relationship.

Descriptive analysis revealed that traditional climate-resilient cereals (bajra, jowar) achieved stable yields across all irrigation types, whereas high-value, water-sensitive crops like onion and tomato yielded 8 to 50 times higher yields under drip systems.

These findings highlight the need for targeted educational interventions and FPO-based extension programs to accelerate drip adoption, particularly focusing on marginalized communities and less-educated farmers to strengthen climate resilience in water-stressed regions.

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sciforum-130608: The Effects Of Conservation Agriculture Practices On Soil Greenhouse Gas Emissions In Maize Production Systems In Buea, Cameroon

Amahnui George Amenchwi [1,*], Paligwendé Nikièma [2], Veronica Ebot Manga [3], Aaron Suh Tening [4], Isimikalu Theophilus Olufemi [5] and Tek Sapoka [6]

[1] International Center for Tropical Agriculture (CIAT), Km 17 recta Cali-Palmira, Cali 763537, Colombia
[2] 4Department of Education, Government of Manitoba, Canada
[3] Department of Environmental Science, Faculty of Science, University of Buea, P. O. Box 63, Buea, Cameroon
[4] Department of Agronomic and Applied Molecular Sciences, University of Buea, P. O. Box 63, Buea, Southwest Region of Cameroon
[5] Department of Natural Sciences, University of Maryland Eastern Shore, MD 21853, USA
[6] International Maize and Wheat Improvement Center (CIMMYT), Carretera México-Veracruz, Km. 45, El Batán 56237 Texcoco, MÉXICO

With a specific focus on reduced tillage and organic fertilization, this study examines the effects of conservation agriculture practices on soil greenhouse gas (GHGs—CO_2, N_2O, and CH_4) emissions, global warming potential (GWP), maize productivity, and greenhouse gas intensity (GHGI) over two growing seasons (2020 minor and 2021 main season) in Buea, Cameroon. Two tillage practices, i.e., zero-tillage and conventional tillage, and three fertilizer treatments, i.e., no fertilizer, synthetic fertilizer (urea), and organic fertilizer (composted municipal solid waste), were factorially combined in a split-plot design with three replications. The hybrid maize cultivar CMS 8704 was used. GHG emissions were measured using the static flux chamber method, and flux rates were calculated with the HMR package in R software. The results showed that tillage and fertilizer types significantly (p0.05) influenced seasonal cumulative CO_2, N_2O, and CH_4 emissions. Synthetic fertilizer treatments produced the highest cumulative N_2O emissions, particularly under zero-tillage in 2020 and conventional tillage in 2021. Conventional tillage paired with organic fertilizer yielded the highest CO_2 emissions across both seasons, while methane fluxes were low and largely negative across treatments, indicating that the volcanic upland soils acted as CH_4 sinks. Application of synthetic fertilizer increased GWP by 20% and 322% under no-tillage in the 2020 and 2021 seasons, respectively. Under conventional tillage, GWP decreased by 15% in 2020 but sharply increased by 295% in 2021, highlighting season-specific effects. Although treatment effects were not significant (P>0.05) on maize yields in 2020, the highest yield (3.06 t/ha) occurred under conventional tillage without fertilization. Fertilizer type and its interaction with tillage significantly (P0.05) influenced yields in 2021, with the highest yield under conventional tillage with synthetic fertilization (6.15 tons/ha). However, conventional tillage treatment without fertilization produced the highest yield (3.06 t/ha) in 2020 and the lowest GHGI (12.04 kg CO_2-eq t^{-1}). In 2021, zero tillage treatment without fertilization resulted in a high yield (5.56 t/ha) with the lowest GHGI (2.15 kg CO_2-eq t^{-1}). The results suggest that in Buea's minor growing season, conventional tillage with or without organic fertilization reduced GHG emissions without compromising yields, while in main seasons, zero tillage without fertilization offered the most favorable yield-emission balance. This study highlights the importance of context-specific soil and nutrient management strategies for sustainable agriculture and climate change mitigation. The findings provide valuable data for national GHG inventory reporting and inform conservation agriculture practices in tropical upland agricultural systems.

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sciforum-132563: Time-Series Forecasting of Maize Production in Bangladesh: Integrating ARIMA Models with Diagnostic Validation

Mahadi Hasan Monshi [1,*], Muntarina Hussan Mouri [2], Fakhrul Islam Monshi [3], Ahmed Khairul Hasan [4] and Rehenuma Tabassum [2]

[1] Department of Economics, University of Chittagong, Chittagong-4331, Bangladesh
[2] Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh
[3] Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh
[4] Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Maize production and consumption in Bangladesh are increasing as an alternative to wheat for sustainable food security and economic growth. An authentic crop production forecasting method is crucial for securing food security through proper agricultural policy-making, especially in developing nations like Bangladesh, where most people depend on agricultural farming. The present study predicted the time-series analysis of maize cultivation area, yield, and production employing the Autoregressive Integrated Moving Average (ARIMA) model. Stationarity assessments were done utilizing the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) and Augmented Dickey–Fuller (ADF) tests at a 5% significance level using yearly data from 2009 to 2024 collected from Index Mundi. The fit model was chosen based on the lowest value of Bayesian Information Criterion (BIC), the Corrected Akaike Information Criterion (AICc), and the Akaike Information Criterion (AIC). Ljung–Box and Jarque–Bera tests were utilized to detect autocorrelation. The metrics MAE, RMSE, MASE, and MAPE were used to verify values. After reviewing all criteria, ARIMA (2,1,0) was identified for the production area, ARIMA (0,1,0) for yield, and ARIMA (1,1,1) for production. The forecast specified a steady increase in the production area, with a compound annual growth rate (CAGR) of 8.1%. Yield is anticipated to remain stable at 9.0 tons per hectare, reflecting the ongoing utilization of high-yielding hybrids and advanced agronomic techniques. It is forecasted that by 2029, maize production will reach around 9.04 million metric tons, with a compound annual growth rate (CAGR) of 10.0%. The results underscore the importance of the increasing maize production trend in Bangladesh's food and feed sector, particularly as a vital resource for the dairy, fishery, and poultry sectors. Furthermore, they demonstrate the reliability and predictability of ARIMA models, thereby assessing their relevance in agricultural planning and judicious decision-making in the face of market and climatic uncertainty.

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Session 2. Ecosystem, Environment, and Climate Change in Agriculture

sciforum-138926: "Relationships Among Riparian Vegetation, Aquatic Diversity and Habitat Conditions in the Sundarbans"

Swapan Kumar Sarker, Abdullah Al Asif and Ananna Dey *

Forestry and Environmental Science, Agriculture and Mineral Science, Shahjalal University of Science and Technology, Sylhet, 3100, Bangladesh

Riparian vegetation is crucial for stabilizing riverbanks, improving water quality, and sustaining aquatic biodiversity by forming a transitional zone between aquatic and terrestrial systems. In the Sundarbans, the world's largest mangrove forest, these vegetated buffers are ecologically essential for preserving delta stability, filtering sediments, and providing nursery grounds for juvenile fish in the Sundarbans. Despite growing understanding of their roles, few studies have explored how environmental gradients together affect estuarine fish resources and riparian vegetation. Therefore, using the hydro-ecological data (vegetation, fish and water) of 65 canals, this study aims to (I) asses the distribution of plant and juvenile fish community in the Sundarbans, (II) investigate the impact of habitat conditions on riparian plant and fish resources, and (III) understand the interconnection between riparian vegetation, fish community, and water conditions. This study found that the distribution of riparian plants and fish species is considerably shaped by water parameters, and a significant variation is present in three ecological zones. Additionally, the association among abiotic parameters, fish richness, and plant richness was significant, but plant richness did not show a significant relationship with fish richness. This implies that the terrestrial and aquatic biota are functionally decoupled or respond asynchronously. These results emphasize that riparian habitats can lead to complex effects on fish richness patterns and suggest the necessity of coordinated conservation strategies and the intricate and context-dependent character of riparian–aquatic interactions. . This study shows how important it is to perform integrated ecological evaluations that look at both land and water biodiversity.

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sciforum-136618: Policy Gaps and Local Governance in Mitigating Climate Change Effects on Sylhet Agriculture

Sharmin Begum

Department of Public Administration, Shahjalal University of Science and Technology, Sylhet, Bangladesh

Climate change has emerged as a critical threat to agriculture in Sylhet, Bangladesh, a region distinguished by its diverse agro-ecological zones, including haor wetlands, hilly tea plantations, and fertile floodplains. Increasingly erratic weather patterns such as unseasonal rainfall, flash floods, and prolonged droughts are destabilizing agricultural productivity, endangering rural livelihoods, and intensifying food insecurity. Although Bangladesh has developed comprehensive climate strategies—such as the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), the National Adaptation Plan (NAP), and the Delta Plan 2100—their effective implementation at the local level remains questionable. This study investigates the policy gaps and evaluates the role of local governance in translating national climate agendas into actionable interventions for climate-resilient agriculture in Sylhet. This study adopted a mixed-methods approach. Quantitative data were collected from a survey of 150 farmers across three agro-ecological zones in Sylhet, assessing their perceptions, losses, and access to institutional support related to climate impacts. Additionally, 20 key informant interviews were conducted with officials from Union Parishads, Upazila administrations, agricultural extension departments, and local NGOs. A policy content analysis was also carried out to examine how national frameworks are operationalized within local administrative and planning structures. Findings reveal significant policy and implementation gaps. These include inadequate decentralization of climate adaptation funds, weak coordination between government departments, limited training of extension workers on climate-resilient farming, and the absence of localized climate risk assessments in development planning. Many farmers reported receiving little to no institutional support during climate shocks, relying instead on traditional knowledge and informal networks. This study recommends greater devolution of climate-related decision-making and financing to the Union and Upazila, targeted training for local officials, improved integration of local data into national planning, and farmer-inclusive adaptation strategies. Strengthening local governance is essential to building long-term resilience in Sylhet's climate-vulnerable agricultural sector.

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sciforum-133356: Landraces of Barley Exhibit Superior Drought Resistance: Insights from Agro-Morphological and Physiological Analysis

Abhisek Shrestha [1,*], Bharti Thapa [2] and Professor Santosh Marahatta [1]

[1] Agriculture and Forestry University
[2] Aassman Nepal

This study investigated the drought resistance of barley landraces compared to modern cultivars, focusing on agro-morphological and physiological traits under controlled drought conditions. The experiment employed a two-factorial completely randomized design (CRD) with 17 barley landraces subjected to drought stress at three growth stages (tillering, jointing, and heading). Key parameters such as SPAD values (chlorophyll content), tiller number, root–shoot length, and yield attributes were measured and analyzed using drought tolerance indices. Six landraces reached maturity. Results revealed significant genotypic variation in drought response. Six landraces exhibited higher SPAD values under drought, indicating better photosynthetic retention. Notably, **NBD 4** demonstrated high yield stability (Stress Tolerance Index, STI = 1.782) under both stress and non-stress conditions. At the same time, **Saptari Local** showed exceptional drought avoidance (low Stress Susceptibility Index, SSI = -0.068) through early maturity and minimal yield reduction. In contrast, genotypes like **Muktinath** and **NGRC 6010** were susceptible to drought, with significant yield losses (49–87%). Physiological traits such as chlorophyll retention and phenological plasticity (e.g., accelerated maturity under stress) were critical for drought adaptation. The findings highlight the potential of landraces like **NBD 4** and **Saptari Local** as genetic resources for breeding climate-resilient barley varieties. Ths study underscores the importance of integrating traditional landraces into modern breeding programs to enhance food security in drought-prone regions.

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sciforum-118410: Leaf Traits as Indicators of Drought Adaptation in Olive Cultivars

Abdelouahab Sahli [1,*], Abdelilah Meddich [1], Cherkaoui El Modafar [1] and Ahmed El Bakkali [2]

[1] Universite´ Cadi Ayyad, Faculté des Sciences et Techniques Gueliz, Laboratoire AgroBiotechL02B005, 40000 Marrakech
[2] INRA, UR Amélioration des Plantes et Conservation de Ressources Phyto-génétiques, Meknès

The olive tree (Olea europaea L.) is one of the most widespread and cultivated trees in the Mediterranean region. The crop faces many challenges in the context of climate change, particularly frequent droughts due to inter-annual variability in the rainfall. Such a situation leads to the emergence of more arid areas, raising questions about the sustainability of the olive crop in the Mediterranean region. Therefore, a deeper knowledge of the mechanisms of drought resilience is crucial for predicting the response of trees to climate change. Objectives: The analysis of the functional and structural leaf-based traits of olive trees can be an effective strategy to (i) classify the current cultivars based on their adaptability to future climatic challenges and (ii) identify the most relevant and easily measurable traits for use in breeding programmes. Methods: A total of 80 olive cultivars were selected from the World Olive Germplasm Bank of Meknes (INRA, Morocco); each cultivar was represented by two trees, and six leaves were taken from each tree. Twelve traits were measured from each leaf, and these twelve traits were divided into three groups: (1) morphological traits, represented by the leaf area (LA), leaf length (LL), leaf width (LW) and leaf shape (LL/LW); (2) ecophysiological traits such as the stomatal density (DS), trichome density (DT) and leaf blade thickness (LT); and (3) structural traits, represented by the dry and fresh leaf weights (DM and FM), leaf mass per area (LMA), specific leaf area (SLA) and leaf dry matter content (LDMAC). The results of an ANOVA and the determination of the coefficient of variation showed that high phenotypic variability was observed for all the traits studied. In addition, the ANOVA showed that all the measured traits can be used for early detection of stress-tolerant varieties, especially the leaf length (LL), leaf shape (LL/LW), leaf thickness (LT) and leaf dry and fresh weights (DM and FM). In addition, investigation of leaves' morphological and structural traits can be used as a simple and rapid way to classify varieties with respect to their response to drought. Furthermore, the European varieties, such as Cobrancosa, Koroneiki, Arbequina and others, were the most stress-tolerant varieties. Conclusions: There was significant variation in the leaves' functional traits among the olive cultivars, with the variability depending on the type of trait and cultivar origin. This suggests that specific traits can be used to identify drought-tolerant cultivars. All the traits can be used in breeding programmes for variety selection, but the leaf shape, leaf width, leaf thickness and dry and fresh weights are the traits that show the most phenotypic variability between varieties. In future, phenotypic plasticity studies could be extended to other local and introduced varieties for comparison with those covered in this study.

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sciforum-137992: Bioprospecting for promising native plant species from Mampuján, Colombia: Application of the circular economy for the benefit of farmers

Irina Patricia Tirado-Ballestas [1, 2, 3,*], Vladimir Roa-Perez [4], Laideth Fernanda Quesada-Fernandez [5] and Karina Caballero-Gallardo [3]

[1] GENOMA Group, Heatlh Sciences Faculty, Universidad del Sinu, Elias Bechara Zainúm
[2] Environmental and computational chemistry group, Universidad de Cartagena, Faculty of Pharmaceutical Sciences
[3] Functional Toxicology Group, Universidad de Cartagena, Faculty of Pharmaceutical Sciences
[4] Universidad del Sinu, grupo DEARTICA, System Engineering, Cartagena de Indias, Colombia
[5] Functional Toxicology Group

This project aims to explore the biotechnological potential of native plant species from Mampuján, Bolívar (Colombia), a historically marginalized territory affected by armed conflict and displacement. Leveraging local biodiversity and ancestral knowledge, the initiative combines ethnobotanical surveys, STEM education, and 4.0 technologies to promote circular bioeconomy and social restoration. Approximately 100 promising plants will be identified through community knowledge and remote sensing via drone-assisted diagnosis. A subset will undergo taxonomic validation and extraction of essential oils or hydroethanolic extracts for chemical characterization and antimicrobial testing.

The antimicrobial activity of extracts will be evaluated against Pseudomonas aeruginosa, Staphylococcus aureus, Moniliophthora roreri, and Fusarium spp., using Kirby–Bauer and Minimum Inhibitory Concentration methods. Gas chromatography–mass spectrometry (GCMS) will determine chemical profiles and extraction efficiency. The results will inform the creation of a publicly accessible repository on promising species with potential pharmacological and agroindustrial applications. Moreover, the project prioritizes the empowerment of girls and adolescents (NNA) by integrating ancestral knowledge into scientific education, fostering social justice and environmental stewardship.

This work aligns with national science missions including “Science for Peace” and “Bioeconomy and Territory,” and contributes to Sustainable Development Goals (SDGs 1, 5, 8, 15). By facilitating knowledge exchange and capacity-building in circular economy practices, the project seeks to reduce economic disparity, strengthen local agroindustry, and provide tools for sustainable regional development. Ultimately, it positions bioprospecting as a path for socio-ecological resilience and health-oriented innovation within post-conflict communities.

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sciforum-114817: Climate Extremes and Agriculture: Addressing the Impacts of Droughts, Floods, and Storms on Farming Systems and Environmental Sustainability

Amruta Nilesh Patil * and Sunila Atul Patil

Department Pharmaceutical Chemistry, P.S.G.V.P.Mandal's College of Pharmacy,Shahada,Nandurbar-425409 (MH),India

Agriculture plays a critical role in ensuring food security, supporting livelihoods, and driving economic development. However, it is increasingly threatened by climate change—particularly by extreme weather events such as droughts, floods, and storms. This review explores the complex relationship between agriculture, ecosystems, and the environment, with a specific focus on how these climate extremes impact agricultural productivity, farming sustainability, and the health of natural resources. It examines how agriculture both contributes to climate change through greenhouse gas emissions and suffers from its consequences, including soil degradation, water scarcity, and biodiversity loss. The review also discusses adaptation and mitigation strategies, such as climate-smart agriculture, sustainable land and water management, technological innovations, and policy interventions. Emphasis is placed on the need for integrated efforts involving science, policy, and local communities to build resilient agricultural systems capable of withstanding climate-related shocks. These strategies are essential to protect environmental health and ensure long-term food security in a changing climate.

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sciforum-128792: Climate vulnerability and food security of chicken-rearing households in Southwestern Nigeria

Nathaniel Siji Olutegbe [1,*], Ifeoluwa Elizabeth Adeagbo [2], Iredele Emmanuel Ogunbayo [2], Oreoluwa Ibukun Akano [2], Benjamin Olusegun Oyelami [2] and Oyewale Yakubu Oyegoke [2]

[1] University of Ibadan, Ibadan Nigeria
[2] Innovation Lab for Policy Leadership in Agriculture and Food Security, University of Ibadan

Climate change presents a significant threat to agricultural livelihoods in Nigeria, particularly for smallholder poultry farmers. This study examined climate vulnerability and food security among chicken-rearing households in southern Nigeria. Using a multistage sampling technique, data was collected from 987 households across four states in the region. Household food security was assessed using the Household Food Insecurity Access Scale (HFIAS), while climate vulnerability was evaluated using the Intergovernmental Panel on Climate Change's Livelihood Vulnerability Index (LVI–IPCC), comprising exposure, sensitivity, and adaptive capacity components. Descriptive statistics revealed moderate to high vulnerability levels across the sample. Independent sample t-tests showed that rural households had a significantly higher adaptive capacity than their urban counterparts (t = 2.27), while urban households exhibited significantly greater sensitivity to climate risks (t = -2.11). Also, 91.0% of the respondents were moderately food-insecure. No significant differences were observed in the exposure levels (t = 1.68) or HFIAS scores (t = 0.08) between rural and urban households. The results from the Tobit model indicated that adaptive capacity significantly reduced food insecurity (z = -6.26), while a higher constraint burden increased it (z = 4.98). Female-headed households (z = 2.58) and those that reared more Fulani ecotype birds (z = 2.16) were more food-insecure, while literacy in English significantly improved food security (z = -3.64). Climate exposure and sensitivity were not statistically significant in explaining HFIAS scores. These results highlight the need for context-specific adaptation strategies that enhance rural households' resilience, address production constraints, and promote inclusive access to information and literacy.

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sciforum-132986: Development of Drought-Resilient Rootstock Grafting and Cell-to-Cell Communications

Sowbiya Muneer

Vellore Institute of Technology

Climate change-driven water scarcity poses a major threat to horticultural productivity. This study explores rootstock grafting as a drought mitigation strategy in two major vegetable crops—tomato (*Solanum lycopersicum*) and okra (*Abelmoschus esculentus*). Drought-tolerant rootstocks were grafted with commercial scions and subjected to controlled drought stress. Grafted plants exhibited improved physiological performance, including higher relative water content, chlorophyll fluorescence (Fv/Fm), and stomatal regulation, compared to non-grafted controls. Gene expression analysis revealed significant upregulation of stress-responsive genes (e.g., **DREB1**, MAPK, **PIP2;1**) in the scion, indicating effective long-distance signaling and rootstock-induced stress priming. Proximate analysis of fruit revealed enhanced protein, fiber, and micronutrient content under stress. Yield assessments further confirmed superior fruit set and biomass in grafted plants under drought conditions. These findings underscore the role of rootstock–scion communication in stress adaptation and nutritional resilience, offering a viable approach to climate-smart vegetable production.

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sciforum-126588: Exploring the Biochemical Dynamics of Rice and Rice Leaf Folder (*Cnaphalocrocis medinalis*) Under Elevated CO_2 Conditions

Arya PS [1,*], Subhash Chander [2], Rajna Salim [3], Sachin Suroshe [3], Prabhulinga T [4] and Yogesh Yele [5]

[1] Assistant Professor, Department of Entomology, CCR(PG) College, Muzaffarnagar, Uttar Pradesh, India
[2] Director (Retired), ICAR-National Research Centre for Integrated Pest Management, New Delhi, India
[3] Scientist, Division of Entomology, ICAR- Indian Agricultural Research Institute, New Delhi, India
[4] Scientist, ICAR- National Bureau of Agricultural Insect Resources, Bengaluru, India
[5] Scientist, ICAR- National Institute of Biotic Stress Management, Raipur, India

Rice (*Oryza sativa* L.) is a vital cereal crop that is significantly impacted by biotic and abiotic stresses. Insect pests, causing 21% of annual yield losses, are the primary biotic stressors. Among them, the rice leaf folder (*Cnaphalocrocis medinalis*), a major foliage feeder, is the most devastating one. Abiotic stresses, including rising temperatures and CO_2 levels, also threaten rice yield. Atmospheric CO_2 levels are projected to reach 570 ppm by 2050 due to increased greenhouse gas emissions, exacerbating the stress on rice production. An experiment was conducted to study the effect of elevated CO_2 (eCO_2) on biochemical changes in rice leaf folder. This study was conducted in Open-Top Chambers (OTCs), provided by the Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi, India. Under eCO2 conditions, the rice plants showed a 26.47% increase in the total number of leaves and improved yield; however, leaf folder infestation reduced the leaf increase to 22.69% and led to a decline in yield. Biochemical changes in the rice plants included a reduced protein content, increased carbon-based compounds (TSS and phenols), elevated catalase activity, and stable peroxidase and SOD activities. The eCO_2 conditions had a significant impact on the rice leaf folder as well, as the larval duration was found to be increased, the percentage survival was reduced, and the larval weight increased. The biochemical analysis of the larval population revealed that the protein content had reduced significantly, while the defense enzymes, viz. catalase, peroxidase, and SOD, were found to have increased. While the effects of eCO_2 and rice leaf folder infestation on the morpho-chemical traits of rice are well studied, their combined impact remains less explored. Hence, principal component analysis (PCA) was employed to reduce the complexity of the dataset, revealing that eCO_2 enhanced the growth and yield of rice but negatively affected rice leaf folder survival and development, although the larvae's damage capacity increased.

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sciforum-127699: Greenhouse Gas Fluxes from the Furrow and the Bed in Furrow-irrigated Soybean on a Silt loam Soil in Southeast Arkansas

Lucia Escalante Ortiz *, Diego Della Lunga and Kristofor Brye

Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, USA

Furrow irrigation in cropping systems creates distinct environments within fields, with raised beds remaining relatively aerobic, while furrows experience wetter, flood-like conditions during irrigation. The distinct adjacent environmental conditions can differentially affect production and release of greenhouse gases (GHGs). While the aerobic raised beds can enhance soil respiration, the wet to saturated furrow can intensify methanogenic activity during irrigation and nitrification–denitrification during drying periods. To date, no study has simultaneously compared carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) fluxes from adjacent raised beds and furrows in a soybean [*Glycine max* (L.) Merr.] production system. This study evaluated the effect of measurement position (i.e., raised bed or furrow) on GHG (i.e., CO_2, CH_4, and N_2O) fluxes and season-long emissions in a conventionally tilled soybean field on a silt loam soil (Aeric Epiaqualfs) in southeast Arkansas. Gas fluxes were measured weekly from May to August 2024 using a field-portable measurement system. A linear mixed model was used to assess the effects of measurement position (i.e., raised bed and furrow), time (weekly measurements), and their interaction on CO_2, CH_4, and N_2O fluxes. Carbon dioxide fluxes were consistently greater ($P \leq 0.05$) in the raised bed than in the furrow across the growing season. Methane fluxes were generally greater in the furrow ($P \leq 0.05$), while N_2O fluxes were typically greater in the raised bed ($P \leq 0.05$). The results demonstrated substantial variation in CO_2, CH_4, and N_2O fluxes between raised beds and furrows, emphasizing the need for field position-specific GHG flux measurements to accurately scale emissions to the whole-field level.

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sciforum-129016: Impact of Open-cast Coal Mining on Soil Health and Ecosystem Recovery: A Case Study from Acidic Inceptisols of Assam, India.

Lumbini Kalita [1,*] and Bhabesh Gogoi [2]

[1] PhD Scholar, Department of Soil Science, Assam Agricultural University, Jorhat, Assam, India
[2] Scientist (Soils)- Stage III,Advanced Centre for Integrated Farming Systems Research, (AICRP on IFS under ICAR-IIFSR), Jorhat, Assam, India

Open-cast coal mining is a globally prevalent method of coal extraction that significantly disrupts terrestrial ecosystems, particularly through its impact on soil health and biological resilience. The process often results in the exposure of pyrite-bearing strata, leading to Acid Mine Drainage (AMD), nutrient depletion, and disruption of microbial functionality. This study explores how different durations of land uses/types and recovery durations influence soil chemical and biological properties in paddy-growing landscapes of Assam, India. Assam is a region predominantly characterized by strongly acidic Inceptisols, with limited buffering capacity and high vulnerability to degradation. We hypothesized that prolonged recovery time following mining cessation would result in gradual ecological restoration of soil quality. Four categories of land use were studied: C1 (active mining), C2 (recovery for 5 years), C3 (recovery for 10 years), and C4 (uncontaminated paddy field as control). Soils in active mining areas (C1) exhibited severe acidification (pH 4.3–5.3), attributed to AMD, with the lowest pH recorded in C1. This was accompanied by marked depletion of macronutrients—Nitrogen (N), Phosphorus (P), and Potassium (K). Microbial analysis revealed the lowest bacterial populations and Soil Microbial Biomass Carbon (SMBC) in C1, indicating biological stress, whereas C3 showed a partial resurgence in microbial activity and nutrient status. These findings suggest that the cessation of mining activities initiates a slow but measurable trajectory of soil health recovery, defined here as the gradual improvement in soil chemical and biological functions, in post-mining landscapes, though full ecological functionality may require targeted interventions.

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sciforum-142733: Impacts of Climate Change on Agro-Ecosystems and Sustainable Adaptation Strategies in Bangladesh

Md. Bidyut Hossain *, Aditi Imtiaz and Md Nasim Hossain

Department of Anthropology, University of Dhaka, Nilkhet Road, Dhaka-1000, Bangladesh

Agriculture in Bangladesh is highly vulnerable to climate variability and change. The country's location exposes it to recurrent floods, droughts, and salinity intrusion, which have intensified in recent decades. This study examined the impacts of climate change on smallholder farming systems in the Jamuna floodplain and explored local adaptation practices. A mixed-methods approach was employed including GIS analysis of land-use and vegetation changes, household surveys involving 120 farmers, and focus group discussions. The findings revealed a 22% decline in seasonal crop productivity over the past two decades, mainly due to delayed monsoons and increased soil salinity. Farmers reported shifting to short-duration rice, drought-tolerant pulses, and increased reliance on organic compost and indigenous pest control. However, institutional support and awareness remained limited. The results indicate that ecosystem-based adaptation strategies—such as crop diversification, wetland restoration, and agroforestry—are more sustainable compared to input-intensive approaches. Strengthening collaboration between scientific research and traditional knowledge is essential for building resilient agricultural systems in Bangladesh.

Bangladesh is one of the most climate-vulnerable countries in the world, where agriculture plays a central role in food security and livelihoods. The country's floodplain ecosystems are highly sensitive to climate-induced hazards such as floods, prolonged droughts, and saltwater intrusion. These hazards have intensified in recent decades, leading to significant disruptions in agricultural productivity and threatening the sustainability of rural livelihoods. Although several studies have documented the general impacts of climate change on agriculture, less attention has been given to localized adaptation practices in floodplain areas. Understanding how farmers perceive and respond to climatic stresses is crucial for designing effective adaptation strategies. Therefore, this study investigated the impacts of climate change on agricultural production in the Jamuna floodplain and analyzed the adaptation strategies adopted by smallholder farmers.

A mixed-methods research design was applied to capture both quantitative and qualitative insights.

GIS Analysis:

Image processing and data extraction were analyzed to detect land-use changes and variations in the Normalized Difference Vegetation Index.

Household Surveys:

Structured questionnaires were administered to 120 smallholder farmers selected through stratified random sampling in the Jamuna floodplain region. The survey collected data on cropping patterns, yield changes, input use, and perceptions of climate change.

Focus Group Discussions (FGDs):

FGDs were conducted to explore traditional ecological knowledge, local coping mechanisms, and community-based adaptation practices. Triangulating these methods enhanced the credibility and validity of the findings.

This study revealed significant shifts in agricultural practices and productivity due to climate change.

Decline in Productivity:

Seasonal crop yields declined by approximately 22% over the last two decades, largely linked to delayed monsoon onset and increased soil salinity in low-lying areas.

Changes in Cropping Patterns:

Farmers reported reducing dependence on long-duration rice and increasingly adopting short-duration rice and drought-tolerant pulses.

Adaptive Practices:

The use of organic compost, indigenous pest control, and water-efficient techniques became more common. Farmers also experimented with crop diversification, including vegetables and oilseeds, as a risk management strategy.

Limitations in Institutional Support:

Despite local innovations, farmers faced inadequate access to extension services, credit facilities, and

training related to climate adaptation

These findings are consistent with the existing literature, which emphasizes the importance of ecosystem-based adaptation approaches. Practices such as wetland restoration, agroforestry, and crop diversification offer long-term sustainability compared to input-intensive methods that may provide short-term gains but degrade natural resources.

Climate change has already had a significant negative impact on agricultural systems in the Jamuna floodplain of Bangladesh. Farmers have adopted several local strategies, including short-duration and stress-tolerant crops, organic inputs, and diversification. However, the absence of strong institutional support limits the effectiveness of these adaptations. Promoting ecosystem-based adaptation and integrating scientific innovations with traditional ecological knowledge can enhance resilience. Policymakers, researchers, and local communities must collaborate to strengthen adaptive capacity and safeguard food security in the face of ongoing climatic challenges.

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sciforum-132412: *In Vitro* Shoot Induction And Multiplication Of Jackfruit *(Artocarpus heterophyllus* Lam.) 'Eviarc Sweet' Variety Supplemented With Plant Growth Regulators (PGRs)

Ramonita Caralde Verano [1,*] and Catherine Castro Arradaza [2]

[1] Capiz State University, Roxas City 5800, Capiz, Philippines
[2] Visayas State University, Baybay City 6521, Leyte, Philippines

Jackfruit (*Artocarpus heterophyllus* Lam.) is monoecious, cross-pollinated, and highly heterozygous. Propagation through seeds is not widely accepted because seeds from one tree do not produce fruit true to the type of the parent plant and are recalcitrant. Jackfruit is still considered a difficult fruit species to propagate by vegetative means through grafting, and the graft survival percentage is only 30.00% - 55.00%. Grafted seedlings of jackfruit var. EVIARC Sweet (3-4 months old after grafting) were acquired from the Plant Propagation Nursery of the Department of Horticulture, Visayas State University, Visca, Baybay City Leyte, and were raised in the screenhouse and were used as donor plants. This study was conducted to evaluate the effect of plant growth regulators, thidiazuron (TDZ), 6-benzylaminopurine (BAP), and indole-3-butyric acid (IBA) at varying concentrations on *in vitro* shoot induction and multiplication of jackfruit. Shoot tips of grafted seedlings were used as the source of explants. Standard MS (Murashige & Skoog, 1962) solid medium was used as the basal medium during the inoculation period. One week after inoculation, the cultures were transferred to full MS media strength supplemented with various plant growth regulators (PGRs). There were 17 treatments and four (4) replications with 15 sample explants per replication arranged in CRD. The results showed that the earliest shoot formation occurred with the application of 0.1 mg/L thidiazuron (TDZ) + 3.0 mg/L benzyl aminopurine (BAP) and 0.5 mg/L TDZ + 5.0 mg/L BAP, taking 17.38 and 18.88 days, respectively. The highest shoot induction rate (83.75%) was observed in the combination of 0.1 mg/L TDZ + 3.0 mg/L BAP, producing 4.00 shoots per explant. The shoot length was also longer (3.12 cm) when applying 0.1 mg/L TDZ + 3.0 mg/L BAP. The combination of TDZ and BAP also led to more internodes, nodes, and leaves than other treatments. A multiplication rate of 2-5 shoots per explant was achieved after the first subculture. Further research is needed to explore the effects of other PGR combinations or alternative cytokinin sources that might further enhance jackfruit propagation.

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sciforum-138733: Integrated Wetland Mapping and Surface Water Quality Assessment Using Sentinel-1/2 and Machine Learning: A Case Study from Sidi Moussa–Oualidia, Morocco

Marwa Zerrouk [1,*], kenza Ait El Kadi [1], imane sebari [1] and Fellahi Siham [2]

[1] Department of Cartography and Photogrammetry, School of Geomatics and Surveying Engineering, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco
[2] Department of Veterinary Medicine, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco

Wetlands are vital ecosystems as they play a key role in agriculture, providing essential resources such as water for crops, livestock, and aquaculture, while also serving as habitats for a diverse range of species, particularly wild birds. Our study focuses on the Sidi Moussa–Oualidia wetland complex, integrating Sentinel-1 and Sentinel-2 imagery with spectral indices, radar backscatter (VV/VH ratio), and topographic features to classify land cover and monitor surface water quality. A Random Forest classifier optimized via Recursive Feature Elimination (RFE) achieved 91% accuracy and a macro F1-score of 0.90 across six classes, including permanent water, salt marshes, artificial marshes, hypersaline zones, oyster farming areas, and others. Surface water quality was also evaluated using the turbidity index as a proxy, revealing notable spatial degradation near aquaculture and agricultural activity hotspots. Our first-of-its-kind study in the Moroccan context proposes a scalable, reproducible methodology for simultaneous wetland land cover mapping and water quality monitoring, reinforcing the importance of remote sensing for integrated wetland-agriculture management in data-limited regions.

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sciforum-138577: Irrigation, Ecology, and Agrarian transformation: a study of environmental degradation in Uttar Pradesh (1850–2000)

Dr Nikhil Gangwar

Department of History, Daulat Ram College, University of Delhi, Delhi, India, 110007

Introduction

This study attempts to understand the ecological changes and agrarian transformations brought about by the irrigation methods used in Uttar Pradesh from 1850 to 2000. Without considering ecological and agrarian concerns, new systems of irrigation based on the scientific revolution were introduced during the colonial period and further expanded during the post-colonial period.

Methodology

The present study uses an integrated historical and environmental analytical approach to trace relations between irrigation means and their ecological effects. It depends on a variety of primary and secondary sources. It draws data from archival sources such as revenue settlement reports, irrigation records, newspapers, administrative records, and policy documents related to the colonial and post-colonial periods. It also includes critical analysis from secondary literature research articles and books.

Result

The main argument of this study is that while irrigation brought initial economic gains by encouraging water-intensive crops and chemical use, it disrupted traditional water systems, altered cropping patterns, and contributed to environmental problems which have been profound and often irreversible. It also posed long-term challenges such as soil degradation, soil salinization, waterlogging and groundwater depletion, and agrarian distress. Traditional water systems were undermined, and disparities in agrarian society were widened.

Discussion

This study concludes that irrigation must be understood not merely as a developmental intervention, but as an ecological force with enduring consequences. Recognizing the historical roots of environmental degradation is essential for formulating sustainable agrarian and irrigation policies today. This study suggests a need to rethink irrigation policy with consideration for environmental concerns.

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sciforum-132387: Monitoring Agricultural Vegetation Health Under Climate Stress Using NDVI and Land Surface Temperature (LST) Indices in the Sylhet Region

Sk. Tanjim Jaman Supto

Department of Environmental Research, Nano Research Centre; Sylhet; 3114; Bangladesh

Agricultural ecosystems in Northeastern Bangladesh are increasingly vulnerable to climate-induced stressors, particularly rising temperatures and seasonal droughts. This study aims to assess the spatiotemporal variations in vegetation health under climate stress in the Sylhet region over the last two decades using remote sensing techniques. The Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST) were derived from Landsat satellite imagery to evaluate trends in vegetation and surface thermal conditions. Seasonal NDVI and LST values were analyzed across major cropping seasons to understand the ecological response of agricultural land to climatic variability. The relationship between vegetation health and surface temperature was quantified using statistical comparison techniques to identify patterns and intensity of climate stress. Preliminary trends indicate that increased LST correlates with reduced vegetation cover in lowland agricultural zones, while elevated regions with forest or tree cover show inverse patterns. Spatial hotspots of thermal stress and drought-prone areas were also identified. The findings highlight the increasing pressure on agricultural productivity due to rising surface temperatures and vegetation stress, particularly during the dry Rabi season. This research provides actionable insights for agronomists, planners, and policymakers in promoting climate-resilient agriculture and sustainable land management in subtropical regions such as Sylhet.

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sciforum-132451: Optimizing Microclimate for Maize–Mushroom Intercropping under Semi-Arid Conditions: A Climate-Smart Farming Approach

Devanakonda Venkata Sai Chakradhar Reddy [1,*], Dheebakaran Ga [1], Thiribhuvanamala Gurudevan [2], Sathyamoorthy NK [1], Divya Dharshini S [1], Selvaprakash Ramalingam [3], H Chandrakant Raj [1] and Sake Manideep [4]

[1] Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore 641003, India
[2] Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore 641003, India
[3] Division of Agricultural Physics, ICAR - Indian Agricultural Research Institute, Pusa, New Delhi 110012, India
[4] Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore 641003, India

Climate variability poses significant challenges to agricultural systems, particularly in semi-arid regions where smallholder farmers depend on reliable yields and efficient resource use. Considering the potential of ecological intensification, this study investigated the intercropping of maize with paddy straw mushroom (*Volvariella volvacea*) as a strategy to optimize the microclimate and improve land use efficiency. Field experiments were conducted at the Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore, during the summer and *kharif* seasons of 2022, using a randomized block design comprising nine treatments. These included four maize planting geometries—wide row spacing (60 × 25 cm), close row spacing (45 × 25 cm), wide paired rows (45/75 × 25 cm), and close paired rows (30/60 × 25 cm)—each tested with and without organic mulch (T1 to T8), along with a polyhouse control (T9). Microclimatic variables such as air and soil temperature, relative humidity, and bed moisture were continuously monitored to assess their influence on mushroom growth and yield. The results showed that close maize spacing (45 × 25 cm), particularly when combined with organic mulch (T6), created a favorable microenvironment with moderated temperatures and increased humidity. This treatment accelerated mushroom development, reducing the cropping duration to 22 days, and resulted in higher biological efficiency and yield compared to wider spacings without mulch. Although the polyhouse control (T9) produced the highest yield, its high infrastructure cost limits feasibility for smallholder farmers. Optimal microclimatic thresholds for mushroom cultivation were identified as 26 to 29 °C in the mornings and 29 to 33 °C in the afternoons, with relative humidity between 80 and 98 percent. All intercropping treatments achieved land equivalent ratio greater than one, indicating improved productivity per unit area. The study demonstrates that simple, field-level interventions aligned with local climatic conditions can mitigate environmental stress, enhance intercrop viability, and promote climate-resilient and resource-efficient agriculture in vulnerable agroecosystems.

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sciforum-125048: Physiological and biochemical responses of maize to *Aspergillus flavus* under irrigation and nitrogen regimes

Heltan M. Mwalugha [1,*], Krisztina Molnár [2], Csaba Rácz [2], Szilvia Kovács [3], Cintia Adácsi [3], Tamás Dövényi-Nagy [4], Károly Bakó [2], István Pócsi [5], Attila Dobos [2] and Tünde Pusztahelyi [3]

[1] Doctoral School of Food Science and Nutrition, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, Debrecen, H-4032, Hungary
[2] Centre for Precision Farming R&D Services, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
[3] Food and Environmental Toxicology Research Group, Central Laboratory of Agricultural and Food Products, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, Debrecen, H-4032, Hungary
[4] Centre for Precision Farming R&D Services, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary
[5] Department of Molecular Biotechnology and Microbiology, Institute of Biotechnology, Faculty of Science and Technology, University of Debrecen, H-4032 Debrecen, Hungary

Maize production faces dual challenges of food safety and productivity due to *Aspergillus flavus* contamination and aflatoxin production, and these risks intensify under abiotic stress conditions. Despite the growing understanding of these threats, the interactive effects of basic agronomic practices on fungal contamination remain poorly understood. Therefore, this study investigated how irrigation and nitrogen fertilization influence maize physiology, *A. flavus* proliferation, and mycotoxin accumulation. Field experiments employed a complete randomized design with factorial arrangements of irrigation (non-irrigated/irrigated) and nitrogen levels (60, 120, and 180 kg/ha) under *Aspergillus flavus*-inoculated and non-inoculated conditions. Measurements included kernel number, mold count, mycotoxins (AFB1, FB1, DON, ZEA), and nutritional parameters. Irrigation improved the kernel performance of inoculated plants. The inoculated-non-irrigated group had significantly poorer kernel production (19.09 ± 0.58) compared to the control-non-irrigated, control-irrigated and inoculated-irrigated groups (21.17 ± 0.48, 21.33 ± 0.46 and 21.11 ± 0.60, respectively). Notably, increasing nitrogen from 60 to 180 kg/ha reduced AFB1 levels in inoculated maize from 164.25 ± 74.25 µg/kg to 114.94 ± 80.80 µg/kg while maintaining stable nutritional parameters across treatments. Nitrogen fertilization demonstrates protective effects against fungal proliferation and AFB1 accumulation under biotic stress, highlighting how optimized agronomic practices can enhance maize's resilience to mycotoxin contamination in changing climate conditions.

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sciforum-116097: Plant Growth-Promoting Rhizobacteria: A Sustainable Response to Agricultural Challenges and Health Issues

Soukayna Jarjini *, Amal Dagni, Abdelaziz Soukri and Bouchra El Khalfi

Laboratory of Physiopathology, Molecular Genetics and Biotechnology, Faculty of Sciences Ain Chock, Health and Biotechnology Research Centre, Hassan II University of Casablanca, Maarif B.P 5366, Casablanca 20570, Morocco

The growing global demand for food production places immense pressure on agricultural systems to produce more with fewer resources. Traditional farming practices often rely heavily on chemical fertilizers and pesticides, leading to soil erosion, water resource pollution, and a decline in crop quality. Exploring the plant rhizosphere, which hosts beneficial microorganisms such as rhizobacteria commonly name as plant growth-promoting rhizobacteria (PGPR) presents a sustainable alternative. These microorganisms enhance plant growth and yield by stimulating the production of plant hormones, promoting biofertilization, and providing biocontrol against pathogens. This reduces the need for chemical fertilizers and pesticides. Furthermore, their use supports soil health, minimizes environmental pollution, and preserves soil biodiversity, reducing public health risks associated with chemical residues in food and the environment.

The use of PGPR in Morocco and the Mediterranean region offers a sustainable solution to address challenges related to drought, soil salinity, and nutrient deficiencies, which are prevalent in this region. Native PGPR strains, particularly those with drought and salt tolerance, can enhance plant resilience by improving water use efficiency, nutrient uptake, and stress adaptation mechanisms. Their application in key crops such as wheat, barley, legumes, olives, and medicinal plants aligns with efforts to promote climate-resilient and low-input agriculture.

The aim of this study is to highlight the potential of the PGPR as an innovative solution to enhance the sustainability of agricultural systems while ensuring ecosystem health and food security.

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sciforum-124845: Resilience Strategies of Carob (Ceratonia siliqua L.) to Salt Stress: Multivariate Approaches and Artificial Intelligence for Sustainable Agriculture

Yassine Mouniane [1,*], Mohamed El Bakkali [2,3], Issam El-Khadir [4], Ahmed Chriqui [4], Yassine Kadmi [5,6] and Driss Hmouni [4]

[1] Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, University Ibn Tofall, Kenitra, Morocco
[2] Higher Institute of Nursing and Health Techniques, Kenitra, Morocco
[3] Natural Resources and Sustainable Development laboratory, Faculty of Sciences, Ibn Tofail University, Ke-nitra, Morocco
[4] Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, Ibn Tofaïl University—KENITRA-University Campus, Kenitra 14000, Morocco
[5] LASIRE, Equipe Physico-Chimie de l'Environnement, CNRS UMR 8516, Université Lille, Sciences et Tech-nologies, CEDEX, 59655 Villeneuve d'Ascq, France
[6] Department of Chemistry, Université d'Artois, IUT de Béthune, 62400 Béthune, France

In arid and semi-arid regions, where water scarcity and soil salinization are major challenges, carob (Ceratonia siliqua L.) has gained attention as a potential drought- and salt-tolerant crop. However, its ability to withstand salt stress is determined by a complex interplay of genetic, physiological, and environmental factors, which requires a comprehensive approach to fully understand. This study aims to explore the resilience of carob to salt stress by integrating advanced multivariate methods, Partial Least Squares Structural Equation Modeling (PLS-SEM), and Artificial Intelligence-assisted Bayesian Inference to identify key determinants of stress tolerance. Through a Multivariate Analysis of Variance (MANOVA), we found significant effects of salt stress ($F(5,30) = 7.3637$, $p < 2.2e-16$) and ecotype ($F(5,30) = 16.4968$, $p < 2.2e-16$) on physiological and biochemical traits. The Principal Component Analysis (PCA) revealed a distinct separation between stressed and control plants, with the first principal component (PC1) explaining 76.66% of the variance, which was closely related to biomass, water content, and root length. The PLS-SEM model identified root length as the primary factor influencing biomass (coefficient = 0.629, $p < 0.05$), while water content and chlorophyll had no direct significant effect. Hierarchical Bayesian Inference allowed for the assessment of intra-population variability, showing that the Ouazzane provenance exhibited the highest salt resistance, followed by Safi and Aït Attab, while Khemissat proved the most vulnerable. Additionally, specific environmental effects (E[i]) demonstrated that certain provenances, such as Berkane and Aït Attab, benefitted significantly from co-cultivation with Spergularia salina under 10 g/L NaCl. These findings underline the importance of varietal selection and biotic interactions as effective strategies to mitigate salt stress, highlighting the potential for agroecological adaptation of carob to increasingly saline environments, offering valuable insights for sustainable agricultural practices in areas affected by salinity.

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sciforum-132550: Role of Chitosan in Enhancing Secondary Metabolism and Stress Tolerance in Rosemary under Drought/Heat Combined Stress

Inês Mansinhos [1,*], Sandra Gonçalves [1], Raquel Rodríguez-Solana [1, 2] and Anabela Romano [1]

[1] MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[2] Department of Agroindustry and Food Quality, Andalusian Institute of Agricultural and Fisheries Research and Training (IFAPA), Rancho de la Merced Center, Carretera Cañada de la Loba (CA-3102) Km 3.1., SN, 11471 Jerez de la Frontera, Cádiz, Spain

Abiotic stresses, particularly drought and elevated temperatures, are becoming increasingly frequent and severe due to climate change, substantially impacting plant physiological, biochemical, and metabolic processes. This study assessed the effects of drought, heat and their combination on *Salvia rosmarinus* (formerly *Rosmarinus officinalis*), while also evaluating the potential of foliar-applied chitosan as an elicitor and stress-mitigating agent. Key biochemical markers were analyzed, including photosynthetic pigments (total chlorophyll and carotenoids), osmoprotectants (soluble sugars and proline), and indicators of oxidative stress (hydrogen peroxide and lipid peroxidation). Secondary metabolism was evaluated through quantification of phenolic and essential oil profiles, as well as the antioxidant activity of green phenolic extracts. Combined drought and heat stress significantly increased oxidative damage and reduced chlorophyll content. The accumulation of osmoprotectants, particularly under drought and combined stress conditions, played a crucial role in stress mitigation. Notably, chitosan application alleviated pigment degradation, promoted the accumulation of soluble sugar, and substantially reduced oxidative damage. Multivariate analyses revealed that specific classes of secondary metabolites are differentially associated with each stress condition, suggesting that rosemary dynamically modulates both phenolic and essential oil composition in response to environmental cues. Under combined drought and heat stress, chitosan-treated plants exhibited enhanced antioxidant activity, with notable increases in rosmarinic acid—the major phenolic compound—and monoterpene hydrocarbons. Conversely, the biosynthesis of sesquiterpene hydrocarbons, oxygenated monoterpenes, and oxygenated sesquiterpenes was less responsive to both the combined stress and chitosan treatment. Overall, these findings underscore the potential of chitosan as a sustainable elicitor that not only enhances the phytochemical profile of rosemary by increasing key bioactive metabolites under stress but also improves abiotic stress tolerance, particularly under compounded environmental conditions.

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sciforum-116707: The root system structure of some edificatory shrubs in the semi-desert steppe pasture landscape

Ariunbold Erdenegerel [1,*], Odsuren Batdelger [1] and Enkhbaatar Altangerel [2]

[1] Institute of Geography and Geoecology, Mongolian Academy of Sciences, Ulaanbaatar 15170, Mongolia
[2] Agency for Land administration and management, geodesy and cartography, Government of Mongolia

The root systems of edificatory plant species (environment-forming plants) play a key role in land restoration. In arid ecosystems subjected to abiotic and biotic stresses, revegetation strategies use drought-tolerant, native shrubs to restore degraded semi-desert steppe ecosystems and promote their long-term ecological functionality.

These shrubs, including species from the genera *Zygophyllum* and *Nitraria*, exhibit distinct root adaptations, such as deep taproots for groundwater access and extensive lateral roots for capturing surface moisture and mitigating soil compaction and nutrient deficiencies.

Understanding the formation of root systems in shrubs from the Zygophyllaceae families, particularly in the semi-desert landscape, is also helpful for informing proper land restoration efforts in arid zones. The growth rate and depth of soil penetration of these shrubs are main factors in the effective restoration of degraded landscapes.

We aimed to investigate the root system formation of the*Zygophyllum xanthoxylon* (Bunge) Maxim. and *Nitraria sibirica* Pall. shrubs in order to determine their ecological role within the semi-desert landscape zone of Mongolia (Eastern Gobi, 2023–2025), focusing on plants at 1 and 3 years of age. This study demonstrates that *Nitraria sibirica* and *Zygophyllum xanthoxylon* exhibit remarkably rapid growth and development of their root systems.

During the first and second year of growth, the root systems of these shrubs penetrated the soil to depths of 100–120 cm, surpassing the aboveground shoot height by a factor of 1.5–2. By the third year, this ratio increased by 3–4 times, indicating significant vertical growth. The ability to rapidly grow and develop a specialized root structure ensures consistent water uptake under drought and moisture-deficient conditions. Furthermore, the depth of root system penetration is strongly influenced by the hydro-physical properties of the edaphic environment.

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Session 3. Agricultural Systems and Management

sciforum-139286: Foresight in Agriculture: How to Be More Resilient in a Volatile, Uncertain, Complex and Ambiguous World

Lina Novickyte

ISM University of Management and Economics, UAB, Gedimino ave. 7, Vilnius, LT-01103, Lithuania

The 21st century presents unprecedented challenges for global agriculture. The sector is at the forefront of this turbulence, tasked with feeding a growing population while contending with resource limitations and significant environmental constraints. Foresight enables agricultural systems to be more resilient and sustainable by anticipating and preparing for potential challenges and opportunities. The capacity for forward-thinking is particularly vital for agriculture functioning within highly volatile, uncertain, complex, and ambiguous (VUCA) environments. This is achieved through the identification of emerging trends and drivers that can impact food safety, climate change, and other factors affecting agriculture. Resilience in agriculture is the capacity of systems to absorb shocks and stresses while maintaining essential functions. Agriculture refers to sudden and unpredictable fluctuations in market prices, weather events, and input costs. Strategic foresight enables a deeper understanding of potential agricultural futures and the associated challenges. Furthermore, this sector is influenced by a complex interplay of biological, economic, social, and political factors that collectively shape agricultural outcomes. Highlighting the significance of resilience, the agricultural sector should take proactive measures to anticipate and respond to forthcoming challenges. Future strategies that incorporate diversification of crops, livestock, and income streams are fundamental to building and sustaining resilience within industry. Climate-Smart Agriculture encompasses practices designed to sustainably improve productivity, strengthen resilience, and mitigate greenhouse gas emissions. Digital agriculture, remote sensing, artificial intelligence, and big data analytics are transforming farm management. Precision agriculture technologies improve input use efficiency and reduce vulnerability to supply chain disruptions. Agricultural insurance, futures contracts, and other financial instruments help buffer farmers against price and yield volatility. Resilient agricultural systems are associated with the presence of appropriate policies, institutional backing, and investments in research and infrastructure. Although progress has been made, several significant challenges remain. Data gaps persist, as limited access to reliable data hampers effective foresight and risk management, particularly in low-income regions. Policy fragmentation is evident, with inconsistencies across sectors potentially undermining resilience initiatives. Resource inequity continues to be an issue, as small-scale farmers, women, and marginalized groups frequently lack sufficient access to finance, technology, and essential knowledge needed to enhance resilience. Moreover, the emergence of new pests, diseases, and market disruptions necessitates continuous efforts to adapt effectively.

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sciforum-132495: Latent viruses of greenhouse vegetables identified by NGS in Russian Federation

Aleksandr N. Ignatov [1,*], Denis A. Nikitinskiy [2] and Ekaterina Nikitinskaya [2]

[1] RUDN University
[2] The Russian Center for Plant Quarantine (FSBI VNIIKR)

Analysis of plant viruses in the greenhouse production of vegetable crops in Russia shows that the introduction of new species with seeds and agricultural products from other regions and countries poses a significant risk to tomato and cucumber. The main challenge in detecting viral infections is the long incubation period and the need for technically advanced diagnostic methods. The successful development of immunological and molecular analysis techniques allows us to detect a wide range of new viruses, but the economic feasibility of these methods must be considered. To determine the minimum number of viruses that need to be diagnosed, we assessed all varieties of viruses that infect vegetables and the risk of their spread in greenhouses in Russia. We analyzed 56 samples of symptomless plants collected in routine assays of commercial greenhouses in the four regions of the Russian Federation in 2022-24 to identify the viruses that can cause potential damage to crop production. Plant samples were used to isolate RNA using the phenolic method. After DNase treatment, the quality and quantity of the RNA were tested using an Agilent 2100 bioanalyzer (Agilent). The preparation of the Illumina library and RNA sequencing was carried out at the Russian Plant Quarantine Center (VNIIKR, Moscow region), using TruSeq RNA. The Illumina libraries were quantified using the qPCR method, and the samples were sequenced using the Illumina HiSeq 2000. The analysis of the data from RNA sequencing (RNA-Seq) was conducted using the Taxonomer software. The following latent viruses were identified in most of the locations with a number of reads ranging from 0.01 to 0.11%: Pepper chlorotic spot virus, Zucchini lethal chlorosis virus, Physalis rugose mosaic virus, Chenopodium quinoa mitovirus 1, Tobacco vein-clearing virus, Dahlia mosaic virus, Pelargonium vein-banding virus and Longan witches' broom-associated virus. While these detected plant viruses may not pose a significant risk to plants, their presence indicates that a viral infection is currently spreading from Latin America and Southeast Asia. These viruses can infect plants and remain active over a number of years, posing a potential threat to plant health. Climate change may contribute to the further spread of these viruses and their vectors in open field ecosystems. The increase in international trade of plant products has led to a greater risk of new viruses entering plant ecosystems.

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sciforum-139271: A comparative study of plant growth affected by soil amendments with recovered nutrients, drought conditions, and seasonal temperatures

Jackson Sauers [1], Veera Gnaneswar Gude [2, 3, 4,*] and K. Raja Reddy [5]

[1] Richard A Rula School of Civil and Environmental Engineering, Mississippi State University, Mississippi State, MS, 39762, USA
[2] Purdue University Northwest Water Institute, Purdue University Northwest, Hammond, Indiana 46323, USA
[3] Mechanical and Civil Engineering Department, Purdue University Northwest, Hammond, Indiana 46323, USA
[4] School of Sustainability Engineering and Environmental Engineering, Purdue University, West Lafayette, IN, 47906, USA
[5] Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS, 39762, USA

Nutrients recovered from municipal and dairy wastewaters in a bioelectrochemical system constructed with terracotta and biochar were used in different soil amendments. These amendments included terracotta addition (TS), biochar (BS), terracotta and biochar nutrient-rich mixtures from bioelectrochemical systems, DWW, and SWW, respectively. Corn growth affected by these amendments wascompared with straight soil (SS). The first experimental setup consisted of 60 plants, four replications per group, and nutrient loadings (0%, 50%, and 100% Hoagland Nutrient Solution, HNS). The experiment lasted 38 days at Mississippi State University in the fall season. The plants were grown under a prefabricated mini-hoop module with two heaters at each end to minimize the weather effects. After harvesting, the plants and soil were analyzed by various methods. At the 100% nutrient treatment, the TS soil had the best yielding plants. The plants grown in the DWW and SWW soil with the 0% and 50% nutrient treatment had the best results in plant height, total plant dry weight, the average number of leaves per plant, leaf surface area, shoot dry weight, root/shoot ratio, root surface area, and NBI when compared to the control group. Following this test, another test consisted of 80 corn plants grown using five different soil mediums and using four different nutrient treatments in the spring season. Twentyof the plants were put through a simulated drought to see how well the different soil mediums can resist the negative effects caused by droughts. In this test, the SWW soil amendment had a negative effect at 0% HNS and in warm weather. The SWW soil medium had a large retention in soil moisture, which had a negative growth effect. It is recommended that the irrigation be monitored closely when applying the SWW soil amendment to avoid overwatering. This presentation will provide critical insights and will highlight future recommendations.

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sciforum-138615: A Foresight Study on the Development of Fiber-Reinforced LDPE Composites for Greenhouse Covering Applications

Mohamed Farid Benlamnouar *, Nabil Bensaid, Yazid Laib dit Laksir and Tahar Saadi

Research Center in Industrial Technologies CRTI, Cheraga 16014, Algiers, Algeria

Although new materials, such as polyvinyl chloride (PVC) and acrylic, have been introduced for greenhouse covering applications, their use still poses challenges in the agricultural sector due to high cost, heaviness, and low biodegradability. This study provides a forward-looking perspective for improving low-density polyethylene (LDPE) by developing it into a fiber-reinforced composite matrix. It also investigates the ability of this composite material to withstand various mechanical and environmental stresses, comparing its performance with the matrix material alone and the fibers alone. The study further integrates statistical and mathematical analyses of material property inputs to achieve optimal mechanical resistance. Additionally, it addresses the statistical and mathematical optimization of key composite material parameters, including thickness, test temperature, and tensile speed, aiming to build a predictive model for enhancing the mechanical properties of the materials used.

This research explores the potential of Taguchi models following the L9 design and employs analysis of variance (ANOVA) to evaluate the mechanical resistance of the studied materials. The study evaluates mechanical tensile strength based on three primary inputs: matrix material (LDPE), fiber material with a copper core, and the composite (LDPE + fibers), which combines matrix flexibility with fiber strength. Three levels were defined for each factor: thickness (100–150–200 µm), test temperature (0–23–40 °C), and tensile speed (10–50–100 mm/min), enabling precise assessment of each factor's individual effect.

Taguchi ANOVA analysis revealed the material type's influence on tensile strength as follows: Composite (LDPE + fibers) 51.11%, fibers (Cu-core) 28.34%, and matrix (LDPE) 20.55%, with the composite achieving a maximum tensile strength of 31.97 MPa. The effects of other factors varied: thickness (18.35–21.60%), test temperature (12.83–14.29%), and tensile speed (16.08–17.41%). For optimal mechanical performance, the composite (LDPE + fibers) is recommended, as it provides the highest tensile strength and superior resistance to puncture and tear compared to the matrix or fibers alone.

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sciforum-110611: A multi-model assessment of Greece's agricultural Water–Energy–Food–Ecosystems Nexus under future scenarios

Stathis Devves [1,*], Angelos Alamanos [2], Giannis Arampatzidis [3], Konstantinos Dellis [1, 4] and Phoebe Koundouri [1,4,5]

[1] Athens University of Economics and Business, 10434 Athens, Greece
[2] Independent Researcher; Berlin; 10243; Germany
[3] School of Economics, Athens University of Economics and Business, Athens, Greece
[4] ATHENA RC; UN SDSN Europe, 10434 Athina, Greece
[5] Department of Technology, Management and Economics, Denmark Technical University (DTU), Kongens Lyngby 2800, Denmark

Agricultural systems are becoming increasingly complex, requiring data-driven, science-supported models to address their multifaceted challenges and ensure sustainable management. In Greece, agriculture is a critical sector, contributing significantly to the economy and rural livelihoods, but it also faces pressing challenges such as competing water uses, energy demands, lackluster productivity, and environmental pressures. This study presents a comprehensive multi-model assessment of Greece's Water–Energy–Food–Ecosystems Nexus, evaluating agricultural production alongside energy and water requirements and quantifying the associated air pollution impacts at the national level. For the first time to our knowledge, we connect the FABLE Calculator (the software of the FABLE Consortium) with LEAP (Low Emissions Analysis Platform, from the Stockholm Environmental Institute) and the WaterReqGCH (a model developed by the Global Climate Hub). The FABLE Calculator provides detailed estimates of agricultural and livestock production, which are then used by LEAP to calculate the respective energy demand and the associated greenhouse gas emissions per fuel type used. The WaterReqGCH model uses the activity levels in FABLE and LEAP in order to estimate the water requirements of the agricultural and livestock sector. The models run based on a current accounts scenario expressing Greece's national commitments to the agri-food, energy, and water sectors according to the Greek Common Agricultural Policy (CAP) Plan, the National Energy and Climate Plan (NECP), and the River Basin Management Plans. The results indicate that the implementation of the CAP Plan, combining higher productivity, together with the NECP, assuming cleaner fuels, can result in a 73.4% decline in Greece's agricultural production GHG emissions despite the slight increase in the sector's energy consumption by 15% in 2050. Agriculture is the dominant consumer of water resources, consistently accounting for 88–89% of the total water consumption over the period 2020-2050. Agricultural water consumption follows a slight increase after 2025 and reaches an average consumption of 8041.12hm^3 by 2050, with only minor fluctuations and large uncertainty ranges due to a combination of hydro-climatic and agronomic parameters. The assumed higher productivity of the agricultural sector is likely to also increase its total water consumption. The insights provided by this multi-model approach are useful and holistic evidence for policymaking, highlighting the need for more coordinated approaches.

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sciforum-133735: Agrophotovoltaics in Practice: Six Lessons from Dual-Use Land Innovation for Food, Energy, and Policy Resilience

Sabrina BenGhida [1,*], Sonia BenGhida [2], D. Ben Ghida [3] and Riad BenGhida [4]

[1] Pukyong National University, Department of Mass Communication, (48513) 45, Yongso-ro, Nam-Gu, Busan, Korea
[2] McGill. University, Department of Sociology, 855 Sherbrooke Street West Montreal, Quebec H3A 2T7, Canada
[3] University of the Basque Country, School of Architecture, Plaza Oñati, 2, 20018 Donostia-San Sebastian, Gipuzkoa, Spain
[4] BenGhida, R., Vitalité Health Network, 19 Aberdeen Street, New Brunswick, E2A 1A9, Canada

This study explores the integration of agricultural cultivation and solar energy generation through agrophotovoltaic (APV) systems, focusing on a case from the canton of Vaud, Switzerland. By mounting photovoltaic panels above arable land, APV enables the simultaneous use of sunlight for crop growth and electricity production, offering a strategic response to global challenges such as rising energy demand, climate stress, and rural economic vulnerability. While APV's environmental potential has been widely recognized in previous studies, this paper provides a distinctive contribution by examining how a real-world project transitioned from near failure to long-term viability through the alignment of technical design, local engagement, and regulatory adaptation.

Using a single-case study analysis method based on official government reports, the scientific literature, and media documentation, this research distills six practical lessons for successful APV deployment: (1) allow energy producers to share electricity locally to avoid grid access barriers; (2) ensure feed-in tariffs are predictable and fair to reduce investor risk; (3) involve local communities in funding and ownership to build long-term support; (4) design infrastructure that allows easy access for farm equipment and does not hinder cultivation; (5) choose crops that grow well in partial shade to maintain or improve yields; and (6) engage early with regulators to adapt legal frameworks and avoid project delays.

The findings show that APV can significantly enhance land-use efficiency and promote climate-smart agriculture, but its success depends on coherent policy alignment, cost-effective infrastructure, and active local stakeholder involvement. The Swiss case exemplifies both the risks and transformative potential of APV when deployed in resource-constrained rural settings. By consolidating these insights, this study offers practical guidance for policymakers, investors, and planners seeking to scale APV as a socially inclusive, economically viable, and environmentally resilient model for integrated land use and renewable energy generation.

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sciforum-138644: Alleviating water stress tolerance in *Aquilaria malaccensis* by using Biochar, *Bacillus altitudinis* (PGPR) and *Trichoderma asperellum*

Rahela Khatun [1], Farhan Shahriar [1]*, Md. Shariar Hossain Sazzad [1], Md Sajib Mia [1], Anna O'Brien [2], Md Sazan Rahman [2], Anthony S.Davis [2] and Romel Ahmed [1]

[1] Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet, Bangladesh
[2] College of Life Sciences and Agriculture, University of New Hampshire, Durham, NH, USA

Soil moisture is a challenging environmental factor adversely affecting the growth of plants under water stress conditions. To cope with water scarcity, plants compromise their growth and switch on their adaptive machineries; however, responses vary with species. How water stress affects Aquilaria malaccensis and how to mitigate water stress to keep the optimum growth of the plant is of high importance considering the socio-economic value of the species. Therefore, this study aimed to investigate the efficacy of environmentally friendly mitigation measures of water stress by applying biochar, *Bacillus altitudinis* (PGPR) and *Trichoderma asperellum*. The results showed that the seedling of Aquilaria exhibited comparable growth performances under water stress conditions with the application of biochar and the two microbes. Stress was alleviated by reducing the oxidative damage of Reactive Oxygen Species (67.63%) and Malondialdehyde (58.78%) and elevating the accumulation of proline (39.72%) in the single or combined treatments of biochar, PGPR and *Trichoderma*. Consequently, the photosynthesis pigment chlorophyll (43.89%) and stomatal conductivity (50.71%) increased in the treated plants grown under water stress. Applying biochar, PGPR and *Trichoderma asperellum* reduced H_2O_2 (67.63%) and MDA (58.78%) levels and helped to accumulate proline (39.72%), reducing oxidative damage. On the other hand, the photosynthesis pigment chlorophyll (43.89%) and stomatal conductivity (50.71%) helped increase gas exchange and the photosynthesis rate. This study highlights a promising result for enhancing Aquilaria malaccensis resilience to drought conditions for its sustainable production in arid and semi-arid areas.

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sciforum-131543: Assisting Oil Palm Farmers' Succession Planning through Online Education on Sustainable Agriculture Practices: A Case Study of a Country with a High Power Distance Index

Saravanan Subbiah [1], Dalbir Singh Valbir Singh [2,*], Elankovan Sundararajan [2], Nurhizam Safie Mohd Satar [2], Farhan Hanis Muhmad Asri [2] and Shri Dewi Applanaidu [3]

[1] Universiti Tunku Abdul Rahman
[2] Universiti Kebangsaan Malaysia
[3] Universiti Utara Malaysia

Succession planning by farmers ensures the continuity, sustainability, and prosperity of palm oil plantations in Malaysia. However, for farmers, succession planning encompasses a range of challenges that includes legal complexities surrounding farm planning, taxation, and inheritance laws, which can complicate the transfer of farm assets and lead to disputes among family members. Additionally, inadequate communication and clarity regarding succession intentions can create tension and conflict within farm families, hampering the planning process. Financial constraints, such as access to capital for retiring farmers and financing options for successors, pose further obstacles to successful succession. Moreover, the generational divide in agricultural knowledge and practices and the reluctance of older farmers to relinquish control can hinder the development of successors' skills and delay the transfer of management responsibilities. Thus, online education on sustainable agriculture practices could provide future generations of farmers with the necessary knowledge to overcome these challenges. This study employs a cultural-based approach that uses quantitative and qualitative data collection techniques based on the Power Distance Index (PDI) dimension of Hofstede's cultural model. The approach consists of four phases that focus on the millennial generation as the intended population of successors to the oil palm farmers in Malaysia. The results reveal a high PDI dimension score for the millennial generation in Malaysia. Thus, educator-centered learning practices should be implemented through social media. Apart from this, the results also urge the creation of 'Agro-Celebrities' as an agent of change. In conclusion, the study's contributions are crucial to the development of national and global food security initiatives.

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sciforum-128044: Design of a Pull-type Combine Harvester for an Alternative Tractor Form in Sub-Saharan Africa

Kwadwo Andoh Owusu *, Emmanuel Bobobee, Joseph Akowuah and Ahmad Addo

Kwame Nkrumah University of Science and Technology (KNUST), Kumasi AK-039-5028, Ghana

Access to affordable and appropriately scaled agricultural machinery remains a major challenge for smallholder soybean farmers in sub-Saharan Africa. As a result, many farmers continue to rely on labour-intensive and primitive harvesting methods, often requiring up to five people per acre per day. Although grain thresher services exist, they frequently fail to reach all farmers in time, leaving harvested crops exposed to termites, theft, germination, and adverse weather conditions, ultimately diminishing grain quality and value.

While combine harvesters offer a complete solution by integrating harvesting and threshing, their large size and dependency on conventional tractors make them unsuitable for smallholder farming systems. This paper presents the design of a pull-type combine harvester specifically developed for an Alternative Tractor Form (ATF), namely the cargo tricycle, to address this gap. The cargo tricycle was selected for its widespread availability in Ghana, sufficient drawbar capacity and bucket which can be used as a grain bin.

Using an axiomatic design approach, the proposed combine harvester was conceptualised through the reverse engineering of an antique All-Crop 66 pull-type combine harvester. Functional requirements and design parameters were systematically identified and adapted to suit the operational context of small farms. The resulting machine is powered by a 12 hp engine, features a cutting width suitable for harvesting two rows of soybeans at a 10 cm cutting height, and is designed to enable, at most, two operators to work multiple acres in a single day, significantly reducing labour demands.

With dimensions of approximately 3.5 m in length, 2.5 m in width, 1.6 m in height, and a total weight of about 700 kg, the machine is compact and light enough to be towed by cargo tricycles, making it a viable and scalable mechanisation solution for smallholder soybean production in the region.

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sciforum-136454: Effect of cannon sprayer configuration and adjustment on spray deposit and ground drift in high-tunnel strawberry cultivation

Daniel Bondesan *, Paolo Miorelli and Claudio Rizzi

Foundation Edmund Mach, Technology Transfer Centre, via E. Mach 1, 38098 S. Michele all'Adige (TN), Italy

Efficient spraying is essential for modern agricultural production to ensure biological efficacy and high-quality and abundant harvests. At the same time, it is crucial to minimise the negative impact of plant protection products on the environment. Hence, it is necessary to implement the appropriate technical and technological factors for the treatment and consider the conditions under which the spray application is carried out (Cieniawska et al., 2024). The aim of this study was to evaluate the use of alternative application techniques, i.e., the reduction in application volume, the use of an electrostatic charger and air injection nozzles, in comparison to a standard cannon sprayer application in high-tunnel cultivation in Trentino (Northern Italy). To do this, paper collectors were placed along strawberry rows at different distances from the front openings of the tunnels, and the tunnels were sprayed with a tracer dye (tartrazine) using the mentioned application techniques to evaluate spray deposition. Moreover, some Petri dishes were placed at different distances outside the tunnel to estimate the ground deposit due to spray drift.

Deposits were similar for all the application techniques for the external part of the canopy. Inside the canopy, slight significant differences were found only for the deposits retrieved in the central part of the tunnel (Kruskal–Wallis test, p0.05). In this case, the electrostatic charged spray showed the highest average value of deposit, and the air injection nozzles marked the lowest. However, the ground deposit retrieved outside the tunnel for the electrostatic configuration was not different from most of the other equipment arrangements. The sprayer equipped with air injection nozzles showed significantly higher losses close to the tunnel and significantly lower losses starting from 3.5 m from the tunnel opening in comparison to the other sprayer configurations.

In general, these spray techniques, singularly or combined with one another, could be considered as alternatives to the reference spray practise in strawberries, and when put together, they may ensure better efficiency of applications and a reduction in negative environmental impacts.

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sciforum-137159: From Policy to Plow: Navigating Farmer Decisions and Structural Barriers to Biopesticide Adoption in the Mediterranean

Michele Filippo Fontefrancesco

Department of Sociolog, Università Cattolica del Sacro Cuore, Milan, 20123, Italy

Introduction: The push for sustainable agriculture in the Mediterranean region has positioned biopesticides as a vital alternative to conventional chemical inputs. Despite their ecological benefits, the adoption of biopesticides remains limited, confined to a small market segment. This presentation synthesizes the findings of a narrative literary review and a comparative qualitative field study to provide a multi-layered analysis of the challenges and opportunities for biopesticide implementation. It focuses on the key agricultural nations of Spain, Tunisia, and Turkey to understand the factors shaping farmers' decisions.

Methods: The research employed a two-phase methodology. The first phase consisted of a narrative review of the academic and grey literature to identify the overarching structural, legislative, economic, and cultural barriers to biopesticide adoption in the Euro-Mediterranean region. The second phase involved a comparative qualitative case study in three key agricultural sites: the Ebro Delta (Spain), the Nabeul region (Tunisia), and Adana province (Turkey). This phase utilized two rounds of semi-structured interviews with farmers to investigate the on-the-ground push and pull factors influencing their pest management choices.

Results: The analysis reveals a "vicious circle" where interactions among farmers, producers, and regulators impede widespread adoption. Key barriers consistently identified include high costs, limited market availability, and significant skepticism among farmers regarding the efficacy of biopesticides compared to conventional products. These are compounded by structural issues such as complex and slow registration processes, a lack of local manufacturing plants, and insufficient technical training for farmers. Conversely, adoption is driven by stringent regulations like the EU's "Farm to Fork" strategy, growing consumer demand for sustainable products, and the presence of supportive cooperatives and agricultural education networks.

Conclusions: The transition to biopesticides is not merely a technical substitution but a complex socio-economic challenge shaped by farmers' economic fragility and risk aversion. Overcoming the current impasse requires a coordinated approach that moves beyond top-down mandates. Priority should be given to providing direct economic support and incentives to farmers, simplifying regulatory pathways for new products, investing in research to improve efficacy and reduce costs, and strengthening farmer training and knowledge-sharing networks to build confidence and technical competency.

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sciforum-138820: Refining Sustainability Indicators for Sugarcane Production in Sofala Province of Mozambique: A Delphi Approach

Gabriel Chico Viegas [1,*], Ana Marta-Costa [2], Rui Fragoso [3] and Edgar Manuel Cambaza [4]

[1] Faculty of Engineering and Agriculture, ISCED Open University, Beira, 0504-01, Mozambique
[2] Centre for Transdisciplinary Development Studies (CETRAD), Universidade de Trás-os-Montes e Alto Douro, Vila Real, 5000-801, Portugal
[3] Center for Advanced Studies in Management and Economics (CEFAGE), Universidade de Évora, Évora, 7005-002, Portugal
[4] Directorate of Research and Extension, ISCED Open University (UnISCED), Beira, 0504-01, Mozambique

The main objective of this article was to select a set of suitable and priority indicators to assess the sustainability of sugarcane production in the province of Sofala, in Mozambique. The Delphi method was used, and the process was conducted in two rounds with the participation of experts from academia, a sugarcane factory and government institutions. From the previous 68 indicators, a total of 38 indicators—which consisted of 9 environmental, 16 economic and 13 social indicators—were selected. Based on the priority of indicators, the following are the seven main sugarcane sustainability indicators, with 100% consensus: water availability during the entire sugarcane production process, sugarcane yield, sugarcane price, evaluation of the production based on market size and prices, sharing production risks between producers and factories, access to adequate protective equipment and wage satisfaction. Monitoring performance through these indicators can provide decision-makers with quantitative information that can contribute towards a sustainable sugarcane production system.

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sciforum-132524: Reframing the Value of Agricultural Data: Stakeholder Perceptions

Havva Uyar [1, 2,]*, Ioannis Karvelas [2], Stamatia Rizou [2], Constantina Costopoulou [3] and Spyros Fountas [1]

[1] Department of Natural Resources Development and Agricultural Engineering, Agricultural University of Athens, Athens, Greece
[2] R&D and Innovation Department, SingularLogic, Athens, Greece
[3] Informatics Laboratory, Agricultural University of Athens, 11855 Athens, Greece

Introduction

While agricultural data is widely seen as a driver of innovation and sustainability, its value is often treated as self-evident and narrowly defined in technical terms. Yet, the ways in which agricultural stakeholders perceive and interpret data value remain underexplored (Uyar et al., 2024). This gap in understanding can hinder inclusive and trusted data-sharing practices, particularly as agri-food systems become increasingly digitized.

Methods

This qualitative study draws on 24 semi-structured interviews with key actors in the agricultural data ecosystem, including farmers, advisors, technology providers and public sector representatives. The interviews examined how participants make sense of agricultural data, what they consider valuable and how their perspectives are shaped by their professional roles and lived experiences. An abductive coding process was applied to analyze recurring themes, divergences and underlying assumptions.

Results

Findings reveal a diversity of perceptions that reflect both instrumental and symbolic understandings of data value. Farmers tend to focus on data's practical relevance and its ability to support immediate decision-making, while advisors emphasize reliability and contextual fit. Technology providers frame value in terms of scalability and integration potential, whereas public actors link value to accountability, transparency, and public good considerations. Across groups, trust in the origin and intent behind data emerged as a central but variably defined condition for assigning value. These differences influence not only what kinds of data are used or shared, but also under what terms and expectations.

Conclusion

This study highlights that agricultural data value is not a fixed attribute but a negotiated and context-dependent construct. Understanding how different stakeholders perceive and prioritize value can inform the development of more inclusive, responsive and trust-sensitive data ecosystems. These insights offer a basis for rethinking data governance frameworks and digital tool design beyond purely technical criteria.

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sciforum-115815: SASB Metrics and Green Management in the Agrifood Sector: Measuring and Driving Sustainability

Maria Bairaktari [1, 2,*] **and Nikolaos Karountzos** [2,3]

[1] Department of Nutritional Science and Dietetics, School of Health Sciences, University of the Peloponnese, Antikalamos, 24100, Kalamata, Greece
[2] Green Metrics, Sustainability Management, Piraeus, 18543, Greece
[3] Department of Digital Systems, School of Economics and Technology, University of the Peloponnese, Valioti's building, Kladas, 23100, Sparta, Greece

The transition towards sustainable agrifood systems requires the use of effective green management strategies with the integration of measurable indicators. The adoption of the Sustainability Accounting Standards Board (SASB) framework introduces a new way to assess sustainability with a structured approach to evaluating and improving both the environmental and social performance of businesses, including those in the agrifood sector.

This research study explores the crucial role of SASB metrics in monitoring key sustainability indicators, such as water and energy consumption, greenhouse gas emissions, and waste management. Through the alignment of agrifood operations with these standards, businesses can gain greater knowledge about their inefficiencies and environmental impact and carry out targeted, data-driven improvements.

In addition to environmental performance, this research highlights how SASB standards support broader ESG goals,[1] helping organizations align with stakeholder expectations and regulatory requirements. Special attention is offered to digital technologies that improve the collection, measuring, and analysis of sustainability data. These tools not only enhance the accuracy of reporting but also facilitate long-term planning and encourage the move to circular economy models.

This study features practical case studies and realistic strategies for incorporating SASB metrics into business operations all through the agrifood supply chain [2]. From primary production to processing and delivery, this research demonstrates how these metrics can promote accountability, transparency, and strategic planning.

By including sustainability at the core of their processes through recognized standards such as SASB metrics, agrifood enterprises can enhance their competence, reduce environmental footprints, and play an important role in addressing global climate and resource challenges.

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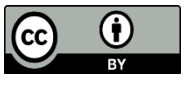

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sciforum-134467: Societal Attitudes, Compensation, and Economics of Hilsha (*Tenualosa Ilisha*) Conservation in Bangladesh

Babor Ahmad [1], Mostafa Monir [1], Shahiduzzaman Selim [2], Shuktara Khanom [3,*], Md. Anowar Hossain [1] and Md. Rakibul Hasan [4]

[1] Department of Economics, Dhaka International University (DIU), Satarkul, Dhaka-1212, Bangladesh
[2] School of Economics and Finance, Xi'an Jiaotong University, Xi'an, Shaanxi Province- 710049, China
[3] Department of Economics, Southeast University of Bangladesh, Tejgaon, Dhaka-1215, Bangladesh
[4] Junior Program Manager, OIC Ministerial Standing Committee on Scientific and Technological Cooperation (COMSTECH) Islamabad, 44000, Pakistan

This paper investigates the socio-economic aspects of Hilsa fish conservation in the Chandpur district of Bangladesh through three riverine villages—Baghadi, Ibrahimpur, and Sakhua. Combining data from both primary and secondary sources collected from 255 fishing households through structured interviews and questionnaires during the Hilsa fishing ban in 2022, we used a mixed-methods approach. The participants were randomly selected in proportion to the distribution of the population for representative coverage. This study uses two-stage least squares (2SLS input-space) methods to control for endogeneity and to examine WTA estimation for fishers to comply with a conservation programme. This study estimates the mean WTA compensation according to household perception, willingness to work, and conservation purposes. The average WTA is 13,372.51 per month, while the highest numbers favour Tk. at 15,000–20,000. Notable positive factors influencing WTA are head-of-household age, fishing experience, and non-fishing income, which suggests that experience and various sources of income affect the value of compensation. By contrast, the negative coefficient of secondary education and access to credit in WTA suggests socio-economic difficulties, such as being indebted and poor economic incomes of formal education in fishing communities. Clearly, the findings elsewhere suggest a high level of uncertainty on the part of the fishing community towards conservation: just 2.75% strongly agreed that conservation helps fish stocks and livelihoods, while more than 30% were neutral and 14.11% strongly disagreed. These findings reinforce the importance of capacity-raising and community engagement. This study emphasizes inclusive policies and suggests a sustainable environmental payment scheme with suitable fishing-related non-fishing activities during the banning period, as well as ensuring easy access to extension services and focusing on the diversification of income. These initiatives could make the journey towards achieving the SDGs easier.

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Session 4. Zero-Pollution Solutions in Crop Protection

sciforum-139337: "Development of a natural pesticide using practical methods for the protection of fruit trees"

Boukhalfa Besma [1,*] and Abdelkrim Bezai [2]

[1] Faculty of Agronomic Sciences, University of Batna 1
[2] Université of Batna 1 Algeria

Introduction

In light of the harmful impacts of synthetic pesticides on both environmental and human health, the need to identify eco-friendly and sustainable alternatives of natural origin has become increasingly urgent. This study explores the potential of plant-derived extracts combined with beneficial microorganisms to develop a bio-based pesticide. Inspired by traditional agricultural practices, the proposed formulation aims to ensure both biological efficacy and ecological safety.

Methodology

A natural formulation was manually developed using a synergistic blend of essential oils, botanical powders, agricultural sulfur, lactic acid bacteria, and purified water. Each component was specifically selected based on its demonstrated or potential bioactivity on plants, including antifungal, insecticidal, and bio-stimulant properties. The final formulation was applied as a foliar spray to selected fruit trees in order to evaluate its effectiveness under field conditions.

Results

The application of the treatment on pear, peach, and apple trees yielded convergent results, demonstrating a notable reduction in pest infestation and a visible improvement in leaf condition. No phytotoxic effects were observed throughout the trials, indicating the formulation's safety for plant health. Moreover, treated plants exhibited enhanced resistance to pests and maintained vigorous growth, outperforming untreated controls in terms of both vitality and resilience.

Conclusion

This natural formulation represents a promising alternative to conventional chemical pesticides, offering a combination of safety, environmental sustainability, and tangible efficacy under field conditions. Its successful application highlights its potential as a bio-based plant protection solution. Further research is planned to validate its effectiveness across larger cultivation areas and on a broader range of crops.

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sciforum-138960: Differences in pathogenicity among the three species of *Colletotrichum* on excised leaves, twigs, and branches of *Dalbergia sissoo*

Moumita Datta *, Tasmia Tabassum Tanha, Md Hashibul Hossain, Romel Ahmed and Mohammed Masum Ul Haque

Department of Forestry and Environmental Science, Shahjalal University of Science and Technology (SUST), Sylhet, 3114, Bangladesh

Sissoo (*Dalbergia sissoo* Roxb.) is an economically and environmentally important tree species in South-East Asia. *Colletotrichum gloeosporioides* was reported to cause leaf blight disease in *D. sissoo* in 2021 in Sylhet, Bangladesh. Additionally, *C. fragariae* and *C. siamense* were reported to cause disease in *Hopea odorata* and *Dipterocarpus turbinatus* in 2021 and 2023, respectively, in Sylhet, Bangladesh. Here, we examined the variation in pathogenicity among the three species of *Colletotrichum* on detached leaves, twigs and branches of *D. sissoo*. Mycelial agar plugs of the *Colletotrichum* species were used to inoculate leaves, twigs, and branches of *D. sissoo*. The findings of this study demonstrated that *C. gloeosporioides* developed the highest lesion length (12.91mm) on inoculated leaves as compared to the other two species of *Colletotrichum* used, while *C. siamense* was the most virulent fungi species on inoculated twigs and branches in terms of lesion length (58.75mm and 48.36mm) followed by *C. fragariae* (50.38mm and 37.01mm) and *C. gloeosporioides* (41.2mm and 26.46mm), respectively. In general, *C. siamense* was the most virulent fungi species among the tested fungi species. The findings of this study showed that the *Colletotrichum* species which are not host-specific to *D. sissoo* may pose a threat to *D. sissoo* equally in future. Further studies are necessary to understand the spread of these pathogens to tree species in other locations in Bangladesh.

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sciforum-127506: Integrated biological control approach for lettuce pathogens: combining beneficial microbes and cultivation practices

Olga Glushenkova [1,*], Dmitry Polyakov [2] and Aleksandr Ignatov [1]

[1] Peoples' Friendship University of Russia (RUDN University), Moscow, Russia, 117198
[2] All-Russian Research Institute of Phytopathology, Moscow Region, Russia, 143050

Soft rot, caused by pectolytic bacteria, especially from the genus *Pectobacterium*, is one of the most significant diseases of lettuce, causing significant crop losses. Due to limitations on the use of chemical pesticides and their limited efficacy, the development of biological control methods, including those based on *Bacillus subtilis*, has become an urgent issue.

The aim of this study was to evaluate the efficacy of various *B. subtilis*-based preparations in controlling wet rot in greenhouse lettuce production. The experiment was conducted during the spring and summer of 2025, and involved artificially infecting plants with predominant local *Pectobacterium* species and then treating them with liquid formulations of *Bacillus subtilis*. The efficacy of treatment was compared under different application frequencies and intervals. To assess the biological effects, a comprehensive evaluation of the plant condition was carried out based on the following parameters: the severity of rot symptoms, the rate of spread and radius of infection, the length and weight of roots and leaves, and the survival of plants 7, 14, and 21 days after infection.

Various strains of *B. subtilis* demonstrated high antagonistic activity against *Pectobacterium*-caused infection, particularly when integrated with specific agricultural techniques. The combined use of microbial preparations and agricultural techniques that promote the activity of these antagonists can be an effective and environmentally friendly alternative to traditional chemical methods of protection.

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sciforum-139046: Activity of Fungal Entomopathogens against Pineapple Pink Mealy Bug [*Dysmicoccus brevipes (*Cockerell) (Hemiptera: Pseudococcidae)]

Myrelle Resma Enriquez * and Maria Juliet C Ceniza

Department of Pest Management, Faculty of Agriculture and Food Science, Visayas State University, Baybay, Leyte, Philippines

Entomopathogenic fungi (EPF) are promising biological control agents against pink pineapple mealybug (PPMB), *Dysmicoccus brevipes* (Cockerell) (Hemiptera: Pseudococcidae), an important insect pest of pineapple. Three EPFs, namely, *Metarhizium anisopliae*, *Beauveria* sp., and *Lecanicillium lecanii*, were tested against PPMB crawlers and adults in a laboratory. Methods of EPF application were direct spraying on insects and pineapple leaf and dipping with a single dosage of a 1 mL suspension of $1x10^8$ spores/mL. Mortality rates were determined at 1 to 10 days after treatment (DAT). The results indicated that the three EPFs showed pathogenicity against the PPMB at varying degrees. At 10 DAT, a 100% mortality rate was observed for the treatment of *M. anisopliae* on all application methods and PPMB stages, followed by *L. lecanii* (55.91%) and *Beauveria* sp. (27.98 %). No significant difference in the percentage of infection was observed between PPMB crawlers and adults. Moreover, a slightly higher percentage of infection was observed in the spraying of the conidial suspension at $1x\ 10^8$ but this was not statistically significant compared to the leaf dipping method. This study suggests that among the EPFs used, *M. anisopliae* has the potential to be used as a biological control against PPMB.

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sciforum-139270: Allelopathy and Cover Crops: Innovative Strategies for Sustainable Agriculture in the Face of Climate Change

Sabrine Soltane * and Tarek Benmeddour

Department of Nature and Life Sciences; Laboratory of Genetic, Biotechnology and Valorisation of Bioresources, University of Mohamed Khider Biskra, Biskra, Algeria

This study delves into the essential role of allelopathy and cover crops for sustainable agriculture, particularly relevant in addressing the complex challenges posed by climate change. By synthesizing quantitative and qualitative data from a variety of studies to examine allelopathic mechanisms, we explored the proven efficacy of cover crops in weed suppression, their significant contribution to improving soil health, and their role in reducing agriculture's environmental footprint in modulating crop and weed growth, while evaluating their potential to enhance agricultural sustainability. Drawing on empirical data from peer-reviewed studies (2013–2023), we synthesized evidence demonstrating that allelochemicals exert dual effects: they suppress weeds by disrupting physiological processes such as photosynthesis, respiration, and enzyme activity while simultaneously promoting crop health through induced systemic resistance and improved soil microbial dynamics.For instance, allelochemicals from cover crops like Rhododendron capitatum reduced weed biomass by 40–60% in field trials, correlating with enhanced crop yields (15–30%) under drought and elevated temperature conditions.

Key findings reveal that allelochemical-driven practices mitigate climate-induced stress by stabilizing soil organic matter, altering pH, and fostering microbial communities that bolster plant tolerance to abiotic stressors. The analysis underscores the critical role of integrating allelopathic strategies with agroecological principles, such as crop diversification and conservation tillage, to maximize yield stability while reducing synthetic herbicide dependence. This work identifies three primary research avenues: (1) advancing metabolomic tools to isolate high-efficacy allelochemicals, (2) modeling climate–allelopathy interactions to predict outcomes under future climate scenarios, and (3) scaling farmer-led trials to validate allelochemical applications in diverse agroecosystems. By bridging knowledge gaps, allelopathy emerges as a cornerstone for achieving the dual goal of global food security and environmental sustainability, offering a scalable pathway to decarbonize agriculture and enhance resilience to climatic changes.

Problem Statement : Conventional agriculture's reliance on synthetic inputs undermines long-term productivity and ecological balance, demanding sustainable alternatives to address climate vulnerability and weed proliferation.

Key Findings:

Allelochemicals suppress weeds by 40–60% while increasing crop yields by 15–30% under stress conditions.

Soil microbial and physicochemical modifications by allelochemicals enhance drought and heat tolerance in crops.

Integrated allelopathic systems reduce synthetic herbicide use by 50–70% without compromising yield.

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sciforum-129673: Antifungal and growth-promoting activities of shell nanoparticles of chitosan aspartate

Natalia Nikolaevna Pozdnyakova [1, 2], Elizaveta Vadimovna Shcherbakova [1, 2], Oksana Viktorovna Tkachenko [1, 3], Alena Yurievna Denisova [1, 3], Kristina Yurievna Kargapolova [1, 3], Xenia Mikhailovna Shipenok [1,*] and Anna Borisovna Shipovskaya [1]

[1] Saratov National Research State University named after N. G. Chernyshevsky
[2] Institute of Biochemistry and Physiology of Plants and Microorganisms – FRC SRC RAS
[3] Saratov State University of Genetics, Biotechnology and Engineering named after N. I. Vavilov

The design and agricultural application of new-generation nanostructured biopreparations with a wide range of functional properties can significantly reduce the use of synthetic plant protection products and growth stimulants. In this work, we studied the antifungal and growth-stimulating activity of chitosan aspartate nanoparticles obtained in situ in the process of the counterionic association of protonated macrochains with counterions of acid residue and stabilized by a polysiloxane shell network. Our study of the growth of soil-dwelling saprotrophic and phytopathogenic fungi of various physiological and ecological groups showed that the shell nanoparticles had antifungal activity. Mycelial growth suppression under the influence of these nanoparticles was noted for the fungi *Trichoderma harzianum* (up to 81.3%), *Fusarium oxysporum* (39.1%), *Schizophyllum commune* (37.9%), *Lecanicillum aphanocladii* (30.4%), *Alternaria* sp. (33.0%), *Botrytis* sp. (30.0%), *Trichoderma viride* (25.3%), *Sclerotinia cf. Sclerotiorum* (18.0%), *Rhizoctonia* sp. (15.0%), *Talaromyces sayulitensis* (7.0%) and *Pleurotus ostreatus* var. Florida (6.1%). At the same time, a stimulating effect of low nanoparticle concentrations on the growth of the ascomycete *T. sayulitensis* isolated from the rhizosphere was found (20%). The treatment of soft wheat seeds with the nanoparticle biopreparation followed by cultivation on an artificial infectious background in the presence of spores of the fungus *Rhizoctonia* sp. reduced the damage degree and the development level of the plant disease by 33%. Along with this, our study of seedlings of four plant species of various taxonomic and economic groups (soft wheat, soybean, cucumber, and lettuce) by a set of morphometric, physiological and biochemical features showed that the shell nanoparticles of chitosan aspartate had pronounced growth-stimulating activity. It was manifested, first of all, in an increase in root biomass, the content of photosynthetic pigments and a change in the activity of antioxidant enzymes. A reliable effect of the nanoparticles on the morphogenetic activity of callus cells and the regeneration of wheat plants was also established. The results of our study demonstrate the potential of biopreparation based on chitosan aspartate nanoparticles both for protecting plants from phytopathogenic fungi and stimulating the growth and development of agricultural crops. Moreover, the preparation is biodegradable and safe for humans and the environment.

Acknowledgment

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sciforum-135129: Application of Epidemiological Screening Concepts to Identify Rice Genotypes with Quantitative Resistance to Sheath Blight (*Rhizoctonia solani* Kühn)

Earlyn Kate Grimares Padrones [1,*], Eula Gems M. Oreiro [2], Ricardo Oliva [3] and Christian Joseph Cumagun [4]

[1] College of Agriculture and Forestry, Jose Rizal Memorial State University, Katipunan Campus, Katipunan, Zamboanga del Norte, 7109 Philippines
[2] Department of Forest Mycology and Plant Pathology, Division of Plant Pathology/Epidemiology, Swedish University of Agricultural Sciences, P.O. Box 7070, SE-750 07 Uppsala, Sweden
[3] Department of Plant Pathology, World Vegetable Centre, 60 Yi-Min Liao, Shanhua, Tainan 74199, Taiwan
[4] Parma Research and Extension Center, University of Idaho, 29603 U of I Ln, Parma, ID 83660, USA

One of the most devastating diseases in the world that affects rice is sheath blight (ShB), caused by *Rhizoctonia solani*. Management of the sheath blight is carried out through cultural, biological, and chemical applications. Breeding for resistance has been explored. However, due to the pathogen's complex mechanisms, complete resistance in rice cultivars has not yet been achieved. Phenotypic evaluation through epidemiological concepts provides a relevant basis for identifying potential donors of resistance. The resistance is assessed through epidemiological phenotypic quantification of physiological and disease escape. Sixteen selected lines were subjected to a micro-field condition to test for overall resistance. Disease resistance was evaluated based on key parameters, including tiller incidence, relative lesion height, and lesion number. Statistical analysis, including ANOVA and multivariate analysis, identified four lines, Da Nuo, Gie 57, ShB 6, and ShB 5, with moderate to high resistance. Moreover, *Oryza rufipogon* lines (ShB 4, ShB 5, ShB 6, and ShB 9) demonstrated promising resistance levels, indicating their potential as donors in breeding programs for enhanced ShB resistance. This study provides valuable insights into the quantitative resistance mechanisms of rice genotypes against sheath blight, laying the groundwork for future breeding strategies to mitigate disease impact.

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sciforum-122665: Baseline Susceptibility of *Eldana saccharina* to CORAGEN® SC: Implications for Resistance Monitoring and Management in Sugarcane

Kwanele Phiwinhlanhla Msele [1,2]*, Lawrence Nkosikhona Malinga [1,2] and Caswell Thinandavha Munyai [2]

[1] South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe 4300, South Africa
[2] School of Life Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville 3209, South Africa

Eldana saccharina Walker is one of the most destructive sugarcane pests in South Africa. The application of chemical pesticides mainly controls this pest; however, the resistance in pest populations threatens the effectiveness of these pesticides. Laboratory bioassays were conducted at the South African Sugarcane Research Institute to assess the baseline susceptibility of *E. saccharina* against different concentrations (0.005, 0.014, 0.024, 0.033, 0.041 and 0.049 µg/ml) of CORAGEN® SC (chlorantraniliprole) insecticide. Two-day-old larvae were inoculated into an artificial diet with CORAGEN® SC solution. Daily monitoring of larval feeding and movement behaviour on the diet was performed for seven days, and the mortality rate and larval weight data were determined. The data was subjected to probit analysis using IBM SPSS version 27 to determine a lethal concentration (LC_{50}) of the *E. saccharina* population and its 95% confidence limits. Differences in mortality and larval weight across different concentrations were assessed using a one-way ANOVA in IBM SPSS. Tukey's multiple comparisons were used to assess differences in larval mortality and weight between concentration groups. The study showed that mortality increases progressively from the lowest to the highest concentration. The highest concentration (0.049 µg/ml) resulted in 79% mortality, while the control (15%) exhibited minimal effects. Additionally, larval weight decreased as concentration increased, with the control having the highest mean weight (8 mg) and the highest concentrations (0.041 and 0.049 µg/ml), resulting in the lowest weight (0.2 mg). The LC50 value was 0.0298 ug/ml with a 95% CI of 0.0252 - 0.0353 ug/ml. The results demonstrated a positive correlation between insecticide concentration, mortality rate and larval weight reduction. These findings provide crucial data for resistance monitoring, aiding in developing sustainable pest management strategies for sugarcane production. This study could further serve as a foundation for developing an IRAC laboratory-based resistance monitoring protocol.

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sciforum-131417: Biological interactions between epazote *Dysphania ambrosioides*, the urbícola soft scale insect *Pulvinaria urbicula*, the ant *Dorymyrmex smithi* and the parasitoid *Coccophagus lycimnia* in Mexico

Agustín Jesús Gonzaga Segura [1]*, Artemio Hernández-Ruiz [2], Víctor Rogelio Castrejón-Gómez [1] and Karla Yolanda Flores Maldonado [3]

[1] Center for the Development of Biotic Products, National Polytechnic Institute (IPN), Yautepec, Morelos 62731, Mexico
[2] Phytosanitary Consulting "Dr. Artemio", Mexico
[3] Faculty of Engineering and Sciences, Autonomous University of Tamaulipas, Ciudad Victoria 87000, Tamaulipas, Mexico

The herb epazote, *Dysphania ambrosioides* (L. Mosyakin and Clemants) (Amaranthaceae), is affected by species that belong to the Hemiptera order, principally those from the Cocoidea family such as soft scale insects. The latter maintain different biotic interactions with species of ants (Hymenoptera: Formicidae) and a wide variety of parasitoids from the Aphelinidae, Encyrtidae, Pteromalidae and Eulophidae (Hymenoptera) families. During February and March 2024, a study was conducted in a homegarden located in Petatlán, Guerrero, Mexico (17°32'50.0"N 101°16'31.0"W, at an altitude of 41 metres above sea level), with the aim of identifying the hemipteran insects associated with epazote, as well as their interactions with ants and natural enemies. The urbicola scale insect *Pulvinaria urbicola* Cockerell (Hemiptera: Coccoidea) was recorded as the main phytophagous species present on the plant. Among the biotic interactions observed, the ant *Dorymyrmex smithi* Cole (Hymenoptera: Formicidae) was documented for the first time as being associated with colonies of *P. urbicola.* Although in Mexico, *D. smithi* has previously been recorded interacting with scale insects and Pseudococcids, there are no reports of any interactions with *P. urbicola.* As for natural enemies, the parasitoid *Coccophagus lycimnia* (Walker) (Hymenoptera: Aphelinidae) was identified, a species introduced in Mexico in 1954 for the biological control of soft scale insects. This study provides new records of interactions associated with a traditional crop of Mexico.

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sciforum-139126: Biopesticidal Effects of Gliricidia sepium (Kakawate) and Cassia alata (Acapulco) Leaf Extracts on Pests of Sugar Beet (Beta vulgaris)

Dairy Jane M. Garcia, Lany L. Cortizano, Mark Allan L. Flores, Arvin B. Taruma * and Marc Sylvester P. Garcia

Laguna State Polytechnic University (LSPU), Santa Cruz 4009, Laguna, Philippines

Sugar beet cultivation has gained prominence as a viable alternative to sugarcane in regions where climatic conditions are less favorable for sugarcane growth. This study, conducted at Barangay Paagahan, Mabitac, Laguna, aimed to evaluate the efficacy of Kakawate (Gliricidia sepium) and Acapulco (Cassia alata) leaf extracts as biopesticides for managing pests in sugar beet (Beta vulgaris). A single-factorial experiment was employed with five treatments, laid out in a Randomized Complete Block Design (RCBD), and replicated across four blocks. The treatments included T1—Control (no biopesticide), T2—Commercial pesticide, T3—Kakawate extract, T4—Acapulco extract, and T5—50% Kakawate + 50% Acapulco. A total of 1,600 sugar beet plants were planted in the experimental area. Our results indicated that Treatment 5 (50% Kakawate and 50% Acapulco) was the most effective, leading to the highest economic yield and heaviest plants. Treatment 3 (Kakawate) produced the longest roots and tallest plants, while Treatment 4 (Acapulco) resulted in the largest root diameter. Furthermore, sugar beets treated with Kakawate and Acapulco were preferred for their appearance, taste, and overall acceptability. Treatment 5 also generated the highest net income (9,000 pesos). These findings suggest that Kakawate and Acapulco leaf extracts are promising, eco-friendly biopesticides for sugar beet pest control, offering potential for sustainable pest management strategies. Further research is recommended to assess their long-term sustainability and explore additional complementary pest control methods.

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sciforum-133519: Botanical Extracts as Sustainable Alternatives to Conventional Pesticides in Crop Protection

Alina Butu [1,*], Steliana Rodino [1,2] and Marian Butu [1,2]

[1] Department of Biotechnology, National Institute of Research and Development for Biological Sciences, Bucharest 060031, Romania
[2] The Research Institute for Agricultural Economics and Rural Development, Bucharest, 011464, Romania

Escalating pathogen resistance to synthetic pesticides and the regulatory impetus of the European “Farm-to-Fork” Strategy have intensified the search for crop-protection tools that eliminate toxic residues while safeguarding yield. In this context, we investigated the antifungal potential of five plant-derived extracts—*Azadirachta indic*a (neem), *Salix babylonica* (willow), *Capsicum annuum* (chilli), *Thymus vulgaris* (thyme), and *Allium sativum* (garlic)—against the economically important tomato pathogens Phytophthora infestans, Alternaria solani, and Botrytis cinerea. Crude extracts were produced by ultrasound-assisted extraction in 70% (v/v) ethanol, achieving mean yields of 12–18% (w/w) relative to dry biomass. Each extract was encapsulated in chitosan–alginate nanoparticles (mean diameter 145 ± 18 nm; ζ-potential –31 mV) to enhance stability and foliar adhesion. Formulations were sprayed at 0.5–2 g L^{-1} in a 10-week greenhouse trial (1 000 m², completely randomized design, three replicates per treatment). In vitro disc diffusion assays confirmed dose-dependent growth inhibition, with minimum inhibitory concentrations ranging from 0.25 to 1.0 g L^{-1}. In vivo, the T. vulgaris nanoformulation curtailed disease incidence by 67%, statistically indistinguishable from the synthetic fungicide fludioxonil ($p > 0.05$), yet left no quantifiable residues in fruit (0.01 mg kg^{-1} by LC-MS/MS). A cradle-to-gate life-cycle assessment, performed according to ISO 14040/44, revealed that the thyme-based treatment reduced eutrophication potential by 55% and greenhouse gas emissions by 40% relative to the grower’s conventional spray program. Sensitivity analysis indicated that nanoparticle encapsulation contributed less than 5% to the overall impact, validating its environmental compatibility. Our findings demonstrate that nano-carried botanical extracts can match the efficacy of commercial fungicides while advancing zero-pollution objectives. The approach offers a scalable pathway for integrating circular bio-resources into plant-health management and supports EU policy goals for pesticide-free, climate-smart agriculture.

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sciforum-120167: Development and Stability Evaluation of an Environmentally Friendly Aqueous Suspoemulsion of Emamectin Benzoate

Gabriela Quintero * and Hermes Andrade

R&D Department, Formulaciones Químicas & Asesorías QA, C.A., Mérida 5101, Venezuela

In this study, an aqueous suspoemulsion (SE) of emamectin benzoate, an effective insecticide, was developed using a mixture of non-ionic and anionic surfactants and soy lecithin as an emulsifying and stabilising agent of natural origin, avoiding the use of toxic organic solvents. The stability of this formulation was evaluated by CIPAC MT-180 methods, obtaining values of 0.03 mL cream, 0.01 mL free oil and no observable sediment at 0.5 h after dispersion. At 24.5 h after dispersion, values of 0.04 mL cream, 0.01 mL free oil and no observable sediment were obtained, ensuring the stability of the dispersion of SE in water. The concentrated SE had a density of 0.95 g/mL at 25 °C, pH = 7.29 at 25 °C, and a dynamic viscosity of 170 cP at 25 °C. The results obtained offer new opportunities for the design of plant protection products with lower environmental impact by incorporating biodegradable additives, favouring the development of a more responsible and efficient agriculture, in line with the principles of sustainability.

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sciforum-133211: Development of Sprayable long hairpin dsRNA Encapsulated with layered double hydroxide nanoparticles against *Bemisia tabaci* and *Pectinophora gossypiella*

Babur Ali Akbar [1,*] and Nadia Iqbal [2]

[1] Centre of Agricultural Biochemistry and Biotechnology, faculty of Agriculture, University of Agriculture Faisalabad, Faisalabad, 64101, Pakistan
[2] National institute for Biotechnology and Genetics Engineering NIBGE-PIEAS , Faculty of Agriculture Biotechnology, Faisalabad, 38000, Pakistan

RNA interference is an eco-friendly pest control mechanism regulating gene expression at a post-transcriptional level in eukaryotes and offers a promising alternative to conventional chemical pesticides, which face challenges such as resistant development and non-target toxicity. The sprayable gene-specific double-stranded RNA (dsRNA) will suppress the insecticide detoxifying genes (Acetylcholine esterase (AChE), orcokinin (Orc), sex lethal protein, Ecdysone receptor (ECR) genes (B. tabaci Asia-1, PgCadI, Cadherin alleles (rI9 and r20), rI5A and rI5B, rI4 allele of the pink bollworm cadherin gene (PgCadI), rI3PgCadI, PgABCA2, PgCadI alleles (rI-r20), and PgABCC2) of white fly and pink bollworm. Initially, this study will screen differences in insecticidal activity across various open reading frames of target genes using similarly sized (approximately 300 bp) dsRNAs. The optimal length of dsRNA will be determined by preparing samples ranging from 100 to 700 bp. Different formulations of dsRNA spray shielded with layered double hydroxide nanoparticles will be used against different target genes. The effects of dsRNA on non-target organisms (NTOs) will be evaluated against honey bees, Apis mellifera, A.cerana, and a natural enemy, Orius laevigatus. The optimal length of hairpin dsRNA will be capsulated with LDH and harmless to NTOs, and then it will be sprayed on Bemisia tabaci and Pectinophora gossypiella infesting lab- and greenhouse-cultivated cotton plants. This study will lead to a significant reduction in pink bollworm and white fly populations compared to the control efficacy of different synthetic chemical insecticides.

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sciforum-127308: Effect of natural farming components on growth, diseases, seed quality and economics in onion

Anubhav Thakur [1,*], Narender Kumar Bharat [2], Kuldeep Singh Thakur [3], Upender Singh [4], Rohit Verma [5] and Kamrul Nissa [1]

[1] PhD Research Scholar
[2] Professor, Department of Seed Science and Technology Dr Yashwant Singh Parmar University of Horticulture and Forestry Himachal Pradesh India
[3] Department of Vegetable Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry Himachal Pradesh India
[4] Department of Soil Science and Water Management Dr Yashwant Singh Parmar University of Horticulture and Forestry Himachal Pradesh India
[5] Department of Seed Science and Technology Dr Yashwant Singh Parmar University of Horticulture and Forestry Himachal Pradesh India

A two-year experiment from 2022- to 2024 was conducted to study the effect of natural farming on field and seed quality parameters in onion seed crop. Among the various treatments, the maximum plant height(cm), number of leaves per plant, number of umbels, umbel diameter (mm), number of seeds per umbel, minimum days to seed harvesting, 1000 seed weight (g), seed yield per plot and hecctare (kg) and lowest diseases incidence were reported with natural farming treatment: T10 – Onion sole crop with four sprays of Buttermilk, which was stastically at par with T4 – Onion+Fenugreek 4 sprays of Buttermilk and conventional control (T13) . Similarily supreriority in seed quality, such as germination (%), seedling length (cm), dry weight (mg) and vigour index-I and II, was observed in the natural farming treatments T10 and T4. These two natural farming treatments also resulted in a higher B:C ratio than that of conventional farming system and thus can be recommended for quality seed production in onion.

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sciforum-139038: Efficacy of endophytic *Beauveria bassiana* (Balsamo) and *Metarhizium anisopliae* (Metchnikoff) against nymph of *Nilaparvata lugens* (Stål) infesting *Oryza sativa* plants

Gina Deanon Balleras [1,*], Barbara Lavina Caoili [2] and Virginia Ramos Ocampo [2]

[1] Department of Agriculture-Philippine Rice Research Institute (DA-PhilRice) Midsayap
[2] Institute of Weed Science, Entomology, and Plant Pathology (IWEP), University of the Philippines Los Baños

Certain entomopathogenic fungi (EPF), such as *Beauveria bassiana* and *Metarhizium anisopliae*, are highly pathogenic to arthropod pests and are able to colonize plant tissue as endophytic entomopathogenic fungi (EEPF), thereby requiring more extensive research on potential mycopesticides in rice. In this study, the entomopathogenic fungal (EPF) *Beauveria bassiana* (2) and *Metarhizium anisopliae* (3) isolates were artificially inoculated onto rice using the seed immersion technique. The successful colonization of rice by *Beauveria bassiana* and *Metarhizium anisopliae* isolates was demonstrated, and the endophytic and direct effects of the EPF against the third instar brown planthopper, *Nilaparvata lugens* (Stål), were assessed. Endophytic colonization of the plant by the EPF was shown by re-isolating the EPF from the leaf lamina and leaf sheath+culm of the rice plant that were not the initial site of inoculation. The results indicated that significant differences (at $p=0.05$) were obtained in mean % successful re-isolation of the EPF from the leaf lamina and leaf sheath + culm at 21 and 28 days after inoculation (DAI). Interestingly, DNA sequence data revealed that the recovered fungal isolates from EEPF-inoculated rice tissues showed 100% nucleotide similarity with the *B. bassiana* and *M. anisopliae* published by the National Center for Biotechnology Information (NCBI), indicating successful endophytic colonization of all the EPF in rice seedlings. Exposure of third instar BPH nymphs to 21-day-old EPF-inoculated rice seedlings resulted in 61-74% mortality recorded for 7 days compared to uninoculated rice plants. In conclusion, this research provides evidence, for the first time, of the endophytic action of *B. bassiana* and *M. anisopliae* against the third instar *N. lugens* and the ability of the EPF-*B. bassiana* and *M. anisopliae* to colonize the internal tissues of *O. sativa* plants.

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sciforum-138856: Efficacy of Zinnia (*Zinnia violacea*) as Intercrop and Oriental Herb Nutrients (OHNs) as Biopesticide in Reducing Pest Incidence and Enhancing Productivity in Squash (*Cucurbita maxima*)

Tricia Gregorie Empemano, Ronalyn O. Trajano, Mark Allan Llantero Flores * and Marc Sylvester P. Garcia

Laguna State Polytechnic University

Intercropping and biopesticide application are two universal practices that can reduce reliance on chemicals and synthetically produced pesticides; additionally, they can also enhance biodiversity and promote sustainability. A single-factorial experiment was conducted to evaluate the efficacy of Zinnia (Zinnia violacea) as an intercrop, and oriental herb nutrients (OHNs) as an organic biopesticide, in reducing pest incidence and improving the productivity of squash (Cucurbita maxima). The experiment was conducted using a Randomized Complete Block Design (RCBD), with four treatments: Control (T1), squash + OHN application (T2), squash + zinnia intercropping (T3), and squash + zinnia intercropping + OHN application (T4). The analysis focused on investigating the natural enemies present as well as the number of pests and their degree of damage and yield component. The results show that, intercropping Zinnias with squash was significantly effective in reducing pest incidence and attracting insects beneficial for pollination and fruit production in squash. Additionally, the combination of Zinnia intercropping and oriental herb nutrient (OHN) application consistently yielded the best results in controlling pests that attack squash, thereby increasing productivity. The findings demonstrated significant results on the efficacy of Zinnia–squash intercropping and OHN application as a method of biological control conservation and provided crucial insights into the practical, low-cost and sustainable pest management of squash production.

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sciforum-140992: Evaluation Of The Insecticide Activity of *Cornulaca monacantha* Against The Migratory Locust *Locusta migratoria* (Acrididae, Oedipodinae)

Chilali Fadhila * and Benrima Atika

Laboratoire de Biotechnologie des Productions Végétales ; Faculté des Sciences de la Nature et de la Vie, Université de Blida 1. B.P. 270, route de Soumaa; Ouled yaich Blida.

Description of the subject:

Current control methods against *Locusta migratoria* use liquid insecticides whose active ingredients belong to the family of organophosphorus pyrethroids and synthetic carbamates, but these preparations have been found to be very harmful to the environment.

Objective:

The objective of the present study is to determine effect of the aqueous extract of *Cornulaca monacantha* on fifth-instar larvae (L5) of the migratory locust *Locusta migratoria*.

The methods:

The parameter studied was the mortality rate. We used three doses: a high dose (D1), an average dose (D2) and a low dose (D3). They were administered with two methods: contact and ingestion.

Results:

According to the results, a maximum mortality rate of 100% was recorded from the first day with the high D1 dose (by contact mode). However, the high D1 dose (by ingestion) induced a mortality rate of 83.33% on the first day, with a maximum mortality rate of 100% reached on the 2nd day. On the other hand, we note that the mortality rate began at 30% with the D2 dose (by ingestion), evolved towards 86.66% mortality on the third day and reached a maximum rate of 100% around the fourth day. The aqueous extract of *Cornulaca monacantha* was toxic by ingestion, with a highly significant difference between controls and treated larvae for the three doses—D1 ($p = 0.0001074$ 5%), D2 ($p = 0.0001382$ 5%) and D3 ($p=0.0001387$).

Conclusion:

The aqueous extract of *C. monacantha* greatly reduced the L5 population of *Locusta migratoria*.

The toxicity of the biopreparation is induced by the secondary molecules present in the leaves of the plant, especially polyphenols.

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sciforum-138502: 84 Field Evaluation of Different Application Frequencies of Extracts from Tubli Roots (Derris elliptica) against Diamondback Moth (Plutella xylostella) and Their Effects on Pechay (Brassica rapa L.)

Enrique Jr. Elisan Biñas

Agusan del Sur State College of Agriculture and Technology

Different application frequencies of tubli root extracts, Derris elliptica, against the diamondback moth (DBM) were assessed to determine the impact on the growth and yield of pechay, Brassica rapa crop. The experiment was arranged in a randomized complete block design, with four treatments replicated three times. The application started a day after transplanting. The treatment of the extract given seven times at 3-day intervals after transplanting (T1) significantly resulted in lower mean DBM populations of 1.90, 0.70, and 0.30 at 7, 21, and 28 days after transplanting, respectively. Relative to plants applied with tubli root extracts four times at 6-day intervals after transplanting (T2), the mean reductions of the moth were 2.50, 0.96, and 0.83, respectively. It was evident that plants treated with tubli root extracts seven times at 3-day intervals (T1) were significant in incurring the minor damage of only 16% at harvest. The treatments helped obtain good crops (98.36 g/hill), a high yield (7.17 kg/plot), and a higher percentage of marketable plants (91.77%/plot) compared to other treatments of the extract with lesser frequencies, like four times at 6-day intervals after transplanting (T2), three times at 9-day intervals after transplanting (T3), and plants without treatment (T0). Overall, the growth of pechay was not affected by the different application frequencies of tubli root extract.

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sciforum-117795: From Singular to Systemic: The Transformative Trajectory of Zero-Pollution Crop Protection Strategies

Lei Liu

[1] China Center for Modernization Research, Chinese Academy of Sciences. Beijing 100190 China
[2] School of Public Policy and Management, University of Chinese Academy of Sciences. Beijing 100049 China

In the evolution of agricultural development, crop protection has always served as a critical mechanism for ensuring both yield security and product quality, undergoing profound technological paradigm shifts. Traditional pest management systems have long relied on chemical inputs—a technological approach that, while significantly boosting per-unit productivity during specific historical periods, has progressively revealed substantial ecological costs through secondary environmental externalities. Of particular concern is the global public health challenge posed by chemical residues, the bio-amplification effects of which cause acute food safety risks through trophic transfer mechanisms . In this context, zero-pollution crop protection solutions have emerged as a transformative response. These strategies aim to minimize or eliminate chemical usage while adopting ecologically harmonious and sustainable crop safeguarding methodologies. Their influence not only addresses the limitations of conventional technologies but also epitomizes a paradigm shift in agricultural philosophy—from a narrow focus on yield maximization to a holistic integration of ecological stewardship and food safety imperatives. The transition from unitary technological approaches to systemic operational models constitutes the core trajectory of evolving zero-pollution solutions. Grounded in agricultural techno-historical analysis and framed by technological systems theory, this study systematically examines the developmental trajectory of zero-pollution crop protection systems. Methodologically, it employs paradigm analysis based on systems thinking to deconstruct technical–institutional co-evolution. The results reveal the synergistic co-evolutionary mechanisms linking technological advancement, ecological adaptation, and societal transformation within agricultural sustainability transitions. This systemic shift accommodates the inherent complexity and diversity of agricultural production, synthesizing multidisciplinary technologies and strategies to achieve comprehensive, efficient, and sustainable crop protection, reflecting a fundamental reorientation in agricultural paradigms—from a “conquest of nature” ethos to a philosophy of “symbiotic coexistence”.

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sciforum-132093: Greenhouse Trials of Hydrothermally Modified Syenite Rocks: A Climate-Smart Potassium Source for Soybean on Depleted Tropical Soils

Amine El Messbahi [1,*], Abdellatif Elghali [1], Hudson Wallace Pereira de Carvalho [2,3], Otmane Raji [1] and Mostafa Benzaazoua [1]

[1] Geology and Sustainable Mining Institute, University Mohammed VI Polytechnic, Benguerir 43150, Morocco
[2] Global Critical Zone Science Chair, University Mohammed VI Polytechnic, Benguerir 43150, Morocco
[3] Center for Nuclear Energy in Agriculture (CENA), University of São Paulo, Piracicaba 13416-000, SP, Brazil

Potassium (K) deficiency is a significant limitation to crop production in tropical regions, where highly weathered soils are prevalent and access to imported K fertilizers, such as potassium chloride (KCl), is often restricted. As a sustainable alternative, K-rich syenite rocks, naturally abundant in silicate minerals, hold promise, though their low solubility limits direct agronomic use. This study investigates the potential of a chlorine-free K fertilizer produced through low-temperature hydrothermal conversion of syenite rocks from Morocco (~15 wt.% K_2O), aimed at enhancing nutrient release while ensuring agro-environmental considerations. Greenhouse trials were conducted using a randomized complete block design (RCBD) with five replicates, on a tropical soil highly K-depleted. Treatments included hydrothermally converted syenite (HTS), untreated syenite, KCl, and a no-K control, with K applied uniformly at a rate of 500 kg K/ha across treatments. Soybean, a nutritionally significant and key contributor to sustainable cropping systems in tropical agriculture, was selected to assess fertilization effectiveness. Plant growth, biomass accumulation, and potassium uptake were measured over 60 days. The results showed that HTS significantly improved plant performance and potassium uptake, with outcomes close to those of KCl, while untreated syenite remained less effective. These findings demonstrate the effectiveness of processing syenite rock to enhance potassium bioavailability for soybean, and highlight the potential of syenite as a locally sourced product and an eco-friendly potassium fertilizer. Its adoption may reduce reliance on imported potash fertilizers, improve tropical soil fertility, and contribute to more resilient and circular nutrient management practices for sustainable agriculture.

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sciforum-135720: Incidence and severity of infestations of maize (*Zea mays* L.) by *Spodoptera frugiperda* J. E. Smith (Lepidoptera: Noctuidae) in relation to altitude in Nyiragongo Territory, DRC

Balthazar Lubunga Kapasa

Department of Plant Production, La Sapientia Catholic University of Goma, City of Goma, P.O. Box: 50 Goma, Democratic Republic of Congo

The armyworm (CLA) causes major damage to cereal crops, particularly maize. In the Democratic Republic of Congo, recent data indicates that the regions currently most affected are Sud-Ubangi, Nord-Ubangi, Lualaba, Kasaï Central, Haut-Katanga and the Kivus. In this study, the level of CLA infestation was assessed as a function of altitude and cropping associations in Nyiragongo Territory. Observations were made in 10 fields, taking altitude into account. The results indicate significant variations in incidence and severity as a function of altitude ($p = 0.01$), but not in the equivalent density coefficient ($p > 0.05$). Thus, it appears that increasing altitude plays a crucial role in reducing the spatial distribution and spread of the armyworm. It should be stressed that other factors, such as variations in the availability of host species and natural enemies, can also have a significant influence on the level of infestation. The role of crop association in reducing CLA population density is also discussed.

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sciforum-132431: Molecular Characterization and Identification of Endophytic Bacteria from Sugarcane Stalk Against Ringspot Disease of Sugarcane (*Epicoccum sorghinum*) in Negros Island Region (NIR), Central Philippines State University

Romnic A. Cabelin *, Jevie P. Jaranilla, Sam Michael R. Decatoria, Hanzel L. Pedrosa, Ma. May P. Opino, Jesimiel A. Curbita, Marie Neila P. Seco, Noel S. Dayono and Maryvic P. Pedrosa

Central Philippines State University, Kabankalan City, Negros Occidental, 6111, Philippines

Abstract

Sugarcane (*Saccharum officinarum* L.) is a crucial crop contributing significantly to the economy and industries of the Philippines. However, its productivity is threatened by ringspot disease, caused by *Epicoccum sorghinum*, which negatively affects growth and yield. This study aims to evaluate the antagonistic potential of endophytic bacteria isolated from sugarcane against *E. sorghinum* using a Dual Culture Assay (DCA) and Volatile Compound Assay (VCA). The study also characterizes the bacterial species through morpho-cultural and Gram staining analysis and identifies them using Polymerase Chain Reaction and Phylogenetic Analysis (PCR-PA). The bacterial isolates, obtained from sugarcane stalks and maintained in the laboratory, were assessed for their inhibitory effects on the pathogen. The findings revealed that *Burkholderia gladioli* (Camingawan) exhibited the highest inhibition in the DCA (57.79%), followed by *Stenotrophomonas rhizophila* (Oringao) (16.55%). In the VCA, *Bacillus pumilus* (Binicuil) was the most effective, showing a 49.56% inhibition rate. Molecular characterization using 16S rRNA sequencing confirmed the identity of these endophytic bacteria. The results indicate that these bacterial strains possess strong antagonistic properties against *E. sorghinum*, demonstrating their potential as sustainable biocontrol agents. This study provides valuable insights into endophytic bacteria as an eco-friendly alternative to chemical pesticides for managing ringspot disease in sugarcane. Further research should explore field applications and formulation development to enhance the practical deployment of these biocontrol agents in sugarcane farms.

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sciforum-137553: Occurrence And Molecular Characterization Of Entomopathogenic Fungi Associated With Spodoptera Frugiperda In Tanzanian Maize Farms

Regan M Nyoni [1,*], Mwema Felix Mwema [2], Agatha Aloyce [3] and Ernest Rashid Mbega [3]

[1] Sustainable Agriculture, The Nelson Mandela African Institution of science and Technology, P.O. Box447, Arusha, Tanzania
[2] School of Materials, Energy, Water and Environmental Sciences (MEWES), The Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box447, Arusha, Tanzania
[3] School of Life Sciences and Bioengineering, Sustainable Agriculture, The Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box447, Arusha, Tanzania

Entomopathogenic fungi (EPF) are promising biological control agents for managing agricultural pests, like *Spodoptera frugiperda* (fall armyworm), which is a major threat to maize production. The present study used morphological and molecular techniques to determine the occurrences and distribution of EPF associated with *S. frugiperda* in maize farms. Field surveys were conducted across diverse agroecological zones, collecting soil samples, insect cadavers in Morogoro (Morogoro rural), Ruvuma (Songea District), and Kilimanjaro (Mwanga District). Morphological identification involved culturing fungal isolates on Potato Dextrose Agar, followed by microscopic examination of conidial and hyphal structures. The isolates were also observed under the microscope for microscopic morphological features. Molecular characterization was performed using PCR amplification and sequencing of the ITS region of rDNA, to enable precise taxonomic identification and phylogenetic analysis. A total of 24 EPF isolates were obtained, with their sources categorized into maize farms and cadavers of *S. frugiperda*. The comparison of isolates using a compound microscope showed that some isolates had a dark olive/brown color, covered with wooly tufts and smooth surfaces, whereas some showed a bright-yellow/green color, covered with thick short piles like cotton on the sides and a rough surface. Molecular analyses confirmed the identity of EPF isolates and revealed high genetic diversity within populations. The findings revealed the occurrence of EPF species like *Metarhizium anisopliae*, *Aspergillus terreus, Aspergillus flavus, Aspergillus fimeti, Talaromyces sp, Cladosprium oxysporium*, and *Cladosporium cladosporiodes*. The evolutionary analysis of the sequences also revealed that the isolates belong to two main clades with subclades, indicating the widespread diversity among them. This study is among the few that integrate morphological and molecular approaches for comprehensive EPF characterization. The insights gained provide a foundation for developing location-specific biocontrol strategies against *S. frugiperda* in maize farming, contributing to sustainable pest management and enhanced crop productivity.

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sciforum-138865: Potential Of Entomopathogenic Nematode Isolates As Biological Control Agents Against The Sweetpotato Weevil *Cylas formicarius* Fabricius (Coleoptera: Brentidae)

Renila Garcia and Mannylen Alde Merioles *

Department of Pest Management, Faculty of Agriculture and Food Science, Visayas State University, Baybay City Campus, Baybay City, 6521, Philippines

Sweetpotato weevil (*Cylas formicarius* F.) is one of the threats of sweetpotatoes in the Philippines. Controlling this pest is important to increase the production of sweetpotatoes. Therefore, a study was conducted to determine the virulence of four local *Heterorhabditis indica* (MBC, ZBC, GBC and VSU) isolates against the different stages of sweetpotato weevil, *Cylas formicarius* Fabricius (Coleoptera: Brentidae), evaluated under laboratory conditions. The four EPN isolates being tested in this study revealed that they have the potential to act as biological control agents against *Cylas formicarius*. The highest percentage mortality was obtained by the MBC isolate with 80.53% and 82.09% in the larval and pupal stage, respectively. On the other hand, the ZBC isolate obtained the highest percentage mortality of 32.76% in the adult stage. Regardless of the EPN concentrations and exposure to time, all of the four isolates were not statistically different.

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sciforum-138403: Reducing Pesticide Dependence through Genetically Modified Crops: Adoption Barriers and Yield Benefits in Sub-Saharan Africa

Chijioke Christopher Uhegwu * and Christian Kosisochukwu Anumudu

[1] Department of Microbiology, Federal University Otuoke, 650211, Bayelsa State, Nigeria
[2] School of Chemical Engineering, University of Birmingham, Edgbaston B15 2TT, UK

Introduction

This study investigates the role of genetically modified (GM) crops in reducing pesticide dependence in sub-Saharan Africa, with an emphasis on yield benefits, environmental sustainability, and socio-economic implications. Although GM crops such as Bt cotton, pest-resistant cowpea, and pest-resistant maize have demonstrated potential to lower pesticide use and increase crop yield, their widespread adoption remains limited across sub-Saharan Africa. Thus, this study examines the barriers to the adoption of GM crops and the strategies that can enhance their uptake for more sustainable and resilient crop production in the region.

Methodology

Using a systematic review approach, the impact of GM crops on pesticide use, farm productivity, and the well-being of farmers was evaluated across three focus countries: Nigeria, South Africa, and Burkina Faso. Cross-country comparisons were conducted to highlight the lessons learned from successful and stalled GM crop programs, such as Nigeria's Bt cotton and cowpea rollout, South Africa's adoption of GM maize, and the suspension of Bt cotton cultivation in Burkina Faso. The key regulatory, socio-cultural, and economic factors influencing adoption were identified, alongside the potential environmental benefits of reduced pesticide application.

Results

Findings show that while GM crops can significantly reduce pesticide usage and production costs, challenges such as public hesitancy, regulatory hurdles, limited farmer awareness, and concerns about trade restrictions hinder wider uptake. In climates where GM crops have been successfully adopted, it was demonstrated that supportive policy frameworks, transparent biosafety regulations, established risk assessment platforms, and community engagement can increase farmer confidence and speed up GM crop adoption.

Conclusion

For GM crops to be speedily adopted for sustainable crop protection in sub-Saharan Africa, governments and stakeholders must strengthen biosafety systems, invest in farmer education, and facilitate public–private partnerships. Furthermore, pilot projects tailored to local conditions and the promotion of genetic literacy among both politicians and the public are crucial in removing the contradictory attitudes towards GM crops and further enhancing uptake, helping the region transition towards lower pollution and more resilient agricultural systems.

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sciforum-138867: Susceptibility Assessment of Dalbergia sissoo Seeds and Seedlings to Colletotrichum gloeosporioides, and other Colletotrichum species (C. siamense and C. fragariae).

Tasmia Tabassum Tanha *, Moumita Datta, Md Hashibul Hossain, Romel Ahmed and Mohammed Masum Ul Haque

Forestry and Environmental Science, Agricultural and Mineral Science, Shahjalal University of Science and Technology, Sylhet, 3114, Bangladesh

Collectotrichum gloeosporioides is a highly aggressive fungi species causing diseases in plants throughout the world. In Bangladesh, *C. gloeosporioides* has been reported to have caused leaf blight disease of *Dalbergia sissoo* in 2021. Seeds and seedlings of *D. sissoo* were examined in vitro for their susceptibility to *C. gloeosporioides* and other two *Colletotrichum* species, namely *C. fragariae* and *C. siamense*. Mycelial agar plugs and spore suspension of the *Colletotrichum* species were used to inoculate seeds and seedlings of *D. sissoo*. Susceptibility was measured in terms of pathogen virulence to inoculated seeds and seedlings and data were recorded after 14 and 42 days of observation, respectively. The findings of the study showed that the germination percentage of the inoculated seeds decreased more by *C. siamense* (45-54%) as compared to *C. fragariae* (33-49%) and *C. gloeosporiodes* (45-51%). On the other hand, the mortality rate (%) increased by *C. fragariae* (~43%) as compared to *C. siamense* (35%) and *C. gloeosporioides* (33%). The results revealed that seeds and seedlings of *D. sissoo* are at risk of infection by *C. gloeosporioides*. In addition, non-host pathogens such as *C. fragariae* and *C. simense* may also pose a serious threat to seeds and seedlings of *D. sissoo*. This is an important concern regarding the natural regeneration of the tree species in the areas of Bangladesh facing disease.

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sciforum-132549: The Adoption of Thermal Treatment Technology (TTT) for Sustainable Post-Harvest Pest Control: A Case Study of Dried Fig Producers in Aydın, Turkey

Masoomeh Shemshad

Ph.D. student in Agroecology, Department of Agroecology and Plant Production, Krakow, Poland

This study investigates the key determinants influencing farmers' adoption of Thermal Treatment Technology (TTT) as a sustainable and agroecological strategy for controlling storage pests and reducing chemical inputs in post-harvest management. Reducing reliance on synthetic pesticides aligns with the principles of Integrated Pest Management (IPM) and supports the European Union's Green Deal objectives, particularly in promoting low-carbon and environmentally friendly agricultural practices. This research focuses on dried fig producers and processors in Aydın, Turkey—one of the country's leading fig-producing regions. Data were collected through face-to-face structured interviews with 170 farmers and processors. To ensure a minimum level of understanding of the technology, participants were shown a 3-minute educational video introducing the concept, benefits, and application of TTT prior to completing the questionnaire. A multinomial logistic regression model was applied to identify the socio-economic variables that significantly influence adoption behavior. The results indicate that access to training and educational resources, financial and marketing support, farm size, and land ownership are positively associated with the likelihood of adopting TTT. Conversely, age shows a negative relationship, with younger farmers demonstrating a higher propensity to adopt innovative and sustainable practices. The model demonstrated good explanatory power, with Nagelkerke R^2 = 0.587 and McFadden R^2 = 0.294. Overall, the findings highlight the importance of supportive institutional frameworks and socio-economic conditions in facilitating the uptake of green technologies in agriculture. Policymakers and agricultural extension services should focus on enhancing awareness, improving financial incentives, and targeting younger generations to scale up sustainable post-harvest practices. This research contributes valuable insights for designing interventions that foster climate-smart agriculture and promote zero-pollution solutions in crop protection systems.

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sciforum-132665: The Effect of a new fungicide for downy mildew control on soil microbial communities: a metagenomic approach

Eliana Monteiro [1, 2, 3,*], Catarina Passão [1, 2, 3], Márcia Carvalho [1, 2, 4], Josué Clemente [5], Pedro Sabino [5], Isabel Cortez [1, 2, 6] and Isaura Castro [1,2,4]

[1] Centre for the Research and Technology of Agroenvironmental and Biological Science (CITAB), University of Trás-os-Montes e Alto Douro (UTAD), Vila Real, 5000-801, Portugal
[2] Institute for Innovation, Capacity Building and Sustainability of Agri-food Production (Inov4Agro), UTAD, Vila Real, 5000-801, Portugal
[3] #Equal contribution
[4] Department of Genetics and Biotechnology, University of Trás-os-Montes e Alto Douro (UTAD), Vila Real, 5000-801, Portugal
[5] Ascenza-Rovensa Company, Ed. Central Office, Lisboa, 1990-084, Portugal
[6] Department of Agronomy, University of Trás-os-Montes e Alto Douro (UTAD), Vila Real, 5000-801, Portugal

Soil microbial communities play a crucial role in vineyard health by supporting nutrient cycling, plant growth, and disease resistance. However, intensive pesticide use can disrupt this balance. Grapevine (*Vitis vinifera* L.) is particularly vulnerable to *Plasmopara viticola*, the causal agent of downy mildew, which is commonly controlled with copper-based fungicides. Despite their effectiveness, these treatments pose environmental and health risks. The European Union is promoting sustainable alternatives and aims to reduce pesticide use by 50% in2030. In this context, we evaluated the impact of a new fungicide for downy mildew control on vineyard soil microbiota using a metagenomic approach. A field trial was conducted in an experimental vineyard of the University of Trás-os-Montes e Alto Douro (Portugal) with the cultivar "Tinta Roriz". Sprayings were carried out in 2024 in leaves unfolded until veraison in a total of nine foliar applications. Six different treatments for downy mildew control were tested: M1—control (without any spray); M2 and M3—two concentrations of the new fungicide; M4—new fungicide combined with elicitor (Prevatect® and chitosan-based); M5—new fungicide combined with elicitor (Equiset®, *Equisetum arvense* L. -based); and M6—conventional fungicide. Soil samples were collected before the first spraying and 15 days after the last round of spraying. Metagenomic libraries for ITS and 16S were prepared and sequenced using the Illumina platform. Proteobacteria and Ascomycota were the most abundant phyla, and *Gaiella occulta* and *Penicillago nodositata* the dominant species among bacteria and fungi, respectively. After the sprayings, an increase in bacterial abundance and diversity in the treatments combining the new fungicide with elicitors (M4 and M5**)** was noted. Fungal species diversity increased in all treatments, except for M1 and M2. Overall, the new fungicide enhanced bacterial abundance and induced changes in fungal diversity, suggesting its potential to positively control downy mildew and disrupt the soil microbial community.

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sciforum-135350: Utilization of Agricultural Waste in Biofertilizer Production: A Sustainable Procedure for Supporting Zero-Waste Approach

Natalija Atanasova-Pancevska

Department of Microbiology and Microbial Biotechnology, Ss. Cyril and Methodius University in Skopje, Faculty of Natural Sciences and Mathematics–Skopje, Institute of Biology, Skopje 1000, North Macedonia

The increasing pressure on global agricultural systems to adopt sustainable and circular practices has propelled the exploration of organic waste valorization pathways. Among these, the conversion of agricultural waste—often abundant and underutilized—into biofertilizers represents a promising avenue for both environmental protection and agronomic enhancement.

Agricultural waste, primarily composed of discarded leafy greens, fruit peels, stems, and overripe or damaged produce, is rich in organic matter and bioactive compounds. However, its management remains a challenge in many agricultural regions, particularly due to seasonal accumulation and lack of structured recycling strategies. Instead of being landfilled or incinerated, these waste streams can serve as ideal substrates for microbial fermentation and composting technologies that produce nutrient-rich biofertilizers.

This study highlights the physico-chemical characteristics of common agricultural residues such as tomato vines, pepper stalks, cucumber peels, and salad waste, and evaluates their compatibility with selected microbial strains—Azotobacter spp., Bacillus subtilis, Trichoderma harzianum, and phosphate-solubilizing bacteria. Through solid-state fermentation and controlled composting trials, the nutrient release profile, microbial viability, and phytotoxicity index of the resulting biofertilizers were assessed.

The results demonstrated that agricultural waste, when pre-treated to optimize carbon-to-nitrogen ratios and moisture content, supports robust microbial growth and enzymatic activity. Moreover, the application of these biofertilizers in test plots of lettuce and spinach yielded significant improvements in plant vigor, chlorophyll content, and root architecture compared to conventional compost or untreated controls.

Importantly, the integration of such biofertilizer production systems into local food supply chains contributes to a circular bioeconomy—reducing reliance on synthetic agrochemicals, minimizing greenhouse gas emissions from organic waste, and promoting zero-waste agricultural ecosystems. This research underlines the potential of agricultural by-products as an untapped resource in the green transition of agriculture and opens the door for localized, low-cost, and high-impact sustainable practices.

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Session 5. Agricultural Water Management

sciforum-138698: Multi-Objective Calibration of a Dual-Source SVAT Model Using Root Zone Soil Moisture: Application to Winter Wheat in Semi-Arid Morocco.

Hiba Ait Ben Ahmed [1,*], Jamal Ezzahar [1,2,3], Salah Er-Raki [2,4], Saïd Khabba [1,2], Jamal Elfarkh [2], Zaineb Bouswir [4], Safaa Bouljihel [1], Hamza Barguache [1], Ghizlane Aouade [5] and Abdelghani Chehbouni [2,6]

[1] LMFE, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco.
[2] CRSA, Centre for Remote Sensing Applications, Mohammed VI Polytechnic University (UM6P), Ben Guerir, Morocco
[3] LSA2D, Higher School of Technology - El Kelaa Des Sraghna, Morocco
[4] ProcEDE, Faculty of Sciences and Technics, Cadi Ayyad University (UCA), Marrakech, Morocco
[5] LMI TREMA, Faculty of Sciences Semlalia, Cadi Ayyad university (UCA), Morocco
[6] CESBIO, Centre d'Etudes Spatiales de la BIOsphère, Toulouse, France

Semi-arid regions are particularly vulnerable to climate change, characterized by rising temperatures, altered precipitation regimes, and more frequent droughts. These factors intensify water scarcity and pose significant challenges to agricultural sustainability. To address this challenges, efficient irrigation management is essential to alleviate crop water stress and maintain yields. This study applies the Interactive Canopy Radiative Exchange (ICARE) soil–vegetation–atmosphere transfer (SVAT) model to simulate water and energy fluxes over four winter wheat fields in Morocco's Tensift Basin. Model calibration was performed on a reference field using the Non-dominated Sorting Genetic Algorithm II (NSGA-II), with a focus on a root zone soil moisture (RZSM)-constrained approach to enhance simulation accuracy. Model performance was evaluated across key phenological stages; initial, development, mid-season, and late season by assessing RZSM, surface energy balance components, and evapotranspiration (ET). The model demonstrated strong predictive capability, with optimal simulations achieving RMSE (R^2) values of 0.01 m^3/m^3 (0.88) for RZSM and 0.46 mm/day (0.83) for ET. Simulations also showed high agreement with observed values: 40 W/m^2 (0.96) for net radiation, 21 W/m^2 (0.86) for ground heat flux, and 37 W/m^2 (0.73) for sensible heat flux. A clear phase-dependent behavior was observed, with the RZSM-constrained calibration yielding particularly accurate results during the development and mid-season stages, when plant transpiration is dominant. Validation conducted on three additional fields confirmed the robustness and transferability of the calibrated model, reinforcing its potential as a decision-support tool for improving irrigation efficiency in semi-arid agricultural systems. Overall, this study advances the understanding of soil–plant–atmosphere interactions and offers practical insights for sustainable water resource management under changing climate conditions.

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sciforum-137960: From Water to Wealth: Transforming Underdeveloped Nations through Agricultural Water Management

Ali Raihan Sapno *, Md. Tashfiqur Rahman Mazumder and Fahima Ahmed Shifa

Civil Engineering Department, East West University, Dhaka, 1212, Dhaka, Bangladesh

Introduction

Water management in agriculture is a critical factor in national development. Although the Earth's water reserves are sufficient, uneven distribution—worsened by climate change and conflicts—limits agricultural productivity in many underdeveloped countries. Ensuring equitable access and sovereign rights to water is both a developmental priority and a matter of sovereignty. In today's AI-driven era, agricultural water management is a key driver of economic development and sustainability.

Methods

This study will use customized AI models trained on historical and recent data from water resource authorities and surveys. Economic models linking water management to financial stability will be integrated into these algorithms. Extensive surveys and field interviews will collect data on local water challenges and community practices. This mixed-method approach aims to develop adaptable, sustainable water management solutions for underdeveloped regions.

Expected Results

Implementation of the proposed system is expected to reduce water wastage by up to 40% and increase crop yields by 25–35%. Improved water governance will enhance the economic conditions of farming communities, stabilizing livelihoods and enabling better household investment in education. These social improvements may lead to healthier populations and more informed citizens, contributing to national GDP and GNI growth.

Conclusions

This research demonstrates that intelligent design and participatory management of agricultural water can drive economic transformation in underdeveloped nations. Harnessing AI and civil engineering innovations can accelerate sustainable development, making agricultural water management a cornerstone of future economic progress.

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sciforum-128011: Remediation of Polluted Water Using Natural Products

Marwa Rammal [1,*], Nour Zalghout [2], Akram Hijazi [3] and Salem Darwich [4]

[1] Department of Food Sciences and Technology, Faculty of Agronomy, Lebanese University, P.O. Box 146404,
[2] Plateforme de recherche et d'analyse en sciences de l'environnement (EDST-PRASE), Beirut P.O. Box 6573/14, Lebanon.
[3] Lebanese University Platform de recherche et d'analyse en sciences de l'environnement (ESDT-PRASE), Beirut P.O Box 6573/14, Lebanon
[4] Lebanese University Faculty of Agronomy

In an international context marked by growing concerns about water pollution, this study focuses on the development of innovative and environmentally friendly solutions for treating contaminated water. This groundbreaking research explores the use of aloe vera gel as an antibacterial agent and avocado peel transformed into activated charcoal to create effective biofilters capable of specifically targeting methylene blue, heavy metals, and bacteria present in polluted water. The study begins with a thorough analysis of the antibacterial properties of aloe vera gel and the adsorption of heavy metals and dyes by activated charcoal derived from avocado peel. The methodology involves precise steps in the treatment of these natural resources into effective water treatment agents. The adsorbents were characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), and scanning electron microscopy (SEM). The results confirmed that the optimal dye concentration for methylene blue adsorption by activated charcoal is 100 mg/l from an aqueous solution, with an adsorption efficiency of 94.9%. Following the conducted tests, it was demonstrated that activated charcoal adsorbed a significantly higher quantity of bacteria compared to aloe vera. These biofilters, utilizing natural resources, offer an organic and economical alternative for water treatment in regions affected by water contamination. The study also examined the influence of additive concentration and mass effects in the filters. This method demonstrates an exceptional ability to treat wastewater, eliminating bacteria, organic pollutants, and dyes, all at a minimal cost and without causing environmental harm.

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sciforum-138716: Agarwood (*Aquilaria malaccensis*) tolerates short-term drought but shows severe morpho-physiological and biochemical changes under prolonged drought

Rahela Khatun [1], Md. Shariar Hossain Sazzad [1,*], Md Sajib Mia [1], Md. Farhan Shahriar [1], Anna O'Brien [2], Md Sazan Rahman [2], Anthony S. Davis [2] and Romel Ahmed [1]

[1] Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet- 3114, Bangladesh
[2] College of Life Sciences and Agriculture, University of New Hampshire, Durham, NH, USA

Water deficiency is a major abiotic stressor that negatively impacts plant growth, physiological functions, and internal biochemical processes. *Aquilaria malaccensis* (agarwood), globally recognized for its economic and medicinal value, was evaluated in this study to understand its response to drought stress. In this study, the seedlings were exposed to four irrigation treatments, regular irrigation (control) and water withholding for 7, 14, and 21 days, representing mild, moderate, and severe drought stress, respectively. Plant height and collar diameter were recorded at 3 and 6 months of the treatment, while other morphological, physiological, and biochemical parameters were measured after 6 months. At 3 months, drought stress showed no significant effect on height or collar diameter. However, at 6 months, moderate and severe stress significantly reduced plant height, leaf number, specific leaf area, and chlorophyll content. Relative Water Content (RWC) remained above the threshold under mild and moderate stress but declined sharply under severe stress. Root length was significantly affected by severe stress, while a higher root-to-shoot ratio under mild and moderate stress indicated root system adaptation to limited water availability. Stomata remained open in control and mildly stressed plants but mostly closed under moderate and severe stress, leading to reduced stomatal conductance and net photosynthetic rate. Biochemically, hydrogen peroxide (H_2O_2), malondialdehyde (MDA), and proline levels increased under moderate and severe stress, indicating oxidative stress and reduced membrane stability. In response, antioxidant enzymes (POD, CAT, GST, and APX) and secondary metabolites (total phenolics and flavonoids) were elevated, indicating activation of protective mechanisms. Overall, *Aquilaria malaccensis* exhibited moderate tolerance to short-term drought but was severely affected under prolonged drought stress, both morpho-physiologically and biochemically. Since no prior studies have been carried out on *Aquilaria malaccensis* under water deficit conditions, further research is required to better understand the effects of water stress.

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sciforum-136968: Ameriolation Of Chromium-Induced Oxidative Stress In Soybean Through Application Of Chromium (Vi)-Reducing Bacterium

Nishat Rumman *, Prinon Saha, Md. Mustafijur Rahman Khan and Gazi Md.Adnan ehsan

Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh, 2200, Bangladesh

Bangladesh faces severe environmental risks from untreated tannery wastewater containing toxic hexavalent chromium (Cr VI), which harms plant growth. Microorganisms that convert Cr (VI) to less toxic Cr (III) offer a potential detoxification solution. The present study aimed to evaluate the effects of Cr stress on soybean (Glycine max L.) under different Cr concentrations (0, 50, and 100 mg/kg) added from Cr salt and tannery wastewater (TW44 and TW88 mg/kg) and evaluate the efficacy of a Cr (VI)-reducing bacterial strain, Tan3, in reducing stress on the plant. Increasing Cr concentrations clearly lowered plant height, biomass, chlorophyll content, and yield attributes. TW88-treated plants showed the greatest decline in chlorophyll b by 34.5%, total chlorophyll (15.88%), carotenoid content by 64.1%, shoot fresh (13.94%), and dry biomass (25.52%) and also the lowest number of pods. Chromium stress also triggered oxidative stress responses, an increase in MDA levels (from 26.17 to 57.36 nmol/g FW), proline content, H_2O_2, and superoxide under 100 mg/kg Cr. Tan3 inoculation significantly alleviated these effects by reducing their activities. Tan3 bacterial inoculation also markedly alleviated Cr-induced stress across all treatments by reducing oxidative damage, enhancing antioxidant enzyme activity (CAT, POD, GST, APX, GPX), improving nutrient uptake (N, P, S, Mg), and decreasing Cr accumulation in plant tissue. Cr accumulation in plant tissues was highest in soil (165.08 mg/kg) and in tannery wastewater (88 mg/kg). In post-harvest soil, Cr concentration was higher in Tan3-inoculated soil than in respective uninoculated soil, suggesting bacterial immobilization of Cr in soil that ultimately reduced the phytoavailability and translocation of Cr from soil to root, shoot, and pod. These findings clearly show that the complex mixture of contaminants causes TW88 to have the greatest negative consequences, but Tan3 inoculation can efficiently minimize Cr-induced damage by means of physiological protection, oxidative stress reduction through antioxidative enzymes, and lower Cr absorption in plants.

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sciforum-139127: An Evaluation of an electronic water treatment device (MAXGROW) for irrigation with fertigation in cucumbers (*Cucumis sativus*) grown under an NGS (New Growing System) in a commercial greenhouse

Athanasios Gertsis [1,*], Konstantinos Zoukidis [2] and Louis Dellis [1]

[1] Sustainable Agriculture & Management, Perrotis College-American Farm School, Thessaloniki, Po Box 23, GR 551 02, Greece
[2] 1 Sustainable Agriculture & Management, Perrotis College-American Farm School, Thessaloniki, Po Box 23, GR 551 02, Greece 3 Department of Agriculture, International Hellenic University, Thessaloniki

Abstract

A common and very effective method of irrigating plants in hydroponics is using a fertigation solution, which in most cases is of high salinity and needs expensive automation systems to maintain it in a reasonable and tolerable way for each species. Cucumber is one of the most popular vegetables, growing mainly in greenhouses under various hydroponics systems and with fertigation systems installed. The objective of this preliminary study was to evaluate the effect of an Electronic Water Treatment-EWT- device (MAXGROW-MG) and test its effectiveness in growing cucumbers under hydroponic solution (fertigation) in commercial greenhouses using NGS (New Growing System) hydroponics. MAX GROW is an electronic water treatment system using multiple transmissions of radio frequencies in three different frequency bands simultaneously (ULF/LW/MW) to tackle the problems caused by saline water and water with a high concentration of calcium carbonate ions, commonly known as limescale.

The commercial greenhouse was split in two sections of 0.4 ha each and the fertigation solution was treated using the MAXGROW system, while the other section was not (control). Various agronomics data on the cucumber and the fertigation solution were measured.

During the growing season and at three periods, the collected data included replications of 20 cucumbers, and leaves from each section were used, whilemean comparisons were performed using JMP v18 software and Student's t-tests for reporting the results in a letter-connecting table.

The results showed that the MAXGROW system significantly reduced the EC of the fertigation solution, from ca. 2.3 to 1.3 dS/m, increased the pH to a more optimum level (ca. from 6.0 to 6.5), and increased the weight and the relative leaf chlorophyll level (SPAD units) of cucumbewr plants. Partial data are only reported here, and this study is in progress for more data collection and further validation. The next crop to be evaluated under the same greenhouse settings will be zucchini, in the net growing season, for further validation of the reported trends.

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sciforum-120717: Characterizing preferential flow in soils of semi-arid Telangana, India

Pushpanjali Pushpanjali

Division of Soil Resource Management, ICAR- Central Research Institute for Dryland Agriculture, Hyderabad 500059, India

The soil matrix is heterogeneous, so it is often very difficult to estimate solute transport through preferential flow. A better understanding of preferential water flow would benefit the understanding of soil's ecological and hydrological functions. Brilliant Blue FCF was used to characterize preferential flow in the Hayathnagar watershed in Hyderabad, India, to generate detailed information on soil preferential flow. The area was divided into three units: upper reach, middle reach, and lower reach. The upper reach area is 54 ha, the middle reach is 60 ha, and the lower reach is about 40 ha. A total of 21 profiles were dug to study preferential flow across different land uses and elevations. Nine representative soil profiles under different land uses (planted forest, fallow land, and cropped land at three elevations) were randomly selected for image analysis and further processing. At each site, two 1×1 m flat plots were selected, and an iron frame with a volume of 0.20 m^3 and 0.5 cm thickness was embedded into the soil. The vertical profile of each layer was recorded with a digital camera. ArcGIS 10.3 was utilized to map and analyse spatial variations in preferential flow patterns across the watershed. By integrating soil profile data, land-use types, and elevation-based flow characteristics, geostatistical analysis helped visualize preferential flow distribution. This study observed that dye coverage was nearly 100% in the upper soil layer (5-10 cm) and decreased with depth, with varied flow behaviours across elevations. The middle reach exhibited the highest degree of preferential flow (0.32), followed by the upper reach (0.27) and lower reach (0.005), indicating that subsurface flow is largely influenced by landscape position. This study's findings provide crucial insights into how preferential flow influences water distribution, nutrient transport, and soil stability, enabling more effective water management, optimized agricultural practices, and improved soil conservation strategies.

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sciforum-138682: Comparative Evaluation of Water-Use Efficiency and Growth Performance of Mustard in NFT, DWC Hydroponics, and Soil-Based Systems

Mazhar Hussain Tunio *, Zaheer Ahmad Aqulani, Musdaque Ali Rind, Imran Ali Khuawaja and Pir Abdul Karim Jan

Khairpur College of Agriculture and Management Sciences Khairpur Mir's, a constituent college of Sindh Agriculture University Tandojam, Pakistan

Climate change and increasing water scarcity necessitate the adoption of efficient water management strategies in agriculture to enhance crop productivity and sustainability. This study comparatively evaluates the growth performance and water-use efficiency of mustard (*Brassica juncea*) cultivated under three systems: Nutrient Film Technique (NFT), Deep Water Culture (DWC) hydroponics, and conventional Soil-Based (SB) cultivation. Mustard seedlings were transplanted into each system; hydroponic setups were supplied with Hoagland's nutrient solution (EC 2.0 mS cm^{-1}, pH 6.0), while the SB system utilized standard fertilization and irrigation. Key growth parameters, including number of leaves (NL), stem diameter (SD), shoot length (SL), root length (RL), and plant height (PH), were statistically analyzed alongside total water consumption per plant. Results demonstrated that the NFT system significantly outperformed both DWC and SB systems, achieving the highest plant height (42.2 cm), shoot length (25.8 cm), root length (16.4 cm), and stem diameter (1.8 cm), while using only 3.2 liters of water per plant. DWC showed moderate growth (PH: 35.6 cm; SL: 21.4 cm; RL: 12.3 cm; water use: 5.8 L/plant), while SB showed the lowest growth performance (PH: 29.1 cm; SL: 17.6 cm; RL: 10.1 cm; water use: 8.5 L/plant), primarily due to inconsistent moisture and nutrient availability. These findings confirm the superior water-use efficiency and biomass productivity of the NFT system, underscoring its potential as a sustainable, climate-smart solution for resource-limited agricultural settings.

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sciforum-123740: Cotton Yield and Profitability Responses to Dripline Spacings Used in Subsurface Drip Irrigation, Fertigation, and Growth Regulators in USA's Coastal Plains

Unius Arinaitwe [1,*], William Hunter Frame [2], Wade Thomason [3], Mark Reiter [4] and David Langston [2]

[1] Agronomy, Horticulture, & Plant Science, South Dakota State University, Brookings, SD 57007, USA
[2] Tidewater Agricultural Research and Extension Center, Virginia Tech, Suffolk, VA, 23437
[3] Oklahoma State University Stillwater, 331 Agricultural Hall Stillwater, Oklahoma, 74078
[4] Eastern Shore AREC, Virginia Tech 33446 Research Drive Painter, VA 23420

The combined effects of subsurface drip irrigation (SDI), nitrogen (N) application, and plant growth regulator (PGR) application rates on the upland cotton (*Gossypium hirsutum*) performance in the Upper Southeast Coastal Plain remain poorly understood. This study aimed to enhance cotton productivity and economic returns by evaluating SDI strategies and their interactions with the PGR application rates, N management, and variety selection. Over three growing seasons (2019–2021), two experiments were conducted at the Tidewater Agricultural Research Center (TAREC) in Suffolk, Virginia. Experiment 1 explored the effect of three dripline spacings (0.91 m, 1.82 m, no irrigation), four PGR application rates (0%, 100%, 150%, 200%), and four cotton varieties, revealing significant impacts of the dripline spacing and PGR application rate on the lint yield and economic gains. The 1.82 m dripline spacing and 100% PGR application rate consistently produced superior lint yields and profits. Experiment 2 evaluated the effects of three irrigation strategies (0.91 m dripline spacing, 0.91 m dripline spacing + fertigation, no irrigation), three N application rates (89, 133, and 178 kg ha^{-1}), three PGR application rates, and two varieties, highlighting an optimal N application rate of 133 kg ha^{-1} for increasing the lint yield in 2 of 3 years and the adverse effects of higher PGR application rates. The findings demonstrated the importance of employing tailored SDI systems integrating variety selection and adaptive management strategies. These results underscore the potential to improve cotton's productivity, profitability, and sustainability in diverse environments in the Southeast Coastal Plain and similar cotton-growing regions in the U.S.

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sciforum-139107: Deriving Crop Coefficients from Remotely Sensed Data for Estimating Crop Evapotranspiration

Zaineb Bouswir [1,*], Salah Er-Raki [1, 2], Saïd Khabba [2, 3], Jamal Ezzahar [2, 4], Abdelhakim Amazirh [2], Hiba Ait Ben Ahmed [3], Lamia Jallal [1],and bdelghani Chehbouni [2]

[1] Agrobiotech Center, Faculty of Sciences and Techniques, Cadi Ayyad University, Marrakesh, Morocco.
[2] CRSA Center, Mohammed VI Polytechnic University, Benguerir, Morocco.
[3] LMFE, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco.
[4] LSA2D, Higher School of Technology, Cadi Ayyad University - El Kelaa Des Sraghna, Morocco.

In arid and semi-arid regions, efficient water resource management depends on the accurate estimation of actual evapotranspiration (ET), a critical parameter for determining crop water needs. However, this estimation is challenging due to complex soil–vegetation–atmosphere interactions and the scarcity of reliable in situ data.

This study evaluates the use of the FAO-56 dual crop coefficient approach, which separates ET into basal crop (Kcb), soil evaporation (Ke), and water stress (Ks) coefficients. We investigate the feasibility of estimating these coefficients using freely available satellite-derived variables: Normalized Difference Vegetation Index (NDVI), land surface temperature (LST), and surface soil moisture at 5 cm depth (SSM). This remote sensing-based method addresses data limitations while ensuring reliable ET estimation. To assess its practical applicability, the methodology was tested on two wheat fields in the Haouz plain of Morocco during the 2016/2017 and 2017/2018 growing seasons, under contrasting irrigation regimes—one fully irrigated and the other experiencing water stress.

The results show that the FAO-56 coefficients can be accurately estimated from satellite data. The Kcb coefficient correlated strongly with Sentinel-2-derived NDVI (R^2 = 0.70), while Ke showed high correlation with SSM from Sentinel-1 (R^2 = 0.81). The Ks coefficient was derived from a thermal index based on Landsat LST, using reference values under stressed and well-watered conditions. ET estimates derived from these parameters were validated against eddy covariance measurements, showing strong agreement: R^2 = 0.77 (0.87) and RMSE = 0.68 mm (0.69 mm) for 2016/2017, and R^2 = 0.74 (0.70) and RMSE = 0.37 mm (0.45 mm) for 2017/2018, for the stressed and non-stressed plots, respectively.

These findings demonstrate the potential of satellite data for reliably estimating FAO-56 parameters, offering a scalable and cost-effective solution for ET monitoring and precision irrigation in data-limited, climate-vulnerable regions.

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sciforum-139257: Diurnal Dynamics of C-Band Radar Backscatter Over an Olive Orchard in a Semi-Arid Region

Abdelhafid Elallaoui [1, 2,*], Pierre-Louis Frison [2], Saïd Khabba [1, 3] and Lionel Jarlan [4]

[1] LMFE, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco
[2] LaSTIG, Gustave Eiffel University, Paris, France
[3] CRSA, Mohammed VI Polytechnic University, Ben Guerir, Morocco
[4] CESBIO, University of Toulouse, IRD/CNRS/UPS/CNES, Toulouse, France

The agricultural sector accounts for the majority of global freshwater use, particularly in the semi-arid regions of the southern Mediterranean, where water demand is especially high. This intense consumption directly contributes to the depletion of groundwater resources, making the rational management of irrigation water imperative. In this context, accurate monitoring of vegetation water status is essential for optimizing irrigation practices. Radar data are directly sensitive to soil and vegetation water status due to their dependence on the dielectric properties of both. Several previous studies on forests and annual crops have demonstrated their sensitivity to vegetation water dynamics. The objective of this study is to analyze the diurnal variations in the C-band radar backscatter coefficient (σ^0) over an olive orchard in a semi-arid region. To this end, an in situ tower-based radar system was installed in 2020 in the Chichaoua region, in the Haouz plain of Morocco. The radar antennas were directed toward an olive orchard, and the system collected C-band radar data in VV, HH, and VH polarizations at 15-minute intervals. In parallel, measurements of evapotranspiration, sap flow, surface soil moisture, and root zone moisture were collected every 30 minutes. The results show that σ^0 exhibits a pronounced diurnal cycle in all three polarizations, with lower values during the night and higher values throughout the day. The increase in σ^0, observed at sunrise, coincides with the onset of evapotranspiration and sap flow. It then continues to rise, reaching its maximum in the early afternoon, before gradually decreasing and stabilizing at night. These diurnal cycles of σ^0 are in phase with those of evapotranspiration and sap flow, highlighting the sensitivity of C-band σ^0 to the diurnal variations in the water status of olive trees. These findings demonstrate the potential of sub-daily C-band radar data for monitoring the water status of vegetation, and thus their possible use for the early detection of water stress.

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sciforum-135179: Effects of Nitrogen Fertilization and Irrigation Regimes on Biodiesel Quality and Emission Performance of Winter Rapeseed (Brassica napus L.)

Lucian Dordai *, Anca Becze and Marius Roman

INCDO-INOE2000, Research Institute for Analytical Instrumentation, ICIA Cluj-Napoca Subsidiary

Biodiesel, a renewable and biodegradable fuel derived from vegetable oils, is a promising alternative to petroleum diesel due to its lower greenhouse gas and pollutant emissions. Optimizing agricultural practices for feedstock production is essential to ensure high-quality biodiesel and reduced environmental impact. This study aimed to evaluate the effects of nitrogen fertilization and irrigation regimes on the fuel properties and engine emissions of biodiesel produced from winter rapeseed. A bifactorial field experiment was conducted in 2023-2024 in Aiton, Cluj County, Romania, on the winter variety 'Dexter.' Two irrigation regimes (non-irrigated, I_0; and irrigated at 50% of IUA, I_1) and four fertilization treatments (0, 100, 150, and 270 kg N/ha plus P and S) were tested in 10 m² plots. Irrigation was applied in autumn, spring, and summer, and nitrogen was split across three growth stages. Biodiesel was produced through methanol transesterification and analyzed for cetane number, sulfur content, and calorific value according to EN 14214 standards. Emissions (CO, HC, PM_{10}, NO_x) were measured on a direct-injection diesel engine and compared to petroleum diesel. Biodiesel met EN 14214 standards, with favorable fuel properties. Compared to petroleum diesel, biodiesel reduced CO emissions by 34.5–39.5%, HC by 48.8–52.2%, and PM_{10} by 42.3–46.9%, while NO_x emissions increased slightly (2.5–9%). The best treatment combination was I_1 × N150, which resulted in optimal biodiesel quality and reduced emissions. Higher nitrogen rates (N270) increased NO_x emissions, and irrigation consistently improved both biodiesel properties and emissions performance compared to non-irrigated variants. Proper nitrogen and water management in rapeseed cultivation can enhance biodiesel quality and reduce harmful emissions, contributing to climate-smart, zero-pollution agricultural practices. Further research is recommended to mitigate NO_x emissions while maintaining fuel performance.

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sciforum-132494: Groundwater Vulnerability to Pesticide Pollution in a Semi-Arid Agricultural Basin and Electrocoagulation-Based Mitigation

Benan Yazici Karabulut

Department of Environmental Engineering, Engineering Faculty, Harran University, Sanliurfa, 63300, Türkiye

Groundwater resources in arid and semi-arid regions are increasingly threatened by overextraction, climate variability, and contamination from agricultural practices. In areas where groundwater is the primary or sole source of freshwater, pesticide infiltration from intensive crop production poses a critical environmental and public health concern. This study investigates the occurrence and electrochemical removal of four widely used pesticides—lufenuron, ethoprophos, dichlobenil, and picloram—from groundwater in a semi-arid agricultural basin located in Southeastern Türkiye. Groundwater samples were collected from two distinct locations within a 1,500 km^2 area and analysed using gas chromatography techniques. Detected concentrations at the first sampling site were 0.54 µg/L (lufenuron), 0.14 µg/L (ethoprophos), 0.38 µg/L (dichlobenil), and 0.61 µg/L (picloram), while values at the second site were 0.48 µg/L, 0.42 µg/L, 0.26 µg/L, and 0.17 µg/L, respectively. To mitigate pesticide contamination, an electrocoagulation (EC) process using aluminium (Al) electrodes was applied. The effect of critical operational parameters—namely initial pH (6–7), current density (2.5 mA/cm^2), and electrolysis duration (30 minutes)—was systematically evaluated to optimize removal performance. The EC treatment achieved outstanding removal efficiencies ranging from 98% to 99% for all pesticides tested. Post-treatment concentrations were brought well below international drinking water standards, confirming the process's effectiveness. In addition to its technical efficacy, electrocoagulation offers a low-cost and environmentally sustainable solution that can be scaled for broader application in water-stressed agricultural regions. The findings highlight the urgent need for integrated groundwater protection strategies and demonstrate the potential of electrochemical technologies in addressing pesticide pollution in vulnerable aquifer systems.

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sciforum-139018: Growing Lettuce *(Lactuca Sativa L.)* in Nutrient Film Technique (NFT) hydroponic systems under a range of saline water conditions by using innovative technologies (agro-nanobubbles and an electronic water treatment system)

Konstantinos Zoukidis [1, 2,*], Nikolaos Mokas [1], Athanasios Gertsis [1], Antonios Apostolidis [1], Vasileios-Stylianos Kyriatzis [3], Ramonna Kosheleva [4] and Anastasia Giannakoula [2]

[1] Department of Sustainable Agriculture and Management, Perrotis College, Thessaloniki, Greece
[2] Department of Agriculture, International Hellenic University, Thessaloniki, Greece
[3] Department of Sustainable Agriculture and Management, Perrotis College, Thessaloniki, Greece.
[4] Hephaestus Laboratory, Department of Chemistry, Democritus University of Thrace, Kavala, Greece

One of the most well-known green vegetables in the world, lettuce, has several purposes beyond just nourishment. Customers can select from a range of varieties in the lettuce group. Furthermore, lettuce is a great source of bioactive substances with associated health advantages, including polyphenols, carotenoids, and chlorophyll (Shi et al. 2022). They can grow in almost any system including NTF hydroponics. The nutrient film technique involves plants growing without the use of a substrate by keeping a layer of nourishing solution around their roots. When the NFT initially surfaced, it appeared to be the perfect growth system since it provided the best control over root watering without requiring the purchase of a substrate. Nevertheless, good water quality should be ensured to achieve maximum yields (van Os et al. 2019). Innovative technologies (nanobubbles and electronic water treatment) might show promise for treating high-salinity water for irrigation purposes (Zoukidis et al. 2025). This research aims to investigate the differences in growth and development of butterhead lettuce in an NFT hydroponic system between high-salinity water treated with nanobubbles by the combination of two innovative technologies (MAXGROW and generator of agro-nanobubbles) and non-treated high-salinity water. Specifically, the experiment includes 8 different levels of salinity (E.C. 1, 4, 6, 8, 10, 12 dS/m) with each one also including 50% Hoagland solution. The results showed that the combination of two devices can reduce the effect of salinity on the lettuce and achieve greater plant development and yield. Nevertheless, there is need for further research on these technologies and especially further investigation into the effect of the treated water on the physiological and biochemical characteristics of lettuce.

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sciforum-139200: Hydro-Justice in Farming: Smart Solutions to Prevent Water Waste and Territorial Disputes

Ali Raihan Sapno, Md. Tashfiqur Rahman Mazumder * and Fahima Ahmed Shifa

Civil Engineering Department, East West University, Dhaka, 1212, Dhaka, Bangladesh

Introduction

Climate change is intensifying water scarcity and increasing competition for this vital resource, especially in agricultural regions. This often leads to significant water waste and escalating territorial disputes among farmers and communities. Traditional water management approaches are proving insufficient to address these complex and interconnected challenges. This study introduces the concept of "hydro-justice," advocating for equitable and sustainable management of water resources in farming.

Methods

We propose a smart water management framework integrating real-time hydrological data with AI-driven predictive analytics for water demand and supply forecasting. The system will leverage IoT-based sensors for precise water monitoring and blockchain technology to ensure transparent and verifiable water allocation. This framework aims to optimize irrigation schedules, detect leaks, and establish clear, immutable records of water rights and usage.

Expected Results

We anticipate a substantial increase in water-use efficiency within agricultural settings, leading to a significant reduction in water waste. Moreover, by providing a transparent and verifiable system for water allocation, we expect a notable decrease in territorial disputes and conflicts over water resources. The AI module will enhance adaptive decision-making for farmers, while the blockchain component will foster trust and accountability.

Conclusion

This AI- and blockchain-integrated water management system offers a novel, scalable solution for achieving hydro-justice in farming. By combining smart technology with transparent governance mechanisms, it aims to create more climate-resilient and socially equitable agricultural ecosystems, promoting both environmental sustainability and peace within farming communities.

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sciforum-139319: Integrated hydroponic bioelectrochemical wastewater treatment process for sustainable agriculture

Nachiket Magesh [1,*], Khin Thandar Tun [2] and Veera Gnaneswar Gude [2]

[1] School of Sustainability Engineering and Environmental Engineering, Purdue University, West Lafayette, Indiana, 47906, USA
[2] Purdue University Northwest Water Institute, Purdue University Northwest, Hammond, Indiana 46323, USA

Increasing global food demands put pressure on existing water resources for supporting water-intensive conventional agricultural systems. Hydroponic systems have emerged as a potential solution for addressing water resource utilization challenges. However, the nutrient solution used in hydroponics poses additional problems. In this research, an integrated hydroponic bioelectrochemical system facilitates simultaneous wastewater treatment, energy generation, and nutrient transport across the membrane for the hydroponic system. This configuration offers the potential to bolster crop growth by transferring valuable ions from treated municipal wastewater. A combined bioelectrochemical–hydroponic system treats municipal wastewater from the Portage Treatment Plant (Indiana) in the anode chamber via an energy-positive process while supporting lettuce growth in the cathode chamber. This is compared to a standard microbial fuel cell configuration with an air cathode. Both employ 1000-ohm resistors, cation exchange membranes (CEMs), and distilled water and wastewater as catholytes and anolytes, respectively. Plant growth in the integrated design is monitored and compared to a traditional hydroponic setup. Coulombic efficiency, chemical oxygen demand (COD), and total nitrogen removal efficiency, as well as power generation in both configurations, are evaluated. Nutrient transport pathways across the membrane and their applications to plant growth are discussed. The findings of this study provide insights into the potential of the innovative bioelectrochemical system for both wastewater treatment plants and modern agriculture in a circular economy framework.

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sciforum-139237: Integrating Vegetation and Thermal Indices for Agricultural Drought Monitoring using Google Earth Engine: A Study from the Semi-Arid region of South India

Suresh Mondal and Arun Prasad Kumar

Department of Geography, School of Earth Sciences, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu, 610005, India

Timely assessing drought conditions is the key to managing the risks posed by water scarcity to agriculture, the environment, and socio-economic stability. In this context, agricultural drought monitoring is vital in semi-arid regions like Tamil Nadu, India. This study aims to evaluate and compare the performance of two remote sensing-based drought indicators —the Temperature Vegetation Dryness Index (TVDI) and the Crop Water Stress Index (CWSI) over Tamil Nadu, India— during the Rabi season. Both indices were generated through Google Earth Engine (GEE) using the MODIS-based Normalized Difference Vegetation Index (NDVI), Land Surface Temperature (LST), and evapotranspiration (ET) data at a monthly scale. A pixel-wise relationship between the NDVI and LST was used to derive the TVDI, while the CWSI was calculated using the energy balance approach. The monthly spatial and temporal dynamics of the TVDI and CWSI were analyzed across the Rabi season. The results revealed a strong positive correlation between the TVDI and CWSI, indicating consistent detection of drought stress across the region. To assess the accuracy of the indices, the Standardized Precipitation Index (SPI) was used, which shows statistically significant correlations for both indices, with the CWSI demonstrating slightly stronger agreement. Furthermore, drought severity was categorized into four levels: mild, moderate, severe, and extreme. All districts within the study area were categorized based on drought severity levels, with several key districts consistently identified as drought-prone. Overall, the results suggest that both indices are suitable for representing drought patterns; their combined application enhances the robustness of drought monitoring with minor differences in sensitivity and spatial expression. This study demonstrates the potential of integrating thermal and vegetation-based remote sensing indices for improved agricultural drought assessment in semi-arid regions like Tamil Nadu.

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sciforum-135567: Irrigating farms the smarter way—a study on the utilization of precision irrigation by vegetable farmers from South 24-Parganas district, West Bengal, India

Panchali Sengupta

Department of Zoology, West Bengal State University, Kolkata, 700126, India

Precision irrigation is a novel concept that optimizes water use precisely when and where needed, thereby enhancing crop productivity and water use efficiency. It involves accurate monitoring of crop and soil parameters to determine the appropriate amount of water for healthy plant growth and crop production. The present study highlights the usage of precision irrigation across vegetable fields practicing monoculture farming in the Baruipur, Sonarpur, and Jaynagar blocks of South 24-Parganas district, West Bengal, India, from April 2024 to March 2025. Cultivation of *Trichosanthes dioica, Abelmoschus esculentus, Cucurbita maxima, Cucumis sativus, Luffa acutangula,* and *Trichosanthes cucumerina* was practiced. This study involves an array of sensors (soil, moisture, temperature, humidity, crop growth monitoring, and soil nutrient analyzer), algorithms, and drip tip and sprinkler irrigation for formulating an optimum irrigating schedule. K-nearest neighbors, logistic regression, support vector machine, decision tree, random forest, and the gradient boosting algorithm were used for analysis using the Raspberry Pi microprocessor. A watering schedule was designed based on the signal generated by a microcontroller. Sprinkler irrigation at 50% Depletion of Available Soil moisture (DASM) was employed for the studied cropping system. Thus, in a typical crop production system, water productivity (WP) was defined as the relationship between crops produced and the amount of water provided for the said purpose. WP in the crop field under the traditional watering schedule recorded values between 18.22 kg/ha/cm (*Cucurbita maxima*) and 48.65 kg/ha/cm (*Trichosanthes dioica*). However, utilizing precision irrigation techniques yielded results varying between 22.15kg/ha/cm (*Trichosanthes cucumerina)* and 52.68 kg/ha/cm (*Cucumis sativus*). The Random Boost algorithm (accuracy=98.20% for *Cucurbita maxima*), random forest (accuracy=97.5 % for *Trichosanthes cucumerina*), and decision tree (accuracy=97.20% for *Trichosanthes cucumerina*) were found to provide the most accurate results. In spite of the prevalence of small, illiterate landholders, adoption of such digitized technologies appears quite rewarding for the farming community.

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sciforum-138262: Nickel Phytoextraction from Wastewater Using *Eichhornia crassipes* and *Oedogonium* sp.: A Sustainable Approach for *Helianthus annuus* Irrigation

Isha Shakoor and Aisha Nazir

Institute of Botany, University of the Punjab, Lahore

The discharge of nickel (Ni)-laden wastewater from the cooking oil industry poses significant environmental hazards. This study explores the potential of *Eichhornia crassipes* and *Oedogonium* sp. for Ni removal from industrial effluents. A 21-day phytoremediation experiment was conducted using wastewater dilutions with rainwater in ratio of 0%, 50% and 100% along with control, which were then treated individually and with a combination of *Eichhornia* and *Oedogonium*. The results showed substantial reductions in biochemical oxygen demand (BOD) and chemical oxygen demand (COD) by 49% and 69%, respectively. Notably, Ni concentration decreased by 81% in combined treatments, with the treated effluent meeting safety standards for agricultural reuse. It was then applied on germinating sunflowers for a period of three months and the Ni bioaccumulation and translocation factor was determined. The findings of this study demonstrate the efficacy of *E. crassipes* and *Oedogonium* sp. in Ni removal, offering a sustainable and eco-friendly solution for industrial wastewater treatment.

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sciforum-132144: Optimizing Deficit Irrigation in Wine Grapes in Portugal's Douro Region: Impacts on Vine Physiology, Yield, and Must Quality

Aureliano C. Malheiro [1,*], António Castro Ribeiro [2] and José Moutinho-Pereira [1]

[1] Centre for the Research and Technology of Agro-environmental and Biological Sciences, CITAB, Inov4Agro, Universidade de Trás-os-Montes e Alto Douro, UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal
[2] Centro de Investigação de Montanha (CIMO), Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

The Douro Demarcated Region in Northeast Portugal, particularly the Douro Superior sub-region, is marked by hot, dry summers that lead to significant water shortages across the soil–vine–atmosphere continuum. Traditionally, vineyards in this area have relied solely on rainfall. However, deficit irrigation has gained recognition as an effective strategy to stabilize or improve grape yield and quality while reducing the risks associated with climate variability. To investigate this approach, a study was carried out in a commercial vineyard using Aragonez (syn. Tempranillo), a widely planted native grape variety. The vines were exposed to two levels of deficit irrigation, along with a non-irrigated control, which reflects the prevailing local practice. The objective was to examine the interactions between weather conditions, physiological responses, yield, and must quality, with the aim of informing improved water management strategies. The findings indicate that deficit irrigation can effectively reduce the adverse effects of severe water scarcity during the maturation period. Specifically, irrigation at 40% of crop evapotranspiration significantly reduced water stress and enhanced physiological performance, particularly in leaf gas exchange and vegetative balance. These results suggest that even relatively low levels of irrigation can help prevent excessive water deficits that might otherwise result in yield losses and unbalanced grape ripening.

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sciforum-116703: Optimizing Water and Pesticide Use in Rice Cultivation through Advanced UAV Nozzle Technology

Pritish Kumar Varadwaj and Shefali Vinod Ramteke *

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

Rice cultivation in the Saharanpur region of Western Uttar Pradesh, particularly for the paddy crop PB 112 during the 2022 season, is crucial for local food security but faces significant challenges in sustainable water and pesticide management. Traditional methods of irrigation and pest control are not only inefficient but also contribute to substantial environmental degradation through excessive water consumption and contamination from pesticide runoff. This study aims to address these challenges by investigating the application of advanced UAV-based spraying technologies, emphasizing the role of nozzle design in enhancing agricultural practices. A series of comprehensive field experiments were conducted to compare various UAV nozzle types, each engineered for optimized spray patterns and droplet sizes suitable for the unique topographical and canopy density variations in the region. These experiments utilized cutting-edge technology, including water flow meters and spectral sensors mounted on drones, to precisely measure the efficacy of each nozzle type in terms of water conservation and accurate pesticide distribution. Preliminary results from the trials indicate that specific nozzle types, particularly those capable of producing ultra-fine droplets, significantly reduce water and pesticide usage—by up to 40% compared to conventional spraying methods. The adoption of these specialized nozzles not only enhanced the targeted coverage area and improved absorption rates by the crops but also substantially minimized the environmental impact. This was evidenced by marked reductions in both runoff and evaporation losses, showcasing the potential of UAV technology to transform agricultural practices. The findings from this research highlight the critical importance of nozzle technology in optimizing UAV spraying applications, demonstrating its viability as a scalable solution for sustainable agriculture in regions suffering from water scarcity and environmental challenges like Saharanpur. This study contributes valuable insights into the design and implementation of precision agriculture tools that can lead to more sustainable cultivation practices and better resource management in agrarian communities.

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sciforum-136896: Optimizing Yield under Saline and Water-Limited Conditions

Iman Hajirad

Ph.D. Candidate, Department of Irrigation and Reclamation Engineering, College of Agriculture and Natural Resources, University of Tehran, Karaj, Iran.

Two important abiotic factors that significantly reduce crop productivity in arid and semi-arid settings are salinity and water scarcity. Optimizing crop productivity in saline and water-limited environments has become a critical global concern due to the acceleration of climate change and the depletion of freshwater supplies. In order to maintain crop performance in these demanding conditions, this paper examines current developments in soil–water techniques, crop physiology, and irrigation management. Complex physiological responses, such as osmotic adjustment, changes in root architecture, and activation of the antioxidant defense, are displayed by plants subjected to combined salt and drought stress. These characteristics are essential for sustaining output under pressure. At the same time, it has been demonstrated that cutting-edge irrigation techniques, including alternate furrow irrigation, partial root-zone drying (PRD), and regulated deficit irrigation (RDI), improve water consumption efficiency while lowering salt accumulation in the root zone. Crop resilience is further enhanced by the use of salt-tolerant cultivars, soil additives (such as compost and gypsum), and advantageous microorganisms like plant growth-promoting rhizobacteria (PGPR). Precise crop and soil status monitoring is made possible by remote sensing and decision-support tools, which lower risks and maximize input efficiency. This study emphasizes the need for a comprehensive, site-specific strategy that incorporates agroecological techniques, intelligent irrigation, and physiological knowledge. In order to optimize yield in saline and drought-prone environments, interdisciplinary cooperation and locally relevant solutions that are adapted to particular soil, climatic, and socioeconomic circumstances are essential. In conclusion, the study provides a thorough framework for enhancing yield under combined salinity and water stress using coordinated, scientifically supported tactics. The advancement of climate-resilient agriculture and the direction of upcoming studies, regulations, and field-level operations in marginal settings depend heavily on these findings.

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sciforum-139291: Performance Assessment of DRL-Based Irrigation Agents in AquaCrop Using Local Data from Tensift Al Haouz: Toward Profit-Oriented Water Management

Mohamed Abdelbaki [1,*], Jamal Ezzahar [2,3,4], Anouar Dalli [5], Saïd Khabba [3,4], Salah Er-Raki [6,7] and Adnane Latif [1]

[1] TIM, ENSA, Université Cadi Ayyad, Marrakech, Morocco
[2] LSA2D, École Supérieure de Technologie, El Kelaa Des Sraghna, Morocco
[3] CRSA, Centre pour les Applications de la Télédétection, UM6P, Benguerir, Morocco
[4] LMFE, Faculté des Sciences Semlalia, Université Cadi Ayyad, Marrakech, Morocco
[5] École Nationale des Sciences Appliquées de Safi (ENSAS), Université Cadi Ayyad, Marrakech, Morocco
[6] CRSA, Mohammed VI Polytechnic University, Ben Guerir, Morocco
[7] CAB, Centre AgroBiotech-URL-CNRST-05, Cadi Ayyad University, Marrakech, Morocco

In arid and semi-arid regions like Tensift Al Haouz in central Morocco, optimizing irrigation strategies is critical due to increasing water scarcity and the high costs of field experimentation. Crop simulation models such as AquaCrop have proven valuable for evaluating water use and crop productivity, particularly for winter wheat. In this study, we develop Deep Reinforcement Learning (DRL) agents using the Proximal Policy Optimization (PPO) algorithm to learn profit-oriented irrigation policies, trained entirely within calibrated AquaCrop environments. The model is configured using local crop, soil, and weather data collected from the Tensift Al Haouz region during the 2002–2004 growing seasons and further calibrated with field measurements from nearby test sites. This simulation-based methodology enables the training of adaptive irrigation strategies without the logistical and financial constraints of real-world trials. Preliminary results show encouraging learning progress in both models, where the agents' performance is comparable to that of experienced human irrigators. The integration of DRL with biophysical crop models demonstrates a promising path toward scalable, data-driven irrigation management in water-limited contexts.

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sciforum-139310: Performance of Steel Slag and Compost on Grain Yield, Irrigation Water Use Efficiency, and Soil Fertility of Durum Wheat (*Triticum durum* Desf.) Under Sustained Deficit Irrigation in Arid Conditions of Morocco

Farid Errouh [1,*], Lahoucine Ech-chatir [1], Salah Er-Raki [1,2], Abdelilah Meddich [1] and [3]

[1] Center of Agrobiotechnology and Bioengineering, Research Unit labeled CNRST (Centre AgroBiotech-URL-CNRST-05), Cadi Ayyad University, Marrakesh 40000, Morocco
[2] Center for Remote Sensing Applications, Mohammed VI Polytechnic University, Lot 660, Hay Moulay Rachid, Ben Guerir 43150, Morocco
[3] African Sustainable Agriculture Research Institute (ASARI), Mohammed VI Polytechnic University, Laayoune 70000, Morocco

Water scarcity is a major limiting factor for crop production in arid regions, requiring sustainable strategies to improve productivity and resource efficiency. This study uniquely investigates the combined use of compost and steel slag, an underutilized industrial by-product, as soil amendments to improve the performance of durum wheat (*Triticum durum* Desf.) under both full and sustained deficit irrigation (SDI) conditions. Field trials were conducted over two growing seasons in an arid area of Morocco, with two irrigation regimes, full irrigation (100% ETc) and SDI at 30% ETc, applied from 21 days after sowing. Five treatments were tested: unamended control (Ct^-), conventional agricultural practices (Ct^+), compost (C, 4.0 t ha^{-1}), steel slag (Ss, 700 kg ha^{-1}), and the combination of steel slag and compost (Ss+C). Under full irrigation, the combined application of Ss+C significantly increased grain yield by 37% and 44% in the first (S1) and second (S2) growing seasons, respectively, compared to the control. Under deficit irrigation, Ss+C considerably improved yield by 68% in S1 and 59% in S2. The harvest index also improved in 2023, rising from 0.268 in the control to 0.285 with Ss+C. Furthermore, irrigation water use efficiency (IWUE) under SDI reached 4.44 kg/m^3 (S1) and 4.85 kg/m^3 (S2) with Ss+C compared to 2.65 and 3.05 kg/m^3 in the stressed controls. Vegetative development, measured by the Normalized Difference Vegetation Index (NDVI) during the dough stage, increased by 66% (S1) and 51% (S2) with Ss+C. Soil micronutrients also improved, with Cu and Zn contents increasing by 35% and 52%, respectively, under full irrigation with Ss+C. These results indicate that combining compost and steel slag is an effective and sustainable soil management strategy to enhance wheat productivity, water use efficiency, and soil quality under arid and water-limited conditions.

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sciforum-132571: Reviving Indigenous Irrigation Systems in Arid and Semi-Arid Ecosystems: A Pathway to Sustainable Water Management

Masoomeh Shemshad

Ph.D. student in Agroecology, Department of Agroecology and Plant Production, Krakow, Poland

Arid and semi-arid regions of the world, including Iran, are facing an escalating water crisis, environmental degradation, and socio-economic vulnerability. Historically, local communities in these regions developed ingenious indigenous irrigation systems—such as qanats, houtaks, degars, ab-bandans, and khoshk—that were thoroughly adapted to the climatic and topographic conditions of their environments. These systems played a vital role not only in ensuring sustainable water supply for agriculture and domestic use but also in maintaining ecological balance, supporting biodiversity, and sustaining rural livelihoods.

However, in recent decades, multiple factors such as climate change, top-down centralized policies, erosion of customary water rights, weakening of participatory governance, and population migration have led to the neglect and destruction of these systems. The consequences have included severe groundwater depletion, land subsidence, ecological disruption, rural depopulation, and threats to migratory species and ecosystem resilience.

This study, using a narrative approach and qualitative analysis of historical records and field data, examines the structural, political, and socio-cultural causes behind the decline in indigenous irrigation systems. It emphasizes the need for policy reorientation toward community-based governance and local knowledge integration. Moreover, the paper provides an in-depth review of the structure, operational mechanisms, and functionality of each indigenous system, aiming to highlight their relevance and potential for revival in the face of contemporary environmental and hydrological challenges.

Reviving indigenous irrigation systems—grounded in traditional ecological knowledge and managed through inclusive, bottom-up governance—offers a promising strategy to mitigate water crises, reduce ecological damage, and promote sustainable development in arid and semi-arid environments.

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sciforum-139532: Salinity, Scarcity, and Survival: How Climate Change is Poisoning Bangladesh's Irrigation Water

Safial Muntasir Sadi [1,*] and Tarak Bin Saifullah [2]

[1] Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur 5200, Bangladesh
[2] Government Bangla College, Dhaka 1216, Bangladesh

Climate change is turning Bangladesh's lifeblood—its irrigation water—into a growing menace. Rising sea levels are pushing salt into freshwater supplies, unpredictable rainfall is throwing availability into chaos, and pollution is contaminating essential resources. This study highlights how these shifts are deteriorating water quality, harming soil health, and drastically reducing crop yields, which threaten food security.

From coastal farms grappling with salinity to drought-stricken areas facing dwindling groundwater, the crisis is worsening. Yet, there are solutions: salt-tolerant crops, precision irrigation, and rainwater harvesting bring a glimmer of hope. We urgently need policy reforms, farmer education, and improved infrastructure to tackle this hidden emergency.

Drawing on the latest research, this paper raises the alarm about Bangladesh's water crisis—and outlines a way forward before it is too late.

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sciforum-133032: The Future of Using Desalinated Water in Agricultural Production in the MENA Region

Mohamed Abdelhamid Dawoud

Environment Agency - Abu Dhabi

The Middle East and North Africa (MENA) region is facing a severe gap between freshwater supply and demand of about 25 billion cubic meters annually, and this gap is projected to grow by 50 % by 2050, which threatens the region's food security, agricultural sector, and socioeconomic stability. The present annual per capita renewable freshwater share is about 450 m^3 (far below the 1,000 m^3 stress global threshold), with agriculture accounting for about 85 % of withdrawals. Meanwhile, the region's annual agrifood exports exceed USD 50 billion (e.g. wheat, olives, citrus). Desalination has emerged as a strategic solution for freshwater supply. At present, MENA represents about 53% of global capacity (over 21,000 plants) led by the GCC region. Saudi Arabia and the UAE alone produce more than 20 million cubic meters daily, and the regional capacity is expected to double by 2030. Morocco aims to reach 1.7 billion m^3 annually by 2030, including using new solar-powered plants. Egypt plans to increase its desalination capacity from 860,00 m^3/day at present to another 3.0 million m^3/day by 2030. Jordan's Aqaba–Amman project (about 0.85 m m^3/day) will provide about 25 % of national water from 2026 onward. These developments underscore desalination's advantages including climate invariance, growing cost-competitiveness (down from USD 5/m^3 in the 1980s to ~USD 0.4–0.5/m^3 at present), and synergies with renewable energy. However, desalination has some disadvantages, including high energy demand, greenhouse gas (GHG) emissions, brine water discharge to environment, and high capital and operation costs. Due to technological improvement, the costs are declining, but they remain high for agricultural applications. Economic modelling shows that cost-effective agricultural deployment depends on co-locating desalination with renewable power supply (solar PV/thermal), integrating innovation with irrigation, and utilizing farm-sector pricing reforms; yet, farmers often cannot return their full costs, and subsidies remain politically sensitive. Opportunities lie in leveraging declining renewable power costs, modular and solar-driven RO systems, nexus-based planning, and expanding regional financing via green bonds, PPPs, and climate funds. Key challenges include limited technical capacity, low water tariffs, governance fragmentation, and cross-border allocation tensions. It is recommended to expand renewable-powered desalination coupled with brine water mining in targeted agricultural zones; increase water-use efficiency (e.g., drip irrigation, non-revenue water reductions to 10 %); rationalize subsidies and tariff structures protecting vulnerable consumers; strengthen institutional frameworks with local authority over water allocation; enhance regional collaboration on data sharing, environmental monitoring, and brine valorisation and management. Only through integrated, climate-smart water–energy–food (WEF) policies can MENA sustain agricultural productivity, secure export revenues, and bridge projected food and water deficits while meeting decarbonization and environmental sustainability imperatives. Financial incentives can also significantly improve the use of desalinated water in agriculture across the MENA region by reducing operational costs, encouraging investment in energy-efficient technologies, and supporting farmers through subsidies, low-interest loans, and tax breaks. These incentives can make desalinated water economically viable, promoting sustainable, climate-resilient agricultural production in water-scarce areas.

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sciforum-118738: Treatment of olive mill wastewaters by *Yarrowia lipolytica ACA YC 5031,* using crude glycerol as a carbon source under sterile/nonsterile conditions and saline environment

Georgios Kiouranakis [1,*], Anna Kerousi [1], Maria Kouzmninidou [1], Zacharias Ioannou [1], Seraphim Papanikolaou [2] and Dimitris Sarris [1]

[1] Laboratory of Physico-Chemical and Biotechnological Valorization of Food By-Products, Department of Food Science & Nutrition, School of Environment, University of the Aegean, Leoforos Dimokratias 66, Myrina 81400, Lemnos, Greece
[2] Department of Food Science and Human Nutrition, Agricultural University of Athens, 75, Iera Odos, 11855 Athens, Greece

Today, more and more bioprocesses are being designed every day due to the high global demand to reuse/recycle/reduce (3R). This research is designed towards the agricultural need to treat olive mill wastewater (OMW) combined with crude glycerol under sterile/nonsterile conditions (to propose a bioprocess less in energy needed) and saline conditions (which can enhance the survival of *Yarrowia lipolytica ACA YC 5031*. During the experimental execution, microbial fermentation was performed in 250 mL ± 1 mL flasks in olive mill wastewater and water (blank fermentation). The culture conditions were 70.0 g/L crude glycerol (as a carbon source) and 1.0 g/L yeast extract – 1.0 g/L peptone (as a nitrogen source), and the whole cycle of fermentations was performed in 0 % - 7% - 9% salt content, pH=3, and under sterile/nonsterile conditions for 9 days. The results in OMW showed max: biomass – 11.20 g/L at 240 hours - OMW (7% salinity/sterile conditions), fat – 3.67 g/L at 240 hours – OMW (7% salinity/sterile conditions), phenol reduction – 33.10 % at 24 hours – OMW (9%/sterile conditions)/ with 46.67% color reduction, citric acid – 10.20 g/L at 240 hours – OMW (0% salinity/sterile conditions), erythritol – 19.90 g/L at 120 hours – OMW (7% salinity/non sterile conditions), mannitol – 2.50 g/L at 120 hours – OMW (7% salinity/sterile conditions). Overall, the experimental results indicated that both heat treatment and salinity conditions had an impact on the quantitative production of the metabolic products but also on the time that this phenomenon occurred during the fermentation. Promising is the increase in production of erythritol under nonsterile conditions in 7% salinity (compared to 0%), which can be proposed as a non-thermal treatment that requires less energy (meaning it is more economical).

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Session 6. Smart Farming: From Sensor to Artificial Intelligence

sciforum-136589: Influence of Red–Blue LED Spectra on Growth Dynamics and Phytochemical Enrichment of Chinese Kale (*Brassica oleracea* var. *alboglabra*) in Hydroponic Vertical Farming System

Ajit Singh [1], Loke Kha Chun [2] and Jiang Xiaoyu [2,*]

[1] University of Nottingham Malaysia, Semenyih 43500, Selangor, Malaysia
[2] School of Biosciences, University of Nottingham Malaysia, Semenyih 43500, Selangor, Malaysia

The rapid pace of global population growth and urbanization continues to deplete arable land, emphasizing the urgent need for sustainable food production systems. This study examines the effectiveness of hydroponic vertical farming systems (HVFSs) equipped with light-emitting diode (LED) technology in cultivating Chinese kale (*Brassica oleracea* var. *alboglabra*). Specifically, it evaluates the impact of three distinct LED treatments—white LEDs (WL), 20% red + 80% blue (20%RL:80%BL), and 80% red + 20% blue (80%RL:20%BL)—on morphological development and phytochemical accumulation.

Plants were grown under controlled conditions (pH 5.8–6.5, EC 2.0–3.0 dSm^{-1}) and assessed at weeks 2, 4, and 6 post-transplanting. The 80%RL:20%BL treatment yielded superior fresh weight, leaf area, root length, and dry biomass, indicating that higher red light proportions significantly enhance morphological growth (P0.05). In contrast, the 20%RL:80%BL treatment resulted in the highest chlorophyll (53.60 mg/g), anthocyanin (11.30 units), and total phenolic content (1.46 mg GAE/g), suggesting blue-light dominance improves phytochemical profiles.

Interestingly, leaf number and maximum quantum yield (QY) remained statistically similar across treatments, though all QY values fell below the ideal benchmark of ~0.83, indicating light-induced stress across the board. Notably, Chinese kale grown under WL exhibited the greatest stem elongation, likely triggered by a low red to far-red ratio that induced shade avoidance responses.

Overall, an 80%-RL:20%-BL ratio emerges as the optimal treatment for promoting vegetative growth, whereas a 20%-RL:80%-BL ratio proves more effective for enhancing phytochemical enrichment. These insights offer practical guidance for optimizing LED configurations in HVFS, balancing yield and nutritional quality for future urban agricultural systems.

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sciforum-138266: Educational Tools in Herbal Medicine: A Streamlit-Based AI Decision Tree Classifier for South Indian Medicinal Herb Identification ("PLANTIFY")

Jaydish J [1,*] and G Chelladurai [2]

[1] Department of Botany ,St.Joseph's college (Autonomous),Trichy-2, Tamil nadu, India.
[2] Assistant professor of zoology, Department of Botany, St.Joseph's college (Autonomous),Trichy-2, Tamil nadu, India.

Educational Tools in Herbal Medicine: A Streamlit-Based AI Decision Tree Classifier for South Indian Medicinal Herb Identification ("PLANTIFY")

J.Jaydish , G.Chelladurai
Department of Botany, St. Joseph's College (Autonomous), Tiruchirappalli, TamilNadu, India
Corresponding author Email:jaydishkennedy@gmail.com

Abstract:

The application of emerging artificial intelligence, particularly the decision tree classifier algorithm, enables the accurate identification and classification of plant species for herbal south Indian medicinal herbs that are vital to traditional systems like Ayurveda and Siddha. However, identifying these herbs is challenging due to their complex morphology and limited taxonomic resources. To address this, we developed **PLANTIFY**, a web-based app using streamlit and a decision tree classifier trained on eight key morphological traits. The model identifies 100 South Indian herbs with 92.5% accuracy using 5-fold cross-validation. The app provides species predictions with confidence scores, detailed taxonomy, ethnobotanical uses, and downloadable PDF reports. A usability study found 90% of users rated the app as user-friendly. PLANTIFY bridges traditional knowledge with AI, promoting herbal education and preserving ethnobotanical heritage. For research into and the identification of plant species for taxonomical purposes, this emerging technology is more convenient and innovative.

Keywords:
morphological trait; tensor flow; streamlit; Ayurveda; plant identification

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sciforum-136961: Meta-analysis: Machine Learning in Legume Production – Faba Bean and Vetch

Ebube Oliver Chukwunyere *, Burlutsky Valery Anatolievich and Meisam Zargar

Department of Agro-Biotechnology, Peoples' Friendship University of Russia, Moscow, Russian Federation

For understudied species like common vetch (Vicia sativa) and faba bean (Vicia faba), the combination of machine learning (ML) and meta-analysis (MA) has revolutionary promise for improving leguminous crops. Using MA and PRISMA-guided systematic review, this work synthesizes 115 peer-reviewed publications from 2015 to 2025 to assess machine learning applications in genomic and phenotypic trait prediction. The results show that ensemble approaches (e.g., Random Forest, XGBoost) perform better than standard models in disease resistance classification (AUC 0.88–0.91 via SVM) and yield prediction (R2 up to 0.92 in Phaseolus vulgaris). ML improves genomic selection (85–95% accuracy for flowering time GWAS) and root trait phenotyping (89% accuracy in faba bean drought adaptation) for Vicia species. Vicia villosa shows considerable phenotypic flexibility (CV 25–50%) but low model performance (F1-score 0.60–0.75 for winter survival), highlighting research gaps in tropical legumes, according to a meta-analysis. CNNs automate root architecture analysis (IoU 0.94); however, PLS regression is superior in NIRS-based nutritional trait prediction (R2 0.91 for protein). Data standards and the computing requirements for huge genomes (such the 13 Gb faba bean genome) are challenges. Precision breeding for nutritional quality and climatic resistance is made possible by the faster trait discovery made possible by the combination of ML and MA. In order to close the gap between model crops and ignored legumes, future efforts will focus on explainable AI, multi-omics integration, and cloud-based pipelines.

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sciforum-135330: Plant phenotyping technology adoption and our quest to cope with climate change

Rick van de Zedde

Netherlands Plant Eco-phenotyping Centre, Wageningen University and Research (WUR), Wageningen 6708 PB, The Netherlands

The adoption of new technology takes time and is a highly complex matter in all domains. Our food production system already suffers from the effects of climate change; therefore, enabling plant scientists in academia and industry to come up with solutions to deal with the effects of climate change is urgently needed. Enabling these experts with efficient new screening technology will boost the quest to find more robust and tolerant crop varieties for coping with climate change effects. Large-scale research infrastructure is a driver of innovation in research and achieving scientific breakthroughs. In the Netherlands, recently, the Netherlands Plant Eco-phenotyping Centre (NPEC) was developed to enable large numbers of users to use high-tech, data-driven screening technologies for the next big step forward. Modern plant phenotyping, or phenomics, involves the objective, accurate, detailed and reproducible recording of a range of characteristics of a large number of plants, over time, in response to their environment. NPEC provides its users with a multitude of state-of-the-art platforms with which to grow plants in controlled, semi-controlled, or natural conditions, equipped with a range of modern sensors for far-reaching automation and digitization of plant phenotyping. Plant phenotyping is currently in the scientific spotlight because of its growing importance as a decisive factor in finding solutions to major global problems related to food security, the climate crisis. and the loss of biodiversity. Several examples will be discussed to show the impact of this upcoming technology.

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sciforum-138085: A hybrid Machine learning approach for monitoring wheat crop traits using Proximal Hyperspectral remote sensing

R. G. Rejith [1,*], Rabi N. Sahoo [1], Tarun Kondraju [2], Amrita Bhandari [2] and Rajeev Ranjan [2]

[1] Division of Agricultural Physics, Indian Council of Agricultural Research (ICAR) – Indian Agricultural Research Institute (IARI), New Delhi, India.
[2] Division of Agricultural Physics, Indian Council of Agricultural Research (ICAR) – Indian Agricultural Research Institute (IARI), Pusa, New Delhi 110012, India

The ability of proximal hyperspectral sensors to capture precise spectral measurements, which signify the inherent properties of the target material, presents a strong potential for accurately estimating key crop health indicators in precision agriculture. This study employs a hybrid methodology that integrates a physical process-based radiative transfer (RT) model and machine learning regression to assess three key wheat crop traits: leaf area index (LAI), leaf chlorophyll content (LCC), and canopy chlorophyll content (CCC). The non-imaging hyperspectral data collected proximally using the ASD FieldSpec Spectroradiometer were spectrally resampled to 269 spectral bands ranging from 400 to 1000 nm for the retrieval of these crop traits. A hybrid retrieval workflow was developed using a Gaussian process regression algorithm, an active learning method for reducing sample size, principal component analysis for spectral dimensionality reduction, and training with spectral simulations from the PROSAIL RT model. Upon validating against in-situ measurements, good accuracies in terms of NRMSE values, 10.65%, 11.63%, and 13.85%, were achieved for LAI, LCC, and CCC, respectively. Plot-wise maps showing the spatial variability of LAI, LCC, and CCC, along with their uncertainties, were also generated to visualize the prediction results. These optimised retrieval models facilitate operational delivery of critical variables for monitoring crop dynamics by facilitating efficient nutrient management practices.

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sciforum-139164: A Telemetry-Based Precision Agriculture System for the Sustainable Cultivation of *Stevia rebaudiana*

Maria Feka [1,*], Panagiotis Oikonomou [2], Vasileios Tsoukas [1] and Athanasios Kakarountas [1]

[1] Department of Computer Science and Biomedical Informatics, Intelligent Systems Laboratory, University of Thessaly, Lamia, 35131, Greece
[2] Department of Informatics and Telecommunications, University of Thessaly, Lamia, 35100, Greece

Abstract

Introduction

The cultivation of *Stevia rebaudiana*, a plant of increasing nutritional and economic value, requires strict control of environmental conditions to ensure high leaf quality and optimal glycoside content. The TELEMETRY project aims to develop a remote telemetry system for the precision monitoring of Stevia cultivation, enabling sustainable agricultural practices through real-time decision support. The system also supports proactive management through a rule-based alerting mechanism and neural networks, enabling the forecasting of future environmental and cultivation conditions.

Methods

The system integrates Narrow Band IoT (NB-IoT) wireless sensors to measure critical environmental (temperature, humidity, rainfall, and soil moisture) parameters in a 4-hectare experimental plot managed by Stevia Hellas Coop. Sensor data are transmitted to central nodes and further relayed to a cloud-based storage and alert system. At the same time, local farmers perform traditional manual measurements (e.g., using analog hygrometers), which serve as a reference baseline for validating the sensor data. This comparative process enhances sensor reliability and contributes to the improvement of data accuracy for downstream machine learning models, including neural networks. The experimental layout ensures data uniformity across replicated plots.

Results

Initial deployments confirmed the system's robustness under field conditions. Sensor-based monitoring enabled early identification of disease-favoring microclimates (e.g., high dew point and humidity), facilitating timely phytosanitary interventions. Compared to traditional irrigation scheduling, the telemetry-guided regime achieved significant water savings while maintaining efficient plant growth. Deviations in soil microclimate were detected and addressed through localized management.

Conclusions

The TELEMETRY system demonstrates the potential of IoT-based solutions for precision agriculture in specialty crops such as Stevia. By integrating real-time data with grower decision-making, the system contributes to input reduction, disease prevention, and high-value product traceability. Future work will focus on increasing the monitored parameters and scaling up the system for broader deployment.

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sciforum-114510: Agriculture's Digital Transformation In Jamaica: Adoption, Adaptation, And Innovation

Paige Natassia Samuels

Sir Arthur Lewis Institute for Social and Economic Studies (SALISES), Faculty of Social Sciences, Mona Campus; University of the West Indies; Kingston; Allman Town PO; Jamaica

Digital transformation is widely advocated for by international organizations and global private entities as a solution to global agricultural challenges. Although digital transformation is seen as a solution for advancing global agriculture, the effects are complex and require in-depth analysis (Lioutas et al. 2021). The vulnerability of global agriculture and the rapid rate of digital transformation necessitates research on the interplay between digital transformation and agriculture.

Previous work on digital transformation in agriculture focuses primarily on countries in the Global North with limited research on the Global South. Research conducted in the Caribbean is limited to one type of crop or digital technology. This proposal aims to address this knowledge gap by conducting a case study in Jamaica assessing the relationship between digital transformation and agriculture.

The main objectives are as follows:

Investigate factors that drive digital technology adoption and adaptation by Jamaican farmers;

Explore the Jamaican farmer's perspectives on the reported effects of digital technology adoption;

Identify innovators driving digital technology innovation in Jamaican agriculture, and explore trends and challenges influencing innovation efforts;

Understand stakeholder's perspectives on the digital transformation of Jamaica's agricultural sector.

The proposal utilises a mixed-method case study to provide a deeper understanding of the interaction between agriculture and digital technologies in Jamaica. It is hypothesised that wealthy farmers will have easier access to, and benefit more from, digital technologies, whereas small and medium-sized farmers face barriers to entry that prevent the adoption of digital technologies. Additionally, it is anticipated that adaptation happens among all farmers. Digital technology innovations in the agricultural sector are being developed, but there are severe financial constraints on innovators.

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sciforum-129125: AI and Remote Sensing for Precision Phenotyping of Onion under Salinity Stress

Hela Chikh Rouhou [1,*] and Gabriel Eze [2]

[1] Regional Research Centre on Horticulture and Organic Agriculture (CRRHAB), LR21AGR03; University of Sousse; Sousse; Tunisia
[2] aSpace Company S.r.l.; Via SS 7 Appia – km 706+030; Brindisi; 72100; Italy

Salinity stress is a major constraint to crop productivity in arid and semi-arid regions, highlighting the need for innovative, data-driven methods to evaluate genotype performance under such conditions. This study, conducted at the Sahline experimental station (Tunisia) in collaboration with the Italian agtech firm aSpace, assesses the salinity tolerance among onion (*Allium cepa* L.) genotypes cultivated in two field plots—one irrigated with saline water and the other with non-saline water. The methodology integrates AI-predicted soil parameters (organic matter, electrical conductivity, pH, and N-P-K contents) with multi-spectral, multi-temporal satellite imagery (Sentinel-2, PROBA-V, Landsat 8, and MODIS) collected from March to June 2025. Key vegetation and salinity indices—including the Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), Soil-Adjusted Vegetation Index (SAVI), Bare Soil Index (BSI), and the Normalized Difference Salinity Index (NDSI)—were computed and cluster analysis was performed to map healthy vegetation patches within the trial. Preliminary results at the plot level reveal clear physiological differences due to salinity. NDVI values were consistently lower in the saline plot, starting as early as March (0.0971 vs. 0.2296 in the non-saline plot) and averaging 0.0984 versus 0.2308 across the entire monitoring period. The NDSI, a salinity-specific index, remained consistently higher in the saline plot (mean: 0.1184 vs. 0.0885), confirming persistent salt stress and aligning with the observed spectral vegetation decline. In parallel, the BSI — which reflects bare soil exposure and indirectly indicates poor canopy development — peaked in April in both plots, reaching 0.2266 in the non-saline and 0.2141 in the saline plot. The slightly higher BSI in the saline plot may reflect areas where salinity stress prevented full canopy development. Interestingly, the MSAVI and EVI were slightly higher in the saline plot across months, possibly due to surface reflectance effects or early-stage physiological responses under stress. These trends were consistent over the three-month monitoring period and are dynamically visualized through an ArcGIS web map interface. aSpace's AI platform enabled rapid, field-scale estimation of soil properties, overcoming the limitations of traditional sampling and providing scalable, high-resolution coverage. The current results demonstrate the value of integrating AI and remote sensing for rapid, non-destructive phenotyping of salinity response. This integrated approach offers a replicable and scalable framework to support smarter, faster, and more precise crop selection strategies and can be extended to assess salinity resilience and responses to other abiotic stresses in marginal environments.

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sciforum-129072: AI Audio-Based Poultry Behavior Monitoring Using Vocal Sound Analysis

Farook Sattar

University of Victoria; Victoria; V8P 5C2; Canada

Recently, a lot of attention has been paid to exploring Artificial Intelligence (AI) for analyzing audio and vocal data, offering a wide range of capabilities in precision livestock farming including poultry behavior monitoring. Animal behaviors provide significant insights into the mental and physical well-being of poultry, serving as an important indicator of their health and subjective states. With the world's population projected to reach 9.5 billion by 2050 and the demand for animal products like eggs, meat, and milk expected to increase by 70% from 2005 levels, it becomes vital to develop automated, precise systems for monitoring poultry behaviors. This achievement is especially important for managing poultry health and welfare efficiently, overcoming the constraints of manual behavioral observations, which are time-consuming. Automated AI-based systems are thus increasingly becoming crucial for monitoring and promoting good welfare within the growing livestock industry.

In this paper, we aim to develop a simple and efficient AI audio-based approach to recognize chickens' key behaviors such as eating, greeting, foraging, hunting, and tidbitting to improve poultry farming. First, the proposed study performs cepstral and entropy analyses on the chickens' vocalizations to extract new vocal features. Second, a simple deep unsupervised clustering method is proposed to recognize the behaviors of the chickens. Alternations in recognized behaviors can be indicators of lameness in chickens. Here, we used an open access chicken language dataset consisting of a total of 74 distinct chicken calls with their probable meanings as based on careful observations. Promising results are obtained by the proposed scheme for chicken behavior monitoring, enabling poultry personnel to accurately determine the health and well-being of chickens.

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sciforum-135959: AI-Driven wheat crop optimization and yield prediction tool

Wareesha Ayub [1,*], Muhammad Sameer [1], Dr. Sharaf Hussain [2] and Muhammad Ali [1]

[1] Department of Computer Science Engineering and Technology, Iqra University, Karachi 75300, Pakistan
[2] Department of Computer Science, Faculty of Engineering, Sciences & Technology, Iqra University, Karachi 75300, Pakistan

Introduction

Wheat is a major crop in Pakistan since it guarantees the country's food supply and economic stability. Effective yield prediction is necessary to maximize output, reduce waste following crop harvesting, and save resources. Conventional approaches to yield prediction are frequently imprecise and fail to recognize how climatic conditions impact crop growth. This research aims to develop an AI-driven framework for wheat yield prediction.

Methods

This research uses 23 years of historical agro-meteorological data, with features including evapotranspiration (mm), mean sea level pressure (hPa), mean soil moisture (m^3/m^3, 7-28 cm depth), mean soil moisture available to plants (fraction, 7-28 cm depth), mean relative humidity (%), minimum temperature (°C, 2m elevation), and mean soil temperature (°C, 7-28 cm depth), retrieved within the archives of Meteoblue and actual historical yield (acres) from the Pakistan Bureau of Statistic. Various machine learning models were trained and tested, and after preprocessing and converting to a time series with lagged features, a two-layer Long Short-Term Memory (LSTM) network performed the best in all evaluation measures.

Results

Early tests showed good results with the proposed models, but the deep learning-based LSTM model was used because of its strong ability with time-series data, improving the accuracy of forecasting yields. Using this method, the features are captured for their time dependencies, leading to accurate yield predictions with an R^2 score of 0.979, a mean squared error (MSE) of 0.0004, a root mean squared error (RMSE) of 0.0201, and a mean absolute error (MAE) of 0.0111 on the test set.

Conclusion

In conclusion, the results demonstrate that in environmentally sensitive regions (like Pakistan), deep learning is a suitable approach for agriculture forecasting. Future research should focus on improving the generalizability of the model and applying the technique to other staple crops for more agricultural relevance.

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sciforum-120784: An Evaluation of Machine Learning Algorithm Performance in Crop Recognition Using Remote Sensing: A Case Study in Southern Ukraine

Pavlo Lykhovyd

Department of Irrigated Agriculture and Decarbonization of Agroecosystems, Institute of Climate-Smart Agriculture; Odessa; 67667; Ukraine

Crop recognition using remote sensing data is vital for modern agriculture, enabling dynamic crop mapping, land use monitoring, and cropland structure analysis. Beyond identifying crops, distinguishing irrigated from rainfed croplands enhances agricultural water management. This study utilized the Normalized Difference Vegetation Index (NDVI), collected monthly from the Kherson and Mykolaiv regions (Ukraine), to classify irrigated and rainfed croplands and crop types via machine learning. NDVI data, sourced from the OneSoil platform, covered grain corn, wheat, sunflower, and soybeans, with equal representation of irrigated and rainfed conditions, forming eight distinct classes. Five algorithms were applied: Linear Discriminant Analysis (LDA), Multiple Logistic Regression (MLR), Support Vector Machine (SVM), Random Forest (RF), and eXtreme Gradient Boosting (XGB). Classification was performed on the original dataset, an augmented dataset (via Gaussian noise), and a normalized dataset. Performance was assessed using k-fold cross-validation, with F1 scores computed for each model in Python 3.13 with relevant libraries. The results showed normalization had no impact on performance. All models excelled at separating irrigated from rainfed croplands, with the SVM achieving the highest F1 scores (0.9292 original; 0.9352 augmented) and LDA and MLR the lowest (0.8938 original; 0.8879 augmented, respectively). Crop type recognition proved more challenging, with F1 scores not exceeding 0.60; XGB scored highest on the original dataset (0.5911) and RF on the augmented dataset (0.6346). Two-fold data augmentation generally improved F1 scores, with the SVM performing best overall on the augmented dataset (average F1: 0.7839), while XGB led on the original dataset (0.7556). Data normalization proved ineffective for monthly NDVI-based crop recognition, suggesting it can be omitted. Gaussian noise augmentation enhanced most models' performance and altered their relative efficacy. The SVM excelled at distinguishing irrigation status, but simultaneous crop type classification remains difficult, warranting further refinement. These findings highlight the potential of applying machine learning with NDVI data for irrigation classification and the need for improved approaches to crop type identification.

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sciforum-137919: An IoT-Based Anomaly Detection Framework for Smart Agriculture Using Hybrid PCA and Isolation Forest

Nurudeen Mahmud Ibrahim

Department of Cybersecurity, Nile University of Nigeria, Abuja

The integration of Internet of Things (IoT) technologies in agriculture has advanced precision farming by enabling real-time monitoring and data-driven decision-making. However, the growing reliance on interconnected sensors introduces challenges such as cybersecurity risks, sensor failures, and data irregularities that can threaten operational reliability. This study presents an IoT-based anomaly detection framework designed to enhance the security and efficiency of smart agriculture systems. The approach employs unsupervised machine learning techniques, specifically a hybrid of Principal Component Analysis (PCA) and Isolation Forest for detecting anomalies in environmental sensor data. A publicly available smart agriculture dataset containing diverse parameters like soil moisture, temperature, humidity, and light intensity was used. The model was evaluated using accuracy, precision, recall, and F1-score metrics. The results show that the PCA + Isolation Forest model achieved a high accuracy of 98.2% and a recall of 99.4%, indicating its effectiveness in detecting true anomalies while minimizing false negatives. This performance surpasses that of standalone models such as PCA, Isolation Forest, and One-Class SVM. The proposed framework is computationally efficient and well-suited for resource-constrained IoT environments commonly found in agricultural settings. By effectively identifying data irregularities, this approach enhances the security, reliability, and operational integrity of smart farming systems, making it a practical solution for supporting sustainable and secure precision agriculture.

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sciforum-109959: Cattle image datasets: the techniques of data augmentation

Olawuyi Fatoki [1], Chunling TU [2], Robert Hans [1] and Rotimi-Williams Bello [2,*]

[1] Department of Computer Science, Tshwane University of Technology, Pretoria 0001, South Africa
[2] Department of Computer Systems Engineering, Tshwane University of Technology, Pretoria 0001, South Africa

Introduction

Data-augmentation algorithms play a crucial role in mitigating the issue of limited training samples in deep learning applications across various agriculture domains. These algorithms are commonly employed by researchers to enhance performance in computer vision tasks. However, with the fast-paced evolution of these methods, the traditional classification, which separates them into classical techniques and generative methods, is now insufficient as it fails to include several important approaches. Furthermore, the abundance of available algorithms makes it difficult to select the most appropriate one for a specific application.

Methods

To address this challenge, this paper proposes a new classification system for image data-augmentation algorithms based on their strategic approaches: matrix transformation techniques, feature expansion methods, and neural network-based generation models.

Results

The study explores the key principles, performance, application contexts, current research trends, and future challenges for each category while offering insights into the future development of data augmentation techniques.

Conclusions

This work provides a useful academic resource for the application of data-augmentation algorithms, particularly in the field of precision livestock farming.

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sciforum-139165: Comparative Evaluation of CNN and ViT Architectures for Citrus Disease Detection in Field Conditions

Rohan Dash

Pine View School; Osprey, Florida; 34229; USA

The citrus industry worldwide has been devastated by widespread diseases, particularly greening, canker, and black spot, leading to significant tree losses, orchard closures, and reduced orange production. The traditional inspection methods for detecting such diseases are expensive and inefficient, thus warranting a better solution. This study aims to compare the effectiveness of different AI-powered, real-time computer vision architectures in accurately detecting and classifying citrus diseases through imagery. Two object detection models were compared: YOLOv8, a Convolutional Neural Network (CNN), and RT-DETR, a Vision Transformer (ViT). Both models were trained and cross-validated on a custom benchmark dataset, which featured 6,000 citrus images. This included 1,500 original images, as well as 4,500 images through augmentation, which were split into three difficulty levels to test the model response to varying simulations of real-world conditions such as lighting and motion blur. Initial training across the original dataset revealed that YOLOv8 outperformed RT-DETR in its accuracy and real-time speed by a slight margin. The weight decay, learning rate, and batch size were finetuned via Bayesian optimization. Additional few-shot learning on several other datasets boosted the performance and speed, resulting in 92.5% mean average precision (mAP) for YOLOv8 versus 87.07% mAP for RT-DETR. While YOLOv8 performed better overall, RT-DETR demonstrated a better performance on the hardest set, which displayed the model's robustness in difficult environmental conditions. The optimized models were deployed on a Raspberry Pi 5 with a camera module and several sensors. Field tests in a citrus grove confirmed successful real-time detection and accurate classification of diseased leaves and fruits, with visual explainability through Grad-CAM analysis. This research showcases the viability of low-cost platforms for object detection and introduces a novel data framework for future research into AI implementation in the citrus industry, allowing for the early detection and rapid treatment of such diseases.

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sciforum-132349: Deep Learning-Based Olive Tree Detection Across Apulia

Ester Pantaleo [1,2,*], Roberto Cilli [1], Gaetano Alessandro Vivaldi [3], Vincenzo Giannico [3], Salvatore Camposeo [3], Alfonso Monaco [1,2], Roberto Bellotti [1,2] and Nicola Amoroso [2,4]

[1] Interuniversity Department of Physics "M. Merlin"; University of Bari Aldo Moro; Bari; 70125; Italy
[2] Bari Section; National Institute for Nuclear Physics (INFN); Bari; 70125; Italy
[3] Department of Soil, Plant and Food Sciences; University of Bari Aldo Moro; Bari; 70125; Italy
[4] Department of Pharmacy – Drug Sciences; University of Bari Aldo Moro; Bari; 70125; Italy

This study presents the first navigable and georeferenced catalog of olive trees in Apulia (Italy), developed as part of the WADIT (Water Digital Twin) project. Olive canopy detection was performed using the YOLO11n-seg semantic segmentation algorithm, trained on 23,000 manually annotated olive trees across 250 parcels in the Barletta-Andria-Trani province. The model achieved strong performance, with sensitivity and precision exceeding 92%, and a mAP(50) of approximately 95%. Inference was scaled to the entire Apulian region using over 3TB of AGEA2019 orthophotos accessed via WMS services and processed in parallel across 254 threads, covering 460,000 tiles (200m × 200m) in 36 hours.

To enhance model generalization and address challenges such as duplicate detections, omissions, and false positives, an active learning strategy was employed. This iterative approach guided the manual review and targeted re-annotation of ambiguous or error-prone regions, significantly improving the model's robustness across diverse agricultural landscapes. Post-processing steps included non-maximum suppression, spatial filtering via Dask–Geopandas, and validation using the Copernicus Crop Type 2019 layer to exclude non-olive tree species.

The final estimate of 59 million olive trees in 2019 closely aligns with official pre-Xylella outbreak figures, demonstrating the effectiveness of the proposed pipeline. This high-resolution catalog supports integration of vegetation data into regional water modeling frameworks, contributing to sustainable water resource management. Future work will focus on expanding temporal coverage, improving detection in degraded or high-density canopies, and advancing full automation of the monitoring pipeline.

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sciforum-132621: Design and development of automatic tube well discharge measuring instrument for sustainable water aquifer management

Muhammad Kamran Rao *, Muhammad Faraz Hussain, Asif Nawaz and Muhammad Waleed Qureshi

Agricultural Engineering Department; Bahauddin Zakariya University; Multan, Punjab; 60000; Pakistan

This research focuses on the development of an automated water discharge measurement instrument aimed at improving the sustainability of aquifer water management. Traditional methods for measuring water discharge are typically manual, labor-intensive, time-consuming, and susceptible to human error, making them inefficient and costly for large-scale or long-term applications. To address these limitations, an advanced system was designed using ultrasonic sensors integrated with a microcontroller-based data acquisition and processing unit. The system is capable of accurately measuring both water level and flow rate in real-time. Extensive testing and calibration were conducted under varying conditions to evaluate the performance of the device. Results demonstrated a high degree of accuracy, with an average error margin of less than 5%. The automated instrument significantly reduces the need for manual labor and associated operational costs, while enhancing the reliability and consistency of the measurements. Its compact design and adaptability make it suitable for a wide range of water management scenarios, including remote or resource-constrained environments. The system also supports data logging, which enables continuous monitoring and historical data analysis for informed decision-making. This innovation offers a scalable and sustainable solution for efficient water resource management. Its successful implementation can help optimize water usage, prevent resource depletion, and support long-term environmental conservation efforts. Future enhancements may include integration with Internet of Things (IoT) platforms to enable remote access, predictive analytics, and automated alerts. Such developments can further increase the instrument's impact in advancing smart water management systems for sustainable development.

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sciforum-137896: Design and Implementation of Microcontroller-Based Climate Control System for Smart Greenhouse Applications

Meriem Ferfar [1,*], Youssouf Driouche [1], Amina Dridi [2], Cherif Boudiar [3] and Hadj Ahmed Abbassi [2]

[1] Environmental Research Center, Boughazi Said, Alzon, Annaba, Algeria
[2] Environmental Research Center, Boughazi Said Avenue, Alzon, Annaba, Algeria
[3] Electronics Department, Badji Mokhtar-Annaba University, BP.12,23000 Annaba, Algeria

The integration of digital technologies into agriculture has become essential for optimizing resource use and improving production efficiency under controlled environments. In this context, greenhouse cultivation represents a strategic system for high-yield crop production, particularly under conditions of climatic uncertainty and land constraints. However, maintaining optimal microclimatic conditions remains a major operational challenge.

This study presents the development and experimental validation of an automated climate control system for greenhouse management, utilizing an Arduino Mega 2560 R3 microcontroller as the central processing unit. The system is equipped with multiple environmental sensors to continuously monitor key variables, including temperature, relative humidity, carbon dioxide concentration, and light intensity. A set of actuators responds to these inputs through a feedback control algorithm, enabling real-time regulation of the internal environment. The control system is interfaced with a desktop application for data acquisition, visualization, and user interaction.

The proposed platform demonstrates a cost-effective and scalable solution for smart greenhouse automation. It contributes to the broader framework of climate-smart and precision agriculture, supporting sustainable intensification and efficient resource management through digital innovation.

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sciforum-138050: Detection of respiratory diseases based on poultry vocalizations using deep learning

Farook Sattar

University of Victoria; Victoria; V8P 5C2; Canada

In large-scale poultry farming, respiratory diseases affect the health of chickens, leading to a decline in the quality and yield of both meat and eggs. Effective monitoring of these diseases is crucial to reducing their impact and enhancing the quality and yield. Currently, most monitoring methods still rely on manually monitoring chicken vocalizations, which are time-consuming, labor-intensive, and require specialized personnel. Existing smart methods are often limited to laboratory environments where individual chickens are monitored separately. These approaches do not meet the industrial and commercial requirements of poultry farms, where a diverse set of complex auditory signals may be captured. These signals include not only chicken vocalizations but also complex noises from cages, human activities, mechanical ventilation systems, and other background noises.

In this study, we design a deep learning-based intelligent recognition method capable of accurately distinguishing abnormal chicken vocalizations among complex sound signals. Our proposed framework is based on wavelet scattering transform (WST) and Long Short-Term Memory (LSTM) network, and the use of preprocessed chicken vocalizations through a deep denoising scheme, adopting an audio image generation model (AIGM). We have used a public chicken language dataset consisting of a total of segments for each of the three categories (Healthy, Sick, None - no chicken sound), totaling 6,000 five-second audio clips from actual farming environments, which were labeled by veterinary experts. Promising robust performances are achieved by the proposed method outperforming the state-of-the-art methods for detecting poultry respiratory diseases, and enabling poultry personnel to accurately determine the health and well-being of the chickens.

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sciforum-135544: Evaluating and Forecasting Vegetation Cover in Mecca City: A Remote Sensing and Machine Learning Approach

Fayaz Ullah Shinwari

Researches Organization for Development (ROAD), Kabul, Afghanistan

The changes in vegetation cover in Mecca City, Saudi Arabia, from 2014 to 2024 are analyzed in this research, utilizing the Normalized Difference Vegetation Index (NDVI) from Landsat imagery. The NDVI provides valuable information on vegetation density and health, offering insights into environmental changes over time. The findings suggest that the city witnessed a positive shift in vegetation health over the span of ten years, which was mainly attributed to an increase in precipitation (66.9 mm) and human-driven water conservation initiatives. The vegetation in the research area was classified into four groups: Healthy Vegetation, Moderately Healthy Vegetation, Unhealthy or No Vegetation, and No Vegetation. The research revealed a 2.07% uptick in Healthy Vegetation between 2014 and 2024, accompanied by a decrease in bare land. Alongside looking back at past data, this study employs machine learning models to estimate NDVI values for 2030, using historical data from 2015 to 2023. The models utilized encompass Artificial Neural Networks (ANNs), Decision Tree Regression, and Random Forest Regression, among other models. The ANN model anticipates an upward NDVI trend, projecting a 2030 NDVI of 0.0313, indicating potential enhancements in vegetation health if current conditions persist. Conversely, the Random Forest model anticipates a reduction in vegetation coverage, projecting an NDVI of 0.01462 for the same year, suggesting potential degradation under specific circumstances. The Decision Tree model aligns more closely with the ANN, projecting an NDVI of 0.01654. These varied projections underscore both the potential for vegetation recovery and the possibility of decline, contingent on environmental management practices and climate variability. The results underscore the significance of adaptable land and resource management strategies, particularly in dry regions like Mecca City, to guarantee sustainable vegetation growth and biodiversity conservation amid ongoing climate changes.

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sciforum-138656: Evaluating the Effectiveness of Soil Moisture Sensors in Optimizing Irrigation: Insights from Extended Farming Trials

Abid Hussain

Department of Biological Sciences, Thal Univeristy Bhakkar, Bhakkar, 30000, Punjab, Pakistan

Water scarcity is a major challenge in agriculture, particularly in regions reliant on irrigation for crop growth, such as deserts. Traditional irrigation methods, which often follow fixed schedules and manual observations, result in inefficient water application. Soil moisture sensors could offer a solution by providing real-time data on soil moisture levels, enabling more precise irrigation scheduling based on actual demands rather than estimations. This study evaluates the impact of integrating soil moisture sensors into irrigation systems to enhance water efficiency and agricultural productivity. The field study was conducted in the Thal Desert (Punjab), Pakistan, where water management is critical due to scarcity. The study compares the two irrigation methods—traditional and sensor-based—over 10 months in multiple crop fields. Weekly soil moisture data were collected at various depths, alongside measurements of water applied, irrigation frequency, crop yield, and soil health indicators. Statistical data were analyzed using ANOVA to assess the effectiveness of both irrigation methods. The results show that the sensor-based irrigation method led to a 20–30% reduction in water consumption compared to traditional methods, while simultaneously enhancing crop yield by 15–25%. These findings demonstrate that soil moisture sensors, even actuating once a week, significantly improve irrigation efficiency, reducing water consumption and boosting crop productivity. These results make the soil sensor-based irrigation systems a promising solution for water management in water-scarce regions.

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sciforum-131325: Evaluation of Machine Learning Approaches in Estimating Crop Water Requirement

Mrunalini Dinkar Humbare [1,*] and Indu Bhushan Bhagat [2]

[1] Kelappaji College of Agricultural Engineering and Food Technology, Tavanur, Kerala Agricultural University, Thrissur, Kerala, India, 679573
[2] College of Agricultural Engineering and Technology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India, 848125

Crop water requirement, the water a crop needs for optimal growth and yield throughout its growing cycle, including transpiration, evaporation, and other losses, must be accurately determined for irrigation scheduling, water resources management, and environmental analysis. Traditionally, this is performed using methods that depend on detailed climate data. However, in many areas, this data may not be available, and the process can take a lot of time. In such cases, using models to predict crop water needs is a good alternative. Machine Learning (ML), a kind of Artificial Intelligence (AI), offers tools that can learn from existing data and make future predictions. This study aimed to predict the water requirement of maize crop of the Samastipur district of Bihar, India, using ML models like Random Forest (RF), Multivariate Adaptive Regression Splines (MARSs), and Support Vector Machine (SVM). It used 20 years (2001–2020) of daily weather data, including maximum and minimum temperature, humidity, wind speed, and solar radiation. The water requirement was first calculated using the FAO-56 Penman–Monteith method combined with crop coefficients. The Gamma test helped choose the best input variables. The data was split into 80% for training the models and 20% for testing. To evaluate the models, this study used three performance measures: the Coefficient of Determination (R^2), Root Mean Square Error (RMSE), and Nash-Sutcliffe Efficiency (NSE). Results showed that choosing the right model reduces errors and improves prediction accuracy. Among the models tested, Random Forest performed the best in both training and testing, followed by MARS and then SVM. These results highlight how effective ML models can be for accurately predicting crop water needs.

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sciforum-135507: Evaluation of Soil Fertility, Geospatial Mapping and Quality Index using Kriging operation in Agricultural Land of Karaikal District, Puducherry, India

Muhilan Gangadaran [1,*], Bagavathi Ammal Uma [1], Sankar Ramasamy [1], Hemavathi Manivannan [2] and Mummadi Thrivikram Reddy [1]

[1] Department of Soil Science and Agricultural Chemistry, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Nedungadu Post, Karaikal, Puducherry, India, 609603
[2] Department of Agricultural Economics and Extension, Division of Agricultural Statistics, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Nedungadu Post, Karaikal, Puducherry, India, 609603

Proper soil thematic maps are essential for developing effective soil nutrient strategies. This study aimed to demarcate soil nutrient properties and spatial variability across the Thirunallar region of Karaikal District through a digital survey, adopting a toposheet and base map from Sentinel 2 satellite data for sample collection in each grid (320-meter interval) at 0-15cm depth. The soil data were fitted into the model and layer maps were generated using *Arc*GIS (*v* 10.8.2) considering the Kriging function and the geostatistical method. The results revealed that soils were in the acidic to alkaline range (5.18 - 8.93), exhibited less saline (0.035 - 3.502 dS m^{-1}), and were low to high in SOC (0.24 - 1.41%), respectively. The available N ranged from low to high (142.80 - 739.20 kg ha^{-1}), while the range was medium to high for available P (15.33 - 98.44 kg ha^{-1}) and low to high for available K (90.18 - 493.42 kg ha^{-1}). Sulphur was reported to be in the medium to high range (9.94 - 99.67 mg kg^{-1}). Exchangeable properties were sufficient, as were micro-nutrient (Fe, Mn and Cu) levels, except for Zn. The coefficient of variation was reported to be high in soil EC (103.36%) and low for pH (10.87%). The efficiency of quantification with respect to the R^2 value and Root Mean Square Error provided explained variance and residuals in the derived model, and the majority of soil properties were best fitted for the spherical model. Semivariogram modelling indicates a strong spatial dependency (SpD) level. The anticipated dataset for each parameter showed the lowest RMSE, which accounted for soil EC and SOC (0.524; 0.154), and the R^2 values corresponded to good model fitting for SOC (0.984) and Cu (0.954). The SQI derived from the PCA underscores the fact that calcium and sulfur had a greater contribution towards soil quality. Thus, integrating spatial analytical data and the SQI provides better regional soil management practices, optimum fertilizer use and future sustainable practices.

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sciforum-123589: Influence of Cow Parity on the Precision of Near-Infrared Spectroscopic Sensing System for Assessing Milk Quality During Milking

Patricia Iweka [1,*], Shuso Kawamura [1], Tomohiro Mitani [2] and Takashi Kawaguchi [3]

[1] Graduate School of Agricultural Science; Hokkaido University; Sapporo; 060-8589; Japan
[2] Field Science Center for Northern Biosphere; Hokkaido University; Sapporo; 060-0811; Japan
[3] Orion Machinery Co. Ltd; Nagano; 382-8502; Japan

The precise and accurate real-time assessment of raw milk quality during the milking process through a near-infrared spectroscopic sensing system has not been performed, and is potentially hindered by elements likes cow parity. Therefore, this research focused on the influence of cow parity, or the number of times a cow has calved, on the reliability and exactness of a near-infrared (NIR) spectral detection system in assessing three key milk quality indicators: fat content, lactose, and somatic cell count (SCC). This study was conducted with two cows in their second calving phase at the dairy facility of Hokkaido University. We gathered milk absorbance spectra with the NIR system across a wavelength spectrum from 700 to 1050 nm. Milk fat and lactose levels were measured through a MilkoScan device, while SCC measurements were taken with a Fossomatic device. Calibration models were developed using three groups of sample data, including one from the first parity trial, another from the second parity trial, and a combined set from both trials. These calibration models employed partial least square regression analysis, and the accuracy and reliability of these models were subsequently tested. The coefficient of determination and standard error of prediction values obtained for both the first and second parity, alongside the combined data, were comparable for the parameters of milk fat and SCC, with the exception of lactose. Additionally, the first parity data set was utilized for validating the second parity data set, and vice versa. The findings showed that the measurements, particularly for lactose levels, were notably influenced. This indicates that a cow's parity could affect the precision of NIR sensing systems in evaluating the quality of cow milk during milking sessions.

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sciforum-128485: Integrating Digital Twins for Predictive and Adaptive Agricultural Optimization

Somnath Nandi *, Amritendu Sil, Mriganka Maity and Manidipto Mukherjee

CSIR-Central Mechanical Engineering Research Institute, Durgapur – 713209, West Bengal, India

The integration of digital technology with agriculture is unlocking a new era of intelligent farm management. The Digital Twin (DT) framework in agriculture has evolved as a major transformation by providing a real-time, dynamic, optimised, and predictive approach between physical agroecosystems and their digital counterparts. The DTs are applied to address the challenges of modern agriculture, where in-situ monitoring, optimisation, and adaptability are critical factors for enhancing sustainability. Therefore, this study explores the design, application, and evolution of DT frameworks, which are developed and customised for agricultural system optimisation. A structured hierarchical design is proposed to integrate agricultural systems with IoT-enabled sensing, AI-driven analytics, and predictive models. This approach allows real-time monitoring, forecasting, and autonomous control across a wide range of agricultural processes. Three case studies from crucial domains like yield forecasting, autonomous machinery coordination, and predictive disease management are considered. The significance of DTs is demonstrated by analysing resource efficiency, environmental impact, and decision-making adaptability on the farm. Finally, challenges for implementing DTs in agriculture, like heterogeneous data sources, model fidelity, computational overhead, and barriers to adoption among smallholder farmers, are explored, and the mitigation strategies using advanced AI frameworks are discussed. The implementation of DTs can become core infrastructure for smart agriculture by enhancing its scalability, interoperability, and adaptability. This study evaluates a fundamental and practical outline by bridging the physical and virtual barriers to make resilient, sustainable, and optimized agricultural operations in real time.

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sciforum-133518: Integrating IoT Sensors and Artificial Intelligence for Irrigation Optimization in Organic Farming Systems

Marian BUTU [1, 2,*], Steliana RODINO [2, 3] and Alina BUTU [3]

[1] Department of Biotechnology, National Institute of Research and Development for Biological Sciences, Bucharest 060031, Romania
[2] Research Institute for Agricultural Economics and Rural Development, Bucharest 011464, Romania
[3] National Institute of Research and Development for Biological Sciences, Bucharest 060031, Romania

Efficient and sustainable water management remains a critical challenge in organic agriculture, where input use is restricted and irrigation decisions must be carefully calibrated to avoid resource waste and crop stress. This study presents a practical and cost-effective solution combining Internet-of-Things (IoT) sensors with artificial intelligence (AI) algorithms to enhance the performance of drip irrigation systems in organic farming contexts. The proposed system integrates capacitive soil moisture sensors, temperature probes, and flow meters into a field-deployable network communicating via LoRaWAN. Sensor data, collected at 15-minute intervals, are transmitted to a cloud platform that also integrates localized weather forecasts and field-specific agronomic data, including soil characteristics and crop phenological stages. After data cleaning and noise reduction using Kalman filtering, the input stream is fed into a hybrid machine learning model combining Long Short-Term Memory (LSTM) neural networks and Random Forest regression. The model is retrained periodically to ensure robustness under dynamic field conditions. Based on the 48-hour irrigation forecasts, the system autonomously adjusts irrigation timing and duration through solenoid valve control, maintaining soil moisture within optimal ranges. The approach was field-tested on two organic vegetable farms (tomato and bell pepper) in southeastern Romania during the 2024 growing season. Compared to traditional irrigation scheduling, the system reduced total water use by 27% and increased crop yield by 15%, with a measurable improvement in water-use efficiency (from 5.8 to 7.1 kg/m^3). These results validate the effectiveness of IoT- and AI-based systems for precision irrigation in small- to medium-scale organic farms. The solution demonstrates tangible benefits in resource conservation, productivity, and climate resilience, and offers a replicable model for enhancing decision-making in data-constrained agroecological systems.

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sciforum-129628: Intelligent Mobile Robot for Agricultural Phenotyping Using Infrared Sensors, Embedded Vision, and Fuzzy Logic Control

Amina Nedjoua Benali * and Abdelkader Benaissa

Laboratory of Intelligent Control and Electrical Power Systems (ICEPS); Djillali Liabes University of Sidi Bel Abbes; Sidi Bel Abbes; 22000; Algeria

Modern agriculture is increasingly challenged by the need for precision, sustainability, and reduced human intervention. This work presents an autonomous robotic solution for phenotyping row crops, combining embedded sensors, onboard vision, and fuzzy logic. A differential-drive mobile robot was developed and tested in a 3D-modeled agricultural field, structured in crop rows. It is equipped with infrared sensors for detecting plant obstacles and a front-facing camera for capturing images for phenotypic analysis. To ensure smooth navigation while preserving the integrity of the crops, fuzzy logic is employed to manage sensor uncertainty and dynamically adapt the robot's movements. This approach enables effective autonomous exploration while avoiding damaging contact with plants. The results highlight the relevance of combining sensors and artificial intelligence in the context of smart agriculture, particularly for non-destructive tasks such as automated phenotyping. This work contributes to the advancement of agricultural robotics by demonstrating the potential of intelligent embedded systems in realistic simulated environments for future field applications.

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sciforum-139004: IoT-Enabled Smart Aquaponics System with AI-Driven Monitoring for Optimized Crop and Fish Growth in Controlled Environments

Bharath G *, Murtaza Hasan and Vinod Kumar S

ICAR–Indian Agricultural Research Institute; New Delhi; 110012; India

This research presents an IoT-enabled smart aquaponics system integrating multi-modal sensor networks with advanced machine learning algorithms to achieve autonomous optimization of symbiotic crop–fish production environments. The system employs a distributed sensor architecture incorporating pH, dissolved oxygen, ammonia, nitrate, temperature, humidity, light intensity and turbidity sensors, interfaced through ESP32-based edge computing nodes with real-time data transmission capabilities via LoRaWAN and WiFi protocols. The core innovation lies in the implementation of a hybrid deep learning framework combining Convolutional Neural Networks (CNNs) for image-based plant health assessment, Long Short-Term Memory (LSTM) networks for temporal pattern recognition in water quality parameters, and Reinforcement Learning (RL) agents for dynamic system optimization. The AI model processes over 15,000 data points hourly, enabling predictive analytics for disease detection, nutrient deficiency identification and growth trajectory forecasting with 94.7% accuracy. Advanced computer vision algorithms utilizing YOLOv8 architecture perform real-time fish behavior analysis and biomass estimation, while hyperspectral imaging integrated with transformer-based attention mechanisms monitors plant stress indicators at cellular resolution. The system's autonomous control mechanisms regulate LED spectrum optimization (380–780 nm), nutrient dosing through precision peristaltic pumps, water circulation via variable-speed pumps and climate control through HVAC integration. Experimental validation demonstrates a 43% increased crop yield, 28% enhanced fish growth rates and a 35% reduction in water consumption compared to conventional systems. The platform achieved 99.2% uptime with sub-second response times for critical parameter adjustments. Machine learning models successfully predicted system failures 72 hours in advance, enabling proactive maintenance protocols. The system's scalability is demonstrated through blockchain-based data integrity verification, edge-to-cloud hybrid processing architecture, and standardized API interfaces enabling seamless integration with existing agricultural management systems. This breakthrough technology represents a paradigm shift toward sustainable, intelligent food production systems capable of addressing global food security challenges while minimizing environmental impact.

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sciforum-138853: Machine Learning for Soil Fertility Assessment: A Comprehensive Study

Shreya Singh

Ramlalit Singh Mahavidyalaya, Uttar Pradesh, India

Geographical, environmental, and meteorological factors have a significant impact on soil, which is referred to as Earth's skin. Mineral and nutrient content is crucial for controlling the ecosystem's core dynamics. Crop yield is aided by soil fertilization activities. However, a smaller crop output volume may result in the amount of soil composition (fertilizer) failing to be regulated and kept constant. Advancements to help avoid lower crop quality and production to control the amount of soil fertilizer, in addition to improving fertilization and plant growth and soil nutrient monitoring, are crucial. Instructive soil parameters to ascertain soil fertility, calcium, phosphorus, and pH are therefore among the parameters that are frequently measured to monitor soil fertility. The grading of soil and prediction of crops that are suitable for specific land areas can be achieved using a machine learning-based method for the examination of key soil attributes. The high demand for laboratory-based analyses of soil fertility has led us to devise a quick, easy, and affordable method for assessing soil fertility. Portable X-ray fluorescence (pXRF) spectrometry determines the total elemental concentration in soils quickly, easily, and without producing hazardous waste, but its use for predicting soil fertility properties in tropical conditions is still in its infancy. It uses supervised machine learning algorithms like decision trees, K-Nearest Neighbor (KNN), and Support Vector Machine (SVM) to predict soil fertility based on the macronutrient and micronutrient status information found in datasets. R Tool is used to create supervised machine learning algorithms, which are then tested on the test dataset and applied to the training dataset. Several assessment criteria, such as accuracy, cross-validation, and mean absolute error, are used to analyze the performance of these algorithms. Analysis of the results reveals that decision tree has the lowest mean square error (MSE) rate and the highest accuracy of 99%. With less waste production and lower expenses, this environmentally friendly approach can be applied to the evaluation of soil fertility characteristics in a variety of tropical and subtropical soil types.

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sciforum-135296: Retrieving Canopy Chlorophyll Content from Sentinel-2 imagery using Google Earth Engine

Tarun Teja Kondraju [1,*], Rabi N. Sahoo [2], R. G. Rejith [2], Amrita Bhandari [2], Rajeev Ranjan [2], Devanakonda Venkata Sai Chakradhar Reddy [2] and Selvaprakash Ramalingam [2]

[1] Indian Council of Agricultural Research (ICAR) - Indian Agricultural Research Institute; New Delhi; 110012; India
[2] ICAR-Indian Agricultural Research Institute

Google Earth Engine (GEE) has revolutionized remote sensing. The GEE cloud platform lets users quickly analyze large satellite imagery datasets with custom programs, enhancing global-scale analysis. Crop condition monitoring using GEE would greatly help in decision-making and precision agriculture. Estimating canopy chlorophyll content (CCC) is an effective method for monitoring crops through remote sensing because chlorophyll in leaves is a key indicator. A hybrid model that combines radiative transfer models (RTMs), such as PROSAIL, with Gaussian Process Regression (GPR) can effectively estimate crop biophysical parameters using remote sensing images. GPR has proven to be one of the best methods for this purpose. This study aimed to develop a hybrid model to estimate CCC from S2 imagery and transfer it to the GEE platform for efficient data processing. In this work, the CCC (g/cm2) data from the S2 biophysical processor toolbox for the S2 imagery of ICAR-Indian Agricultural Research Institute (IARI) on February 23rd, 2023, was used as observation data to train the hybrid algorithm. The hybrid model was successfully validated against the 155 input data with an R2 of 0.94, RMSE of 10.02, and NRMSE of 5.04%. The model was integrated into GEE to successfully create a CCC estimated map of IARI using S2 imagery from February 23, 2023. An R2 value of 0.96 was observed when GEE-estimated CCC values were compared against CCC values estimated locally. This establishes that the GEE-based CCC estimation with the PROSAIL+GPR hybrid model is an effective and accurate method for monitoring vegetation and crop conditions over large areas and extended periods.

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sciforum-137503: SMABS (Smart Modular Agro-Bot Swarm)

Fahim Shakil Rahman

DEpartment Of Agricultural Science, Daffodil International University

Introduction

This **self-developed** initiative introduces SMABS (Smart Modular Agro-Bot Swarm)—a cutting-edge solution designed to **revolutionize** agricultural practices in developing regions. SMABS consists of compact, modular, **solar-powered** robotic units utilizing a **hybrid energy** system that combines **biofuel** with **lithium-ion** batteries for sustainable and uninterrupted operation. It addresses key agricultural challenges, including labor shortages, escalating production costs, and inefficient agro-input management.

Methods

SMABS functions through a decentralized, **intelligent network** where each robot communicates and collaborates using **AI-based** decision-making algorithms and **real-time** environmental sensors. Inspired by the swarm behavior of ants and bees, the system dynamically allocates tasks based on real-time field data. The project followed a multi-phase methodology comprising advanced digital **prototyping**, **hardware–software** integration, extensive field trials across diverse farm scales, and iterative refinement based on continuous farmer feedback. To ensure local adaptability, a Bengali and English **voice-command** interface and user-friendly **DIY** repair manuals were developed, enabling effective adoption by **rural farming** communities. The total estimated cost of SMABS (in USD) is approximately **USD 4,000** (based on USD 1= BDT 120). This includes solar panels, robot hardware, and tools, sensors, AI-boards, batteries, software development, expert salaries, testing, promotion, and backup. With a dedicated team and consistent funding, the full system can be launched in **under 8 months. One** robot is needed for **0.05 ha-0.10 ha** of land. Two to three robots are needed for **0.20 ha-1.0 ha** of land. Three to five robots are needed for **1.0 ha-2.0 ha** of land. Five to eight robots are needed for **2.0 ha-3.0 ha, while 10+** robots are needed for bigger lands.

Results

Field evaluations demonstrate that SMABS effectively performs a wide array of tasks including **precision planting**, targeted **weeding**, **pest scouting**, calibrated **spraying**, early **disease detection** with immediate responses, efficient **harvesting**, and continuous **monitoring** of soil and crop health. These trials revealed substantial gains in operational efficiency, reduced **agrochemical** usage, and improved resource management. The modular design ensures seamless scalability, making it suitable for both **smallholder** plots and **large-scale** farming operations.

Conclusion

SMABS represents a paradigm shift in **precision and decentralized** agriculture, merging robotics, renewable energy, and AI to create a robust and scalable solution. It **enhances** farm productivity, promotes sustainability, and contributes meaningfully to **global food security** efforts. By empowering farmers with accessible, intelligent tools, SMABS sets a new benchmark for **future-ready** agriculture in **resource-constrained regions.**

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sciforum-139325: Smart Agriculture in Mauritania: Integrating AI-Driven Yield Prediction with Simulated IoT-Based Climate Monitoring

Cheikh Abdelkader Ahmed Telmoud

Scientific Computing, Computer Science and Data Science Research Unit (CSIDS), Computer Sciences Department, Faculty of Sciences and Techniques (FST), University of Nouakchott (UN), Nouakchott, Mauritania

Mauritania's agricultural sector, particularly rice production, faces significant challenges due to climate variability, market inefficiencies, and limited access to technological resources. In response, this study proposes a smart agriculture framework that integrates Artificial Intelligence (AI), Big Data, and simulated Internet of Things (IoT) technologies to enhance rice yield forecasting and farm climate monitoring. Building upon our prior work—including yield prediction via Random Forest and LSTM models, IoT-based digital twin climate monitoring, and national agricultural datasets—we present an improved architecture combining real-time data analytics and scalable decision support.

The framework utilizes historical datasets spanning 1960–2023, covering rice yields, agricultural value added, fertilizer use, population, employment, trade, and rice prices. Simulated IoT data, based on historical temperature and humidity records, serve as a proxy for field sensors in data-scarce environments. Three predictive models were benchmarked: Random Forest achieved the highest R^2 (0.87), followed by XGBoost and LSTM. Feature importance analysis highlighted temperature, rainfall, and fertilizer use as key yield predictors. A weak correlation (0.08) between retail and wholesale prices indicates limited market integration, which may affect production planning.

Beyond model accuracy, the study emphasizes the practical value of integrating AI-driven prediction with IoT-based monitoring to support precision agriculture in Sub-Saharan Africa. This approach enables farmers to make data-informed decisions on crop scheduling and resource allocation, potentially increasing yields by 10–15% under climate uncertainty. It also lays the groundwork for a future SaaS platform tailored to smallholder needs, incorporating real-time alerts, decision dashboards, and mobile access.

The proposed solution aligns with the goals of climate-smart agriculture and sustainable development. Future work will focus on deploying real sensors, validating predictions in the field, and expanding to other staple crops critical to regional food security.

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sciforum-131894: Smart Farming and Digital Divide: Structural Inequalities in Access to AI and Digital Technologies among Smallholder Farmers

Andrea Apicella

University of Pisa; Pisa; 56126; Italy

Introduction

The integration of artificial intelligence (AI) and digital technologies into the agricultural sector represents a potentially transformative development for increasing productivity, optimizing resource use, and promoting sustainable practices. However, the diffusion of such innovations is far from uniform: significant disparities are emerging between small and large-scale farms, as well as between developed and marginal rural areas. This scenario raises serious concerns regarding existing structural inequalities and the risk of digital exclusion for a substantial portion of the farming population, particularly in disadvantaged contexts.

Methods

This study presents a systematic review of recent empirical and conceptual literature (2019–2025), focusing on the adoption of smart farming technologies in sub-Saharan Africa. It analyzes eight key studies from Scopus-indexed sources, assessing infrastructure availability, economic barriers, and farmers' digital literacy through qualitative and quantitative approaches.

Results

The findings reveal a substantial digital divide. Smallholder farmers report limited access to ICTs due to high costs, poor connectivity, and lack of technical support. In South Africa, 78.8% of surveyed farmers perceived digital tools as too expensive and 81% lacked the required skills (Bontsa et al. 2024). These barriers are compounded by perceptions of limited reliability and low trust in digital systems.

Conclusions

While AI-driven farming promises increased efficiency, its benefits remain unequally distributed. Without targeted interventions, such as infrastructure development, affordable technology, and context-specific training, digital agriculture risks reinforcing existing inequalities. To ensure an inclusive agricultural transformation, policies must prioritize digital equity, particularly for marginalized rural producers.

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sciforum-132545: Smart Fertigation for Indoor Paddy: A MATLAB Simulink-Controlled Approach to Sustainable Rice Farming

Diana S.N.M. Nasir [1,*], Siti Khadijah Ali [2], Siti Nur Hannah Ismail [3], Nor Suzylah Sohaimi [4] and Ben Richard Hughes [1]

[1] School of Mechanical, Aerospace and Civil Engineering, Sir Frederick Mappin Building, The University of Sheffield, Mappin Street, Sheffield S1 4DT
[2] Department of Multimedia,Faculty of Computer Science and Information Technology, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[3] Department of Landscape Architecture, Faculty of Built Environment & Surveying, Universiti Teknologi Malaysia, 81310, Johor, Malaysia
[4] Department of Planning and Property Development, Universiti Utara Malaysia, 06010, Sintok, Kedah, Malaysia

In response to increasing pressure on arable land and freshwater resources, this study presents the conceptualisation and development of an integrated fertigation system tailored for the indoor cultivation of paddy (*Oryza sativa*). The system combines precision irrigation with nutrient delivery in a controlled environment, using sensor-based automation to monitor and regulate key parameters, including soil moisture content, electrical conductivity, and pH in real time. A modified hydroponic design was implemented to replicate paddy's semi-aquatic conditions while avoiding traditional water-intensive flooding methods. The fertigation process is managed by a programmable logic controller (PLC), with control logic and feedback loops designed and simulated using MATLAB Simulink to optimise irrigation timing and nutrient dosing strategies. Additionally, a computational fluid dynamics (CFD) model was developed to analyse flow distribution and nutrient dispersion within the root zone, ensuring uniform delivery and mitigating risks of nutrient stratification or stagnation. Experimental trials conducted under LED-regulated photoperiods demonstrated a reduction in water usage by approximately 30% while maintaining effective nutrient uptake and consistent growth throughout the crop cycle. The system's modular architecture allows scalability and adaptation to various spatial and climatic constraints. These findings highlight the potential of integrating CFD-based fluid analysis and simulation-driven control design with controlled-environment agriculture to promote sustainable, high-efficiency rice production in urban and climate-challenged settings.

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sciforum-132533: Symbiotic AI for Resilient Agriculture: A Federated Co-learning Framework with Interactive Counterfactual Explanations for Crop Disease Management

Rahool Dembani [1, 2,*], Ioannis Karvelas [1], Stamatia Rizou [1] and Domenico Tegolo [3]

[1] R&D and Innovation Department; SingularLogic; Athens; Greece
[2] Department of Mathematics and Computational Sciences; University of Messina; Messina, Sicily; 98122; Italy
[3] Department of Mathematics and Computer Science; University of Palermo; Palermo; 90133; Italy

Crop diseases represent a critical threat to global food security, demanding early and accurate detection to mitigate devastating losses. While AI offers immense potential, its adoption in agriculture is hampered by farmers' data privacy concerns and a lack of trust in "black box" models. Existing solutions combining federated learning for privacy and explainable AI (XAI) for transparency are a step forward, but they remain passive, offering one-way explanations to the user. This research introduces a paradigm-shifting framework, Symbiotic AI, that moves beyond passive explanation to active, collaborative intelligence. We propose a novel Federated Co-learning system where farmers and AI models learn from each other in a continuous, privacy-preserving loop. The core of this framework is an Interactive Counterfactual Explanation module. Instead of merely highlighting what the model saw (e.g., via heatmaps), our system uses a generative model (GAN) to show the farmer a counterfactual: a synthetic image of their own crop, subtly altered to show the minimal change required to flip the model's diagnosis (e.g., "This is what your healthy leaf would need to look like to be classified as having blight").

Crucially, the farmer can then interact with this explanation, confirming its accuracy or providing corrective feedback, such as, "No, the key indicator you missed is this stem discoloration." This expert human feedback is quantified and integrated back into the federated learning process, directly refining not only the central predictive model but also the local generative models that create the explanations. This creates a powerful co-learning dynamic where the AI becomes personalized to the unique environmental conditions and tacit knowledge of each participating farm, without ever compromising data sovereignty. The methodology involves a dual-model federated architecture—a Convolutional Neural Network (CNN) for disease detection and a conditional Generative Adversarial Network (cGAN) for generating counterfactuals—trained across decentralized farm data. Rigorous privacy is ensured through differential privacy. Expected outcomes include a system that not only achieves state-of-the-art detection accuracy (>97%) but also demonstrably improves over time by codifying farmer expertise. This research pioneers a new class of human-in-the-loop AI systems that fosters deep trust, accelerates adoption, and creates a dynamically evolving, resilient, and truly farmer-centric digital agriculture ecosystem.

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sciforum-139444: Towards Accurate Crop Yield Forecasting with Quantum Machine Learning Models

Abhinav Kriti Gupta [1,*], Anshu Bharadwaj [2] and Md. Ashraful Haque [3]

[1] Division of Computer Application; ICAR–Indian Agricultural Statistics Research Institute; New Delhi; 110012; India
[2] Principal Scientist, ICAR–Indian Agricultural Statistics Research Institute; New Delhi; 110012; India
[3] Scientist, ICAR–Indian Agricultural Statistics Research Institute; New Delhi; 110012; India

Addressing the persistent issue of food insecurity—particularly in regions experiencing agricultural deficits—requires accurate and timely forecasting of crop yields. Reliable yield predictions are vital for policymakers in key agricultural regions, as they facilitate strategic planning for the redistribution of surplus commodities through international trade. This, in turn, contributes to regional food security and enhances the economic stability of exporting nations.

Among the most widely cultivated crops globally are rice, wheat, maize, soybean, and pigeon pea. Yield prediction for these crops has traditionally relied on various statistical and machine learning approaches. Recently, Quantum Machine Learning (QML) methods—particularly Quantum Neural Networks (QNNs)—have been proposed as a novel paradigm for forecasting applications due to their potential to capture complex, high-dimensional relationships in large datasets. QNNs, leveraging qubits and quantum gates, offer computational advantages over classical models in specific contexts, especially in handling non-linear interactions and entangled feature spaces.

This study aims to forecast the yields of the aforementioned five major crops for the years 2025, 2026, and 2027 using historical data spanning from 1961 onward. The dataset, curated from the Food and Agriculture Organization (FAO) of the United Nations, comprises officially reported statistics from national bureaus across the five leading producing countries for each crop. A training-to-testing split of 75:25 was utilized to develop and evaluate predictive models.

Several baseline models—including conventional statistical regressors and classical machine learning algorithms—were implemented and benchmarked against quantum counterparts, namely Quantum Neural Networks (QNNs) and the Variational Quantum Regressor (VQR). Model evaluation was conducted using standard performance metrics, including Root Mean Squared Error (RMSE), Relative Root Mean Squared Error (RRMSE), and Minkowski distances (with p-values of 1, 2, and 3).

The results demonstrate that quantum models, particularly QNNs, exhibit competitive or superior performance in yield forecasting tasks compared to classical models, highlighting their potential as effective tools for data-driven agricultural decision-making in the quantum era.

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sciforum-132666: UAV-Based Nitrogen and Phosphorus Content Estimation for Early-Season Nutrient Mapping Using Vegetation Indices and Machine Learning Techniques

Lebogang Phahlane [1,*], George Johannes Chirima [1] and Kgaogelo Mogano [2]

[1] Agricultural Research Council – Natural Resources and Engineering, Soil, Climate and Water, Pretoria 0001, South Africa
[2] University of the Free State, Qwaqwa Campus, Phuthaditjhaba 9866, South Africa

Early-season estimation and mapping of the nitrogen and phosphorus contents are essential for enhancing sugarcane production and preventing yield loss. Timely data acquisition is needed to estimate and map the nitrogen and phosphorus contents to facilitate decision-making and precision agriculture in sugarcane production. However, the traditional methods used to estimate and map the nitrogen and phosphorus contents are time-consuming, laborious, and expensive.

This study's aims were to map the spatial and temporal variation in the nitrogen and phosphorus contents early in the sugarcane season using UAVs, machine learning algorithms, and soil and vegetation indices. The sugarcane plantations were in Emangweni in the Nkomazi Local Municipality, Mpumalanga, South Africa.

Soil and leaf samples, computed vegetation indices, and ground survey data were used as inputs for the machine learning algorithms. The performance of Random Forest, Support Vector Machines, and Partial Least Squares Regression was compared based on the accuracy of the models in estimating and mapping the nitrogen and phosphorus contents in sugarcane plantations. The Pearson Correlation Coefficient (R), p-Value (p), Coefficient of Determination (R^2), and Root Mean Square Error (RMSE) were used to validate the accuracy of the machine learning algorithms.

Based on our results, Random Forest is expected to outperform Support Vector Machines and Partial Least Squares Regression in estimating and mapping the nitrogen and phosphorus contents. The Normalized Difference Red Edge is expected to perform better in estimating and mapping the nitrogen contents; however, a combination of vegetation indices will be required to estimate and map the phosphorus contents in sugarcane plantations.

Future studies employing unmanned aerial vehicles should focus on the estimation and mapping of the nitrogen, phosphorus, and potassium contents over the entire sugarcane season.

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Session 7. Agricultural Soil

sciforum-132831: Agronomic Influence and Cost Assessment of Natural Rocks and Biological Inoculants in Potato Production

Abo Bakr Alsedik Youssef [1,*], Amal Badr [2] and Walid Fouad [3]

[1] Agricultural Genetic Engineering Research Institute, Agricultural Research Center, Giza, Egypt
[2] Biotechnology Graduate Program, School of Sciences and Engineering, The American University in Cairo, New Cairo 11835, Egypt
[3] Department of Biology, School of Sciences and Engineering, The American University in Cairo, New Cairo 11835, Egypt

Potato (Solanum tuberosum) is a significant global food crop. Intensive cultivation has heightened dependence on chemical fertilizers, leading to environmental and economic issues. A primary challenge in potato cultivation is the supply of phosphorus, which frequently demonstrates low levels due to leaching, inefficient utilization, and escalating fertilizer manufacturing costs. This study investigates the agronomic and economic benefits of employing natural rock amendments, specifically rock phosphate and feldspar, in conjunction with plant growth-promoting rhizobacteria (PGPR) as a sustainable input instead of chemical fertilizers for enhancing the yield and tuber quality of potatoes. A field experiment was executed to evaluate three treatments: conventional chemical fertilizers (T1), reduced chemical fertilizers combined with PGPR Bacillus megaterium and Azotobacter (T2), and natural rock potassium feldspar, and rock phosphate injected with PGPRs (T3). Regarding tuber quality, T2 and T3 exhibited enhanced tuber quality compared to T1. Also, the highest starch content and the lowest reducing sugar content were in T3. Moreover, T3 demonstrated superior soil quality post-harvest, exhibiting an enhanced total phosphorus level in soil compared to the usual chemical fertilizer treatment, in addition to higher tuber quality. T3 decreased operating expenses by 11% and attained a maximum production of 42 tons per hectare. The return on investment was approximately 79%, accompanied by a 28% profit gain ($3,988/ha) compared to T1 ($2,460/ha). The results show that using PGPR with natural rock fertilizers is a cheaper and effective option compared to regular chemical fertilizers, improving production, profits, and the long-term health of the soil.

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sciforum-136112: Sodium Alginate-Based Bioplastic Matrices Applied for Soil Regeneration

Carmen Mª Granados-Carrera [1,*], Victor Manuel Perez-Puyana [2], Daniel Castro-Criado [1], Andrea Crespo-Barreiro [3] and Alberto Romero [1]

[1] Department of Chemical Engineering, Faculty of Chemistry, University of Seville, 41012 Seville, Spain
[2] Department of Engineering and Materials Science and Transportation, University of Seville, 41092 Seville, Spain
[3] Chemical, Environmental and Bioprocess Engineering Group, I4 Institute, University of León, 24071 León, Spain

Introduction

Uncontrolled release of agrochemical products, as well as climate change, has damaged agricultural soils, requiring the development of sustainable materials for their regeneration. Simultaneously, the eutrophication of runoff channels and seas has promoted the overgrowth of macroalgae, which serves as a base material for the production of biopolymers. In this context, this study develops sodium alginate–glycerol-based bioplastic through injection molding techniques, evaluating its potential application for improving soil quality.

Methods

Physicochemical properties were determined using Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and colorimetry tests. Mechanical performance was evaluated using strain and frequency sweep tests, as well as temperature ramps. Moreover, water uptake capacity and soluble matter loss were measured. Finally, biodegradability tests were developed to evaluate the modification of soils before and after the incorporation of the matrices.

Results

Alginate-based bioplastics exhibit favorable mechanical properties when injected at a high mold temperature (100 °C) rather than 60 °C, due to their transparent, amorphous, and stable structural material, resulting from a thermosetting procedure. Additionally, blends exhibit favorable interactions, as observed in XRD, as well as enhanced thermal stability. Their biodegradation time was below 180 days, and their behavior in calcareous soil was characterized by a pH rise and a reduction in electrical conductivity and organic matter content.

Conclusions

Sodium alginate-based bioplastics show potential for soil regeneration due to their modification of soil properties, highlighting their contribution to sustainable agricultural techniques.

Acknowledgments

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sciforum-116102: A soil pedotransfer function for the soils of Algeria: the search for the most suitable parameters for water retention

Samia Souici

Scientific and Technical Research Center on Arid Regions (CRSTRA); Biskra; 7000; Algeria

Description of the subject

Pedotransfer functions are based on the search for mathematical relationships allowing the water properties of soils to be deduced from known or easily measurable characteristics of the soils.

Objective

This work aims to establish pedotransfer functions (FPTs) at eight levels of soil water retention potential on a north–south transect from Algiers to Djelfa (Algiers, Mitidja, Médéa, Djelfa).

Methods

The measurements and analyses were carried out on a set of 38 soil samples representing the main soils of Algeria (vertisols, fersiallitic soils, calcimagnesic soils, less evolved soils). The importance of the contribution of various soil variables with respect to water retention is estimated by the values of the determination and correlation coefficients. The level of reliability of the established pedotransfer functions was estimated using 20 test samples from the studied soils.

Results

The main results obtained showed that clay, organic matter and fine silt, and coarse silt and total limestone are the factors that contribute the most to the water retention of soils, including at low potentials (-1600 kPa). In addition, it emerges from this study that reworking of the ground provoked an increase in porosity, essentially structural, in spite of small variations in its values. Validation of the pedotransfer functions indicates that the biases of the predictions are low, thus reflecting a good quality estimate of the water contents.

Conclusion

The results of this research show once again the importance that should be given to understanding the water functioning of soils in the Mediterranean environment. The results obtained for this study, covering a very large space and a wide range of Algerian soils, deal with a diversity of soils with different parental materials, located under several bioclimatic floors and with varied occupations.

We highlight several interesting results in particular on the soil factors to take into consideration for the calculation of the equations.

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sciforum-130091: can staple crops clean contaminated soil? Perceptions from the phytoremediation potential of ogbomoso soybean landrace, southwest nigeria

Ifeoluwa Simeon Odesina, Ruth Oluyomi Onakanmi * and Moses Adeniyi Osundina

Department of Pure and Applied Biology, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso 210214, Oyo State, Nigeria

Industrialization has contributed largely to the non-availability of arable lands targeted for growing staple crops. The advent of phytoremediation has revealed the possibility of the deployment of eco-friendly and cost-effective alternatives to traditional remediation approaches, utilizing plants to reduce harmful substances from the soil. Although conventionally overlooked in this role, staple crops have shown emerging promise as dual-function plants, supporting both food production and agricultural soil recovery. This study aimed to assess the phytoremediation potential of a locally used soybean landrace, known to farmers in Ogbomoso as “ewa bimpe”. The experiment was carried out at the Botanical Gardens of the Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso. The experiment was laid out in a completely randomized design (CRD), replicated four times. The soil was contaminated with industrial effluent at different concentrations (0%, 50%, and 100%). Cadmium (Cd), lead (Pb), and mercury (Hg) were detected in the effluents using an atomic absorption spectrometer. The results showed that the concentration of the effluent had a minimal effect on the plant, although a significant one ($P \leq 0.05$). Generally, the growth of the soybean planted on non-polluted soil significantly differed ($P \leq 0.05$) from that of the plant established on soil contaminated with 50% and 100% concentrations. The level of Cd (0.05 $mgkg^{-1}$) and Pb (0.04 $mgkg^{-1}$) uptake by the plants was higher, reducing its concentration in the soil. Landraces of other staple crops such as “ewa bimpe” show strong pollutant tolerance and uptake potential for phytoremediation. Considering their nutritional and economic value, they are ideal for low-resource environments. This study ideates the consideration of staple legumes as powerful tools for the recovery of the soil on arable land.

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sciforum-132593: Characterization of Selected Problem Soils in Capiz, Philippines: Basis for the Development of an Intervention Program

Richelle Mojica Gregore [1,*], Ryan Sarimong [2] and Angelica Celso [2]

[1] Research Assistant, Crop Science Research and Development Center, Capiz State University, Mambusao, 5807 Capiz, Philippines
[2] College of Agriculture and Forestry, Capiz State University, Burias, Mambusao, 5807 Capiz, Philippines

Soil survey and characterization were conducted in five identified locations in the province of Capiz, Philippines, to determine the occurrence of problem soils. Site description and soil profiling were done in each site. Soil samples were collected and processed. Soil physical properties that were determined included soil texture, soil structure, soil color, bulk density, and soil porosity. The chemical properties of soil analyzed were pH, soil organic matter, total nitrogen (N), available phosphorus (P), exchangeable potassium (K), calcium (Ca), magnesium (Mg), and electrical conductivity (EC). The microbial respiration rate was determined for the soil's biological properties. The physical, chemical, and biological properties of topsoil and subsoil of the five sites were interpreted using their means and compared with the established values for different soil parameters indicative of each problem soil. Results revealed that the site in Sitio Asag, Barangay Lonoy, Sapian, Capiz, qualified to be a saline soil because of its EC and pH values. The subsoil is a potential acid sulfate soil. The site in Sitio Cabugao, Barangay Burias, Mambusao, Capiz was confirmed to be a nutrient-depleted soil, particularly of N, P, K, Ca, and Mg. The site is also an acidic soil with very shallow true soil. The site in Sitio Proper, Barangay Duyoc, Dao, Capiz, was, at the time of sampling, not considered compact soil. However, the site has the potential tto become compact soil if the production practices remain the same or if not managed properly. The site in Sitio Agkawayan, Barangay Burias, Mambusao, Capiz, proved to be a strongly acidic soil and a nutrient-depleted soil. The site in Sitio Proper, Barangay Agloloway, Jamindan, Capiz, revealed degraded soil and is presently under the state of recovery. Hence, an intervention program was crafted to address the soil problems in each site.

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sciforum-127113: Comparative Analysis of Raw and Pre-processed MIR and Vis-NIR Spectra for Soil Property Estimation

Yasas Gamagedara [1,*], Gary Feng [2], Mary Love Tagert [1], Vitor S. Martins [1] and Nuwan K. Wijewardane [1]

[1] Department of Agricultural & Biological Engineering, Mississippi State University, MS 39762, USA
[2] United States Department of Agriculture – Agricultural Research Service, Genetics and Sustainable Agriculture Research Unit, Crop Science Research Laboratory, 810 Highway 12 East, Starkville, MS 39762, USA

The demand for cost-effective, high-throughput soil analysis is growing and can be addressed using diffuse reflectance spectroscopy in the visible–near-infrared (Vis-NIR) and mid-infrared (MIR) regions. This study compares the predictive performance of raw and pre-processed (baseline correction and standard normal variate) spectra from both MIR and Vis-NIR for estimating 11 soil properties: organic carbon (OC), total carbon (TC), total nitrogen (TN), cation exchange capacity (CEC), clay, sand, total solids (TS), pH, potassium (K), bulk density (BD), and nitrate-nitrogen (NO_3^--N). A dataset of 8,304 samples common to both spectral domains was selected from the USDA-NRCS Kellogg Soil Survey Laboratory library. The MIR spectra (2,500–16,260 nm) were collected using a Bruker Vertex 70 FTIR with HTS-XT, and Vis-NIR spectra (350–2,500 nm) using an ASD LabSpec. Eight machine learning models were evaluated. For MIR, spectral pre-processing improved prediction performance for all soil properties. The largest R^2 gains were observed for K (0.59 → 0.74), NO_3^--N (0.56 → 0.69), BD (0.53 → 0.59), and pH (0.84 → 0.87). Already strong models for OC, TC, TN, CEC, TS, and clay show further improvement (e.g., TN: 0.93 → 0.95; OC: 0.98 → 0.99). For Vis-NIR, preprocessing yielded more significant improvements. R^2 increased notably for clay (0.64 → 0.74), sand (0.50 → 0.67), silt (0.43 → 0.63), K (0.38 → 0.56), and pH (0.68 → 0.73). OC and TC maintained high predictability ($R^2 > 0.90$), while BD and NO_3^--N remained challenging ($R^2 \leq 0.56$). Overall, MIR outperformed Vis-NIR across all properties, and preprocessing notably enhanced model performance, for both spectral regions. ANN and CatBoost emerged as the most robust algorithms across both spectral regions and pre-processing conditions. These findings support the strategic use of MIR spectroscopy and pre-processing techniques to improve the reliability of soil property estimation in large-scale applications.

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sciforum-133226: Effect of organic and inorganic amendments on composition and stability of aggregates, and on soil organic carbon fractions in Lithuanian Retisol

Ameer Hamza [1, 2,*], Danutė Karčauskienė [3] and Mukkram Ali Tahir [2]

[1] Vezaiciai Branch, Intitute of Agriculture, Lithuanian Research Center for Agriculture and Forestry, Instituto al. 1, Akademija, 58344 Kėdainiai district.
[2] College of Agriculture, University of Sargodha, Sargodha, Pakistan, 40100
[3] Vėžaičiai Branch, Institute of Agricluture, Lithuanian Research Center for Agriculture and |Forestry, Instituto al. 1, Akademija, 58344 Kėdainiai district.

Soil particle aggregation and its stability are vital for maintaining soil health, ecosystem functioning, and sustainable land use largely governed by soil organic carbon (SOC). However, long-term strategies to enhance aggregation and carbon sequestration in naturally acidic soils remain insufficiently explored. This study presents a rare long-term field experiment, initiated in 1949 on Retisol (moraine loam) in western Lithuania, to evaluate the effects of liming, farmyard manure (FYM), and their combination on soil aggregation and carbon dynamics. Treatments included (T_1) Unlimed and Unfertilized (Control), (T_2) FYM at 60 t ha^{-1}, (T_3) lime at 3.5 t ha^{-1}, and (T_4) lime + FYM. Amendments were applied every five years. Soil samples from depths of 0 to 10 cm and 10 to 20 cm were analyzed for aggregate distribution via dry (nine fractions) and wet sieving (five fractions), and classified into macroaggregates, mesoaggregates, microaggregates, and silt-clay fractions. Mean weight diameter (MWD), water-stable aggregates (WSA ≥ 0.25 mm), and carbon fractions [SOC, permanganate oxidizable carbon (POXC), humic and fulvic acids] were measured. The combined application of lime and FYM (T_4) significantly improved soil structure, increasing macroaggregates by 32.81%, while reducing mesoaggregates (–21.47%), microaggregates (–34.70%), and the silt-clay fraction (–33.15%) relative to the control. T_4 also showed the highest WSA (18.59%) and MWD (22.30%), followed by T_3 (13.48% WSA, 12.60% MWD) and T_2 (10.29% WSA, 5.60% MWD). SOC was highest in T4, particularly in the silt-clay fraction (19.28% higher than T_1). POXC was highest in mesoaggregates (57%) and the silt-clay fraction (46%), while fulvic acid content decreased by 35% in the silt-clay fraction under T_4. These findings provide novel, long-term evidence that the integration of lime with organic amendments enhances soil physical structure and promotes aggregate-associated carbon stabilization in acidic soils offering a sustainable and climate-resilient soil management strategy.

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sciforum-132000: Effect of Organic and Mineral Fertilizers on Soil Physical Properties in an Arid Greenhouse Environment: Emphasis on Date Palm Waste Compost

Mira Merad [1,*], Kamel Guimeur [2] and Hanane Bedjaoui [1]

[1] Department of Agricultural Sciences, University of Biskra / Laboratory of Promotion of Agricultural Innovation in Arid Regions (PIARA), Algeria
[2] Department of Agricultural Sciences, University of Biskra / Laboratory of Ecosystem Diversity and Dynamics of Agricultural Production Systems in Arid Zones (DEDSPAZA), Algeria

Soil degradation is a growing concern, particularly in arid and semi-arid regions, where unsustainable agricultural practices often lead to a significant decline in soil fertility and structure. One of the major consequences of this degradation is nutrient depletion, which adversely affects crop productivity and ecological balance. In this context, sustainable soil management practices that restore soil health are of paramount importance. Among these, the use of organic amendments such as compost derived from agricultural residues particularly date palm waste offers a promising, eco-friendly solution. This study was conducted in a controlled greenhouse environment at the Department of Agronomic Sciences, University of Biskra, to evaluate the effect of different fertilization treatments on key physical soil properties. The treatments included palm-based compost, farmyard manure, and a commercial NPK mineral fertilizer. The parameters assessed were soil moisture content, bulk density, porosity, useful water reserve, and readily available water (RFU). Results showed that compost based on date palm residues significantly improved soil physical characteristics, particularly enhancing water retention capacity, increasing porosity, and reducing bulk density attributes that collectively promote better soil structure and microbial activity. These changes contributed positively to plant development. While NPK fertilizer improved plant growth, its impact on soil physical properties was relatively limited. Farmyard manure showed intermediate effects but was less effective than compost. Overall, this study highlights the potential of date palm compost as a sustainable and locally available soil amendment that not only supports plant growth but also contributes to long-term soil health and resilience in arid regions.

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sciforum-132397: Effects of Sawdust-fortified Topsoil on the Spouting rate, Growth and Development of Mini-stem Propagated Plantain Suckers.

Barakat Adeshola Adelubi * and IB Famuwagun

Department of Crop, Soil and Pest Management, Federal University of Technology Akure (FUTA), Akure 340282, Ondo State, Nigeria

The use of sawdust-fortified topsoil as a growing medium has emerged as a promising approach to promote increase in yield and promotion of sustainability in agriculture. Given that different crops have varying soil requirements, it is essential to determine the optimal ratio of sawdust to topsoil for each crop. This study investigates the effect of sawdust-fortified topsoil on the growth and development of mini-stem propagated plantain suckers, using the detached corm (split) technique—a macropropagation method used in generating healthy plantain mini-stems. This experiment compared the effect of varying ratios of topsoil (TS) and sawdust (SD), namely, 100TS (control), 50TS50SD, 60TS40SD, and 70TS30SD, on plantain mini-stems. Growth parameters recorded across five replicates per treatment included stem height, stem girth, leaf number, and leaf area. Data were analyzed using ANOVA via SPSS.

The result showed that all treatments positively influence growth parameters, with Treatment 4 (70TS30SD) showing the most significant effect on stem height, stem girth, and leaf area. This outcome is attributed to a balance ratio between sawdust and topsoil resulting to improved soil structure, balanced nutrient availability, optimal aeration, and water retention.

This study suggests that fortifying topsoil with sawdust, particularly at the ratio of 70TS30SD, can improve the sprouting rate, growth, and development of mini-stem propagated plantain suckers. This finding therefore presents a viable and sustainable alternative to traditional propagation media (i.e., topsoil only) in plantain production. It also provides farmers around tropical regions with a clear practical ratio to adopt.

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sciforum-134477: Engineered Biochar–Nanocomposites Enhanced Vetiver Growth and Nickel Uptake in Ni-Elevated Ultramafic Soils

Marilou M. Sarong [1,2,*], Paul Jhon G. Eugenio [3], Gerald Glenn A. Hernandez [4], Franz Marielle N. Garcia [1], Ariel G. Mactal [2], Fernan T. Fiegalan [2], Maria Luisa T. Mason [2] and Juvy J. Monserate [3]

[1] Crops and Resources Research and Development Center, Central Luzon State University
[2] Department of Soil Science, College of Agriculture, Central Luzon State University
[3] Department of Chemistry, College of Science, Central Luzon State University
[4] Department of Chemistry, College of Arts and Sciences, Batangas State University

Ultramafic soils, particularly those affected by mining activities, are often enriched with toxic levels of nickel (Ni), posing serious constraints to plant growth and ecosystem rehabilitation. This study evaluated the efficacy of engineered biochar–nanocomposite amendments in enhancing vetiver (Chrysopogon zizanioides) growth, biomass production, and Ni phytoextraction in Ni-elevated ultramafic soils. A pot experiment was conducted using soils collected from mined areas in Zambales, a region known for its extensive ultramafic landscapes and Ni mining operations. Seven treatment combinations were assessed: T1—No Application (Control); T2—Biochar Alone; T3—Nanocomposite Alone; T4—Biochar + Nano Silica; T5—Biochar + Nano Calcium; T6—Biochar + Nano Chitosan; and T7—Biochar + Nanocomposite. Among all treatments, **T4 (Biochar + Nano Silica)** resulted in the **highest biomass yield** (17.2 g pot^{-1}) and **maximum Ni phytoextraction** (31.6 mg Ni $plant^{-1}$), significantly outperforming all other treatments. Plants grown under T4 exhibited robust shoot and root development, and superior tolerance to Ni stress. Correspondingly, Ni accumulation in plant tissues was significantly higher in T4, suggesting enhanced metal uptake and translocation capacity. The synergistic effect of biochar and nano silica improved soil pH and nutrient availability, while also enhancing the bioavailability of Ni in the rhizosphere, promoting more effective uptake by vetiver. T7 (Biochar + Nanocomposite) and T6 (Biochar + Nano Chitosan) also contributed to improved growth and Ni uptake but were less effective than T4. The results demonstrate the potential of nano silica-engineered biochar as a low-cost, environmentally sustainable amendment for the phytoremediation of Ni-contaminated ultramafic soils. This study highlights the practical application of nanotechnology-enhanced phytoremediation strategies using locally available soil and plant resources to rehabilitate Ni-impacted mined lands in the Philippines.

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sciforum-136380: Enhancing Salinity Resistance in *Zea mays* through Biopriming with Pullulan from *Aureobasidium pullulans* and *Chlorella vulgaris*

Camila A. Vilca Pascuali [1,*], Gilberto Colina Andrade [1] and Ruly Terán Hilares [2]

[1] de Bioprocesos, Facultad de Ciencias Farmacéuticas, Bioquímicas y Biotecnológicas, Universidad Católica de Santa María—UCSM, Urb. San José s/n—Umacollo, Arequipa 04000, Peru.
[2] Bioprocess Laboratory - Faculty of Pharmaceutical, Biochemical and Biotechnological Sciences, Catholic University of Santa María—UCSM, Urb. San José s/n—Umacollo, Arequipa 04000, Peru.

Soil salinity poses a significant threat to agriculture by disrupting essential physiological processes in crops such as *Zea mays*. To address this challenge, the synergistic effect of the combined application of pullulan, an exopolysaccharide produced by *Aureobasidium pullulans* ATCC 42023, and the microalga *Chlorella vulgaris* was investigated to evaluate its potential as a biostimulant strategy to mitigate salt stress in maize. Pullulan was produced in a stirred-tank bioreactor (STR) using glucose as a carbon source at concentrations of 60, 80, and 100 g/L. The highest yield was obtained at 100 g/L, reaching a productivity of 0.28 g/g of substrate. The polymer was recovered via ethanol precipitation and characterized using FTIR spectroscopy. In preliminary bioassays, maize seeds were primed with pullulan solutions at concentrations of 0, 2.5, 5.0, and 10.0 g/L. The 2.5 g/L treatment significantly enhanced coleoptile and root elongation, while higher concentrations exhibited inhibitory effects. A salinity threshold of 300 mM NaCl was established to simulate salt stress conditions. To optimize the biopriming conditions, a Central Composite Design (CCD) was implemented, evaluating pullulan concentration (0.17–5.83 g/L) and microalgal biomass loading (3.4–116.5 mg). The resulting empirical model was statistically significant (p 0.001; R^2 = 0.9762), predicting that moderate levels of both biostimulants maximized seedling height. Conversely, excessive microalgae loading inhibited growth, likely due to reduced water availability at the seed surface. In conclusion, the combined application of pullulan and *Chlorella vulgaris* demonstrated a synergistic biostimulant effect under saline conditions, enhancing germination and early growth of Zea mays. This integrated biopriming approach offers a promising and sustainable strategy to alleviate salinity-induced stress in crop production systems.

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sciforum-139262: Isolation and Characterization of PGPR from Date Palm Rhizosphere in the Algerian Sahara: Insights into Soil Fertility and Stress Tolerance

Roumaissa Moulkaf [1,*], Tassadit Ait Kettout [2], Nassima Baha [1] and Massakib Bekkaye [1]

[1] Laboratory of Biology and Physiology of Organisms, Faculty of Biological Sciences, University of Sciences and Technology Houari Boumediene, BP 32, EL ALIA, 16111, Bab Ezzouar, Algiers, Algeria.
[2] Laboratory of Research on Arid Zones, Faculty of Biological Sciences, University of Sciences and Technology Houari Boumediene, BP 32, EL ALIA, 16111, Bab Ezzouar, Algiers, Algeria.

Plant growth-promoting rhizobacteria (PGPR) in arid environments such as the Algerian Sahara Desert have attracted increasing scientific interest due to their potential to improve soil fertility and crop productivity under extreme conditions. In these regions, oasis agroecosystems are characterized by low-nutrient soils, high salinity, and extreme temperatures, yet they support the growth of both date palms (*Phoenix dactylifera* L.) and other cultivated plants. This resilience suggests thatroot-associated microbial communities play a crucial role.

The aim of this study was to isolate and characterize the culturable bacterial communities associated with the rhizosphere and root endosphere of date palms growing in oasis soils. Using culture-dependent methods, we isolated a diverse collection of bacterial strains, with a predominance of genera such as *Bacillus*, *Pseudomonas*, and members of the *Actinobacteria* phylum. These isolates were screened for key PGPR traits, including inorganic phosphate solubilization, nitrogen fixation potential, and indole-3-acetic acid (IAA) production. In addition, their tolerance to abiotic stresses such as high salinity and temperature was evaluated.

Several isolates demonstrated antagonistic activity against *Fusarium oxysporum* under in vitro conditions, suggesting potential for use in biological control strategies. These findings highlight the capacity of date palm-associated bacterial communities to enhance soil fertility and support plant growth in harsh agroecological conditions.

Overall, the results show the importance of native PGPR in sustaining productivity in desert agriculture and offer promising prospects for the development of microbial biofertilizers and biocontrol agents adapted to arid environments.

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sciforum-138122: Landscape-Based Mitigation of Agrochemical Runoff in Erodible Agricultural Catchments: A Terrain and Soil-Driven Approach from the Idemili Watershed, Southeastern Nigeria

Nelson Nwobi

Department of Environmental Safety and Product Quality Management, Faculty of Environmental Engineering, Peoples' Friendship University of Russia (RUDN University), Moscow 117198, Russia

Introduction

Characterised by steep slopes and a humid tropical climate with intense seasonal rains, the Idemili Watershed is prone to soil erosion and agrochemical runoff. Land use and cover change, driven by agricultural practices and urbanisation, exacerbate these processes. This study seeks to evaluate landscape-induced agrochemical runoff potential and determine hotspot erosion zones within the watershed.

Methods

Geospatial and environmental modelling approaches were applied. A 10m Copernicus DEM, SoilGrids v2.0 (sand, silt, clay (SOC)) datasets, and Sentinel-2 images were downloaded. Field surveys and Google Earth were used to validate gully erosion points. The datasets were clipped to the extent of the watershed and projected to WGS 1984 UTM Zone 32N. Slope, Stream, and Power Index (SPI) and Topographic Wetness Index (TWI) were derived in ArcGIS Pro 3.4. The K-factor was estimated using soil texture. Google Earth Engine (GEE) was used to generate LULC classes, namely farmland, built-up, and other. Critical Runoff Source Areas (CRSAs) were determined using slope, SPI, and TWI. The final erosional risk map was produced through weighted overlay (CRSA: 40%, K-factor: 40%, LULC: 20%). The map was validated by overlaying existing gully erosion points.

Results

Elevation varied from 2 to 262m, with high SPI and erosion potential associated with the central steep slopes (up to 55.4°). TWI values highlighted areas of potential moisture accumulation. The silt and clay soils of the northeast and central areas displayed moderate-to-high erodibility over 78% of the watershed. Farmland and built-up land use covered more than 30% of the land area. Areas of high erosion risk (36.5%) and moderate vulnerability (41.6%) overlap with steep, farmed, erodible terrain.

Conclusion

The integrated geospatial approach enabled the identification of erosion hotspots and priority areas for agrochemical runoff. The results have practical implications for targeted and evidence-based interventions to address runoff problems and promote sustainable land use.

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sciforum-132487: Mapping soil salinity by integrating field EC measurements and Landsat-derived spectral Indices by cloud-based geospatial analysis

Saffi Ur Rehman [1,*], Zahid Maqbool [2] and Muhammad Adnan Shahid [2,3]

[1] College of Agricultural Science and Engineering, Hohai University, Nanjing 210098, China.
[2] Agricultural Remote Sensing Lab, National Centre for GIS and Space Applications (NCGSA), University of Agriculture, Faisalabad 38000, Pakistan.
[3] Department of Irrigation and Drainage, University of Agriculture, Faisalabad 38000, Pakistan.

Soil salinity is an essential constraint to sustainable crop production related to soil fertility, especially in arid and semi-arid regions. This study presents a data-driven approach for mapping soil salinity by integrating field-based electrical conductivity (EC) measurements with remote sensing and geospatial analysis in the district of Mandi Baha Uddin, Pakistan. Eleven georeferenced soil samples were collected and analyzed for EC (range: 0.59–1.06 dS/m), serving as training data for model calibration. Using Landsat 8 Surface Reflectance imagery within Google Earth Engine, spectral indices Normalized Difference Salinity Index (NDSI), Salinity Index (SI), and Brightness Index (BI) were extracted. Among various modeling approaches, a linear regression model was applied to these indices, revealing NDSI as the most significant predictor (coefficient = 3.862), while SI and BI showed negligible contribution. The model achieved moderate accuracy (R^2 = 0.526, RMSE = 0.089 dS/m). A Random Forest approach yielded higher training accuracy (R^2 = 0.811) but suffered from overfitting during cross-validation, indicating limited sample size constraints. The regression equation (EC = 3.862 × NDSI + 1.71) was applied in GEE to generate the EC prediction map. The resulting 30-meter resolution EC map was classified into FAO salinity categories and validated through independent field observations. This framework highlights the effectiveness of using freely available satellite data and cloud-based platforms like GEE for cost-effective soil salinity monitoring. This study provides a transferable methodology for precision agriculture, enabling informed land management and crop planning in salinity-affected regions.

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sciforum-132328: Methanotrophic consortium isolated from unique Chernevaya taiga soil and its feasibility in agrosoil

Liana G. Gogmachadze [1,*] and Irina K. Kravchenko [2]

[1] Lomonosov Moscow State University, Moscow 119991, Russia; Winogradsky Institute of Microbiology, Research Center of Biotechnology, Russian Academy of Sciences, Moscow 119071, Russia
[2] Winogradsky Institute of Microbiology, Research Center of Biotechnology, Russian Academy of Sciences, Moscow 119071, Russia

Methane, a potent greenhouse gas, is a significant contributor to global warming. One of the primary natural sinks for atmospheric methane is forest soils, which, teeming with special microorganisms, actively consume methane through a process called methanotrophy. However, this natural balance is being disrupted mainly by the conversion of forest lands into agricultural areas. This land-use change often leads to a reduction in the area covered by methane-consuming soils, exacerbating the overall methane emissions problem.

Chernevaya Taiga is a unique forest ecosystem in Siberia, known for intense microbial activity related to the nitrogen and carbon cycles. However, studies focusing on methane cycling and the isolation of methanotrophs within these forests have not been conducted. We hypothesized that active methanotrophs might be present in these soils with specialized adaptations to harsh environmental conditions.

We isolated methanotrophic consortium; T1 exhibited exceptionally high methane oxidation rates from the dark gray soil of the Chernevaya taiga, Tomsk region. 16S rRNA gene profiling revealed the predominance (74%) of *Methylocystis*. It was established that the introduction of the T1 into the agrosoil with low methane oxidation activity resulted in an increased methane uptake rate. Furthermore, measuring the accumulation of CO_2 in the samples correlates well with the methane oxidation rate and confirms the high activity of the introduced culture as a methane sink. Nevertheless, the number of 16S rRNA gene copies reached 3.9×10^9 and changed minimally over a period of four weeks. Concurrently, the number of *pmo*A gene copies remained at a relatively high level of 8.81×10^5 – 1.47×10^6, which indicates the significant presence of methanotrophs within the agrosoil microbial community.

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sciforum-138983: Population of Fungi and Bacteria in Alfisols is Dependent on Seasonal Changes, Poultry Manure Application and Cowpea Varieties

Oluwaseyi Lola Awoyomi [1,*], Folasade Christianah Olaoye [2], Olajire Fagbola [2], Abisoye Oyepero Oyepero [1], Olutoye Olushola Fashola [1], Best Chidiebere Anukwu [1], Joseph Oluwabusayo Amao [3], Bisola Khadijat Oladimeji [1], Bolaji Elizabeth Oyekan [1] and Aderonke Esther Agunbiade [1]

[1] National Centre for Genetic Resources and Biotechnology (NACGRAB), Apata, Ibadan, Oyo State 200262, Nigeria
[2] University of Ibadan, Ibadan, Oyo State 200284, Nigeria
[3] National Biotechnology Research and Development Agency (NBRDA), Abuja 900211, Nigeria

Abstract

Soils and cowpea are known to harbour microbes thatproduce hormones and other chemicals that help to stimulate plant growth. A field experiment was carried out on an Alfisol to determine the effects of poultry manure application and cowpea varieties on microbial population density during two seasons (dry and wet). The experiment followed a split-plot design and was arranged in a Randomised Completely Block Design (RCBD) with three cowpea varieties (FUAMPEA 1, FUAMPEA 2 and ITO7K-318-33) and three rates of poultry manure, 0t/ha, 2t/ha and 4t/ha, and replicated thrice. Soil samples were collected before and after planting at intervals of 2, 4, 6 and 8 weeks after sowing (WAS) for fungi and bacteria population density during the two seasons.

The results indicated that there were significant differences in population densities of fungi and bacteria under rates of poultry manure application and a preference for cowpea varieties at different weeks after sowing (WAS) and season. Fungus population increased weekly with the poultry manure application of 2t/ha during the dry season, 2t/ha had the highest fungus population density of 6.0 x 10^4 CFU/g of soil at 6WAS with ITO7K-318-33 and the control had the smallest fungus population density of 6.0 x 10^3 CFU/g of soil with FUAMPEA 2. The bacteria population was highest with a population density of 8.5 x 10^6 CFU/g of soil under the application of 4t/ha poultry manure at 6WAS with FUAMPEA 2. In the wet season, 2t/ha had the highest bacteria population of 8.5 x 10^6 CFU/g of soil with FUAMPEA 2 at 4WAS and 2t/ha with FUAMPEA 2 had the highest fungus population density of 4.0 x 10^4 CFU/g, while ITO7K-318-33 and FUAMPEA 2 gave the lowest with the control.

Hence, the populations of bacteria and fungi in Alfisols were influenced by the seasons, selected based on preference and compatibility with cowpea varieties and rates of poultry manure applications.

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sciforum-122362: Potential And Management Of Agrowastes In Agricultural Production In Nigeria

Ayeni Leye Samuel

Department of Agricultural Science; Adeyemi Federal University of Education; Ondo; Nigeria

Nigeria is an agrarian society with various crops and animals, leading to the production of enormous wastes from agriculture known as agro-wastes. This paper examined the types and amount of agro-waste generated and the effects of agricultural by-products on man, the environment, and soil health, as well as the various management practices targeted at improving soil health and crop yield. The country produces agro-wastes based on geographical locations, and the management practices are different from one location to the other. The outstanding waste management practices include farmers' simulation methods and integrated plant nutrition management, which involves the combined use of various agro-wastes and mineral fertilizers, compost making, farm yard manure, dumping of refuse inside gutters or streams, and burying of agro-wastes. Among all the agro-waste management strategies identified, controlled burning of the agro-wastes, the use of organomineral fertilizers and manufactured organic fertilizers or bio fertilizers, and compost making, as means of reducing agro-waste's negative effects on humans, water bodies, and the environment, are recommended.

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sciforum-132694: Precision Fertilization of Zea mays L. Using an Autonomous UGV: Real-Time Soil Nutrient Mapping with Embedded Sensors and AI

Lalo Villacorta Garcia [1,*], Adrian Dominique Medrano Reyes [1], Miguel Alfonso Lara Quispe [1] and Julian Chura Chuquija [2]

[1] Faculty of Engineering, School of Mechatronics Engineering, Universidad Peruana de Ciencias Aplicadas (UPC), Lima 15023, Peru
[2] Universidad Nacional Agraria La Molina, Ap. 456, Lima, Perú

Current fertilization practices in the country rely on generalized, empirical methods, resulting in inefficient input use and suboptimal crop management. The high cost and limited spatial resolution of traditional soil analysis restrict farmers' ability to optimize fertilization in maize fields. This project proposes an autonomous unmanned ground vehicle (UGV) for characterizing soil fertility and nutrient content in Zea mays L. (hard yellow maize), a crop critical to Peru's food security.

The system integrates low-cost sensors to measure pH, electrical conductivity (EC), and nitrogen, phosphorus, and potassium (NPK) levels in maize fields. These sensors are calibrated using a machine learning model based on Random Forest, trained with soil samples analyzed at the **Instituto Nacional de Innovación Agraria (INIA)**. To enable sampling, a mechanism was developed that combines a rotary auger—capable of drilling up to 15 cm—and a vertical displacement system that positions the sensor in the soil. This mechanism also ensures operation in compacted soils, protecting the sensor needles. The sampling system is mounted on a mobile platform equipped with GPS-RTK for geolocation and a ZED stereo camera for autonomous navigation and environmental perception.

The UGV collects measurements across the field and transmits data in real time to a digital platform that generates fertilization maps and reports. The goal is to provide farmers with an accessible tool for improved fertilization decision-making in hard yellow maize cultivation. Field tests at Universidad Nacional Agraria La Molina—including comparisons between sensor data and laboratory analyses—demonstrate the feasibility of autonomous operation and the system's effectiveness in assessing soil fertility under real conditions.

This innovation fosters the adoption of autonomous robotics for sustainable agriculture, with strong potential to increase yields, improve fertilizer efficiency, and support national food security.

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sciforum-129033: Production Performance, Heavy Metal Dynamics in Soil, and Uptake of Selected Crops Following Treatment with Different Forms of Compost-based Soil Amendment

RYAN T. Sarimong [1,*], Salvacion J. Legaspi [1] and Felomino C. Llorico [2]

[1] College of Agriculture and Forestry, Capiz State University, Burias, Mambusao, 5807 Capiz, Philippines
[2] Crop Science Research and Development Center, Capiz State University, Mambusao, 5807 Capiz, Philippines

Ensuring food security and safety by guaranteeing the quality of inputs that enter the crop production continuum is an important aspect of research and development. It is based on this premise that this research investigation was conducted, cutting across the foregoing areas of concern. This study aimed to determine the effect of compost-based soil amendments applied in various forms on the production performance, the lead (Pb) and cadmium (Cd) dynamics in soil, and the uptake of selected crops. Field experiments were established using four selected food crops: radish (*Raphanus sativus*), cucumber (*Cucumis sativus*), sweetcorn (*Zea mays var. saccharata*), and kangkong (*Ipomoea reptans*) treated with different forms of compost-based soil amendment, namely vermicast, vermi tea, and ordinary compost following a Randomized Complete Block Design with three replications. Standard cultural management practices for the culture of each crop were followed. Growth and yield data were gathered for each crop and analyzed statistically. The initial concentrations of Pb and cadmium Cd in thesoil in the experimental area were recorded. The soil was also sampled at the end of every cropping season to determine the changes in the Pb and Cd level. The different economically important parts of the crop were subjected to plant tissue analysis to determine the heavy metal (Pb and Cd) uptake. The results revealed that better growth and yield of radish, cucumber, sweetcorn, and kangkong were attained with the application of vermicast. Application of solid forms of compost-based soil amendment, namely vermicast and ordinary compost, favored net accumulation of Pb in soil grown with radish and cucumber, while vermi tea application favored net uptake. There was net accumulation of Pb in soil in which sweetcorn was grown, regardless of the form of compost that was applied. Kangkong proved to be a hyperaccumulator plant in terms of Pb uptake regardless of the compost used.

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sciforum-137852: Rhizosphere Soil Properties of Peanut (*Arachis hypogaea* L.) Growing Under Field Conditions in Southern Algeria.

Oulad Heddar Meriem [1], Kraimat Mohamed [2,*], Laouar Bouchra [3], Souilem Zineb [1], Labgaa Imene [1] and Bissati Samia [4]

[1] Département de Biologie, Faculté des Sciences de la Nature et de la Vie et Sciences de la Terre, Université de Ghardaïa, 47000, Algeria.
[2] Laboratoire de Valorisation et de Conservation des Ecosystèmes Arides, Université de Ghardaïa, 47000, Algeria.
[3] Laboratoire des Matériaux, Technologie des Systèmes Energétiques et Environnement, Université de Ghardaïa, 47000, Algeria.
[4] Laboratoire Bioressources Sahariennes, Université Kasdi Merbah, Ouargla, 30000, Algeria.

The rhizosphere, a confined area of soil plant roots, is an intersection of microbial activity and root exudates. Known as the rhizosphere effect, this phenomenon plays a crucial role in crop yield and sustainable agricultural management by providing nutrients, producing beneficial compounds, or controlling pathogens. Using a geostatistical approach, this study aimed to analyze the effect of peanut cultivation on soil quality improvement by comparing the physicochemical characteristics of rhizosphere and bulk soils in the Ghardaïa regions from southern Algeria. Samples of rhizosphere and bulk soils were prospected using a systematic plan. Subsequently, the pH, electrical conductivity, calcium carbonate, organic matter, total nitrogen, available phosphorus, total potassium, and soluble sodium were determined for each soil (rhizosphere and bulk soil). The results showed that both types of soils were moderately alkaline, with a reduction of 5.52% in the pH of the rhizosphere compared to the bulk soils. Soils were relatively low in organic matter, with only 3.3% of soils having organic matter levels above 20 $g.kg^{-1}$. However, organic matter contents were consistently higher in the rhizosphere (8.51 ± 0.46 $g.kg^{-1}$) than in the bulk soil (6.78 ± 0.68 $g.kg^{-1}$). In the rhizosphere, an increase of 10% in labile phosphorus was noted. Total nitrogen was increased by 52.57%. T-tests suggested no significant difference in potassium and sodium levels, and they were moderately present in both soils. Significantly positive relationships were noted between electrical conductivity and soluble sodium (p0.001). However, negative correlations were revealed between pH and organic matter ((p0.01) and pH and total nitrogen (p0.01). These results indicate the effects of rhizosphere interactions on soil properties improvement and their implications for sustainable agricultural practices. Incorporating peanut cultivation into crop rotation systems enriches the soil with nutrients, reduces agricultural carbon footprints, and helps farmers maintain soil quality in arid regions.

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sciforum-134179: Silent Disappearance: Observations on the Decline of Black-Colored Earthworms in Uttarakhand Paddy Fields

Bhawna Joshi

Independent researcher ,haldwani Uttarakhand India

Earthworms, often described as "ecosystem engineers," play a foundational role in maintaining soil health by enhancing aeration, organic matter breakdown, and natural fertilization. Their presence is commonly used as a biological indicator of soil quality and biodiversity. However, recent field-based observations in the Devalchaur region of Kaladhungi, Nainital district (Uttarakhand), reveal a concerning decline in the population of black-colored earthworms, especially during the rainy season when they were once commonly seen surfacing in abundance.

This observational study was conducted during the months of May and June 2025, involving repeated field visits and informal interactions with local farmers. Most farmers reported that over the past 4–5 years, the presence of earthworms has drastically reduced in their paddy fields. They linked this decline with a sharp increase in chemical fertilizer usage, compared to earlier years when agricultural practices were more organic and less input-intensive.

The study also noted that even after significant rainfall events, which previously led to visible earthworm activity on the soil surface, no such patterns were observed. Soil across several fields appeared compacted and less porous and showed signs of low organic content, all of which are unfavorable to earthworm survival. The shift from traditionally balanced agro-ecosystems to chemically driven monoculture farming appears to be playing a significant role in the observed decline.

These findings suggest that the disappearance of earthworms may be an early indicator of broader ecological imbalance and soil degradation. The study underscores the urgent need for in-depth ecological assessments and a shift toward sustainable agricultural practices to restore soil biodiversity and long-term fertility.

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sciforum-130369: Soil Chemical and Microbial Responses to Cover Crops as Alternatives to Plastic Mulch in Southern Californian Strawberry Fields

Savanah Senn [1,*], Robert Pelka [2], Les Vion [1], Kaitlyn Satter [3], Willy Cortez-Zarate [1], Brianna Zimmerman [1], Marzen John Abala [1] and Arianna Bozzolo [4]

[1] Los Angeles Pierce College Department of Agriculture Sciences, Plant Science program, Woodland Hills, CA, 91371, USA
[2] Los Angeles Pierce College, Department of Physics and Planetary Sciences, Woodland Hills, CA 91371, USA
[3] Los Angeles Pierce College Department of Agriculture Sciences, Plant Science program, Woodland Hills, CA 91371
[4] Rodale Organic Institute, California Organic Center, Camarillo, CA, 93010, USA

This study evaluated soil health in response to five cover treatments at Rodale Institute California Organic Center (Camarillo, CA) during the 2023–2024 strawberry growing seasons. The goal of the Institute was to identify sustainable alternatives to plastic mulch by examining edaphic properties under the different cover crop treatments: Perennial White Clover, Buckwheat and Peas, and Sorghum and Peas (112 kg/ha and 224 kg/ha); polyethylene plastic film mulch was the control. Soil sampling occurred in February of Year 2 of this study, immediately prior to the spring strawberry season.

At Pierce College, organic matter was determined by dry combustion, percent moisture by the oven dry method, N, P, and K by spectrophotometry using Hach reagents, TDS of soil filtrate using a ThermoFisher meter, and pH using a ThermoFisher meter and 1:5 water. Preliminary data analysis was carried out in Excel. PLFA was carried out by Trace Genomics, and diagnostics were visualized with TraceView.

Results showed that Buckwheat and Peas had the highest organic matter (3.2%) and favorable moisture and phosphorus levels. Sorghum and Peas at 112 kg/ha had the highest potassium (250 ppm) and phosphorus levels (45 ppm). Perennial Clover exhibited the highest nitrogen concentrations (17–19 ppm) and low pH, making it a suitable alternative to plastic where nitrogen is prioritized. Sorghum–Peas at 224 kg/ha displayed the highest mycorrhizal fungi levels, elevated pH (7.95), and high TDS, but also increased Phytophthora fragariae.

A bulked PLFA (Phospholipid Fatty Acid) analysis at the end of Year 2 indicated that the Buckwheat–Peas plots had the lowest levels of Phytophthora spp., while Plastic and White Clover showed the highest Phytophthora cactorum and Verticillium levels, respectively. Oxygen availability was similar across treatments, slightly below the benchmark (~75%).

Buckwheat and Peas and Sorghum–Peas (112 kg/ha) show promise as alternatives to Plastic for moisture retention and fertility, while Perennial Clover may be more suitable where nitrogen is a concern. Disease suppression and salt accumulation varied among treatments.

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sciforum-136251: Spatiotemporal Assessment of Soil Erosion in the Dhansiri River Basin Using the RUSLE and Geospatial Techniques

Salam Lamyanba Luwang [1,*], Imyanglula Imyanglula [1], Kedovito Chasie [1], Grace Nengzouzam [1], Prabhakar Sharma [1] and Chitrasen Lairenjam [2]

[1] Department of Agricultural Engineering, School of Engineering and Technology, Nagaland University, Kohima Campus, 797004, Meriema, Nagaland, India
[2] Department of Agricultural Engineering,School of Agricultural Sciences,Medziphema,Nagaland University,797106,Nagaland,India

Soil erosion remains a critical concern in the northeastern hill regions of India, threatening soil productivity and watershed sustainability. This study employs the Revised Universal Soil Loss Equation (RUSLE) model, integrated with remote sensing and Geographic Information System (GIS) data, to evaluate the spatial and temporal soil erosion patterns in the Dhansiri River Basin from 2010 to 2023. The rainfall erosivity (R) factor was computed using Indian Precipitation Ensemble Dataset (IPED) rainfall data, which has a 0.1° resolution, while the topography/Length–Slope (LS) factor was derived from a 30 m resolution Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM). The Soil Erodibilty (K) factor was estimated from SOILGRIDS-based texture and organic matter parameters, and the Crop management (C) factor was generated from MODIS-derived NDVI composites. Land use/land cover (LULC) classification determined the P-factors, assuming little conservation. The estimated average annual soil loss for the basin was almost 34.6 t ha^{-1} yr^{-1}, exceeding the acceptable limit of 25 t ha^{-1} yr^{-1} for mountainous areas. The peak annual soil loss was documented in 2017 (56.01 t ha^{-1} yr^{-1}), whereas the minimum was noted in 2010 (16.97 t ha^{-1} yr^{-1}). Spatial classification indicated that 45.07% of the basin area is subject to Slight erosion (0–5 t ha^{-1} yr^{-1}), whereas 6.94% is categorized as experiencing Extremely Severe erosion (>80 t ha^{-1} yr^{-1}). The integration of the RUSLE with GIS tools demonstrated efficacy in identifying erosion-prone areas and provides essential insights for the development of focused, evidence-driven conservation strategies. These findings establish a scientific basis for formulating sustainable soil and water management strategies for implementation in the Dhansiri River Basin.

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sciforum-131676: Temperature Impact on Soil Bacterial Diversity During Early Decomposition Stage of Aspen Litter

Irina Konstantinovna Kravchenko

Winogradsky Institute of Microbiology, Research Center of Biotechnology, Russian Academy of Sciences (RAS), Moscow 119071, Russia

The biogeochemical cycling of elements in the environment is significantly influenced by litter decomposition in terrestrial ecosystems; yet, little is known about the processes involved in the early phases of litter decomposition in temperate forest ecosystems. Because forest ecosystems' soil organic matter is so sensitive to temperature increases, it is particularly vulnerable to the effects of global warming. We evaluate how aspen litter (leaves and twigs) affects the activity and quantitative traits of soil microbial communities under climate change-modeling circumstances. In order to conduct the studies, samples of gray forest soil from the Moscow region's typical forest biocenosis in Europe were used. Crushed leaves and twigs were applied to soil samples at a rate of 0.5% by weight during a 28-day incubation period at constant temperatures of 5, 15, and 25°C. CO_2 emissions, organic carbon, and the amount of microbial biomass were assessed in relation to the quantity of ribosomal genes found in bacteria, archaea, and fungi. The ideal temperature for the plant litter's breakdown was determined to be 15°C, and both decreases and increases resulted in a less severe litter degradation process. When plant wastes were applied, the temperature sensitivity of the soil respiration process increased significantly in the 5–15°C temperature range, and the temperature coefficient Q10 rose from 1.75 to 3.44–3.54. Incorporating plant leftovers promoted the breakdown of soil organic matter at elevated temperatures. The number of bacteria, fungus, and microbial biomass did not alter much. The bacterial and archaeal succession was investigated using a MiSeq sequencing technique using ribosomal markers in order to gain a thorough understanding of the initial phases of aspen litter decomposition. Bettaproteobacteria, Bacteroidetes, Firmicutes, and Acidobacteria were among the fast-cycling microorganisms that were present during the early phases of decomposition. This succession was probably caused by a decline in readily degradable carbohydrates. The results gained can be utilized in predictive models of plant litter decomposition processes and soil organic matter dynamics in Eurasian forest biocenoses under climate change, improving our understanding of soil carbon dynamics.

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sciforum-132614: The legacy effects of fertilization: Revealing known Knowns and known unknowns in depth-dependent soil carbon dynamics

Prabhsimran Singh [1, 2]*, Gurmeet Singh Dheri [1] and Gazala Nazir [1]

[1] Department of Soil Science, Punjab Agricultural University, Ludhiana 141004, Punjab, India
[2] Department of Plant and Environmental Sciences, Clemson University, Clemson, SC 29634, USA

How do long-term fertilization practices alter the channelling of carbon into its fractions across different layers of the soil profile? The potential of soil to sequester carbon is largely determined by how carbon is stored in its fractions. While numerous long-term fertilization studies have investigated carbon fractions, most have primarily focused on the surface soil. Consequently, the extent to which these fertilization practices impact carbon fractions at greater depths within the soil profile remains largely unexamined. This study investigates the impacts of different fertilization practices (100% N, 100% NPK, 150% NPK and 100% NPK+FYM) on different carbon fractions in the deeper layers of soil (0-100cm). The soil samples were collected from an ongoing 51-year long-term experiment that was started in 1971. This study determined total SOC and its fractions including particulate organic matter (POM), light and heavy fraction carbon (LFC and HFC), aggregate associated C, acid hydrolyzable and non-hydrolyzable C (AHC and ANHC), dissolved organic carbon (DOC), fractions of different oxidizability and microbial biomass carbon (MBC). The results showed that 100% NPK+FYM has the highest TSOC stocks up to 100 cm depth. Moreover, 100% NPK+FYM consistently enhanced labile carbon fractions throughout the soil profile (0-100 cm). While all fertilization treatments generally increase carbon fractions, their positive impacts on particulate and density-based organic carbon fractions diminished significantly with increasing soil depth, particularly below 30 cm. Ultimately, our research demonstrates that carbon sequestration and its subsequent persistence in agricultural soils necessitates integrated nutrient management, as evidenced by the sustained positive impact of 100% NPK+FYM on diverse carbon fractions throughout the soil profile, whereas the benefits of chemical fertilizers alone become limited with increasing depth.

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sciforum-141672: Transforming Early Growth of Cruciferous Vegetables with Biochar

Rofiqul Islam Nayem *, Md. Touhidul Islam Sourav and Dr. Mohammad Nuruzzaman

Department of Agriculture, Noakhali Science and Technology University, Noakhali 3814, Bangladesh

This study investigates the effects of maize straw biochar application on the early growth of broccoli and cauliflower under coastal conditions in Southern Bangladesh. The experiment was conducted at Noakhali Science and Technology University over the winter cropping season (December–March), using a randomized complete block design with five biochar treatments (0, 2, 4, 6, and 8 tons/ha) applied before transplanting. Growth parameters, such as plant height, leaf number, and leaf breadth, were measured at 15 and 35 days after transplanting (DAT). Statistical analysis using R programming and two-way ANOVA revealed significant effects of crop type and biochar application. At 15 DAT, crop type influenced plant height, while biochar significantly enhanced plant height and leaf breadth by 35 DAT, though its effect on leaf number was transient. The transient nature of biochar's effects on leaf number and plant height emphasizes the importance of crop type and timing of the application. Final biomass and yield assessments are part of the full-season study and will be presented in subsequent publications, complementing these early growth findings. These findings provide insights for optimizing biochar use in sustainable agriculture in salinity-prone coastal regions.

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sciforum-139014: Vineyard Restructuration Using Organic–Inorganic Fertilizers and Biostimulants

Vasileios Stylianos Kyriatzis [1,*], Konstantinos Zoukidis [1,2], Christos Kissoudis [1] and Athanasios Gertsis [1]

[1] Department of Sustainable Agriculture and Management, Perrotis College, Thessaloniki, Greece
[2] Department of Agriculture, International Hellenic University, Thessaloniki, Greece

The problem of vineyard restructuration is that it is a very difficult and time-consuming process. This research investigates a quicker way of replanting an old vineyard using organic–inorganic fertilizers and biostimulants. Specifically, in the experiment, we used a common chemical fertilizer 8-8-8+M.C, an organic fertilizer from leonardite, and two products with beneficial microorganisms (one with mycorrhiza, “Click Nature”, and one with mycorrhiza and trichoderma, “Click Horto”). The process also involved the cleaning of the field of any old vines, a soil analysis, and an analysis for nematodes to determine the soil condition. The old variety consisted of the French variety, Chardonnay, and the new Greek variety, Vidiano, with the rootstock 140RU VCR120. Each treatment was evaluated depending on the plant height, branching ability, leaf size, chlorophyll (SPAD units), and normalized difference vegetation index (NDVI). In addition, verification analyses were performed (soil analyses and qPCR) to examine, in further detail, each treatment and its effect, aiming for an accurate comparison. The qPCR (QLAZEN DNeasy PowerSoil Pro Kit) results showed that the treatment “Click Horto” (mycorrhiza and trichoderma), even though it created an antagonistic condition, resulting in overall lower microbial activity (LI-COR LI-6800 soil CO_2 flux chamber), achieved better plant establishment and development while simultaneously achieving better soil fertility than the other treatments. Moreover, the organic fertilizer achieved higher microbial biodiversity and activity while maintaining a satisfied level of plant development. On the contrary, the chemical fertilizer managed to affect soil health negatively by increasing the soil E.C by 18.1%, total $CaCO_3$ by 41.1%, and decreasing the organic matter (-11.3%) and microbial activity–biodiversity when compared to other treatments. Finally, this research suggests that vineyard restructuration with the use of the “Click Horto” product could be performed in a quicker and more sustainable and environmentally friendly way by improving the soil health and microbial activity.

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Session 8. Crop Production

sciforum-135060: Effects of Foliar Application of Varying Levels of Paclobutrazol on the Morphological Response of NSIC SP 30 Sweet Potato Variety (*Ipomoea batatas* L.) under Waterlogged Conditions

John Mark R. Francisco, Anna Lea M. Layola *, Mary Grace R. Magluyan and Marilyn M. Belarmino

[1] Department of Horticulture, Faculty of Agriculture and Food Science, Visayas State University, Baybay City, Leyte 6521-A
[2] Office of the Graduate Education, Visayas State University, Baybay City, Leyte 6521-A

The Philippines, being highly prone to natural hazards, is frequently struck by typhoons. In Region VIII, Eastern Visayas, the major islands of Samar and Leyte lie within the infamous typhoon belt. These areas are repeatedly battered by strong winds, storm surges, and heavy rains, often resulting in floods that damage a significant portion of productive land. Flooding caused by intense rainfall poses a serious threat to the fresh market production of sweet potato in the region. In response, this study aimed to evaluate the morphological responses of *Ipomoea batatas* L. var. NSIC SP 30 (Sweet Potato) to foliar applications of paclobutrazol (PBZ) under waterlogged conditions. The experiment was conducted at the BL2 Greenhouse of the Philippine Root Crops Research and Training Center (PRRTC), Visayas State University, Baybay City, Leyte, from March 14, 2025, to May 17, 2025. A Randomized Complete Block Design (RCBD) was employed with five treatments: 0 ppm (control), 25 ppm, 50 ppm, 75 ppm, and 100 ppm PBZ, each replicated three times. Plants were subjected to continuous waterlogging, submerged in a basin with water, and observed for four weeks.

Vine diameter, petiole length, and lateral branches exhibited no significant differences. PBZ treatments significantly affected vine length, internode length, number of leaves, and leaf length and width. The control group produced the most vigorous vegetative growth; however, the 75 ppm PBZ treatment maintained comparable shoot and root biomass, with a fresh root weight of 18.71 g, fresh shoot weight of 92.86 g, oven-dried root weight of 1.81 g, and oven-dried shoot weight of 24.89 g, despite its reduced shoot elongation. Higher PBZ levels, especially at 100 ppm, caused excessive growth suppression, leading to reduced biomass and poor root development. Economically, cost and return analysis indicated that PBZ-treated plants achieved higher net income per hectare compared to the untreated control. Foliar application of 75 ppm PBZ was found to be the most effective and economical treatment, promoting stress resilience while maintaining productive growth, making it a viable option for agricultural areas prone to waterlogging.

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sciforum-111149: Exploring Vertical Farming as an Innovative Solution for Urban Crop Production

Muhammad Asim [1], Mian Muhammad Ahmed [2, 3,*], Muhammad Saud Khan [4], Pan Zhiyong [5] and [6]

[1] National Key Laboratory for Germplasm Innovation and Utilization of Horticultural Crops, Huazhong Agricultural University, Wuhan, 430070, Hubei, China
[2] College of Life Science and Technology, Tarim University, Alar Xingjiang, China
[3] National and Local Joint Engineering Laboratory for High-Efficiency and High-Quality Cultivation and Deep Processing Technology of Characteristic Fruit Trees in Southern Xinjiang, China
[4] College of life Science and Technology, Tarim University, Alar, Xinjiang, 843301, China
[5] College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, P.R. China
[6] National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizhishan Street, Hongshan District, Wuhan, Hubei, 430070 China.

With urban populations rapidly increasing, the demand for efficient, sustainable food production in cities is becoming more urgent. Traditional agriculture struggles to meet the needs of urban areas due to limited land and environmental concerns. Vertical farming (VF), which utilizes stacked layers and controlled environments to grow crops, presents a potential solution. This study evaluates the viability of VF through a combination of data collection from urban farms using hydroponic and aeroponic systems, along with a review of existing case studies. Key metrics such as water usage, crop yields, energy consumption, and economic costs were analyzed across multiple VF operations. Advanced technologies like artificial intelligence and automation were also examined for their impact on yield optimization. Vertical farming systems demonstrated a 90% reduction in water usage compared to traditional farming methods. Additionally, AI-driven systems were found to increase crop yields by 30-50% by optimizing environmental conditions. Initial setup costs ranged between USD 50,000 and USD 200,000 per facility, with long-term benefits such as reduced transportation costs and job creation offsetting the initial investment. VF also contributed to increased local food security, particularly in urban food deserts. Despite challenges such as high energy consumption and technological complexity, vertical farming has the potential to revolutionize urban agriculture. It offers a sustainable, efficient solution to food production in cities, contributing to food security and resilience. Vertical farming could play a crucial role in addressing the future food demands of urban populations, offering a transformative approach to urban agriculture.

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sciforum-127923: Genetic variability and trait association in Oleiferous brassica for identifying potential genotypes fit for T-Aman and Boro rice cropping window

Ahmed Khairul Hasan [1], Mahadi Hasan Monshi [2,*], Muntarina Hussan Mouri [3], Fakhrul Islam Monshi [4] and Rehenuma Tabassum [3]

[1] Department of Agronomy, Bangladesh Agricultural University, Mymensingh -2202, Bangladesh
[2] Department of Economics, University of Chittagong, Chittagong-4331, Bangladesh
[3] Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh
[4] Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Cultivating oleiferous brassica species, including rapeseed and mustard, is essential for increasing edible oil production in Bangladesh. However, the expansion of its cultivation faces challenges due to the dominance of rice-based cropping patterns. The present study evaluated 30 genotypes of *B. campestris*, *B. napus*, and *B. juncea* over two growing seasons (2022-2023 and 2023-2024) in Gazipur, Bangladesh, to identify short-duration high-yielding genotypes that are fit for cultivation in the 70-80-day gap between T-Aman and Boro rice cropping windows. An analysis of variance (ANOVA) revealed significant genetic effects (p 0.001) for most traits, with no substantial differences between years. High genotypic coefficient of variance (GCV) and phenotypic coefficient of variance (PCV) values were observed for traits such as pods on secondary branches, secondary branches, mature pod plants^{-1}, and pods on primary branches, indicating consequential genetic control and selection potential. Correlation analyses demonstrated that grain yield was positively and significantly associated with biomass (BIO; r = 0.92***), thousand grain weight (TGwt; r = 0.87***), and phenological traits such as days to flowering and days to maturity, indicating their importance in selection. Among the four clusters, the highest yield-producing genotypes were grouped in Cluster III, while early flowering genotypes formed in Cluster II. Principal component analysis explained over 63% of the total variation, capturing heritability-controlled traits (grain yield, biological yield, mature pod plants^{-1}, pods on primary branches, and days to maturity) in PC1, whereas environmentally influenced traits (pod length, harvest index, and oil content) were in PC2. Heatmap analysis further confirmed distinct trait patterns, aiding in selecting specific genotypes with early flowering and high yield. Genotypes G12 (TH-2) and G6 (SAU Sarisha-1) produced moderate yields (average 1.79 and 1.75 t ha^{-1}, respectively) in the shortest possible time (average 78.81 and 76.79 days, respectively), making them suitable for cultivation in a gap between the popular T-Aman and Boro rice cropping window. These findings provide valuable insights to support sustainable agriculture and enhanced farmer profitability.

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sciforum-127766: Morpho-Biochemical Responses of Sugarcane Varieties to Salinity Stress During Formative Growth

Dr. Shakuntala Rao

Department of Biotechnology; I.K. Gujral Punjab Technical University; Jalandhar, Punjab; India

Sugarcane, a key tropical cash crop, suffers significant yield losses in arid regions due to soil salinity stress. This study evaluated ten sugarcane varieties under normal and saline soils to identify salt-tolerant genotypes. Key morphological traits (shoot height, green leaf count, leaf area) and biochemical parameters (protein, amino acids, proline, chlorophyll) were investigated to assess salinity's impact and guide selection for saline cultivation. The climatic parameters were monitored throughout the experiment. The study revealed that salinity reduced sugarcane's growth but enhanced its biochemical traits, including its protein, free amino acid, and proline contents. In terms of the mother shoot height, varieties CoSe 01424 and CoS 95255 exhibited strong tolerance to salinity, despite a 43.6 % reduction in the mother shoot height from an average of 106.6 cm to 60.1 cm under saline conditions. The average leaf count showed a slight decline from 9.8 to 9.2 under saline conditions. The leaf area decreased by 35.4 % under saline conditions, with CoSe 03234 maintaining the largest leaf size among the varieties. Biochemical analysis revealed that sugarcane grown in saline soil had a 6.6% higher average protein content (100.4 μg/g) compared to that grown in normal soil (94.1 μg/g). Varieties CoSe 03234, CoS 03251, and CoS 95255 exhibited increased protein levels under salinity, indicating enhanced protein accumulation under salt-affected conditions. Sugarcane in saline soil had, on average, 48% more free amino acids, with CoSe 03234 showing the highest levels. The proline levels increased in almost all the sugarcane varieties under salinity, with CoSe 03234 and CoS 03251 showing the highest accumulation. The chlorophyll content in sugarcane dropped by 20.6% in saline soil (0.257 μg/g) compared to normal soil (0.324 μg/g). CoSe 03251 had the highest chlorophyll content (0.451 μg/g) in the saline soil. This study identified salt-tolerant sugarcane varieties, CoSe 03234, CoS 03251, CoSe 01424, and CoS 95255, that support saline soil cultivation, higher yields, and sustainable agriculture.

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sciforum-138965: Performance of SL-8H in Modified System of Rice Intensification (SRI) under a Lowland Irrigated Ecosystem

Joan Tamayao Cabantac

Ifugao State University (IFSU), Nayon, Lamut 3605, Ifugao, Philippines

This study was conducted at Barangay Villa Cruz, San Mateo, Isabela, from December 2019 to March 2020, to evaluate the growth, yield, and profitability of hybrid rice (SL-8H) under a Modified System of Rice Intensification (SRI) in a lowland irrigated ecosystem. The aim was to evaluate the effect of integrating vermicast with inorganic fertilizers on plant growth, yield, and profitability. A Randomized Complete Block Design with three replications and five treatments was used. The treatments included T1—Conventional/Farmer's Practice; T2—SRI Protocol (1 ton of vermicast per hectare); T3—Modified SRI1 (120-30-0 kg NPK per hectare); T4—Modified SRI2 (1 ton of vermicast per hectare + 120-30-0 kg NPK per hectare); and T5—Modified SRI3 (0.5 tons of vermicast per hectare + 60-15-0 kg NPK per hectare). The study revealed that Modified SRI1 (T3) produced the tallest plants (108.6 cm), the highest quantity of productive tillers (11.3 $hill^{-1}$), and the greatest number of full spikelets with (204.9 $panicle^{-1}$), while the maximum grain yield was achieved in Modified SRI2 (T4) at 10.0 t ha^{-1}, representing a 61% increase compared to that produced under Farmer's Practice with (6.2 t ha^{-1}). The economic analysis showed that T3 gained the highest return on investment at 131.9%, in contrast to 40.3% for Farmer's Practice, while no significant differences were noted in 1,000-grain weight and panicle length across the treatments. These results revealed that the integration of SRI principles with balanced organic and inorganic fertilizers notably enhances rice productivity and profitability, which highlights a viable and sustainable substitute for conventional rice farming, providing farmers with enhanced yields and reduced farming expenses.

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sciforum-135481: Root Conversion From Aerial To Subterranean Roots Of Philodendron Lemon Lime (*Philodendron domesticum* cv. Lemon lime T.) Stem Cuttings Under Different Growing Media

Reyno Vicente Sevillena Guirindola and Roden Dy Troyo

Visayas State University

This study evaluated how the aerial root maturity and different growing media influence root conversion and growth performance in Philodendron lemon lime stem cuttings. Conducted from February to April 2025 in the Department of Horticulture, Visayas State University, the research aimed to determine the most suitable root maturity level and substrate type for efficient propagation. The treatment groups included young and mature aerial roots planted in five growing media: pure coco peat, pure coco cubes, and combinations of coco peat or coco cubes with rice hull and vermicast.

Our findings showed that the aerial root maturity had no significant effect on the plant survival, root conversion rate, or overall growth. In contrast, the growing medium had a significant influence on all the measured parameters. Pure coco peat consistently supported better root development, including a higher root length gain, number of root tips, and root surface area, while pure coco cubes performed poorly, likely due to limited moisture retention.

These results highlight the importance of choosing appropriate growing media to enhance the rooting success and plant vigor in Philodendron lemon lime propagation.

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sciforum-132022: Assessing potential of CO_2 sequestration by sowing precision of legume in support of sustainable agriculture

Karolina Ratajczak *, Agnieszka Faligowska, Katarzyna Panasiewicz and Grażyna Szymańska

Department of Agronomy, Poznań University of Life Sciences, 11 Dojazd St., 60-632 Poznań, Poland

In response to the forecasts of ongoing global climate change, many studies emphasize the need for continuous monitoring of greenhouse gas emissions using the carbon footprint method in order to support environmental management in agricultural production, and thus slow down the rate of growth of the concentration of these gases. The use of low-emission technologies, including sequestration, which involves reducing carbon dioxide emissions into the atmosphere, is currently a priority action for sustainable development in agriculture, thus it is important to search for new solutions.

The material for this research consisted of the results of rigorous 5-year field experiments on yellow lupine (*Lupinus luteus* L.) as a legume crop. The first factor was sowing method: row sowing (traditional) and single-grain sowing. The second factor was sowing rate: 40, 60, 80, and 100 germinated seeds per square meter. Gas emissions were calculated as the sum of direct and indirect emissions produced during fuel combustion by tractors participating in all technological operations of cultivation, gas emissions from the field as a result of the use of mineral fertilizers and their production, emissions related to seed preparation, pesticide application, and the use of electricity and agricultural machines.The aim of this study was to determine the effect of row sowing and single-grain sowing, as well as sowing rate, on the CO_2 sequestration and productivity of yellow lupine.

The carbon footprint values for yellow lupin cultivation calculated on the basis of multi-annual data for an area of 1 ha amounted to an average of 1522.6 kg CO_2 equivalent. The lowest average emission values were calculated for the lowest sowing rate and precise single-grain sowing. The increase in seed yield due to precise single-grain sowing in the sowing density range of 40-80 plants per square meter reduced the carbon footprint of the legume crop.

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sciforum-134434: Bacterial Consortia Enhance Nutrient Uptake and Molecular Response in Tomato Seedlings Under Alkaline Soil Stress: A Comparative Study

Keerthana Rangasamy

Vellore Institute of Technology (VIT), Vellore 632014, Tamil Nadu, India

Nutrient deficiencies in alkaline soils (pH 7.9–8.5) frequently limit plant growth due to insufficient nutrient availability and uptake. This study investigated the effects of two bacterial strains, VITK-1 and VITK-3, on nutrient absorption, growth, and gene expression in tomato (*Solanum lycopersicum*) seedlings grown in alkaline soil. Bacterial treatments were applied individually and as a consortium, and their ability to promote plant growth and nutrient solubility was evaluated. In vitro studies demonstrated the strains' ability to solubilize essential nutrients, generate extracellular enzymes, and exhibit a variety of Plant Growth-Promoting Rhizobacteria (PGPR) characteristics, including soil-borne pathogen control. In vivo investigations revealed notable improvements in germination, root and shoot development, and overall seedling vigor when compared to untreated controls. The bacterial consortium significantly improved protein and proline levels, antioxidant activity, phenolic and flavonoid content, and decreased carbohydrate accumulation. Furthermore, treated plants exhibited activation of nutrient-regulating genes associated with better root metabolism and resilience to stress. These results show the potential of PGPR inoculants, particularly consortia, as a promising strategy for improving nutrient uptake, biochemical characteristics, and stress tolerance in crops grown in alkaline soils.

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sciforum-132396: Biotic and abiotic factors affecting *Cistus ladanifer* production in cultivated plots from mainland Spain

José Plaza, Lilyana Tihomirova-Hristova, Esther Morate-Gutiérrez, Marta Adalia-Mínguez, Belén Álvarez * and Pedro Vicente Mauri-Ablanque

Área de Investigación Agroambiental, IMIDRA, A2-Km 38,200, 28805 Madrid, Spain

The sustainable production of rockroses is being actively encouraged due to their contribution to rural development and circular economy. Particularly, rockrose (*Cistus ladanifer* L.) exploitation has great socioeconomic and environmental potential, since it is not only a source of essential oils and labdanum gum but also of residual products involved in biomass generation. Moreover, the management of rockroses has beneficial effects on the preservation of traditional landscapes and their biodiversity. It is considered that the cultivation of rockrose does not have high resource requirements, and very few pests and diseases are known to affect it, as plant extracts and essential oils of this crop have been described to have antifungal and antibacterial properties. However, in cultivated rockrose plots from Mainland Spain, a high number of plants were observed with symptoms of general yellowing and decline, eventually resulting in death. Samples were taken for pathogen diagnosis, and data were collected from environmental conditions in the area. Isolations were performed on culture media from crowns and stems, and fungal colonies were molecularly analysed by the amplification of their ITS (*Internal Transcribed Spacer*) DNA regions. Sequencing revealed the presence of the pathogenic species *Macrophomina phaseolina*, *Fusarium acuminatum*, *F. equiseti*, and *F. tricinctum*. Environmental data suggested the contribution of a prolonged period of rain in late spring, a crop field that was not subsolated, and plants from staking. This could indicate a combined effect of deleterious biotic and abiotic factors as the cause of the unexpected appearance of the symptoms and damage that occurred on the rockrose crop production, which suggests the need to develop an integrated management strategy in this kind of agroecosystem.

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sciforum-123741: Corn Yield and Profitability Improved with Subsurface Drip Irrigation in the Mid-Atlantic United States

Unius Arinaitwe [1,*], William Hunter Frame [2], Wade Thomason [3], Mark Male (M) Reiter [4] and David Male (M) Langston [2]

[1] Agronomy, Horticulture, & Plant Science, South Dakota State University, Brookings, SD 57007, USA
[2] Tidewater Agricultural Research and Extension Center, Virginia Tech 6321 Holland Road, Suffolk, VA 23437, USA
[3] Oklahoma State University 331 Agricultural Hall, Stillwater, OK 74078, USA
[4] Eastern Shore Agricultural Research and Extension Center, Virginia Tech 33446 Research Drive, Painter, VA 23420, USA

With the global population projected to reach 11.2 billion by 2100, enhancing maize yields through efficient irrigation and nutrient management is crucial for reducing yield gaps and ensuring food security. Subsurface drip irrigation (SDI) offers a promising alternative to traditional, less efficient methods. This three-year study (2022-2024) employed a split-split-plot design to evaluate optimal SDI strategies, including six dripline spacings (0.91-meter dripline, 1.82-meter dripline, and 0.91-meter + volumetric water content (VWC) sensors; 0.91-meter + fertigation, 1.82-meter + fertigation (2022), and 0.91-meter + Pivot Bio® (2023 and 2024); and non-irrigated (control)), four seeding rates (59,280 to 103,740 plants ha^{-1}), and four nitrogen (N) rates (133 to 333 kg N ha^{-1}). Data analysis revealed significant irrigation, N application, and seeding rates on grain yield, and irrigation by N rates interactions each year. Yearly irrigation impact on yield was 102%, 13%, and 51% over non-irrigated in 2022, 2023, and 2024, respectively. The 0.91-meter dripline averaged the greatest revenue ($985 ha^{-1}) over non-irrigated. The 0.91-meter dripline + VWC Sensor showed the strongest relationship between N rates and grain yield in 2022 (R^2 = 0.997), while the 0.91-meter dripline + Pivot Bio had the greatest effect in 2023 (R^2 = 0.998) and 2024 (R^2 = 1.000). These findings highlight SDI's effectiveness in increasing maize yield and profitability, reducing production risks in Virginia and the Mid-Atlantic region. The study shows the potential of targeted irrigation and nutrient management to maximize maize yields.

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sciforum-123747: Corn Yield Response to Microbial Nitrogen, Irrigation and Seeding Rate Strategies

Unius Arinaitwe

Agronomy, Horticulture, & Plant Science, South Dakota State University, Brookings, SD 57007, USA

Optimizing nitrogen (N) management in corn (*Zea mays* L.) production is critical for enhancing sustainability and profitability, especially given its non-nitrogen-fixing nature and the inefficiency of conventional N fertilization due to losses. This study, conducted in 2023 and 2024 at the Tidewater Agricultural Research and Extension Center (TAREC), evaluated the effectiveness of the microbial nitrogen product Pivot Bio® under irrigated and non-irrigated environments. A split-split plot design with three replications was used to assess four N rates (133, 200, 267, and 333 kg N ha^{-1}), four seeding rates (59,000, 74,000, 89,000, and 104,000 plants ha^{-1}), and the presence or absence of Pivot Bio®, which allowed a 45 kg ha^{-1} N reduction in the biological treatments. Results revealed significant main effects of irrigation, nitrogen rate, and seeding rate on grain yield (p 0.05), with the highest yield (12,668 kg ha^{-1}) observed under irrigated conditions with Pivot Bio® and 333 kg N ha^{-1}. Notably, the interaction between nitrogen and irrigation, seeding rate and irrigation, and nitrogen and seeding rate significantly influenced yield. Under non-irrigated conditions, yield was consistently lower and less responsive to increased N or plant density. These findings suggest that Pivot Bio® has potential as a sustainable nitrogen supplement in irrigated systems, allowing for reduced N application without sacrificing yield

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sciforum-137021: Cost, Profitability, and Risk Analysis of Rice Production in the BORO season in Thakurgaon District, Bangladesh

Mamun Ur Rashid [1,*], Md. Hadiul Kabir [2], Md. Sifat Hossain [1] and Md. Nayeem Islam [1]

[1] Department of Statistics, University of Rajshahi, Rajshahi - 6205, Bangladesh
[2] Professor, Department of Statistics, University of Rajshahi, Rajshahi - 6205, Bangladesh

Bangladesh is a country with an agriculture-based economy. Rice is the main food among Bangladeshis. There are three seasons for rice cultivation: BORO, AMAN, and AUS. Our research area was the Thakurgaon district. The local farmers cultivate rice in only two seasons, BORO and AMON. We only considered the BORO season for this research. Our research objective was to find out if the farmers are making profit or a loss in rice cultivation; we also investigate the risk of cultivation for these seasons. We have collected data through direct interviews with the farmers using a structured questionnaire. We used a stratified purposive sampling technique for collecting data. We cover the five upozilas in this district. For analyzing the data, we have used the chi-square test, as well as regression and factor analysis, to determine the risk and profitability of rice production. We found that most of the farmers benefit from rice cultivation, but the percentage of farmers who are making a loss is also not that low. One of the reasons for this is that the farmers do not have their own land, and so they have to spend extra money for the land they use for cultivation. We also found that the yield, investment cost, and return are higher for the BORO season, because farmers have to irrigate their land in the BORO season. The yield from BORO is high; as such, farmers acquire much more money in the BORO season. The risk is also high in the BORO season, because there is a risk of drought and the land has to be irrigated manually. The cost of fertilizer and pesticide is very high in this season. All the farmers suggested that the government should take necessary steps to lessen the cost of fertilizer and pesticides.

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sciforum-134011: Development And Performance Evaluation Of A Tractor-Drawn Mouldboard Ridger For Cassava Production

Kwabena Agyeman Abebrese

Department of Agricultural and Biosystems Engineering, Kwame Nkrumah University of Science and Technology, Ghana.

Ridged seedbed preparation is the most important procedure in cassava cultivation if mechanization is to be utilized in subsequent operations like planting, weeding and harvesting. Manual ridging is, however, characterized by high labour demands, requiring 108 man-days/ha compared to 2.44 to 3.33 h/ha for mechanized ridging. Weed infestation is a major challenge within cassava cropping systems, with yield losses varying between 40% and 94%. Manual weeding accounts for 50 to 80 percent of the overall production budget. The objective of this study was to develop a double-bottom mouldboard ridger and to evaluate its performance for ridging and weed control in cassava production. The implement was constructed from locally sourced materials using easily accessible manufacturing techniques. The developed mouldboard ridger was tested against a double-row disc ridger for draught, wheel slip, fuel consumption, weed control capacity, percentage crop damage and profile of constructed ridges. A techno-economic analysis was conducted on the two tractor-mounted ridgers to compare against the manual method for ridging and weeding. A hazard and operability study was also conducted on the double-bottom mouldboard ridger. The results showed a net draught force of 3.5kN and 6.0kN for the mouldboard and disc ridger, respectively, for weeding, while ridging recorded 5.4kN and 5.6kN. Fuel consumption for weeding was 4.6l/ha and 9.8l/ha for the mouldboard and disc ridger, respectively, while ridging recorded 5l/ha and 5.8l/ha. For weeding, wheel slips of 2.5% and 2.3% were recorded for the mouldboard and disc ridger, respectively, while ridging recorded 2.6% and 2.5%. Weed control capacities of 73.4% and 71.3% were recorded for the mouldboard and disc ridger, respectively. Crop damages of 7% and 8% were recorded for the mouldboard and disc ridger, respectively. There was no significant difference ($p \geq 0.05$) between the profiles of the ridges constructed with the two ridgers, with R^2 values of 0.9797 and 0.9762, respectively, for the mean profile of ridges constructed with the mouldboard ridger and disc ridger. The techno-economic study showed that to ridge a hectare of land, it took the mouldboard ridger 36.36 minutes at a cost of GHS 111.29, the disc ridger 40 minutes at a cost of GHS 129.1 and the manual method took 907.18 man-hours at a cost of GHS 6,236.75. To weed a hectare of cassava farm, it took the mouldboard ridger 38.22 minutes at a cost of GHS 102.36, the disc ridger 71.43 minutes at a cost of GHS 218.07 and the manual method 74.1 man-hours at a cost of GHS 3,087.5. A hazard and operability (HAZOP) study was conducted to establish possible deviations, causes and their consequences. Recommendations were made to ensure a hazard-free utilization of the implement. Further research is necessary to establish the effect of varying moisture contents on the performance of the mouldboard ridger. Research into the wear rate and durability of the share of the mouldboard ridger is also recommended. The effect of different soil types on the performance of the mouldboard ridger needs to be investigated.

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sciforum-139155: Development of an Empirical Model for Estimating Quinoa Canopy Cover from NDVI under Different Irrigation and Fertilization Stress Conditions

Iamia jallal [1,*], Salah Er-Raki [1,2], Saïd Khabba [2,3], Jamal Ezzahar [2,4], Zaineb Bouswir [1] and Abdelghani Chehbouni [2]

[1] Agrobiotec Center, Faculty of Sciences and Techniques, Cadi Ayyad University, Marrakech, Morocco
[2] Center for Remote Sensing Applications (CRSA), Mohammed VI Polytechnic University (UM6P), Morocco
[3] LMFE, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco
[4] LSA2D, Higher School of Technology - El Kelaa Des Sraghna, Morocco

Canopy cover (CC) is a critical parameter for characterizing crop growth and calibrating crop models. While the relationship between CC and the Normalized Difference Vegetation Index (NDVI) has been established through linear and quadratic models, a robust empirical approach for deriving CC from NDVI observations remains elusive. This study aims to develop an adequate equation relating NDVI to CC for quinoa crops that can be applied across different irrigation and fertilization stress conditions. A field trial was conducted from March to June 2023 in Chichaoua, a water-scarce region in central Morocco. Both NDVI and CC were determined through field measurements, with NDVI obtained using a handheld NDVI sensor and CC determined through hemispherical photography analysis. The NDVI and CC were evaluated for four treatment combinations: T1 (100% irrigation, 100% fertilization), T2 (80%, 100%), T3 (60%, 25%), and T4 (40%, 25%). Percentages were relative to optimal levels. Strong correlations between NDVI and canopy cover were observed across all treatments, with correlation coefficients ranging from 0.77 to 0.98. Multiple linear and quadratic models were derived for each of the four plots (T1-T4). Each plot-specific equation was then cross-validated by applying it to predict canopy cover in the remaining three plots. The linear model derived from the T3 treatment data emerged as the most representative equation: CC (%) = 141.75 × (NDVI) - 30.913. When applied to predict CC values across all plots, this model demonstrated good performance between predicted and observed CC values with R^2 (RMSE) values of 0.83 (14.99%), 0.96 (9.63%), 0.60 (8.70%), and 0.69 (8.89%) for T1, T2, T3, and T4, respectively. The developed linear model provides a practical tool for estimating quinoa canopy cover from NDVI measurements under varying irrigation and fertilization conditions, contributing to the improvement of crop monitoring and model calibration in water-scarce environments.

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sciforum-132218: Diversity Assessment of Traditional Cowpea (*Vigna unguiculata* (L.) Walp.) Landraces in Morocco

Zineb Moudni [1,2]*, Younes Hmimsa [1,2], Widad Benziane [1,2], Nouhaila Dihaz [1,2], Imane El Hassani [1,2] and Salama El Fatehi [1,2]

[1] TEDAEEP Team Research, Abdelmalek Essaadi University – (UAE-FPL), Larache, 93004, Morocco.
[2] Department of Life Sciences, Polydisciplinary Faculty, Abdelmalek Essaadi University, Larache 93004,Morocco.

Cowpea (Vigna unguiculata (L.) Walp.) is one of the most important cultivated legumes in Africa, with an estimated global annual production of approximately 5.4 million metric tons of dry seeds. However, in Morocco, cowpea remains a marginalized crop, traditionally grown in a limited number of regions. Local landraces, maintained over generations by farmers, may harbor substantial genetic and phenotypic diversity. The characterization of plant genetic resources is essential for understanding phenotypic variation, assessing genetic relationships among genotypes, and supporting their conservation and use in crop improvement programs. This study aimed to evaluate the agro-morphological diversity of 19 traditional Moroccan cowpea populations collected from various agro-ecological zones across the country. The accessions were characterized using 20 morphological, phenological, and yield-related traits, following the descriptor list established by the International Board for Plant Genetic Resources (IBPGR, 1983). Our results revealed a high level of diversity both among and within the studied landraces, with no clear association with their geographical origin. This considerable phenotypic variability underscores the potential of these traditional varieties as valuable genetic resources for cowpea breeding, particularly for traits related to adaptation to local environmental conditions. Given that some morphological traits may be influenced by environmental factors, further studies using molecular markers are recommended to validate and refine the observed patterns of diversity.

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sciforum-138466: Drought-Tolerant Traits In Winter Legume Cover Crops Under Different Water Regimes In Semi-Arid Conditions

Amokelani Florah Maepa [1,*], Kwabena Kingsley Ayisi [2], Lawrance Munjonji [3] and Emogine Mamabolo [4]

[1] Department of plant Production, Soil Science and Agricultural Engineering, University of Limpopo
[2] Centre for Global Change, Department of Plant Production, Soil Science and Agricultural Engineering, University Of Limpopo.
[3] Department of Soil Science, Stellenbosch University.
[4] Centre for Global Change, Department of Plant Production, Soil Science and Agricultural Engineering, University of Limpopo.

Climate change and water scarcity pose a threat to current crop productivity. Considering that Limpopo is a dry area, it will be hard to increase crop productivity under the continuous decline in rainfall resulting from climate change. It is vital to understand the impact of water stress on crop production in order to improve crops' ability to adapt to water stress in the future. To explore their potential under water-limited conditions, a study was conducted in Limpopo to assess the drought tolerance of four winter legume cover crops, i.e., pea, lupin, clover and vetch, in terms of key drought-tolerance traits, including the leaf area index, shoot biomass production, leaf gas exchange processes such as transpiration, stomatal conductance, intercellular CO_2 concentration, the photosynthetic rate and soil carbon dioxide emission rates. The experiment was carried out with a split-plot design, with the main factor being the winter legume—pea (*Pisum sativum*), lupin (*Lupinus albus*), clover (*Trifolium* spp.) or hairy vetch (*Vicia villosa*)—and the sub-factor being one of two irrigation regimes (well-watered and water stress). The results reveal that all cover crops performed better in well-watered conditions, with significantly higher shoot and root biomass than in water-stressed plots. Increased biomass had a positive effect on the shoot-to-root ratio, suggesting good adaptability to irrigation regimens. Although transpiration rates were elevated in well-watered treatment groups, stomatal conductance, transpiration, and photosynthetic rates did not differ significantly between the irrigation treatments. These findings highlight the resilience of these legume cover crops and suggest their potential for sustainable integration into dry-land farming systems, especially under future climate uncertainty.

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sciforum-139152: Eco-Design of Pressmud-Based Organic Blends for Revitalizing Nutrient-Depleted Agricultural Soils

Girish Vittal Badiger

Research Scholar, Department of Civil Engineering, Visvesvaraya Technological University, RRC, Kalaburagi - 585105, Karnataka, India

Pressmud, a by-product of the sugar industry, is rich in organic carbon and nutrients. This study explores the eco-design of pressmud-based organic blends integrated with biochar, vermicompost, and microbial inoculants to restore the fertility of nutrient-depleted soils. Through laboratory and field experiments, we assessed physicochemical properties, microbial activity, and crop response. The results demonstrate a significant improvement in soil health, increased organic carbon, and yield enhancements in crops such as maize and pulses. This research offers a sustainable waste valorization approach aligned with circular economy principles and environmental management. The degradation of agricultural soils due to intensive farming practices and excessive chemical input has led to widespread nutrient depletion, affecting crop productivity and ecological balance. This study presents an eco-design approach to formulate organic soil amendments using sugar industry pressmud, in combination with biochar, vermicompost, and microbial inoculants. Through laboratory characterization and field trials, we evaluated the blends' effects on soil physicochemical properties, microbial biomass, and crop yield performance. Results indicated significant improvements in organic carbon content, nutrient availability (NPK), microbial activity, and crop productivity compared to control treatments. The most effective blend—combining pressmud, biochar, and beneficial microbes—achieved up to 40% higher soil organic carbon and a 37% increase in crop yield. This eco-designed approach not only valorizes agro-industrial waste but also supports sustainable soil management and circular agricultural practices. The findings demonstrate the potential of pressmud-based blends as viable biofertilizers for the rehabilitation of nutrient-depleted farmlands.

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sciforum-124820: Effect of foliar fertilization on the size and quality of oilseed sunflower achenes

Wacław Jarecki

University of Rzeszow; Rzeszów; 35-959; Poland

Foliar fertilization is an agronomic practice commonly used in crop cultivation. The effectiveness of this treatment depends on many factors, including plant species, chemical composition of the preparation, dosage and date of application, and soil and weather conditions. Sunflower has moderate fertilization requirements, but certain elements are crucial for achieving high, good quality seed yield. The purpose of this study was to evaluate the response of oilseed sunflower (variety MAS 81K) to foliar application of micronutrients, zinc (Zn), iron (Fe), copper (Cu), manganese (Mn), molybdenum (Mo), and boron (B), in comparison to the control. A one-factor field experiment was conducted in 2022 and 2023 in a randomized block design. The soil at the experimental site was classified as Haplic Cambisol (Eutric) formed from loess, with moderate levels of Zn, Fe, Cu, and Mn and low levels of B. The results of the present field experiment demonstrated a significant response of sunflower to foliar application of individual micronutrients (Zn, Fe, Cu, Mn, Mo, and B) compared to the control. The most favorable results were obtained following foliar B fertilization, but positive results were also achieved with the application of Mo and Cu. Weather conditions during the study years had a significant impact on the results of foliar fertilization. For these reasons, the results from the first year were not always reproducible in the second year. Seed quality (oil) was mainly affected by the application of Cu, followed by Mn, Fe, and Zn. The results of the current experiment demonstrated that the application of B was most beneficial, while the use of molybdenum (Mo) and copper (Cu) exerted a comparatively smaller effect. The application of the remaining micronutrients yielded results that were below expectations.

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sciforum-135471: Effect of Hydrogen peroxide pretreatment on shade tolerance in Maize (*Zea mays*)

Muhammad Saleem

University of Agriculture Faisalabad, Pakistan

In the shade, maize leaves exhibit high senescence because of the suppression of blue light. They also demonstrate oxidative stress traits. The shade effect also depends on light intensity and hydrogen peroxide. H_2O_2 is involved in signaling pathways related to various responses of antioxidants to abiotic stress. A pot experiment was conducted to investigate the effects of shade on the physiology and morphology of plants and presoaked seeds with H_2O_2. The maize variety Malka 2012 was soaked with different levels of H_2O_2 (100µM, 200µM, 300µM, 400µM, water-soaked and unsoaked). These seeds were sown in pots containing soil. After germination, half of the plants were moved to grow under tree shade, and the other half were kept under bright light. The experiment was conducted under a completely randomized design with three replicates per treatment in a factorial arrangement. After two months of sowing, the data were recorded for different growth and physiological attributes. Growth parameters including shoot length, root length, shoot diameter, number of leaves, area of leaves per plant, and fresh and dry weight of shoot and root were recorded. The physiological parameters determined include photosynthetic pigments, total chlorophyll, hydrogen peroxide, soluble phenolic, flavonoids, soluble sugar, anthocyanins, ascorbic acid, K+ , Na+ , Ca2+, Phosphate-P, Nitrate-N and Sulphate-S. Morphological and physiological parameters showed negative growth under shade stress but positive growth under light conditions with the application of 100 and 200µM of H_2O_2. Potassium and sulfur ions of the root and shoot show non-significant differences. Results revealed that shade stress reduces the physiology and morphology of maize. Tukey's test was used to compare the least significant difference (LSD) at 5% probability levels. The data were analyzed using COSTAT software.

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sciforum-132066: Effect of Sokoto Phosphate Rock on Growth and Yield of Bambara Groundnut in Sudan Savanna of Nigeria

Sheriffdee Femi Ayorinde [1,*], Jazuli Alhasan [1], Musa Mukhtar [1] and Singh Ajit [2]

[1] Department of Crop Science, Usuman Danfodiyo University, P. M. B 2346, Sokoto, Nigeria.
[2] The University of Nottingham Malaysia Jalan Broga 43500, Semenyih Selangor Darul Ehsan, Malaysia

Bambara groundnut is a drought-tolerant legume with high potential for food security, yet nutrient management strategies remain under-researched. A field trial was conducted during the 2024 rainy season at the Dryland Teaching and Research Farm, Usmanu Danfodiyo University, Sokoto, to evaluate the effect of Sokoto phosphate rock on the growth and yield of Bambara groundnut. The experiment consisted of five levels of Sokoto phosphate rock (0, 20, 40, 60 and 80 kg ha^{-1}). The treatments were laid out in a randomized complete block design, replicated three times. Data were collected on the growth and yield parameters of the crop. The results obtained revealed a significant (P0.05) effect of Sokoto phosphate rock on leaf area and leaf area index, with maximum values of 665 and 0.665, respectively, observed at the application rate of 20 kg ha^{-1}. Other parameters (plant height, number of leaves per plant, day to 50% flowering, day to 50% maturity, number of pods per plant, total dry weight, pod yield (g), grain weight, shell weight, shelling percentage, haulm weight, stover weight, harvest index (%), 100-grain weight) measured were not significantly influenced by the application of Sokoto phosphate rock on the crop. Based on the results, the application of 20 kg ha^{-1} Sokoto phosphate rock is recommended to improve vegetative growth (leaf area and leaf area index) of Bambara groundnut under dryland conditions.

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sciforum-135917: Effects Of Different Hydroponic Growing Substrates On Growth and Quality of Lettuce (*Lactuca sativa* L.) Microgreens

Reyna Mae Cornites [1,*] and Joy Codog [2]

[1] WPU, Department of Agriculture
[2] Visayas State University

The COVID-19 pandemic, along with other factors such as climate change, limited agricultural resources, energy crises, population growth, and urbanization, has significantly threatened global food security. In response to these challenges, the development of sustainable technologies for growing nutritious crops in controlled environments has emerged as an important strategy for urban agriculture. This study was conducted at the Plant Tissue Culture Laboratory of the Philippine Rootcrops Research and Training Center (PRCRTC), located at the Visayas State University Main Campus, Baybay City, Leyte. The study was carried out to (1) assess the impact of different growing substrates on the growth and quality characteristics of lettuce microgreens and (2) identify the most suitable growing substrate that would generate the highest productivity and nutritional content in lettuce microgreens. The experimental design employed was a Complete Randomized Design (CRD), consisting of five treatments: T_1—soil; T_2—a Coco Fiber Mat; T_3—a jute fiber mat; T_4—Rockwool; and T_5—vermiculite.

This study highlights the advantages of using a soil substrate for growing lettuce microgreens. This substrate provided favorable conditions with regard to its nutrient availability, water retention, and organic matter content, resulting in greater shoot development and a higher dry weight, leaf size, and total yield. However, plants grown with vermiculite and the jute fiber mat demonstrated higher chlorophyll content, suggesting these treatments' potential for promoting enhanced photosynthetic capabilities.

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sciforum-134812: Effects of Different Nutrient Media on Mycelial Growth Quality During Pure Culture and Spawn Production Stages of White Oyster Mushroom (*Pleurotus ostreatus* var. Florida)

John Mark R. Francisco [1,*] and Catherine C. Arradaza [2]

[1] Department of Horticulture, Faculty of Agriculture and Food Science, Visayas State University, Baybay City, Leyte 6521-A
[2] Plant Tissue Culture Laboratory, Department of Horticulture, Faculty of Agriculture and Food Science, Visayas State University, Baybay City, Leyte 6521-A

Potato Dextrose Agar (PDA) has been widely recognized in mycological research for its effectiveness in cultivating a broad spectrum of fungi, including edible mushrooms such as *Pleurotus ostreatus*. However, the high cost of commercial agar limits its accessibility for local mushroom growers. Therefore, this study aims to investigate the potential of low-cost agar formulations and other alternatives to PDA in a laboratory setting. Five treatments were applied: PDA (control), Malt Extract Agar (MEA), Murashige and Skoog (MS), Rice Water Agar (RWA), and Potato Sucrose Agar (PSA). The experiment was arranged in a complete block design with three replications. Data were collected at two stages of oyster mushroom cultivation: pure and spawn culture. The mycelial growth quality was determined. Results revealed that, at the pure culture stage, RWA had the highest mycelial growth rate at 9 days after inoculation (DAI) with 7.73 cm, but there was no statistical difference compared to PSA and PDA. MEA obtained the highest mycelial weight at 1.08 g. PSA, MEA, and RWA favored mycelial visual parameters, while PDA, PSA, and MEA favored thickness. RWA showed the highest growth vigor, and MEA and PDA the highest mycelial density. RWA completed the stage in 9.30 days, including the time mycelium appears at 1.03 days. No contamination occurred at RWA. At the spawn culture stage, RWA had the highest mycelial growth rate at 11.50 cm in 12 DAI. RWA was also high at mycelial visual parameters. MEA completed the stage in 14.87 days with comparable results in mycelial germination in all treatments except MS. Contamination occurred at the spawn stage, with high contamination observed in MS at 26.67%. Contamination during spawn and culture stages is influenced by inoculation technique and environmental conditions, not just the media. Temperature and RH significantly affected weight and color score. The MS medium showed the least favorable performance, likely due to its high salt content being unsuitable for fungal growth. This study provides a reference for mycelial growth quality on how mycelium behaves across two stages of oyster mushroom production.

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sciforum-139166: Efficient In Vitro Propagation Approach for Mass Multiplication of *Curcuma longa* L (Turmeric)

Achinthi Premasiri * and Kumari Fonseka

Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka - zip code - 81000

Curcuma longa (Turmeric) is a remarkable plant widely used in Ayurvedic medicine, pharmacology, culinary practices, and cosmetic production. Its primary bioactive compound, curcumin, a potent polyphenol, possesses anti-inflammatory, antioxidant, antimicrobial, anticancer, and neuroprotective properties. It acts as a remedy for various chronic diseases, including cancer, diabetes, and cardiovascular disorders. Turmeric is valued as a natural colorant and preservative in agriculture and the food industry. This study aims to investigate the in vitro propagation of turmeric, offering a scalable solution for high-quality plant production. Rhizome buds were surface-sterilized using 10% and 15% Clorox solutions with exposure times of 10 and 15 minutes. Initially, the buds were placed in sealed culture containers filled with sterilized coir dust. Each rhizome produced more than eight buds simultaneously, allowing for reuse. Out of 120 replicates, the most effective sterilization protocol was 10% Clorox for 10 minutes, yielding 81% contamination-free cultures. The results were statistically significant under a two-factor Completely Randomized Design (P 0.05). Healthy buds were subcultured on Murashige and Skoog (MS) medium supplemented with BAP (1.5, 2.0, and 2.5 mg/L) and NAA (0.5 mg/L) to induce shooting and rooting. The optimal response was observed with 2.0 mg/L BAP with 0.5 mg/L NAA, resulting in an average of 9 shoots (6.5 cm in length) and 11 roots (7 cm in length) per explant within 8 weeks. The results were statistically significant under a completely randomized design (p 0.05). Statistical analysis was performed using the SAS software, employing ANOVA, with mean separation conducted through Duncan's Multiple Range Test (DMRT). The optimized protocol developed through this study offers a reliable, efficient, and reproducible method for the rapid multiplication and conservation of elite turmeric varieties, producing over 50 in vitro derived plantlets from each rhizome bud. This represents a significant advancement for commercial-scale propagation and germplasm preservation.

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sciforum-131610: Endophytic mycoflora associated with winter wheat grain

Olga Shevchuk *, Oksana Afanasieva, Lesia Golosna, Denis Zlenko and Sergii Kryvosheiev

Institute of Plant Protection, National Academy of Agrarian Sciences of Ukraine

Determining the mycoflora of wheat grain is important because it is the basis for making decisions about how to use it. For seed batches, this makes it possible to assess the risk of seed-borne diseases and build an appropriate protection system, including a reasoned approach to the choice of a seed treatment agent. This study was conducted in different zones of Ukraine during 2020-2023. In total, fungi of 12 genera were identified. Among the endophytic mycoflora of winter wheat seeds, *Alternaria* spp. were most often detected. They were found in all studied samples. The proportion of their presence in the grain varied in the years of research. In some cases, its share reached 78%, and on average, it was 10,7-35,1%. The highest level of contamination was observed in 2022. A high presence of *Fusarium* spp. was also noted. They were isolated from the vast majority of samples (70-91%). The highest isolation frequency, for *Alternaria* spp., was observed in 2022. Also, in the same year, the highest level of contamination (in average 7%) was noted. The presence of fungi of other genera was much lower. *Epicoccum* spp., *Penicillium* spp., *Nigrospora* spp., *Cladosporium* spp., and *Aspergillus* spp. were isolated every year and had a share in the total complex on average from 0.2 to 2.1% over the years of research. So, *Alternaria* dominate in the complex of endophytic microflora on winter wheat seeds. *Fusarium* ranks second in terms of isolation frequency.

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sciforum-136175: Enhancing Germination of Stored Adlai *(Coix lacryma-jobi)* Seeds Using Black Soldier Fly Frass Tea as an Organic Biofertilizer

Domy Bonn Monterde Untalan

Davao de Oro State College, Compostela 8803, Davao de Oro, Philippines

Seed dormancy in Adlai (Coix lacryma-jobi) limits its agricultural potential. This underutilized crop has great potential as an alternative source to common carbohydrates such as rice and corn, but it is hampered by this physiological condition. Conventional dormancy-breaking methods often involve synthetic chemicals, which are costly and environmentally detrimental. This study evaluates Black Soldier Fly Frass Tea (BSF FT), an organic alternative rich in nutrients and plant growth regulators (PGRs), as a priming agent for stored Adlai seeds. A completely randomized design (CRD) with eight treatments (including BSF FT at 10–25 mL/L, gibberellic acid (GA_3), and control) was replicated three times. Germination parameters (days to 50% germination, germination rate, seedling vigor, and biomass) and pH effects were analyzed. The results revealed that BSF FT at 20 mL/L significantly improved germination (92%, comparable to GA_3), with a 77.78% germination rate (3.33 days to 50% seed germination and enhanced seedling vigor (shoot: 16.03 cm; root: 16.67 cm)) and biomass of 16.97%, showing great potential as a seed priming agent. Undiluted BSF FT (pH 4.45) inhibited germination, highlighting pH-dependent efficacy. The results signified that BSF FT is a low-cost, eco-friendly alternative to synthetic PGRs, and is optimal at 20 mL/L. Field trials and biochemical analysis of PGRs in BSF FT are recommended for scalability.

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sciforum-138667: Enhancing Nitrogen Efficiency and Reducing Carbon Footprint in Malting Barley through *Ascophyllum nodosum* Biostimulants and Optimized Fertilization Strategies

Loukas Orfeas Orfeas Loukakis [1,*], Eleftheria Garoufali [1], Theoni Karaviti [1], Kyriakos Giannoulis [2] and Garyfalia Economou [1]

[1] Laboratory of Agronomy, Department of Crop Science, Agricultural University of Athens (AUA), Athens, 11855, Greece
[2] Laboratory of Agronomy and Applied Crop Physiology, Department of Agriculture, Crop Production & Rural Environment, University of Thessaly, Volos, 38446, Greece

Nitrogen (N) is a key nutrient that significantly affects yield and grain protein content in malting barley. However, excessive N fertilization contributes substantially to total greenhouse gas (GHG) emissions. To align malting barley cultivation with the European Green Deal, it is essential to reduce N inputs while maintaining high productivity and grain quality. Biostimulants derived from *Ascophyllum nodosum* extract (ANE) have been shown to improve soil N uptake and enhance nitrogen use efficiency. To evaluate their agronomic and environmental impact, field trials were conducted in Almyros, Greece, during the 2022–2023 and 2023–2024 growing seasons using two malting barley genotypes: a commercial variety (Fortuna) and a genotype (G62) with a different growth cycle. Five fertilization treatments were applied: i) sulfur-coated urea at 90 kg N/ha (U), ii) U + ANE (U + B), iii) urea with urease inhibitor at 75 kg N/ha (UI), iv) UI + ANE (UI + B), and v) an unfertilized control (C). Applications of ANE were carried out at Zadoks' stages Z*24–30 and for surface fertilization at Z*30–33 for Fortuna and G62, respectively. The UI + B treatment significantly increased aboveground biomass and grain yield—by 50.72% and 53.23% in the first year, and 75.25% and 70.99% in the second—compared to the control. For G62, U + B proved more effective, enhancing biomass and yield by up to 55.67% and 78.75%, respectively. In terms of carbon footprint, UI + B resulted in a maximum reduction of 48.3% and 36.9% CO_2-eq per kg of yield for *Fortuna*, and 27.2% and 18.9% CO_2-eq per kg for G62, across the two consecutive seasons. In conclusion, the combined use of ANE with reduced N fertilization and urease inhibitors can improve yield and nitrogen efficiency while significantly lowering the carbon footprint of malting barley cultivation.

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sciforum-138239: Enhancing seed quality of Okra (*Abelmoschus esculentus* (L.) Moench) through native root endophytic bacteria

Naveen Gujjar [1,*], Pankaj Kumar [2], Vinod Kumar [1] and Preeti Yadav [3]

[1] Department of Vegetable Science, Maharana Pratap Horticultural University (MHU), Karnal 132001, Haryana, India
[2] Department of Plant Protection, Maharana Pratap Horticultural University (MHU), Karnal 132001, Haryana, India
[3] Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar 125004, Haryana, India

Bacterial endophytes are symbiotic microbes that live inside the internal tissue of plants and promote their growth by various mechanisms such as phyto hormone production, nutrient solubilization, and tolerance to biotic and abiotic stress. Okra (*Abelmoschus esculentus* (L.) Moench) is a popular vegetable worldwide due to its tender nutritious pods; however, its production is limited due to poor seed quality and low germination. Okra has a hard seed coat, which is a hindrance in germination and intensifies this problem. Bacterial endophytes have the potential to solve this problem by producing phyto hormones like GA_3 that break seed dormancy and by producing various enzymes that can soften its hard seed coat. Therefore, this study was conducted at MHU, Karnal, with the aim to improve the seed quality of okra using bacterial endophytes in CRD design with the treatment of 47 different endophytic bacterial isolates, which were retrieved from the roots of healthy okra plants. To evaluate their effect on seed quality, a paper test was conducted by treating sterilized okra seeds with different bacterial isolates @ 1×10^6 cfu/ml for 24hr and key seed quality parameters were evaluated after 10 days of inoculation as per standards of the ISTA. All the isolates improved the seed quality parameters over the control: ONRE-26 achieved the highest seedling length of 31.24cm, a germination rate of 82%, a seedling fresh weight of 4.84g, a vigor index I of 2561.27 and a vigor index II of 33.42, while the control achieved a seedling length of 27.21cm, germination rate of 68.50%, seedling fresh weight of 3.51g, vigor index I of 1868.76 and vigor index II of 26.05. Isolate ONRE-26 was identified as *Pseudomonas fluorescens* using 16s rRNA sequencing. It can be concluded that bacterial endophytes, particularly ONRE-26, significantly enhance okra seed quality under in vitro conditions. These findings suggest their promising role as eco-friendly biostimulants for the sustainable improvement of crop production.

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sciforum-132104: Evaluating the combined use of Kolosal Pro Fungicide and novel resistant spring wheat cultivars (*Triticum aestivum L.*) against *Septoria Tritici Blotch* and Yield enhancement

Riad Saidu Korom, Francess Sia Saquee * and Elena Pakina

Department of Agrobiotechnology, Institute of Agriculture, RUDN University, 117198, Moscow, Russia

Septoria Tritici Blotch (STB) is a common disease of wheat, often occurring alongside other foliar diseases. It is known as *Septoria* leaf spot and is caused by the fungal pathogen *Zymoseptoria tritici*. STB is a major global wheat pathogen causing significant yield and quality loss. Its management is difficult due to climate variability and fungicide resistance, making an integrated approach essential. This combines using resistant hybrid cultivars with two-component systemic fungicide treatments to protect crops. This study evaluated the integrated pest management effectiveness of Kolosal Pro fungicide and identified Belyana and Agros spring wheat breeding lines (Belyana and Agros) for resistance to STB. The experiment was established from 2022 to 2024, and a wheat field experiment was conducted in Moscow, Russia. This study used a 3x3 factorial split-block design with three replications at the "Nemchinovka" Research Center. Treatments include Agros with no fungicide, Belyana with no fungicide, and integrated treatments combining Kolosal Pro with each cultivar. The application of fungicides was performed at key phenological stages (tillering, stem elongation, and flag leaf emergence), which are critical periods of effective disease management. The results indicate significant differences (p0.05) in disease incidence, severity, and yield among treatments. The wheat lines showed considerable variation in the percentage of disease incidence and severity, which were classified as resistant and moderately resistant. The results show that Belyana x Kolosal Pro (the integrated treatment) was more resistant to STB severity (1.68%) compared to Agros and Kolosal Pro (1.70%). However, it was classified as moderately resistant. Regarding variety resistance and yield increase, the Belyana variety attained the least incidence (30.23%) and severity (1.82%) and exhibited the highest average grain yield of 4.64 t/ha. The findings demonstrated that combining the fungicide Kolosal Pro and the Belyana cultivar increases yield and reduces STB incidence and severity to an acceptable threshold level.

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sciforum-139373: Evaluating the nutritional value of fruits of two edible wild monkey kola species of West African origin

Effiom Eyo Ita *, Peggy Obai-Ojei Willie, Ayobami Abodunrin, Julius Oyohosuho Phillip, Anthony Agbor and Michael Bissong

Department of Genetics and Biotechnology, University of Calabar, Calabar, Nigeria

Monkey kola is a common name given to the edible wild relatives of West African kolanut. These are neglected and underutilized indigenous tropical fruit species growing in the West and Central African forests. Knowledge on the nutrient and antinutrient composition of the fruits is highly inadequate. In this study, mature fruits of two wild monkey kola species (*Cola pachycarpa* and *Cola lepidota)* were air-dried, milled, and stored in air-tight containers. They were evaluated for phytochemical, proximate, vitamin and mineral compositions. The nutrient compositions were determined using standard AOAC methods. Gravimetric and spectrophotometric methods were used for antinutrient determinations. The two species of monkey kola were found to be rich in both nutrients and antinutrients. However, there were significant (p 0.05) differences in the proximate, mineral, and vitamin compositions of the two varieties. *Cola lepidota* was richer in moisture, protein, fat, phosphorus, iron, and zinc, while *Cola pachycarpa* was richer in ash content, crude fiber, magnesium, potassium, sodium, Vitamin B2, Vitamin B3, Vitamin C, Vitamin A, and Vitamin E. Regarding phytochemicals, *Cola lepidota* was richer in alkaloids, while *Cola pachycarpa* was richer in flavonoids. However, there were no significant (p>0.05) differences between the two monkey kola species in their saponin, tannin, and phytate compositions. The abundance of a wide variety of minerals, vitamins, and other bioactive compounds in both kola species justifies their wide consumption by natives in regions where they grow. The fruits of these species should be fully exploited for their potential health benefits.

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sciforum-138714: Evaluating the Role of Plant Growth-Promoting Rhizobacteria on the Nutritional Quality of *Trifolium alexandrium*

Yousra Debbah * and Mohamed bencherchali

Laboratory of Research on Medicinal and Aromatic Plants, Science Nature and Life Faculty, University of Blida 1, Blida, Algeria.

Trifolium alexandrinum L. (berseem) is a major forage legume known for its high nutritional value and importance in animal feeding systems. Enhancing its nutritive profile through sustainable practices can contribute significantly to improving livestock productivity. Plant growth-promoting rhizobacteria (PGPR) have gained attention as eco-friendly biofertilizers that can enhance plant growth and nutrient content. This study aimed to assess the effect of a single PGPR strain (BT1) on the nutritional quality of *T. alexandrinum* grown under natural field conditions. An open-field experiment was conducted in which seeds were primed with the BT1 strain and irrigated accordingly. An untreated control group was maintained for comparison. The experimental setup included five replicates per treatment. At the vegetative stage, samples were collected and analyzed for nutritional parameters, including dry matter, crude protein, crude fiber, organic matter, PDIE, PDIN, and energy values (UFL and UFV), using standard analytical procedures (AOAC, 1990) and INRA equations. The results indicated that inoculation with BT1 significantly enhanced the nutritional value of *T. alexandrinum*. Crude protein content increased to 21.53% DM in the BT1-treated group, compared to 16.05% in the control. Organic matter was also higher in the BT1 group (89.70% DM) versus the control (87.48% DM). Although dry matter content was slightly reduced in the BT1 treatment (22.76%) relative to the control (24.35%). Moreover, crude fiber content was slightly lower in the BT1 group (15.74%) than in the control (16.32%). Notably, all modifications observed in the BT1 treatment were in favor of improved forage quality, as reflected by the higher values of energy parameters (UFL and UFV) and protein digestibility indices (PDIN and PDIE) compared to the control. This consistent improvement across multiple nutritional parameters highlights the efficacy of BT1 as a biofertilizer.

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sciforum-135652: Evaluating The Yield And Economic Impact Of Oxamyl And Imidacloprid Treatments On Sugarcane Under Varying Stress Conditions

Slindile Brightness Sithole

South African Sugarcane Research Institute

Sugarcane grown in sandy soils (≤10% clay) is prone to drought stress and pest infestations, including nematodes, yellow sugarcane aphids (YSAs), and thrips. A granular soil-applied product containing oxamyl and imidacloprid is commonly used for pest control, with imidacloprid also reported to alleviate stress responses in various crops. This study by the South African Sugarcane Research Institute aimed to evaluate the yield response of different sugarcane varieties to this product across ratoon crops and to assess its cost-effectiveness under varying stress indices. Varieties were grown under treated and untreated conditions, and their performance was assessed relative to a calculated stress index (defined as the average yield of untreated controls as a percentage of the modelled yield potential). There was a statistically significant inverse correlation between the percentage yield increase (tch) and the crop stress index (Pearson's r = –0.273; p 0.01; n = 131), suggesting greater yield gains in more stressed environments. Ratoon crops with stress indices below 75% showed the most notable yield improvements. For example, N60 (North Coast, Blythedale) recorded a 109% increase and N51 (North Coast, Umhlali) 61%, and N62 (Midlands South) showed an increase of 71%. Additionally, gross margin differences (calculated using the July 2024 RV price) were generally positive in treated crops with 75% stress index, and most varieties under marginal and unstressed conditions also saw economic benefits. Negative gross margins observed in some crops may reflect unmeasured stressors affecting the yield response. These findings highlight the value of the strategic application of oxamyl/imidacloprid, particularly in stressed environments, and offer practical guidelines for variety selection and pest management in sandy soils.

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sciforum-139111: Evaluation of olive mill wastewater as a biostimulant for wheat growth under salinity stress

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

Department of Biochemistry, Molecular Biology, Edaphology and Agricultural Chemistry, Faculty of Sciences, University of Alicante, 03690 Alicante, Spain

Wheat is one of the most widely cultivated crops worldwide, ranking first in area and fourth in production. It is the second most important cereal for human consumption after rice and for feed after maize. However, its growth is increasingly affected by abiotic stresses such as salinity, mainly caused by inadequate agricultural practices and saline irrigation. Another environmental concern is the large volume of toxic wastewater from olive oil mills (OMW). Recovering this waste is key to reducing environmental impact and supporting the circular economy. Based on this current issue, the objective of this study is to evaluate OMW as a potential biostimulant for wheat grown under salinity conditions. To achieve this, a greenhouse experiment was carried out in which wheat plants (*Triticum aestivum* L.) were grown under controlled conditions, and three different doses of OMW (0.050, 0.125, 0.25 mM of phenolic compounds) were applied via foliar. The plants were treated with OMW both under saline (100 mM NaCl) and normal conditions. Under non-saline conditions, the highest OMW dose led to a 15% increase in stem length and a 17% in fresh weight compared to the untreated control. Additionally, this treatment resulted in a 20% higher protein concentration and improved membrane stability by 6%. In contrast, the two lower concentrations did not produce significant changes in growth parameters and remained similar to the non-saline control. Under saline conditions, plant growth was reduced in all treatments, and OMW applications did not counteract salt stress. Although the two highest OMW doses under salinity increased protein and proline levels, they did not improve fresh weight or stem length. While higher OMW concentration improved growth and physiological traits under non-saline conditions, no enhancement in growth was observed under salt stress, suggesting that an alternative OMW pretreatment or modified application strategies should be considered.

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sciforum-132691: Evaluation of the Health Status of *Capsicum pubescens* (rocoto) Crops Using UAS Multispectral Imaging in Amazonas, Peru

Sivmny V. Valqui-Reina, Alex J. Vergara and Carlos I. Arbizu *

Facultad de Ingeniería y Ciencias Agrarias, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas

This study presents the preliminary findings from a field experiment aimed at evaluating the health status of *Capsicum pubescens* crops, commonly known as rocoto in Peru, using unmanned aerial systems (UASs) equipped with multispectral sensors. *C. pubescens* is a neglected and underutilized crop with significant agroecological and nutritional value, traditionally cultivated in the Andean highlands but lacking modern cultivation and monitoring practices. The experiment was conducted in the province of Rodríguez de Mendoza, Amazonas, Peru. A DJI Mavic 3M drone, fitted with a multispectral camera, was used to collect aerial imagery over three rocoto crop plots during the production stage. From these images, a Green Area Index (GAI) map was generated, and ten vegetation indices (VIs) were calculated to assess the plant health. Key indicators included the Green Chlorophyll Index (CIgreen), which reached a maximum of 1.22, and the Red Edge Chlorophyll Index (CIred edge), with a peak value of 1.16, both suggestive of active vegetation with a moderate chlorophyll content. The Normalized Difference Vegetation Index (NDVI) and Green NDVI (GNDVI) reached values of 0.99 and 0.92, respectively, indicating a healthy physiological status and high productive potential. These vegetation indices will serve as input variables for machine learning models (multiple linear regression, support vector machines, and random forests), which will be used, combined with feature selection techniques, to further refine crop health assessments. The integration of UAS technologies and artificial intelligence represents an innovative approach to modernize agricultural monitoring of neglected crops such as *C. pubescens*. This effort supports progress toward the broader goal of revitalizing the cultivation of traditional crops in the Andean–Amazonian region, enhancing food security, and adapting agriculture to climate variability.

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sciforum-141953: Evaluation of the yield component and Phytochemical Compositions of Liberica Beans from West Java that applied Various Harvesting Stages and Soaking Durations

Yudithia Maxiselly [1,*], Abdillah Azzam Wahyudin [1] and Haris Maulana [2]

[1] Department of Agronomy, Agriculture Faculty, Universitas Padjadjaran, Indonesia
[2] National Research and Innovation Agency, Indonesia

Coffea liberica is one of many local African coffee species, and is found in Indonesia, including the West Java area. The yield and phytochemical compositions show the quality of Liberica coffee. Those components are affected by many factors, such as the fruit harvesting time and post-harvest processing. The coffee beans' various yield components and phytochemical compositions will be impacted by the maturity stage of the coffee fruits at harvest time and post-harvest treatment. This study aimed to examine the yield and phytochemical contents of Liberica coffee beans at different stages of harvest and soaking times. A completely randomized design was used for the experiment (CRD). Eight treatments were examined, including soaking times (S0 = 0, S1 = 12, S2 = 24, and S3 = 36 h) and harvesting times (H1 = only red fruit/ripe stage, H2 = green, yellow, red fruits/strip-picking stage), with four replications. The main observations were the yield components (size, weight, moisture content, bean yield, bean colour) and the phytochemical compositions (TPC = total phenolic content, AA = antioxidant activity, and CC = caffeine content) of the coffee bean before and after the drying process. The general yield characteristics show no significant differences except for weight, water content (before and after drying), bean yield, and colour. The highest weight before drying was shown by H1S0, and after drying by H2S0 and H2S1. H1S2 has the highest water content before drying, while H0S1 has the greatest water content after drying. In addition, H1S2 and H1S3 produced the highest bean yield. The a* and b* values before and after drying reflect the color component that has the most effect. However, the phytochemical contents exhibited the highest TPC and AA values, with H1S0. On the other hand, H1S1, or selective harvesting, had the highest CC value after 12 hours of soaking. Liberica coffee beans will be of better quantity and quality if optimal methods of harvesting and soaking times are applied.

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sciforum-138489: Exogenous application of *Lantana camara* Linn. flower extract enhances growth promotion in soybean (*Glycine max* (L.) Merrill)

Krishnagowdu Saravanan [1,*], Afrith Wajith [2], Sundarasamy Dhanapal [2], Nagarajan Kiruthiga [2] and Chinnappan Deepa Joan of Arc [2]

[1] Post Graduate and Research Centre in Biotechnology, Arignar Anna College (Arts & Science), Krishnagiri - 635 115, Tamil Nadu, India.
[2] Post Graduate and Research Center in Biotechnology, Arignar Anna College (Arts and Science), Krishnagiri – 635 115, Tamil Nadu, India.

Soybean (*Glycine max* (L.) Merrill), a major global source of vegetable protein and oil, requires sustainable growth-enhancing strategies to meet increasing agricultural demands. This study evaluates the biostimulant potential of *Lantana camara* Linn. flower extract (LcFE) on the growth and physiological attributes of soybean cultivar JS335. *L. camara*, an invasive weed, is a phytochemically rich species known to contain bioactive compounds such as flavonoids, phenolics, alkaloids, and terpenoids, which positively influence plant growth. Fresh *L. camara* flowers were harvested from non-agricultural areas, cleaned, blot-dried, and mechanically ground to obtain crude pulp. The crude pulp was filtered through nylon cloth to extract LcFE, which was stored at 4°C until use. Five-dayold germinated seedlings were divided into six treatment groups: T1 (control) and T2 to T6 (10%, 25%, 50%, 75%, and 100% LcFE, respectively). LcFE treatments were applied via soil drenching at five-day intervals, repeated six times under controlled environmental conditions. On the 33rd day after sowing, plant samples were evaluated for growth parameters including plant height, root length, leaf number, biomass (shoot and root), photosynthetic pigments, and antioxidant enzyme activities (SOD, CAT, and POD). Among the treatments, 10% LcFE (T2) significantly enhanced shoot and root length, biomass, and photosynthetic pigment content. LcFE also improved antioxidant enzyme activities, contributing to improved plant health and vigor. These results demonstrate that *L. camara* flower extract acts as a promising eco-friendly and cost-effective biostimulant, promoting vegetative and physiological development in soybean plants. This study provides a scientific basis for integrating *L. camara* extract into sustainable legume production practices. Further studies are needed to validate its field efficacy, optimize dosage, and elucidate the molecular mechanisms involved under diverse agro-climatic conditions.

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sciforum-130110: Farmer-Driven Perception for Sustainable Potato Production in Nigeria: An Insight from the Mambilla Plateau

Ifeoluwa Simeon Odesina [1,*], Obaiya Grace Utobolo [2], Covenant Ije Egbaji [1], Sylvia Makvereng Satdom [1], Andrea Zemmi Dama [3] and Diana Unwana Affiah [1]

[1] Universidade Estadual do Norte Fluminense Darcy Ribeiro, Av. Alberto Lamego, 2000 - Parque Califórnia, Campos dos Goytacazes, Rio de Janeiro, Brazil.
[2] Cytogenetics and Plant Breeding Unit, Department of Plant Science and Biotechnology, University of Jos, PMB 2084, Jos, Plateau State, Nigeria
[3] Department of Crop Production and Horticulture, Modibbo Adama University, Yola, Adamawa State, Nigeria

In Nigeria, potato crops are known to be widely cultivated in Plateau, Kaduna, and some parts of Kano, but little or no information is known for prospective production hubs such as the Mambilla Plateau in Taraba State, Nigeria. However, this study aims to examine relatable prospects for sustainable potato production in Nigeria with data-driven insight from the farmers in the Mambilla Plateau, Taraba State, Nigeria. The study was conducted in August 2023 at Sarduana Local Government Area, Taraba State, Nigeria. Men and women potato farmers were consulted using a quantitative structured individual in-depth interview (QSIDI) approach on information focused on the demographic, agronomic, nutrient, disease management, and postharvest management practices specific to the potato production at the Mambilla Plateau. Results showed disparities in both agronomic and management practices for the cultivation of potatoes between the men and women farmers, but they were not statistically significant ($p > 0.05$). However, a significant difference ($p \leq 0.05$) was observed in the postharvest activities practiced by the men and women farmers interviewed, particularly in the storage facilities utilized after harvest. Four potato varieties were mentioned by the farmers, and Yellow Sese was the most preferred. The majority of the potato varieties were sourced from an open market in Cameroon, with less preference for varieties in Nigeria. The linear regression model from the study also revealed that seed source ($R^2 = 0.48$) could positively and significantly ($p \leq 0.05$) be used to predict potato yield in the study area. The overview of potato production at the Mambilla Plateau, Taraba State, had clearly shown prospects for national and international intervention with a focus on driving breeding initiatives, improving the livelihoods of small-scale farmers, and increasing the chances of potatoes becoming a national crop.

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sciforum-133500: Fruit Storage of Bitter Gourd (*Momordica charantia)* to Enhance its Seedling Vigor

Mariz Dahilig, Raymund Julius Rosales *, Christian Butch Andrew Balbas, Glisten Faith Pascua and Micah Benize Gregorio-Balbas

Mariano Marcos State University (MMSU), City of Batac 2906, Ilocos Norte, Philippines

Unpredictable weather conditions, infestation of pests, and infection with diseases are common problems in bitter gourd fruits when still attached to the mother plants, which affect the seedling vigor. Thus, it is a big problem for farmers to face. Fruit storage under ambient conditions may alleviate this problem. A study was conducted on the fruit storage (0, 2, 4, and 6 days) of bitter gourd (half-ripe stage) under ambient conditions (temperature: 28 ± 2 °C and relative humidity: 65 ± 5%). It was conducted to evaluate the impact of fruit storage on the enhancement of bitter gourd's seedling vigor. A completely randomized design with four replicates was used. Based on the results, 4 days of fruit storage significantly improved the seedling vigor index (SVI), and time beyond this period did not contribute to a higher SVI. Likewise, this fruit-storage period produced better growth for shoot, root, and seedling lengths as compared to lower and higher periods as well as unstored fruits. Moreover, a higher root count per seedling and seedling fresh weight was observed in 4-day fruit storage. Conversely, 6-day fruit storage exhibited a higher chlorophyll content (SPAD index) as compared to shorter storage periods and unstored fruits. A 4-day fruit-storage period may be recommended to the farmers to obtain vigorous bitter gourd seedlings.

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sciforum-132609: Fungal community composition across different organs in two distinct almond tree cultivars

Ana Luísa Ferreira Faustino [1, 2, 3,*], Maria Margarida Oliveira [4], M. Rosário Félix [5] and Liliana Marum [6,7]

[1] Alentejo Biotechnology Center for Agriculture and Agro-Food (CEBAL)/ Polytechnic University of Beja (IPBeja), Beja, Portugal
[2] MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL, Portugal
[3] MED – Mediterranean Institute for Agriculture, Environment and Development, Instituto de Investigação e Formação Avançada, Universidade de Évora, Portugal
[4] Instituto de Tecnologia Química e Biológica António Xavier, Universidade NOVA de Lisboa, Plant Functional Genomics Laboratory, Portugal
[5] MED & CHANGE – Global Change and Sustainability Institute, Departamento de Fitotecnia, Universidade de Évora, Portugal.
[6] Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo (CEBAL)/Instituto Politécnico de Beja (IPBeja), Portugal.
[7] MED – Mediterranean Institute for Agriculture, Environment and Development & CHANGE – Global Change and Sustainability Institute, CEBAL, Portugal.

The implementation of advanced irrigation systems, combined with modern agricultural techniques, allows for the establishment of almond plantations in new Mediterranean regions, namely the south of Portugal. The context of climatic changes, together with high-density, irrigated agricultural systems, may contribute to the appearance of almond tree diseases, and more specifically, fungal diseases. This study aims to understand the composition and distribution of fungal communities in different organs of symptomatic almond trees from a plantation in Beja, Alentejo. Samples of branches, trunks, and leaves have been collected from three symptomatic trees of two different cultivars (Vairo and Soleta). The samples have been surface-disinfected and inoculated in Petri dishes with Potato Dextrose Agar (PDA). The colonies are re-isolated into new Petri dishes with PDA and analyzed by molecular techniques, targeting nuclear rDNA's internal transcribed spacer (ITS) region for PCR amplification and Sanger sequencing. The results demonstrated differences in the fungal community between the different organs. Two fungal isolates were obtained from leaves and identified as *Biscogniauxia mediterranea* (sample from Vairo) and *Preussia* sp. (sample from Soleta). In the branch samples, *B mediterranea,* followed by *Alternaria alternata,* is the most representative fungus in both cultivars. *Fusarium* spp, *Cystospora* sp (includes pathogenic species associated with canker development in almond trees) and *Trichoderma harzianum* (an endophytic fungus known for its antagonistic capacity) are only present in trunk samples. In terms of the fungal community, we did not observe differences between the two cultivars, but we observed distinct patterns in community structure across organs. These results contribute to understanding the composition and distribution of fungal communities in almond trees, which allows for the design of new approaches for disease management and sustainable production.

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sciforum-139213: Grape Pomace Extract as a Biostimulant to Enhance Tomato and Cucumber Seed Germination Under Salt Stress Conditions

Zineb El Bouchikhy [1,*], Cristina García Cano [2], Borja Ferrández Gómez [3], Juana J. Jordá [4], Antonio Sánchez Sánchez [3] and Mar Cerdán [5]

[1] Department of Biochemistry and Molecular Biology and Edaphology and Agricultural Chemistry, University of Alicante, 03690, Alicante, Spain
[2] Department of Biochemistry, Molecular Biology, Edaphology and Agricultural Chemistry, Faculty of Sciences, University of Alicante,03690, Alicante, Spain
[3] Department of Biochemistry and Molecular Biology and Edaphology and Agricultural Chemistry, University of Alicante, 03690,Alicante, Spain.
[4] Department of Biochemistry and Molecular Biology and Edaphology and Agricultural Chemistry, University of Alicante,03690,Alicante, Spain.
[5] Department of Biochemistry and Molecular Biology and Edaphology and Agricultural Chemistry, University of Alicante, 03690, Alicante, Spain.

Introduction

Salinity is a major environmental issue that negatively impacts agricultural productivity and food security. A promising strategy for mitigating salt stress is the use of biostimulants that enhance plant tolerance to this abiotic stress. Grape pomace, an abundant agro-industrial byproduct, contains bioactive compounds that can be utilized as biostimulants.

Methods

This study examines the impact of grape pomace extract on the germination of tomato (*Solanum lycopersicum*) and cucumber (*Cucumis sativus*) seeds under both normal and salt stress conditions. Various concentrations of the extract were evaluated to determine their effects on key germination parameters, including germination percentage, Timson's germination index, germination uniformity coefficient, mean germination time, coefficient of velocity of germination, relative seed germination, relative root growth, and the overall germination index.

Results

Characterization of the grape pomace extract revealed a high content of bioactive secondary metabolites. At low concentrations, the extract significantly improved all germination parameters in both tomato and cucumber under normal and salt stress conditions, indicating a pronounced biostimulant effect across both species. However, higher concentrations exhibited phytotoxic effects, negatively impacting seed germination.

Conclusion

These findings highlight the potential of grape pomace extract as an eco-friendly biostimulant when applied at the optimal concentrations.

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sciforum-128909: Healthy seeds and cultivars tolerant to Bacteria Soft Rot for the safe production of potato

Dooshima Rita Dugeri [1,*], Imoter Joseph Akende [2], Riad Saidu Koroma [3] and Aleksandr N. Ignatov [4]

[1] Department of Agrobiotechnology, Agrarian-Technological Institute, RUDN University, 117198 Moscow, Russia .
[2] Joseph Sarwuan Tarka University, Makurdi (JOSTUM) P.M.B. 2373, Makurdi, Benue state, Nigeria.
[3] Department of Agrobiotechnology, Agrarian-Technological Institute, RUDN University, 117198 Moscow, Russia.
[4] Professor, Department of Agrobiotechnology, Agrarian-Technological Institute, RUDN University, 117198 Moscow, Russia.

This review explores the impact of soft rot bacteria, particularly *Pectobacterium* and *Pseudomonas*, on potatoes (*Solanum tuberosum*), a crucial staple crop worldwide. Potatoes lost due to infection by Pectobacteria, causing soft rot, represent a significant challenge in potato cultivation, affecting both seed and marketable tuber production, reducing crop quality and threatening food security.

Pathogens can pose a serious threat to plants during the early stages of seed production. The presence of Pectobacteria in seed potatoes in Russia is strictly regulated by national standards, such as GOST 33996-2016 and GOST R 59551-2021. However, these standards do not address other soft-rot bacteria, like Pseudomonas, that pose a significant risk to healthy seed tuber production. This study aims to investigate the interaction between *Pseudomonas* D9, a soft rot pathogen found on potato tubers, and two other harmful bacteria, *Pectobacterium brasiliense* and *P. atrosepticum*. The goal is to understand the factors that influence the multiplication of these bacteria and the development of soft rot on potatoes. To do this, the experiment involves incubating potato samples with various combinations of these three bacteria at different temperatures (5–30 degrees Celsius) for 72 hours. The results show that when the temperature is above 24 degrees Celsius, the Pectobacterium strains show more signs of soft rot. However, in the presence of *Pseudomonas* D9, soft rot is favored by a lower temperature. These findings highlight the importance of monitoring mixed infections in order to control soft rot and minimize potato yield losses. Future research could focus on developing strategies to reduce the impact of this disease on food security.

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sciforum-135483: how exogenously administered ascorbic acid may reduce the negative effects of NaCl on maize (Zea mays).

Muhammad Saleem and Muazzma Ilyas

University of Agriculture Faisalabad, Pakistan

Maize (*Zea mays*), initially domesticated in Central America, is the world's leading crop and is widely cultivated as a cereal grain. It is one of the most versatile emerging crops with wide adaptability. Ascorbic acid was applied to the plants growing under control, 60 and 120 mM NaCl, in two ways: as a foliar spray on leaves or through roots in the soil at two levels, 100 and 150 ppm. At UAF Community College PARS, a pot experiment with three replicates was conducted using a CRD with a factorial layout to investigate the influence of ascorbic acid on a variety of physiological and morphological parameters. After the application of NaCl treatment, various parameters were recorded, like shoot attributes, root attributes, and photosynthetic pigments; nutrient analysis was conducted using a standard procedure. NaCl significantly reduced the growth of the plants. All the considered parameters showed negative growth with high NaCl, but the application of ascorbic acid improved and alleviated the effects of NaCl toxicity on all parameters, except in the roots, where salt accumulated, leading to non-significant results. The leaf area index, root length, shoot length, per plant leaves, maximum plant height, (a and b) carotenoids, SOD, POD, MDA, BOD, CAT, chlorophyll content, nitrogen content Na^{+}, K, $Ca^{2+,}$ protein content, and soluble sugar are some of the parameters that were measured. The collected data was scrutinized using COSTAT software, and treatment means were compared using the LSD test with a probability level of at least 5%. Moreover, Tukey's test was applied to compare the means of the samples.

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sciforum-137793: Impact of *Vicia ervilia* Ecotypes, Seedling Date, Dose, and Cutting Stage on the Nutritive Value of Bitter Vetch Ecotypes

Soumaya Boukrouh [1,*], Ali Noutfia [2], Jean-François Cabaraux [3] and Mouad Chentouf [2]

[1] Mohammed VI Polytechnic University (UM6P), Ben Guerir 43150, Morocco
[2] National Institute of Agricultural Research (INRA), Tangier 90000, Morocco
[3] Faculty of Veterinary Medicine, University of Liège, Liège 4000, Belgium

In Morocco, livestock production faces significant challenges, such as drought and rangeland degradation, which reduce feed availability. To address this, alternative feed resources such as *Vicia ervilia* (bitter vetch) have been explored owing to their drought tolerance and ability to grow on poor soils. Bitter vetch is traditionally used for grain production, with a high protein content (~27% DM) and yields of up to 1 ton/ha, but its potential as a high-quality forage has been less studied. This study evaluated the expansion of bitter vetch use beyond grain, aiming to optimize cultivation practices for forage production under Mediterranean conditions in northern Morocco during the 2020/2021 season. A randomized block design with a split-plot arrangement tested three sowing dates (early, Dec 24; mid, Jan 10; late, Feb 1), four plant densities, and three ecotypes differing in flowering time (early, medium, and late). Plants were harvested at three flowering stages (start, full, and end), dried, ground, and analyzed for chemical composition, fiber fractions, and digestibility using standard methods. The results showed no significant effect of ecotype or sowing density on nutritive value, but sowing date influenced all measured parameters, and flowering stage affected fiber content (CF, ADF, cellulose) and dry matter digestibility. Early sowing reduced fiber content but did not lead to the highest organic matter digestibility, possibly due to fiber-digestibility relationships. Surprisingly, plants harvested at the start of flowering had the highest fiber content, and digestibility was lower at full flowering, potentially owing to inflorescence metabolites affecting rumen microbes. In conclusion, medium sowing combined with harvest at the start or end of flowering optimizes bitter vetch nutritional quality and fiber digestibility. These findings suggest that adjusting cultivation practices can enhance the value of bitter vetch as a sustainable alternative forage in drought-prone Moroccan regions, thereby supporting livestock production under challenging environmental conditions.

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sciforum-133503: Improving rice productivity and quality through optimum plant population and nitrogen management

Danveer Singh [1,*], Rahul Kaushal [2] and Simran Sindhu [3]

[1] Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India
[2] Department of Soil Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India
[3] Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India

Rice yields can be improved with the optimum plant population and nitrogen levels. A field experiment was conducted at Krishi Vigyan Kendra, Panipat (Haryana), during kharif 2023 to explore the effect of the plant population dynamics and nitrogen management on Basmati rice. In this study, three different plant populations, viz. P1, P2, and P3 (33, 25, and 20 plants m-2), and five nitrogen levels, viz. N1, N2, N3, N4, and N5 (100% RDN; 100 RDN + two sprays of nano nitrogen at 40-50 and 60-70 DAT; LCC-based nitrogen scheduling; 125% RDN; and 150% RDN), kept as the main plot and a sub plot, respectively, were replicated thrice in a split-plot design. The results revealed that P2N5 had the highest yield (5292 kg ha-1), which was higher than that (3.14~11.05) under the other treatments. This can be attributed to a higher number of grains in panicle-1. However, the combination of P2N5 leads to better gross returns and a better benefit:cost ratio. This study suggests that P2N5 treatments could enhance rice yields up to a significant level.

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sciforum-132607: Influence of different nitrogen fertilization on photosynthetic pigments in winter wheat

Gabriele Antanaviciene [1,*], Ernestas Zaleckas [1], Darija Jodaugiene [1], Adomas Butka [1], Eividas Stelmokas [1], Edita Mazuolyte - Miskine [1] and Egle Petraitiene [2]

[1] Vytautas Magnus University Agriculture Academy, Akademija, Kaunas District 53361, Lithuania
[2] AgroITC Innovation and Research Centre, Akademija, Kaunas District 53361, Lithuania

Higher nitrogen fertilizer rates usually lead to an increase in photosynthetic pigments and can significantly affect not only the vegetative mass of plants, but also the content of photosynthetic pigments in plants, which is a key factor determining overall plant productivity. For this purpose, a three-factor field experiment was conducted in 2025 in the fields of the AgroITC Innovation and Research Center of the Agro Concern Group. The aim of this study was to investigate the influence of different nitrogen fertilization rates on the content of photosynthetic pigments in three winter wheat varieties (Factor A): 1) 'Chevignon', 2) 'LG Keramik', 3) 'Euforia'; Factor B—nitrogen fertilization rates: 1) 150 kg ha^{-1}, 2) 180 kg ha^{-1}; Factor C—nitrogen application time: 1) three times (BBCH 27–29; BBCH 29–30; BBCH 32–33); 2) four times (BBCH 27–29; BBCH 29–30; BBCH 32–33; BBCH 37–39). When fertilizing three times, the nitrogen rates were divided into $N_{60}+N_{60}+N_{30}$ and $N_{70}+N_{70}+N_{40}$, and when fertilizing four times, they were divided into $N_{50}+N_{50}+N_{20}+N_{30}$ and $N_{60}+N_{60}+N_{30}+N_{30}$. The photosynthetic pigments content was determined at BBCH 32-33 and BBCH 37-39 of winter wheat using the Holm–Wettstein methodology. The studies showed that the total amount of photosynthetic pigments and the mass of the aboveground part of the plants depended on the winter wheat variety and the level of nitrogen rates. The highest total amount of photosynthetic pigments was determined in the BBCH 32-33 stage in the winter wheat 'Chevignon', when the plants were fertilized with N_{150}, applied four times. However, the total amount of photosynthetic pigments in the BBCH 37-39 stage was the highest in 'Chevignon', when the plants were fertilized with N_{150}, applied three times.

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sciforum-135688: Integrating Metabolic Profiling and RSM to Enhance Biocontrol Efficiency of *Bacillus amyloliquefaciens* VFS2

Imen Haddoudi [1,*], Jordi Cabrefega [2], Isabel Mora [3], Loua Haddoudi [4], Emilio Montesinos [3] and Moncef Mrabet [5]

[1] Laboratory of Legumes and Sustainable Agrosystems, Centre of Biotechnology of Borj-Cedria, Tunisia
[2] IRTA, Sustainable Plant Protection, 17134 Canet de La Tallada, Girona, Spain.
[3] 3Laboratory of Plant Pathology, Institute of Food and Agricultural Technology-XaRTA-CIDSAV, University of Girona, Campus Montilivi, 17071 Girona, Spain
[4] Laboratory of Extremophile Plants, Centre of Biotechnology of Borj-Cedria, Tunisia
[5] Laboratory of Legumes and Sustainable Agrosystems, Centre of Biotechnology of Borj-Cédria, Tunisia

Optimizing fermentation conditions is crucial in maximizing the production of bioactive metabolites and improving the consistency and efficacy of microbial biocontrol agents. This study investigates the influence of specific carbon and nitrogen sources on the growth, cyclolipopeptide (cLP) production, and antifungal activity of *Bacillus amyloliquefaciens* strain VFS2 against *Fusarium equiseti*. Batch fermentations were conducted in four media types (LB, LA, GA, and PM) across five incubation periods (0, 8, 24, 48, and 72 hours). A one-factor-at-a-time approach followed by optimization using Response Surface Methodology (RSM) revealed that the highest antifungal activity (up to 95%) was achieved in PM and LB media. HPLC profiling showed that the composition of the culture media significantly influenced the production of key cLPs, including isoforms of iturins, fengycins, and surfactins. Pearson correlation analysis confirmed a strong, significant association (p 0.001) between specific cLPs isoforms and the antifungal activity of VFS2, with media-dependent variability. These results demonstrate the potential of integrated metabolic profiling and RSM-based optimization to enhance the biocontrol performance of *B. amyloliquefaciens* VFS2 under tailored fermentation conditions.

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sciforum-135685: Light spectrum-mediated improved drought-resilient rootstock performance under drought stress in Okra genotypes

Preethika Suresh [1,*] and Sowbiya Muneer [2]

[1] School of Biosciences and Technology, Vellore Institute of Technology, Vellore.
[2] VIT School of Agricultural Innovations and Advanced Learning, Vellore Institute of Technology, Vellore

Introduction

Drought stress poses a major risk to global agriculture, particularly in arid and semi-arid regions with low crop yields. Okra (Abelmoschus esculentus L.), an underappreciated but nutritionally important crop, suffers from yield and quality reductions in response to water scarcity. Grafting has emerged as a practical technique for enhancing drought tolerance by fusing sturdy rootstocks with high-yielding scions. Furthermore, light quality directly affects stress adaptation by modulating plant physiological, biochemical, and proteomic responses. Thus, this study's goal is to maximize drought-resistant rootstock performance under various light spectrums.

Materials and Results

Two okra genotypes, NS 7772 and NS 7774, were evaluated in this study under drought stress and under two different light spectra: 100% white light and red–blue–white (R:B:W) LED. The improved drought tolerance of NS-7774 was demonstrated by infrared thermographic pictures, which showed a lower canopy temperature, an increased relative water content, decreased oxidative damage (MDA), and increased antioxidant enzyme activity. Thylakoidal proteomic profiling and 2D-SDS-PAGE demonstrated improved metabolic stability, demonstrating that NS 7774 under R:B:W retained photosynthetic protein complexes and produced stress-responsive polypeptides. SEM-EDAX provided additional confirmation of nutrient retention under stress. Multivariate analysis revealed that antioxidant activity, protein, and chlorophyll are all significant components that support resilience.

Conclusion

These findings demonstrate that, when combined with spectrum light alteration, grafting can significantly boost okra's tolerance to drought. Because of its remarkable performance under R:B:W light, NS 7774 may be cultivated in drought-prone locations.

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sciforum-128078: Machine Learning-Based Analysis Of Crop Yield Variability In The Philippines Under Irrigated And Rainfed Conditions: The Role Of Nitrogen, Phosphorus, And Magnesium Fertilization

Jay Cabarles Liza [1,*], Bobby Dioquino Gerardo [2, 3] and Louie Famisaran Cervantes [2]

[1] West Visayas State University – Janiuay Campus, Janiuay, Iloilo 5035, Philippines
[2] West Visayas State University, Iloilo City 5000, Philippines
[3] Northern Iloilo State University, Estancia, Iloilo 5017, Philippines

This study explores the elements that impact the fluctuations in crop yield in the Philippines for both irrigation and rainfed agricultural systems, focusing on the effects of nitrogen, phosphorus, and magnesium fertilization on crop yield. Spearman's Rank Correlation determines the relationship between soil fertility, nutrient content, and crop yield. These correlations suggest that adequate water allows for the efficient use of nutrients. On the other hand, rainfed systems show a strong negative correlation with fertilization for nitrogen (r = -0.562, p \ 0.001) and phosphorus (r = -0.565, p \ 0.001), suggesting that water limitations affect nitrogen use. We observed that irrigation has a strong positive correlation with nitrogen application (r = 0.773, p \ 0.001) and magnesium application (r = 0.346, p = 0.001), among other nutrients. Machine learning models such as Decision Tree, Random Forests, Support Vector Regression (SVR), and K-Nearest Neighbors (KNN) were used; regarding the model performance evaluation, the Random Forest model demonstrated strong consistency and robustness, regardless of whether it was an irrigated or rainfed area, with only slight increases in MAE (0.3107 to 0.3607), MSE (0.1790 to 0.2391), and RMSE (0.4230 to 0.4890), while maintaining high R^2 values (0.8661 to 0.8095). The study points out the need for tailored agricultural practices, emphasizing synchronized water and nutrient management in irrigated areas and water conservation in rainfed areas to enhance rice production and ensure food security.

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sciforum-126920: Micropropagation of *Hyphaene thebaica* Through Seed and Root Tip Cultures: A Strategy for Sustainable Crop Production

Doaa Jamal Abudarwish

Plant Biodiversity Research Directorate , National Seed Bank (NSB), National Agricultural Research Center (NARC), Al-Balqa' 19381, Jordan

Hyphaene thebaica (L.) Mart., commonly known as doum palm, is a culturally, nutritionally, and medicinally valuable (yet underutilized) species predominantly found in arid and semi-arid regions of Africa and the Middle East. Despite its ecological and economic potential, no standardized or comprehensive in vitro propagation protocol has been previously established for this species. Traditional propagation methods, primarily via seeds, are constrained by slow germination, long juvenile phases, and genetic heterogeneity. Therefore, the development of reliable tissue culture techniques is essential for the species' large-scale propagation, conservation, and genetic enhancement.

This review presents, for the first time, a scientific synthesis and evaluation of in vitro culture strategies for *Hyphaene thebaica*, based on original research findings and emerging data. It explores the use of various explants, including seed-derived radicles, root tips, and floral tissues, in initiating callus, shoot, and root formation. The influence of key factors such as plant growth regulators (e.g., 2,4-D, IBA, BAP, 2iP), carbon sources, and culture media compositions (e.g., MS, B5) is discussed in detail. Special emphasis is placed on the successful induction of embryogenic callus and somatic embryos from female inflorescences, marking a novel achievement in *H. thebaica* micropropagation.

Additionally, the review addresses challenges such as phenolic compound exudation, tissue browning, and somaclonal variation, offering practical mitigation strategies. This pioneering work lays the foundation for future conservation, genetic improvement, and commercial exploitation of *H. thebaica* through plant biotechnology.

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sciforum-134357: Multifaceted Plant Growth-Promoting Rhizobacteria Improve Tomato Growth and Suppress Key Phytopathogens

Hasna El Hjouji [1,*], El Hassan Mayad [2], Khadija Dari [3] and Hind Aassila [3]

[1] Phytopathologie
[2] Department of Biology, Faculty of Sciences – Agadir, Agroecology / Crop Protection, Ibn Zohr University (UIZ), BP 8106, Hay Dakhla, 80000 Agadir, Morocco
[3] Laboratory of Agri-food and Health, Department of Applied Biology and Agri-food, Faculty of Sciences and Techniques, Hassan First University of Settat, Settat 26000, Morocco

Abstract: Plant Growth-Promoting Rhizobacteria (PGPR) play a crucial role in sustainable agriculture by enhancing plant growth and health. This study aimed to characterize the PGPR potential of ten bacterial strains isolated from the rhizosphere of tomato (Solanum lycopersicum) plants, with the goal of developing a bacterial consortium for use as a biofertilizer. The investigation focused on evaluating their physiological characteristics and in vitro antifungal activities, as well as their in vivo effects on tomato plant growth.

All ten isolates demonstrated the ability to produce indole-3-acetic acid (IAA), a key phytohormone, with concentrations ranging from 1.09±0.05 μg/ml to 12.30±1.09 μg/ml. Ammonia production was also a common characteristic among all tested strains. While not universal, nitrogen fixation and phosphate solubilization were observed in a subset of the isolates, with seven strains showing phosphate solubilization on solid medium and eight on liquid medium, and six strains demonstrating nitrogen fixation. Furthermore, all ten strains produced at least one of the tested hydrolytic enzymes (protease, cellulase, or lipase) which are implicated in antifungal activity. In vitro antagonistic assays revealed significant inhibitory effects against Fusarium, Alternaria, and Stemphylium, but no inhibition was observed against Cladosporium. Strains MNA8 and MNA6 showed the highest inhibition rates against Alternaria (87.88% and 82.58%, respectively), while MNA3 exhibited the strongest antagonism against Fusarium (71.85%). MNA10, MNA6, and MNA8 were most effective against Stemphylium.

In vivo experiments showed that inoculation with the bacterial strains positively influenced tomato seed germination parameters, including final germination percentage (FGP), mean daily germination (MDG), mean germination time (MGT), and germination index (GI). All strains achieved a 100% FGP, representing a 60% improvement over the control. Morphological parameters such as stem and root lengths, and fresh and dry biomass, were also enhanced by bacterial inoculation. Notably, MNA7 increased stem length by 30% , and root length saw improvements between 71% and 117% across various treatments. MNA1 significantly boosted fresh and dry biomass by over 200%. Biochemical parameters, specifically chlorophyll content, also showed improvement, with eight strains increasing the total chlorophyll by 5.47% to 25.24%.

These findings highlight the promising potential of these rhizobacterial strains as effective bioinoculants for enhancing tomato plant growth and providing biocontrol against key phytopathogens. Further research, including molecular identification, abiotic stress resistance studies, in vivo validation of antifungal activity, and investigations into synergistic effects in bacterial consortia, are warranted to optimize their application and explore commercialization possibilities.

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sciforum-129649: Mycopriming with fungal extracts enhances quality in nursery tomato seedling

Álvaro Iglesias Ganado *, Jorge Poveda, Óscar Santamaría and Jorge Martín-García

University of Valladolid, Valladolid 47002, Spain

Improving seedling quality is a key objective in commercial horticulture, as it directly influences crop establishment, productivity, and performance in the field. Mycopriming, the application of bioactive fungal compounds to seeds, represents a sustainable strategy to enhance early plant development. In this study, we investigated the effects of seed priming with extracts derived from the mycelium and culture filtrates of endophytic fungi in *Solanum lycopersicum* seedlings under nursery conditions. Greenhouse trials were conducted to assess germination dynamics, root and shoot development, and physiological traits, including chlorophyll content, the flavonol index, and the anthocyanin index. Although germination percentage and shoot-related traits did not show significant variation compared to the control, both types of fungal extracts consistently enhanced root development across experiments. The culture filtrate extract increased root length by 33% (p 0.05) and root dry weight by 32% (p 0.05) compared to the control, while the mycelial extract increased root length by 25% (p 0.05) and root dry weight by 22% (p 0.05) compared to the control. This stimulation of root growth is particularly relevant for improving water and nutrient uptake capacity, which are critical for early seedling vigor and transplant success. These results demonstrate the potential of fungal metabolite-based seed treatments as a practical and efficient tool to improve the physiological quality of nursery-grown tomato seedlings. The use of naturally derived fungal extracts provides an environmentally friendly alternative to synthetic growth regulators, aligning with the principles of sustainable agriculture. Overall, mycopriming with fungal endophyte extracts emerges as a promising technique to support early-stage development and seedling vigor in tomato production, especially in nursery systems focused on delivering high-quality transplants.

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sciforum-130226: Nonlinear Dynamics of a Soil Nutrient–Plant Biomass Interaction Model for Agricultural Systems

Megala T [1,*], Nandha Gopal T [1], Sivabalan M [1], Siva Pradeep M [2], Yasotha A [3] and Raja N [4]

[1] Department of Mathematics, Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Periyanaickenpalayam, Coimbatore, Tamil Nadu 641 020, India
[2] Department of Mathematics, United College of Arts and Science, Periyanaickenpalayam, Coimbatore, Tamil Nadu 641 020, India
[3] Department of Mathematics, United Institute of Technology, Periyanaickenpalayam, Coimbatore, Tamil Nadu 641 020, India
[4] Department of Mathematics, Rathinam Technical Campus, Eachanari, Coimbatore , Tamil Nadu 641 021, India

Soil nutrient dynamics play a vital role in maintaining the productivity and long-term sustainability of agricultural ecosystems. Yet, many existing models fall short by overlooking critical biological feedbacks or oversimplifying the complex interactions between inorganic nutrients, organic matter, and plant biomass. These oversights limit their usefulness in guiding effective and sustainable land management practices. In this study, we aim to address this gap by formulating a comprehensive nonlinear mathematical model that captures the key ecological processes driving nutrient cycling in soils.

We develop a three-dimensional system to represent the dynamic interplay among inorganic nitrogen, soil organic matter, and plant biomass. The model incorporates essential processes such as mineralization, fertilization, nutrient uptake by plants, plant growth, and organic turnover. We establish the positivity and boundedness of model solutions to ensure that they remain biologically meaningful. Equilibrium points, including a plant-free state and a biologically feasible positive state, are identified and analyzed for stability using the Jacobian matrix.

To understand the influence of different factors on system behavior, a detailed sensitivity analysis is performed. This reveals which parameters—such as fertilization rate or mineralization efficiency—most significantly affect long-term nutrient levels and plant biomass. Numerical simulations validate the analytical results and provide great perspective into how the system evolves over time. These simulations illustrate the conditions under which the soil–plant system reaches stability or becomes degraded.

Overall, the proposed model offers a valuable theoretical framework for evaluating soil fertility dynamics and optimizing nutrient management in agricultural settings. It contributes to the understanding of sustainable farming practices and supports data-driven strategies in precision agriculture.

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sciforum-140165: Optimization of UAV-based Spraying Parameters and Nozzle Type Efficacy for Rice Crop Canopy

Shefali Vinod Ramteke [1,*], Pritish Kumar Varadwaj [1] and Vineet Tiwari [2]

[1] Department of Applied Sciences, Indian Institute of Information Technology Allahabad (IIIT Allahabad), Prayagraj 211015, Uttar Pradesh, India
[2] Department of Management Studies, Indian Institute of Information Technology Allahabad (IIIT Allahabad), Prayagraj 211015, Uttar Pradesh, India

The increasing adoption of UAV-based spraying systems to deliver precise and uniform agrochemical applications is necessitating the optimization of operational parameters such as height and nozzle type to enhance efficacy and minimize the environmental impact. This study evaluated the influence of nozzle types (N-1, N-2, N-3, and N-4) and UAV heights (2 m, 2.5 m, and 3 m) on critical spraying parameters including volume median diameter (VMD), droplet density (DD), crop canopy coverage area (CA%), and swath width (SW) across different canopy positions. Statistical analysis using ANOVA and Tukey's post hoc tests revealed significant differences (p0.05) in the deposition patterns across the nozzle types and heights. Among the configurations tested, nozzle N-3 at a height of 2.5 m above the crop canopy achieved the highest canopy coverage (93.5%), with an optimal volume median diameter (417.3 μm), ensuring an effective and uniform deposition across the canopy positions. Droplet density was highest at the middle canopy position (605.5 droplets/cm^2) for the nozzle N-2 at 2 m, while the bottom canopy showed the most variability across the nozzle types and heights. Laboratory nozzle characterization validated these results, along with maintaining the consistency of the droplet size classification within the ASABE standards. This study demonstrates that the UAV height and nozzle type can significantly influence spraying efficiency, thus providing actionable insights for optimizing UAV-based spraying systems. These findings are particularly relevant for improving sustainable agricultural practices in Northern India, where UAV-based spraying can maximize resource efficiency and minimize environmental risks, even for smallholder farmers.

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sciforum-125893: Optimizing Irrigation Strategies to Enhance Growth, Phenology, and Yield in Bread Wheat (Triticum aestivum L.)

Muntarina Hussan Mouri [1,*], Mahadi Hasan Monshi [2], Ahmed Khairul Hasan [3], Rehenuma Tabassum [1] and Fakhrul Islam Monshi [4]

[1] Department of Crop Botany and Tea Production Technology, Sylhet Agricultural University, Sylhet-3100, Bangladesh
[2] Department of Economics, University of Chittagong, Chittagong- 4331, Bangladesh.
[3] Department of Agronomy, Bangladesh Agricultural University, Mymensingh -2202, Bangladesh.
[4] Department of Genetics and Plant Breeding, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Efficient water management is very crucial for increasing wheat production, particularly in climate-sensitive regions like Bangladesh. The present study was performed in Mymensingh, a typical wheat-cultivating area in Bangladesh, to assess the impact of stage-specific irrigation scheduling on the growth dynamics, phenological development, and yield performance of bread wheat. In a field experiment, seven wheat varieties (Protiva, BARI Gom-19, -20, -22, -25, -30, and -32) were selected based on their popularity and widespread adoption among farmers and used as treatments. A two-factor split-plot experiment with three replications was employed, comprising four irrigation treatments: rainfed control = I_0; single irrigation at crown root initiation (CRI) = I_1; dual irrigation at CRI and booting = I_2; and triple irrigation at CRI, booting, and grain filling = I_3. The results showed significant variation among the varieties (treatments) for most of the measured traits; in particular, BARI Gom-32 produced the highest grain yield (4.66 tha^{-1}) along with its attributing traits, including the highest plant height (95.11 cm), length of spike (13.25 cm), thousand-grain weight (51.39 g), and harvest index (54.38%). Meanwhile, irrigation treatments provided significant variation for all studied traits; notably, the triple irrigation (irrigating at CRI, booting, and grain filling stages) system produced the highest value for morphological, phenological, and yield-related traits compared to other irrigation regimes. The combined effect of varying irrigation levels and varieties significantly impacted all traits related to growth and yield performance, resulting in the highest spike length (14.87 cm), number of grains $spike^{-1}$ (49.76), thousand-grain weight (52.55 g), harvest index (56.83%), and grain yield (4.82 tha^{-1}) in BARI Gom-32, with three irrigations applied in the CRI, booting, and grain filling stages. Grain yield had a very significant positive correlation with effective tiller number, spike length, and thousand-grain weight, particularly under I_3 irrigation. Both PCA and heatmap clustering also confirmed the high genotype × irrigation regime interaction effects, which were optimally expressed by BARI Gom-32 and BARI Gom-25 under I_3 irrigation. The findings highlight the importance of adaptive water management frameworks to optimize wheat productivity in water-scarce environments, offering a climate-resilient and agronomically effective approach to boost its domestic production in Bangladesh.

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sciforum-110011: Physiological and Agronomic Benefits of Seed Priming in Durum Wheat Exposed to Tillering and Anthesis Drought

Abdallah Aldahadha

National Agricultural Research Centre (NARC); Baqa'a, Al Balqa; Jordan

A controlled pot experiment was conducted to evaluate the effects of seed priming on physiological traits, growth, and yield components of four durum wheat (*Triticum durum*) varieties—Hourani, Umqais, Sham 1, and Maru 1—under drought stress imposed during the tillering and anthesis stages. Four seed treatments were applied prior to sowing: hydropriming with distilled water, osmopriming with polyethylene glycol (PEG), osmopriming with 1.5% calcium chloride ($CaCl_2$), and an untreated control. Seeds were primed for 12 hours at 24 °C. Drought stress was simulated by withholding irrigation for seven days during each respective stage, and plants exposed to drought stress were compared to well-watered controls. The experimental layout followed a 4 × 4 × 3 factorial design within a completely randomized design (CRD) with three replicates. Under anthesis-stage drought, seed priming significantly improved key physiological parameters, including the transpiration rate (+29%), total chlorophyll content (+1.7%), and relative water content (RWC, +3.5%), relative to the tillering stage. Conversely, drought stress reduced these parameters by 18.6%, 6.5%, and 12.1%, respectively. Osmopriming with PEG led to a 35% higher transpiration rate and 4.9% greater RWC compared to hydropriming during anthesis. In terms of agronomic performance, the PEG and $CaCl_2$ osmopriming treatments significantly enhanced both growth and yield metrics over hydropriming. Notably, Sham 1 exhibited the highest grain yield increase (82.7%) under PEG priming, while Hourani showed the most severe yield reduction (67.8%) under anthesis-stage drought. In conclusion, seed priming, particularly with PEG or $CaCl_2$, substantially enhanced durum wheat's physiological resilience and productivity under drought, with the most pronounced effects observed during anthesis. This suggests that seed priming is a promising strategy for improving drought tolerance in durum wheat cultivated under water-limited conditions.

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sciforum-135446: Physiological and Biochemical Responses of *Acacia saligna* to Salinity Stress and Its Tolerance Threshold

Khadidja Benmaiza * and Hamida Mallem

University of Amar Telidji Laghouat ,department of agricultural science

Salinity is one of the most impactful abiotic stresses limiting the growth and productivity of many plant species. This study aimed to evaluate the salt tolerance of *Acacia saligna* by exposing juvenile *Acacia* plants to increasing NaCl concentrations (control 0.35 g/L, 10, 20, 30, and 40 g/L) for 10 days following 9 months of greenhouse cultivation. We assessed the physiological and biochemical parameters using six replicates per treatment. Data were analysed using one-way ANOVA (p 0.05) with Minitab 17 software, and group differences were determined via Tukey's test. Normality of residuals was confirmed using the Shapiro–Wilk test.

Salt stress negatively affected growth, with the lowest number of leaves (7.8 leaves/plant) and the slowest growth rate (0.01 cm/day) observed at 40 g/L. Dry matter content increased with salinity, peaking at 30.38% under 40 g/L NaCl, while water content declined to 69.62%. Proline levels rose with salinity, reaching 0.173 µg/mg FW at 40 g/L, though a notable dip was observed at 20 g/L. Soluble sugar content peaked at 10 and 20 g/L (11.44 and 7.70 µg/mg FW, respectively) and then declined sharply at higher concentrations. Chlorophyll content increased progressively with salinity, reaching 12.28 mg/g FW at the highest stress level.

Our findings suggest that *A. saligna* exhibits flexible osmotic adjustment mechanisms favouring sugar accumulation under moderate salinity and proline under higher stress. However, optimal tolerance appears to be maintained up to 20 g/L NaCl, beyond which growth performance and sugar levels decline despite continued biochemical adaptation. Due to its resilience, *A. saligna* shows promise for use in reforestation and land rehabilitation on saline or degraded soils.

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sciforum-132074: Potential of *Bacillus thuringiensis* B9 and *Bacillus pacificus* B11 Isolated from Tomato (*Solanum lycopersicum* L.) Rhizosphere for Enhancing Groundnut (*Arachis hypogaea* L.) Production and Reducing Aflatoxigenic *Aspergillus flavus* Contamination

Arielle Grâce Mpoam Miague, Pierre Germain Ntsoli *, Idriss Djoko Kouam, Roland Wilfried Titti and Aoudou Yaouba

Department of Crop Sciences, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang P.O. Box 222

Context: Plant Growth-Promoting Rhizobacteria (PGPR) are crucial for enhancing plant nutrition and health. This study investigated the dual potential of PGPR as biocontrol agents to suppress aflatoxigenic *Aspergillus flavus* contamination in groundnut (*Arachis hypogaea* L.) and to concurrently improve crop growth and yield, addressing critical food safety and productivity challenges. **Methodology:** Two *Bacillus* strains, *B. thuringiensis* B9 and *B. pacificus* B11, isolated from tomato rhizosphere, were evaluated. In vitro antagonistic activity against aflatoxigenic *A. flavus* was assessed using vertical, circular confrontation and poisoned medium dual culture methods. A field trial was simultaneously conducted at astation, employing a Completely Randomized Block Design with four replications. Factors included two groundnut varieties (Grimari and Siksa) and four treatments (*B. pacificus* B11, *B. thuringiensis* B9, DAP+manure, and an untreated control). Growth and yield parameters were subsequently measured and statistically analyzed. **Results:** In vitro, *B. pacificus* B11 consistently inhibited aflatoxigenic *A. flavus* growth by over 50% across all methods, achieving the highest inhibition (83.9%) via circular confrontation. Field results demonstrated significant (p0.05) differences among treatments for most growth and yield variables. Notably, *B. pacificus* B11 significantly improved groundnut performance regardless of variety, leading to a higher emergence rate (87.50%). Furthermore, this strain positively impacted pod number (40 per plant) and remarkably increased overall yield by more than 100% compared to the control. **Conclusion:** *Bacillus pacificus* B11 shows strong promise as a biofertilizer and biocontrol agent. Its capacity to enhance groundnut production while simultaneously reducing *Aspergillus flavus* contamination and potentially aflatoxin B1 contamination offers a sustainable alternative to chemical inputs, contributing to safer, higher-quality food production and reduced public health risks.

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sciforum-135052: Potential of Spent Mushroom Substrates (SMSs) from Oyster Mushroom (*Pleurotus ostreatus*) Production as Growth Media For Vegetative Growth of Garden Balsam (*Impatiens balsamina*)

John Mark R. Francisco [1,*] and Roden D. Troyo [2]

[1] Department of Horticulture, Faculty of Agriculture and Food Science, Visayas State University, Baybay City, Leyte 6521-A
[2] Ornamental Division, Department of Horticulture, Faculty of Agriculture and Food Science, Visayas State University, Baybay City, Leyte 6521-A

Globally, approximately 242 million tons of Spent Mushroom Substrate (SMS) were produced in 2022. This figure corresponds to the global cultivation of approximately 48 million tons of mushrooms, with SMS typically being generated at a rate of 5 kilograms per kilogram of mushrooms. The mushroom production industry is facing a growing challenge in managing the increasing volume of SMS. Finding environmentally and economically viable solutions for this organic waste is, therefore, of utmost importance. This research work was conducted to investigate the potential of SMS from oyster mushroom (*Pleurotus ostreatus*) production as a potting medium for the vegetative growth of garden balsam (*Impatiens balsamina*). Five treatments were applied: T1 (25% SMS + 75% GS), T2 (50% SMS + 50% GS), T3 (75% SMS + 25% GS), and T4 (100% SMS). A substrate of 100% garden soil was used as the control. The experiment was arranged in a randomized complete block design with three replications. Prior to the conduct of the study, a chemical analysis of the SMS was determined. The data collected included the following: plant height, number of leaves, leaf length, leaf width, stem diameter, shoot length, root length, shoot-to-root ratio, lateral shoots, and total biomass. The results showed that 100% garden soil (GS) exhibited significant results across all parameters, being mineral-rich and more stable in nutrient composition. Meanwhile, 25% SMS + 75% GS and 50% SMS + 50% GS consistently produced significantly higher or comparable growth parameters at 1 WAT, including plant height (7.37 cm and 7.35 cm), number of leaves (3.20 and 4.20), leaf length (3.05 cm and 3.29 cm), and stem diameter (1.35 mm and 1.44 mm), compared with the control. However, in later stages, 100% GS outperformed all treatments, indicating that pure garden soil remains the most effective substrate for sustained plant growth. The 100% pure SMS consistently showed the lowest values across all parameters, indicating its unsuitability as a sole growth medium due to nutrient imbalances and potential salinity issues. SMS when mixed with moderate levels of garden soil (25–50%) can enhance early seedling growth and promote sustainable agricultural waste use. Pre-treatment to reduce salinity and nutrient deficiencies is recommended for optimal use.

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sciforum-139168: Promoting Sustainable Agriculture: PGPR-Driven Enhancement of Plant Growth and Salinity Stress Tolerance

Massakib Bekkaye *, Nassima Baha, Sabrina Behairi, Karima Karaali, Roumaissa Moulkaf, Samia Issad and Yahia Kaci

University of Science and Technology Houari Boumediene (USTHB), Bab Ezzouar, Algiers 16111, Algeria

Salinity poses a major challenge to agriculture, especially in arid environments such as those found in Algeria, by significantly reducing crop yield. This study investigates the use of native Plant Growth-Promoting Rhizobacteria to improve the growth and stress tolerance of durum wheat (*Triticum durum* L.) under saline conditions. A bacterial isolate, designated BSSM27, was recovered from saline soils and assessed for key biofertilizer traits, including indole-3-acetic acid (IAA) production, siderophore secretion, ammonium generation, and phosphate solubilization. Its biocontrol potential was also evaluated through antagonism against *Fusarium* spp.

Wheat seeds were inoculated with this strain and grown in pots filled with sandy soil from the Oued Souf region in Southern Algeria. Plants were irrigated with bacterial suspensions under different salinity levels (0, 0.1 M, and 0.2 M NaCl). Inoculated plants showed enhanced germination, increased shoot and root biomass, and a higher number of lateral roots compared to non-inoculated controls. Physiological assessments revealed improved chlorophyll content, relative water content, and membrane stability. Moreover, lower levels of proline and malondialdehyde (MDA) indicated reduced oxidative stress. Hormonal profiling demonstrated a favorable balance, with reduced abscisic acid (ABA) and elevated IAA levels, supporting improved growth under stress.

These results highlight the multifunctional role of native PGPR in promoting plant growth and mitigating salinity stress through nutrient mobilization, hormonal regulation, and physiological enhancement. The use of such bio-inoculants represents a sustainable and environmentally friendly strategy for improving crop performance in saline soils.

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sciforum-138284: Recent trends in organic priming for germination enforcement: enhancing crop yield with sustainable agricultural practices

Jay Singh, CL Maurya

Department of Seed Science and Technology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh (208002), India

Due to its potential to increase crop yield and support sustainable farming methods, organic priming, the technique of treating seeds with advantageous naturally occurring substances or organic formulations before sowing, has drawn much interest in contemporary agriculture. Recent developments in organic priming have shown how it may boost nutrient availability and encourage plant growth, all of which increase yield. An experiment was conducted at the Vegetable Research Farm (Kalyanpur), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh 208002, India, using a Randomized Block Design. The research was carried out oncoriander cv. Azad Dhania-1 during 2023-24 and 2024-25 by taking different priming treatments, viz. control (without priming), hydropriming for 24 h soaking, vermiwash (15% for 24 h soaking), cow urine (20% for 24 h soaking), panchgavya (20% for 24 h soaking), humic acid (20% for 24 h soaking), GA_3 (50 ppm for 24 h soaking), IAA (50 ppm for 24 h soaking), Cytokinin (100 ppm for 16 h soaking), KNO_3 (3% for 16 h soaking), and NaCl (4 gl^{-1} for 16 h soaking). Precise results were obtained in panchgavya (20%) for the number of primary branches (7.61) and number of secondary branches (10.72), while, in humic acid (20%), thenumber of tertiary branches (4.06), number of umbel $plant^{-1}$ (42.94), number of seed $umbel^{-1}$ (41.88), raw seed yield $plant^{-1}$ (11.63 g), graded seed yield $plant^{-1}$ (10.48 g), raw seed yield $plot^{-1}$ (0.767 kg), graded seed yield $plot^{-1}$ (0.692 kg), raw seed yield ha^{-1} (1534.72 kg), and graded seed yield ha^{-1} (1383.84 kg) differed in the pooled compared to control samples. Thus, it may be concluded that priming with organics such as humic acid and panchgavya are more beneficial in achieving improved growth and yield in coriander.

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sciforum-138191: Regenerative cotton cultivation in semi-arid environments: first results in southern Italy

Simone Pietro Garofalo [1,*], Giuseppe Scarascia-Mugnozza [2], Anna Francesca Modugno [3], Mesele Negash Tesemma [4] and Pasquale Campi [1]

[1] Research Centre for Agriculture and Environment, Council for Agricultural Research and Economics, via Celso Ulpiani, 125, 70125 – Bari, Italy
[2] European Forest Institute - Biocities Facility, Via Manziana 30, 00189, Rome, Italy.
[3] Research Centre for Agriculture and Environment, Council for Agricultural Research and Economics, via Celso Ulpiani, 125, 70125 – Bari, Italy.
[4] European Forest Institute-Biocities Facility, Via Manziana 30, 00189, Rome, Italy

Introduction

Regenerative agriculture is increasingly seen as a sustainable strategy to improve soil health, promote biodiversity, and increase water use efficiency, which are particularly relevant issues in water-limited and semi-arid environments. This approach may be especially useful for crops with high environmental footprints, such as cotton, where innovative management practices are needed to reduce negative impacts and enhance agroecosystem resilience.

Material and Methods

In the 2024 growing season, a field trial was carried out in southern Italy using a randomised block design to evaluate the potential integration of two farming practices—no tillage (NT) and deficit irrigation (DI)—within regenerative cotton systems. These were compared to conventional tillage (T) and full irrigation (FI) across two cultivars (ST402 and HA1432). The effect on the water stress integral (Sψ), above ground biomass (AGB), yield, and irrigation water productivity (IWP) were analysed.

Results

Analysis of Sψ indicated a significant irrigation × cultivar interaction ($p = 0.016$): under DI conditions, HA1432 exhibited greater water stress accumulation (Sψ = 35.2 MPa day-1) than ST402 (Sψ = 19.1 MPa * day). AGB production was significantly higher under FI (6320 kg/ha) than that under DI (3689 kg/ha; p 0.001). IWP was significantly greater under DI (1.11 kg/m^3) than that under FI (0.85 kg/m^3; $p = 0.025$). Although the average yields ranged from 2364 to 3521 kg/ha across treatments, these differences were not statistically significant ($p > 0.05$).

Conclusions

Both NT and DI can be integrated into Mediterranean regenerative cotton systems without compromising the yield. These findings support the adoption of soil- and water-conserving practices in regenerative cotton cultivation in semi-arid environments, contributing to a reduced environmental impact and enhanced resilience under water-limited conditions.

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sciforum-128100: Reinvigoration of Deteriorated Seeds of Two Okra varieties (*Abelmoschus esculentus* var. ''Smooth Green' and Var. 'Red Ruby') Using Atmospheric Pressure Plasma-Activated Water

Alangelico Ortiz San Pascual [1,*], Catherine Joy M Dela Cruz [1], Maurice B Gravidez [2] and Annalissa L Aquino [3]

[1] Research Unit, Philippine Science High School – Main Campus, Quezon City 1101, Philippines
[2] De La Salle Araneta University, Malabon City 1474, Philippines
[3] Institute of Crop Science, College of Agriculture and Food Science, University of the Philippines Los Baños, Los Baños, Laguna 4031, Philippines

This study investigates the effects of Atmospheric Pressure Plasma (APP)-activated distilled water (PAW) on the germination and seedling characteristics of deteriorated seeds from two Okra varieties (Abelmoschus esculentus cv. 'Smooth Green' and cv. 'Red Ruby.') Deteriorated seeds were soaked in PAW for 8 hours, followed by 8 hours of air-drying, before being germinated using the top-of-paper method. Parameters including germination percentage, seed vigor, and germination speed were evaluated after 7 days. Additionally, seedlings were grown in sterile soil, and traits such as shoot and root length, fresh and dry shoot and root weight, and seedling vigor were assessed after 2 weeks of growth. This study followed a completely randomized design (CRD), with three replications and two subsamples: 100 seeds per subsample for germination testing and 10 plants per subsample for seedling evaluation. Comparisons were made among three treatments: PAW-treated deteriorated seeds, distilled water-treated deteriorated seeds, and untreated deteriorated seeds. Data analysis was performed using ANOVA and Tukey's HSD test at a 95% level of significance. The results revealed that PAW-treated seeds exhibited the highest germination percentage, germination index, and faster germination compared to the other groups for both Okra varieties. Furthermore, PAW-treated seeds developed longer shoots and roots, and showed greater fresh and dry biomass compared to distilled water-treated and untreated seeds. PAW treatment improved germination percentage by 20% in 'Smooth Green' and 22% in 'Red Ruby'. These findings demonstrate that PAW priming is an effective technique for enhancing the germinability, seed vigor, and seedling performance of deteriorated Okra seeds.

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sciforum-139250: Related Effects of Climate Change on Root System Dynamics and Symbiotic Activity in Local Bean Varieties (*Phaseolus vulgaris* L.) in the Humid Tropics of Costa Rica

IDRISSA Diédhiou *, Josafath A. Otero and Rosa Isabella Rossi Franco

EARTH University is in Guácimo, Limón Province, Costa Rica, postal code 4442-1000

Climate change presents increasing challenges for tropical agriculture, especially for crops such as common bean (*Phaseolus vulgaris* L.), which are highly sensitive to thermal stress. This study evaluates the effects of moderate warming on the root system structure and symbioses of two local varieties, *Matambú* and *Guaymí,* grown under humid tropical conditions in Costa Rica. Field experiments were conducted using open-top chambers (OTCs) to simulate a passive temperature increase of approximately +2 °C above ambient conditions. The experimental setup comprised twelve plots (six OTCs and six controls), with destructive root sampling after harvesting the pods. Root biomass, depth, number of nodules, and arbuscular mycorrhizal (AM) colonization were quantified. Preliminary results indicated that *Matambú* exhibited a 28% increase in root biomass under OTC conditions (5.4 ± 0.3 g/plant) compared to controls (4.2 ± 0.2 g/plant), while *Guaymí* showed a smaller increase of 12%. Root depth in *Matambú* increased from 19.5 ± 1.1 cm (control) to 24.7 ± 1.3 cm (OTC), suggesting a heat-induced root elongation strategy. Additionally, *Matambú* plants under warming formed, on average, 38.2 ± 3.1 nodules per plant, versus 27.4 ± 2.8 in control, with AM colonization rates of 64 ± 5% vs. 51 ± 4%, respectively. In contrast, *Guaymí* displayed lower nodulation and mycorrhizal response. These findings suggest that *Matambú* may possess enhanced adaptive traits for coping with moderate thermal stress, particularly in terms of root architecture and beneficial microbial interactions. The results underscore the importance of conserving and promoting resilient local genotypes for sustainable agriculture under future climate scenarios.

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sciforum-137424: Screening of Barley (*Hordeum vulgare* L.) for Early Seedling Growth Traits Under Polyethylene Glycol 6000 Drought Stress

Mesfin Hailemariam Habtegebriel [1,*], Prof. Tileye Feyissa [2, 3], Dr.Tesfahun Setotaw [4] and Dr. Yemsirach Melkie [5]

[1] Ethiopian Institute of Agricultural Research(EIAR) and Addis Ababa University(AAU)
[2] Department of Microbial Sciences and Genetics, College of Natural and Computational Sciences, Addis Ababa University, Addis Ababa, Ethiopia,
[3] Centre for Biotechnology Research, Addis Ababa University, Addis Ababa
[4] Cornell University, New York, United States of America
[5] Bio and Emerging Technologies Institute, Addis Ababa, Ethiopia

Drought is an abiotic stress that significantly threatens global food security by reducing crop yields. This study aimed to evaluate the drought tolerance of barley (Hordeum vulgare L.) using polyethylene glycol 6000. A hydroponic experiment was conducted to assess twenty-four barley genotypes with potential drought resilience during the seedling stage. These genotypes were subjected to four levels of drought stress, applied using PEG-6000 at concentrations of 0%, 5%, 10%, and 20%. The experiment followed a randomized factorial design with two replications. Two-way ANOVA revealed significant effects of genotype (p 0.001) and PEG-induced drought stress levels (p 0.001) on most measured traits, except for root number, shoot dry weight, and root dry weight. The interaction between genotype and stress level was also significant (p 0.001), except for shoot length, root number, SPAD readings, shoot dry weight, and shoot water content. Four barley genotypes—G16, G24, G13, and G17—exhibited the highest drought tolerance. Overall, as the PEG concentrations increased, there was a decline in germination percentage, vigour index, root and shoot length, and both new and dry weight. The identified drought-tolerant genotypes show promise for cultivation in water-limited environments, as they can maintain better growth performance under drought stress. In the future, efforts should focus on field validation, genetic and molecular research, breeding programs, and collaborative initiatives to enhance drought resilience strategies under real-world conditions.

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sciforum-139277: Screening of High Capsaicin Rich and High-Yielding Hot Chilli Genotypes for Future Varietal Improvement

Amit Kumar Basunia * and Md Mokter Hossain

Bangladesh Agricultural University (BAU), Mymensingh 2202, Bangladesh

Bangladesh has a wealth of Capsicum species, which has led to the development of a large number of hot chili landraces. Information on their genetic diversity, conservation status andpotential use is lacking. It is possible to introduce new varieties as there is plenty of favorable environments for chili cultivation and high demand for hot chili. To generate useful information toward the sustainable use, management and conservation of these species, evaluation of diversity, sustainability and productivity of 50 chili genotypes from home and abroad was carried out. Among them, Bangladesh Agricultural Research Institute (BARI)-released varieties were used as a reference. A one-factor experiment with three replications following RCBD was conudcted. The results indicated that most of the genotypes demonstrated satisfactory performance in yield. Few genotypes did not perform well, so all the genotypes are needed to identify genetic variation and evaluate chemical components to detect a higher level of sustainability.

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sciforum-139267: Selection Of High-Yielding Stable Genotypes Of Cherry Tomato (*Solanum lycopersicum* var. *cerasiforme*) Through Multilocation Trials

Saleha Aziza [1], Md. Nure Adil Siddique [2], Samia Afroz Eva [1], Sohana Jui [1], Mst. Tanjina Shahanaj Turin [1], Md. Abdullah Al Sowrov [1] and MD Arifuzzaman [1,*]

[1] Department of Genetics and Plant Breeding, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh
[2] Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

Introduction

Cherry tomato (*Solanum lycopersicum* var*. cerasiforme)* is a nutrient-rich vegetable exotic to Bangladesh, where only a limited number of varieties are currently available. The identification of high-yielding and stable genotypes is the key to increasing agricultural productivity and achieving food security in this country.

Methods

An investigation was carried out with ten exotic and two released cherry tomato genotypes to identify high-yielding, stable genotypes through multilocation trials. The study was conducted at three locations in Bangladesh, viz. Dinajpur, Rangpur, and Panchagarh, during the period from November 2023 to May 2024, in a randomized complete block design (RCBD) with three replications.

Results

A genotype–environment interaction (GEI) was observed in the mixed-effect model for all variables except fruit length. Based on the multi-trait genotype–ideotype distance index (MGIDI), genotypes L13 and L14 in Dinajpur and Rangpur and L13 and L09 in Panchagarh were found to be the most promising. To further evaluate yield stability across environments, GGE biplot analysis was performed, which revealed L13 as the most stable and high-yielding genotype, followed by L14 and L09, and Dinajpur was the most suitable environment for stable yield performance. Moreover, molecular characterization using seven simple sequence repeat (SSR) markers classified the genotypes into two distinct populations. Notably, the phenotypically stable genotypes L13, L14, and L09 were genetically distinct from the released varieties BU-2 and BU-5.

Conclusion

The high-yielding stable genotypes L13, L14, and L09 could be taken into consideration for registration as cherry tomato varieties in Bangladesh.

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sciforum-132659: Somatic Embryogenesis as a Tool for the Clonal Propagation of Elite Cork Oak Genotypes in Montado Restoration

Catarina Macedo [1, 2,*], Cláudia Marinho [1, 2], Ana Faustino [1, 3], Ana Usié [1, 2] and Liliana Marum [1,2]

[1] Alentejo Biotechnology Center for Agriculture and Agro-Food (CEBAL)/ Polytechnic University of Beja (IPBeja), 7801-908 Beja, Portugal
[2] MED – Mediterranean Institute for Agriculture, Environment, and Development and CHANGE – Global Change and Sustainability Institute, CEBAL, 7801-908, Beja, Portugal
[3] MED – Mediterranean Institute for Agriculture, Environment and Development, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

The cork oak (Quercus suber) supports Montado ecosystems in the Mediterranean region, a rich biodiversity hotspot. Its high-value bark enables diverse production, fuelling the regional economy and global exports. Q. suber survival is threatened by climate change, desertification, and unsustainable practices. It is crucial to repopulate Montado ecosystems with genetically superior, longer-living cork oaks. Thus, clonal propagation of disease-free, more resistant cork oaks proves fundamental. Currently, new methods are being implemented by our research group based on a unique germplasm resource with high genetic potential from the F1 population of known pedigree. After traditional propagation methods failed, the main goal of this study was to implement an innovative method of somatic embryogenesis (SE) on the F1 population. Leaf explants with two different vegetative stages (0.5-1cm and 1-1.5cm) were selected on G31, G36 and J2 genotypes, using the protocol described by Hernandez et al. 2003. The results revealed that SE induction varied significantly by genotype (G31-70%, J2-40%, and G36-0%, with N>11), but not by leaf size. Somatic embryos matured spontaneously in free-hormone media, doubling their weight after 11 weeks, resulting in seven medium-sized (5-10mm) and 1.7 large-sized (>10mm) mature embryos per initial gram. Germination was attempted via a two-month cold-dark treatment, which promoted radicle and hypocotyl emergence in most embryos, but resulted in poor shoot formation. Subsequent photoperiod exposure did not improve shoot development, and posterior ex vitro acclimation failed. This result is consistent with those of other studies, which present germination as a bottleneck in SE. This emphasises the importance of optimising the final stages of SE. Additionally, maturation conditions are being optimised to increase embryo energetic reserves, thereby improving plantlet subsequent survival during the germination and acclimatisation phases. Overall, this work represents an important step towards developing efficient SE protocols for regenerating Montado with genetically uniform, resilient cork oaks.

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sciforum-114757: The Mycorrhizal Fungus *Rhizophagus irregularis* Promotes Olive Tree (*Olea europaea* L.) Growth and Reduces Verticillium Wilt Symptoms

Hanane Boutaj [1,2,*], Meddich Abdelilah [2,3], Said Wahbi [2], Zainab El Alaoui-Talibi [2], Allal Douira [4], Abdelkarim Filali-Maltouf [5] and Cherkaoui El Modafar [2]

[1] Laboratory of Life and Health Sciences, Faculty of Medicine and Pharmacy, Abdelmalek Essaadi University, Tetouan 93000, Morocco;
[2] Centre d'Agrobiotechnologie et de Bioingénierie, Unité de Recherche labellisée CNRST (Centre AgroBiotech-URL-CNRST-05), équipe « Physiologie des stress abiotiques », Université Cadi Ayyad, Marrakech 40000, Morocco
[3] African Sustainable Agriculture Research Institute (ASARI), University Mohammed VI Polytechnic (UM6P), Laayoune 70000, Morocco
[4] Botany and Plant Protection Laboratory, Faculty of Science, Ibn Tofail University, Kénitra, Morocco
[5] Microbiology and Molecular Biology Laboratory, Faculty of Sciences. Mohammed V University, Rabat, Morocco

A controlled study was conducted on the susceptible olive cultivar "Picholine Marocaine" to examine the relationship between Verticillium dahliae and Rhizophagus irregularis. After three months of pre-inoculation with R. irregularis, olive trees were post-inoculated with V. dahliae for nine months. The current study evaluated how combined inoculation affected disease tolerance, nutrient uptake, root colonization, and plant development factors. The findings demonstrated that, even when *V. dahliae* was present, *R. irregularis* considerably enhanced mycorrhizal colonization, including the development of vesicles and arbuscules, in comparison to non-mycorrhizal controls. Increased shoot and root lengths, more leaves and branches, and a larger total dry biomass were all indicators of better plant growth that was linked to enhanced colonization. Lower dwarfing and leaf alteration indices further demonstrated that *R. irregularis* considerably lessened the severity of the disease. Additionally, mycorrhizal inoculation significantly increased the uptake of nutrients, especially potassium, calcium, and available phosphorus, in the roots and shoots of olive plants. Remarkably, plants colonized exclusively by R. irregularis had increased salt uptake, indicating a possible influence on particular nutrient dynamics. Overall, this study shows that R. irregularis greatly increases disease tolerance against Verticillium wilt in sensitive olive cultivars, boosts plant growth and nutrient uptake, and efficiently encourages root colonization.

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sciforum-136385: Yield And Grain Quality Of Hybrid And Inbred Lowland Rice (Oryza sativa L.) As Influenced By Combined Application Of Inorganic And Organic Fertilizers Supplemented With Carabao Manure Tea

Rhelivyn Merino Rosendal [1,*] and Ulysses Cagasan [2]

[1] Biliran Province State University (BiPSU), Naval 6543, Biliran, Philippines
[2] Visayas State University (VSU), Baybay City 6521, Leyte, Philippines

The combined application of fertilizers may provide essential nutrients needed by plants. This study aimed to determine the effects of the combined application of inorganic and organic fertilizers supplemented with carabao manure tea (CMT) on the growth, yield and interaction effects between hybrid and inbred of lowland rice types and fertilizer applications. A split plot-RCBD was used, with rice type (M_1- hybrid, M_2- Inbred) as the mainplot, and fertilizers (T0- No Fertilizer Application, T1- 120-90-60kg ha^{-1} N-P_2O_5-K_2O, T2- 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} rice straw mixed with CRH + CMT, T3- 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} Carabao Manure + CMT, T4- 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} VermiCompost+ CMT, T5- 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} Chicken Dung + CMT, and T6- 2.5 tons ha^{-1} Rice Straw-CRH Compost + 2.5 tons ha^{-1} Carabao Manure + 2.5 tons ha^{-1} Vermi Compost + 2.5 tons ha^{-1} Chicken Dung + CMT) as the subplots. Results showed that the hybrid and inbred lowland rice types resulted indelayed heading and maturity and longer plant height, producing more productive tillers and spikelets when applied with a fertilizer combination of 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} Chicken Dung + CMT. An optimum yield of hybrid and inbred rice can be obtained with the application of 50% RR inorganic combined with any of the organic fertilizers at a rate of 60-30-30 kg ha^{-1} N-P_2O_5-K_2O + 5 tons ha^{-1} supplemented with manure tea. The sole application of inorganic fertilizer and 50% RR combined with 5 tons ha^{-1} Chicken Dung supplemented with CMT produces greater plant height in hybrid rice, while inbred rice significantly responded to sole applications of inorganic fertilizers and 50% RR combined with any of the organic fertilizers at 5 tons ha^{-1} supplemented with CMT.

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sciforum-132393: Yield of Sweet Corn as Influenced by Sowing Date, Production Method, and Hybrid

Jelena V. Stojiljković [1], Ivan Tupajić [1], Darko Jovanović [1,*], Marija Bajagić [2], Milan Ugrinović [1], Vladimir Miladinović [1] and Biljana Šević [1]

[1] Institute for Vegetable Crops, Karađorđeva 71, 11420 Smederevska Palanka, Serbia
[2] University of Bijeljina, Pavlovića put bb, 76300 Bijeljina, Bosnia and Herzegovina

Sweet corn (*Zea mays* L. var. *saccharata* Sturt.) is a valuable vegetable crop, prized for its nutritional value and sweet taste. It is used fresh, canned, or frozen. The research aimed to examine the influence of sowing date, production method (direct sowing versus container production), and hybrid choice on the yield and yield components of sweet corn in open-field conditions. The experiment was conducted in 2024 on a family farm in Bogojevac, near Leskovac, southern Serbia (43°05'38.31" N, 21°96'77.54" E), 225 m above sea level). Two supersweet hybrids, Sweet Nugget and 255 DDST, were tested with two sowing/planting dates (May 18 and June 29, 2024) and two production methods. The distance between strips was 70 cm, the distance between rows in the strip was 50 cm, and the distance between plants was 20 cm. Ear sampling was conducted 22–25 days after fertilization. Data were analyzed using ANOVA (IBM SPSS Statistics v26.0, p0.05 and p0.01) and Pearson correlation (Minitab trial version). The results showed that hybrid 255 DDST in container production during the first sowing date achieved the highest average number of rows (14 compared to 12 for direct sowing). Containerized seedling production achieved better results than direct seeding when analyzing ear weight, with the hybrid 255 DDST achieving 221.01 g and the hybrid Sweet Nugget 177.90 g in the first sowing date, compared to 99.44 g and 83.00 g, respectively, in the second sowing date. The total kernel weight was the highest (115.22 g) in hybrid 255 DDST in container production during the first sowing date. The sowing date had the greatest influence on kernel weight. Containerized production, especially on the first sowing date, had a positive impact on yield components, with genotype 255 DDST showing an advantage over Sweet Nugget, providing practical recommendations for sweet corn production planning.

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sciforum-138690: Yield Stability of Selected Potato Cultivars under Mulch and Fungicide Application for Different Environments

Nosipho Minenhle Phungula [1, 2,*], Sandile Thamsanqa Hadebe [3], Lucky Sithole [4] and Nomali Ziphorah Ngobese [2]

[1] Department of Science, Botany and Plant Biotechnology, University of Johannesburg, P.O. Box 524, Auckland Park 2006, South Africa
[2] Unit for Environmental Sciences and Management, Faculty of Natural and Agricultural Sciences, North-West University, Private Bag X6001, Potchefstroom, South Africa
[3] Department of Plant Production, Soil Science and Agricultural Engineering, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa
[4] Department of Agriculture and Rural Development Pietermaritzburg, 3245, South Africa

Smallholder farmers often experience low yields that fluctuate yearly due to the variability of climate, resources, and diseases. The objective of the study was to assess cultivar x environment x management on potato yield stability. The experiments were conducted in five different environments (Mbalenhle, Hlathikhulu, Mbhava, Stezi, and Gobizembe) in KwaZulu-Natal (South Africa) for two consecutive seasons (2022/23 and 2023/24) at smallholder farming settings under rainfed open field conditions. Four selected potato cultivars (Mondial, Electra, Sababa, and Panamera) were planted in different management practices, which were two levels of mulch (non-mulch and mulch), and fungicides (sprayed and unsprayed) in a randomized complete block design. Analysis was conducted using Genotype and Genotype by Environment (GGE) biplot and Additive Main effects and Multiplicative Interaction (AMMI) models. The analysis of variance from AMMI revealed that the cultivar and environment interactions showed significant differences (P0.05) under different management practices. A GGE and AMMI biplot graphically showed the inter-relationship between the tested environment and cultivars under different management practices. Mondial was more stable across management practices, except under mulched and unsprayed conditions, although a low yield was observed compared to Electra and Panamera. Electra was found to be stable and had high yield stability across all management practices and environments except Hlathikhulu due to its high tolerance against dry spells and foliar diseases such as late blight. At Hlathikhulu, Panamera was found to have a stable yield across different management practices. Smallholder farmers from Stezi, Mbalenhle, Mbhava, and Gobizembe can select Electra and apply the spraying of fungicides; in contrast, those from Hlathikhulu can use Panamera and fungicide spraying to obtain a potato yield with fewer fluctuations.

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sciforum-132869: Zeolite and attapoulgite foliar applications improve the photosynthetic performance of ‘Muscat Hamburg’ grapevines

Despoina G. Petoumenou and Vasiliki Liava *

Laboratory of Viticulture, Department of Agriculture, Crop Production and Rural Environment, University of Thessaly, 38446 Volos, Greece

Climate change has significantly altered weather patterns, with elevated temperatures and heatwaves emerging as major environmental challenges for viticulture. High temperatures can negatively affect grapevine growth, maturity, and overall quality. In response to these challenges, there is an increasing interest in sustainable, cost-effective mitigation strategies that reduce reliance on chemical inputs. In this study, an open-field experiment was conducted to assess the effects of foliar applications of zeolite and attapulgite on the grapevine cultivar ‘Muscat Hamburg’ under the Mediterranean conditions in Central Greece. The experiment followed a randomized complete block design with three treatments (control, zeolite applied at 4% w/v, and attapulgite applied at 4% w/v) and five replications. The application of these chemically inert mineral particles significantly decreased leaf temperature and enhanced physiological performance in veraison and maturity stages, particularly at midday. Specifically, stomatal conductance (g_s), transpiration rate (E), and the net photosynthetic rate (A) were significantly increased compared to the control. Regarding yield components, foliar applications did not significantly affect yield per vine, number of clusters per vine, cluster width and length, or the berries' weight. However, attapulgite application led to a significant increase in cluster weight, cluster density, and number of berries per cluster. Additionally, both zeolite and attapulgite significantly increased the relative skin mass. In terms of grape quality traits, total acidity (TA) was not affected by foliar applications, although attapulgite significantly increased must pH, while zeolite application led to a reduction in total soluble solids (TSSs). In conclusion, foliar applications of zeolite and attapulgite can be integrated into sustainable viticultural practices to mitigate the adverse effects of high temperatures. By reducing leaf temperature and improving physiological performance, these treatments contribute to the protection of grapevines under heat stress conditions.

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Session 9. Farm Animal Production

sciforum-137708: In situ Rumen Degradation of Fresh and Ensiled Guinea Grass (*Megathyrsus maximus* Jacq.) Cultivars Harvested at 30 and 45 Days

Angelo Francis Fausto Atole [1,*], Jade Dhapnee Z Compendio [2], Oscar B Posas [2], Lijueraj J Cuadra [2] and Manuel D Gacutan, Jr. [2]

[1] Central Bicol State University of Agriculture, San Jose, Pili, Camarines Sur, Philippines 4418
[2] Visayas State University, Visca, Baybay City, Leyte, Philippines 6521

No prior studies have compared the in situ degradation of fresh and ensiled Guinea grass cultivars grown in the microclimate of Visayas State University, Baybay City, Leyte, the Philippines. This study evaluated the in situ degradation characteristics of two Guinea grass cultivars—Local Guinea grass (LG) and Mombasa grass (MG)—harvested at 30 and 45 days. Six test diets were prepared: fresh LG (FLG), fresh MG (FMG), and ensiled LG and MG harvested at 30 and 45 days (LG30, LG45, MG30, and MG45, respectively). Three rumen-fistulated Brahman heifers (180 ± 10 kg bodyweight) were dewormed, pre-conditioned, and incubated with the test diets using the sequential addition method at 0, 24, 48, and 72 hours. At 0 and 24 hours, all treatments showed a comparable degradation of DM and ADF ($p>0.05$). The NDF degradation of all treatments was comparable only at 0 hours. At 24 hours, MG30 showed significantly greater NDF degradation compared to most other treatments (p0.01). At 48 and 72 hours, MG30 showed a significantly greater degradation of DM, NDF, and ADF compared to most other treatments (p0.01). MG30 showed a significantly greater effective degradability of DM, NDF, and ADF compared to most other treatments (p0.01). These findings indicate that MG30 has superior in situ degradability characteristics, making it a promising forage option for ruminant diets.

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sciforum-137299: Proposed Ear Cuff Heart Rate Monitor With Light Indicator For Pigs

Hope Deloso Ynot *, Annie Abella, Madel Amista, Kristel Marge Ymbong and Chum Keji Ocan

Cebu Institute of Technology – University (CIT-U), N. Bacalso Avenue, Cebu City 6000, Philippines

Early detection of health issues in sows is critical to reducing mortality, controlling disease spread, and improving herd welfare. Traditional monitoring methods are labor-intensive, often ineffective in early-stage detection, and can stress animals during handling. This study introduces a non-invasive ear-cuff heart rate monitor designed for daily use during farmers' routine checks, enabling real-time, stress-free monitoring.

A prototype device was developed featuring a waterproof compact housing with an adjustable hypoallergenic strap positioned at the sow's ear base. A photoplethysmography (PPG) sensor detects blood volume changes, and a NodeMCU microcontroller processes the data to trigger RGB LED indicators—blue for low (70 bpm), green for normal (70–120 bpm), and red for high (>120 bpm). Intended for daily use during farmers' routine checks, the system allows real-time monitoring without restraining the animal, reducing stress and enabling timely interventions. A purposive survey of 30 pig farmers from Cebu City and Province was conducted using structured questionnaires covering demographics, farm practices, monitoring challenges, and technology adoption attitudes. The findings show 76.67% consider traditional methods ineffective, 46.67% cite inadequate technology, 93.33% express strong interest in the device, and 90% are willing to join pilot testing. The proposed ear-cuff heart rate monitor provides a potential solution that is cost-effective, user-friendly, and non-invasive for integrating heart rate monitoring into the farmer's daily routines, supporting earlier interventions and improved swine health outcomes.

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sciforum-138422: Assessing the Impact of Free-Range and Indoor Rearing Systems on small ruminants in Sierra Leone

Hassan Benya [1], Emmanuel Odanye [2,*] and Ibrahim Benya [1]

[1] Celebrity Agricultural Company (SL) Limited, Freetown, Sierra Leone
[2] Lithesome Impact Development Initiative, Abuja, Nigeria

Background

Free-range small ruminant production has gained increasing attention for its perceived benefits on animal welfare and meat quality. Despite goats ranking as the third most productive small ruminants farmed globally, little research explores how different rearing systems affect their health, behavior, muscle characteristics, and welfare. This study investigates the impact of a long-distance pasture system (LDPS) versus conventional indoor rearing in Sierra Leone.

Objectives

We aimed to evaluate how free-range grazing, particularly LDPS, influences goats' and sheep's health, feeding behavior, muscle fiber structure, and welfare indicators, such as locomotion and behavioral patterns, in comparison to an indoor confinement system.

Methods

Twenty animals (10 goats and 10 sheep) were randomly divided into two groups: LDPS (grazing up to 200 meters within the farm) and an indoor system (IS) with regulated feeding. From May to July 10, 2025, researchers monitored health conditions, feeding habits, muscle fiber composition, and welfare indicators, including mobility and behavioral responses from 8 am to 6 pm daily.

Results

The LDPS group showed enhanced walking ability and more natural foraging behavior than their IS counterparts. Free-range goats exhibited fewer stress-related symptoms, and muscle analysis revealed fiber type variations potentially linked to meat quality. However, the IS group achieved more consistent weight gain, likely due to structured feeding.

Conclusion

Free-range systems like LDPS can improve welfare indicators, especially in goats, by encouraging natural behavior and reducing stress. Indoor systems, however, may be more effective for rapid weight gain. These findings support ongoing discourse on sustainable small ruminant farming and offer context-specific insights for improving goat and sheep rearing practices in Sierra Leone.

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sciforum-139352: Automated Diagnostic Approach in Swine Production with Focus on Locomotor Sensing

Lucas Augustinho Trevisan [1,*], Leda Gobbo de Freitas Bueno [2], Silvia Regina Lucas de Souza [2] and Cleber Alexandre de Amorim [2]

[1] Faculty of Agricultural Sciences, São Paulo State University "Júlio de Mesquita Filho", University Avenue, 3780, Botucatu, Sao Paulo, 18610-034, Brazil.
[2] Department of Rural Engineering and Socioeconomics, Faculty of Agricultural Sciences, São Paulo State University "Júlio de Mesquita Filho", University Avenue, 3780, Botucatu, Sao Paulo, 18610-034, Brazil.

Currently, pig production faces several challenges in ensuring the individual welfare of animals, especially with the rapid expansion of the sector and the shortage of available labor. Locomotor problems, such as lameness, are among the leading causes of sow culling, economically affecting productivity and overall animal welfare. In this context, Precision Livestock Farming (PLF) has gained prominence as a strategy for introducing technologies into the field that enable the detection of various issues, including locomotor disorders, bringing benefits to both animals and producers and resulting in greater system sustainability. The objective of this study was to conduct a preliminary evaluation of the behavior of piezoelectric sensors under controlled loads as an initial step toward the development of a platform for detecting locomotor variables in intensive production systems. Laboratory tests were conducted without the presence of animals. A sensor system was developed and connected to a microcontroller for acquiring electrical signals generated by the manual application of five standardized masses (100g, 150g, 170g, 190g, and 200g) at regular intervals. The collected signals were smoothed and analyzed based on the average peak amplitude using Python software. The results showed a positive correlation between the increase in applied mass and the average amplitude of the signals, indicating the system's sensitivity to pressure variations. These responses reinforce the potential of the technology to detect loads under various conditions, such as animal body weight, for use in automated monitoring applications.

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sciforum-132302: Behavioral traits of honeybees (*Apis mellifera)* influence resistance against infestation of *Varroa destructor* mite

Akongte Peter Njukang [1, 2,*], Kim Dongwon [1] and Choi Yongsoo [1]

[1] Honeybee Resource Materials Laboratory, Department of Agricultural Biology, National Institute of Agricultural Science, Wanju 55365, Republic of Korea
[2] Institute of Agricultural Research for Development (IRAD), Buea PMB 25, Cameroon

The parasitic mite *Varroa destructor* remains the principal threat to honeybees worldwide. Many control measures, including the use of both soft and strong acaricides to eradicate or limit the spread of the parasite, are still very unsuccessful. Although some behavioral traits of honeybees are of great concern, understanding their mode of action is a priority. Therefore, it is necessary to put in place possible measures and outline sustainable approaches against the V. destructor. A total of 50 honeybee colonies were kept in the experimental apiary prior to evaluating their different behavioral outputs. The colony survival rate and infestation rate were determined. The results demonstrated a significant variation between the evaluated traits (hygiene, grooming, postcapping brood period, and Varroa-sensitive hygiene) and shaped it into three main categories based on hygiene and grooming. Hygienic colonies recorded low grooming activity (biting observed after more than 42 seconds) while non-hygienic colonies recorded high grooming activity (biting observed in less than 35 seconds). Colony mortality differed significantly among groups (p 0.0001). The infestation rate differed significantly among colonies (p 0.0001). Among the detected diseases, high levels of expression of deformed wing virus, acute bee paralysis virus, and Israeli acute paralysis virus were recorded compared to the prevalence of chronic bee paralysis virus. Though selective breeding of honeybee colonies with *V. destructor* immune-related traits may be hard to achieve, results have demonstrated that association of multiple traits can yield better outputs. As colonies with some behavioral traits (hygiene and grooming) showed some level of resistance, it is recommended to associate this approach with various soft chemicals and evaluate the efficacy.

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sciforum-135888: Biosecurity Practices Against And Readiness Of Backyard Pig Farmers For African Swine Fever In Hungduan, Ifugao, Philippines

Codamon Madiano Leizle

Ifugao State University – Hapao Campus, Hungduan, Ifugao 3603, Philippines

African Swine Fever (ASF) remains a serious threat to the swine production in the Philippines; this affects backyard farmers due to limited access to veterinary services and inadequate biosecurity practices. This study assessed the level of ASF awareness, existing biosecurity practices, and outbreak preparedness among backyard swine raisers in Hungduan, Ifugao. Using a descriptive research design, data were collected from 78 farmers through structured questionnaires, key informant interviews, and on-site observations. The results showed that while African Swine Fever (ASF) awareness reached 100%, only 22% had received formal training. Key biosecurity practices such as regular disinfection (38%), quarantine areas (13%), and rodent control (14%) were poorly implemented. Remarkably, 36% of respondents continued swill feeding, a high-risk practice for ASF transmission. Despite these gaps, 82% of farmers expressed willingness to adopt improved biosecurity measures if training and support were provided. Chi-square tests showed significant association between a farmer's educational attainment and their practice of swill feeding, while there is no significant association between education and rodent control, or occupation and quarantine practice. The findings stress the urgent need for targeted educational interventions, localized veterinary services, and community-based disease surveillance to strengthen ASF prevention and control strategies in rural backyard settings.

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sciforum-135883: Biosecurity Practices and Readiness of Backyard Pig Farmers Against African Swine Fever in Hungduan, Ifugao, Philippines

Codamon Madiano Leizle

College of Agriculture, Ifugao State University – Hapao Campus, Hungduan, Ifugao, Philippines, 3603

African Swine Fever (ASF) continues to pose a significant threat to swine production in the Philippines, particularly impacting backyard farmers due to limited access to veterinary services and insufficient biosecurity practices. This study assessed ASF awareness, existing biosecurity measures, and outbreak preparedness among backyard swine raisers in Hungduan, Ifugao. Employing a descriptive research design, data were gathered from 78 farmers through structured questionnaires, key informant interviews, and on-site observations. While ASF awareness was universal (100%), only 22% of respondents had received formal training. Key biosecurity practices—including regular disinfection (38%), the presence of quarantine areas (13%), and rodent control (14%)—were poorly implemented. Notably, 36% of respondents continued the high-risk practice of swill feeding, which increases the risk of ASF transmission. Despite these gaps, 82% expressed willingness to adopt improved biosecurity measures if training and support were provided. Chi-square analysis revealed a significant association between educational attainment and the practice of swill feeding, while no significant associations were found between educational attainment and rodent control, or occupation and the implementation of quarantine measures. The findings underscore the urgent need for targeted education campaigns, localized veterinary services, and community-based surveillance systems to enhance ASF prevention and control in backyard swine operations.

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sciforum-138990: Comparing feeding strategies of local sheep breeds and crossbred goats in the Ain Khiar alder forest (Algeria) for optimised management

Razika Bouras [1,*], kahina chaker-houd [2] and lamia mebirouk-boudechiche [1]

[1] Epidemiological Surveillance, Health, Production and Reproduction Laboratory, Domestic and Wild Animal Experimentation and Cell Therapy, Faculty of Natural and Life Sciences, Chadli Bendjedid University of El Tarf, Algeria
[2] Laboratory of Agriculture and Ecosystem Functioning, Faculty of Natural and Life Sciences, Chadli Bendjedid University of El Tarf, Algeria

The ecological context of the Ain Khiar alder forest, a rare and fragile environment, as well as the decline in its food resources, especially in winter, require appropriate herd management to preserve its agroecological balance. To this end, this study compares the daily activities and feeding behaviour of two local ruminant breeds, Berber sheep and Arbia crossbred goats, in this alder forest during the winter period.

The experiment involved visual observation of five two-year-old ewes and five two-year-old goats over ten consecutive days. The main daily activities were recorded using the regular interval observation method, and the quantities ingested were recorded using the 'bite count' method. Thus, ewes spend more time feeding and resting (287 and 70 minutes per day, respectively), while goats spend more time moving around (159 minutes per day) in search of food, reflecting their more selective feeding behaviour.

In terms of diet, the total grazing time is identical for both species (480 min/day), but goats consume more shrubs (100% of bites), while sheep adopt a mixed diet (53.5% shrubs, 46.5% grasses). The average weight of each bite and the total amount of dry matter ingested are lower in goats (0.17 g DM and 0.91 kg DM vs. 0.21 g DM and 1.2 kg DM).

In conclusion, there are notable differences in the feeding strategy and use of grazing space between the two species. A better understanding of these specific characteristics offers avenues for optimising the exploitation and management of natural resources, especially shrubs, while preserving the fragile biodiversity of the Ain Khiar alder forest.

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sciforum-132182: Effect of mode of vitamin E supplementation on stress indicators and biomarkers on Uda Ram in semi-arid region

Abdullahi Adeoye Abdulazeez * and muhammad Aljameel Khalifa

Department of Animal Science, Usmanu Danfodiyo University, P. M. B 2346, Sokoto, Nigeria.

Abstract

The experiment was conducted at the Department of Animal Science, Livestock Teaching and Research Farm, Usmanu Danfodiyo University, Sokoto, Nigeria. The objective was to evaluate the effects of different modes of vitamin E supplementation on adaptability and stress biomarkers in Uda rams under semi-arid conditions. Twelve yearling Uda rams (18–23 kg BW) were randomly assigned to three treatment groups (n = 4 per group; experimental unit = ram) in a Completely Randomized Design (CRD) with four replications. Vitamin E (DL-α-tocopheryl acetate, Shaanxi Bieyouth Biotech Co. Ltd., China) was supplemented at 40g/kg DM in feed or 40g/L DM in water. The feeding trial lasted for seven weeks (41 days). The basal diet contained 2509 Kcal/kg metabolizable energy, 17.14% crude protein, 19.46% crude fibre, and no additional selenium or carotenoid supplementation.

Feed and water intake were recorded daily. Stress biomarkers (cortisol, prolactin, triiodothyronine [T3], and thyroxine [T4]), antioxidant activity (malondialdehyde [MDA] measured using the TBARS method, superoxide dismutase [SOD] determined with a commercial assay kit, and total antioxidant capacity), and stress indicators (pulse rate, rectal temperature, and respiratory rate) were measured weekly at 8:00 am and 3:00 pm. Data were analyzed using ANOVA under a CRD model, and treatment means were separated using the Least Significant Difference (LSD) test at p 0.05.

Significant changes were observed in cortisol (55.33, 45.33, 52.66 ng/ml), T4 (8.43, 6.67, 6.57 µg/ml), MDA (2.86, 1.88, 1.89 nmol/ml), and respiratory rate (42.70, 26.00, 31.20 bpm), while other parameters showed no significant differences. Vitamin E supplementation reduced cortisol levels (p 0.05) when provided in feed, decreased T4 levels when supplemented in water (p 0.05), and lowered MDA concentrations in both feed and water treatments (p 0.05), indicating reduced oxidative stress. SOD activity increased when vitamin E was supplemented in water (p 0.05), whereas prolactin, T3, TAC, pulse rate, and rectal temperature were unaffected.

From these results, we can conclude that Vitamin E supplementation, particularly through feed, effectively reduces stress biomarkers and enhances antioxidant activity in Uda rams, although its effects on thyroid hormones and prolactin require further investigation.

Keywords

Vitamin E; Stress Biomarkers; stress indicators; Antioxidant activity; Uda Ram.

All procedures were conducted in accordance with animal welfare standards and approved by the Department of Animal Science, Faculty of Agricultural Sciences, Usmanu Danfodiyo University Sokoto.

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sciforum-135449: Effects of close-up period dietary cation–anion difference on post-calving performance of dairy cows with different body condition scores

Muhammad Uzair Akhtar [1,*], Faiz-ul Hassan [2], Muhammad Naeem Tahir [3] and Muhammad Naveed-ul Haque [4]

[1] Department of Animal Nutrition, Cholistan University of Veterinary and Animal Sciences, Bahawalpur 63100, Pakistan
[2] Faculty of Animal Production and Technology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur 63100, Pakistan
[3] Department of Livestock Management, The Islamia University of Bahawalpur, Bahawalpur 63100, Pakistan
[4] Department of Animal Nutrition, University of Veterinary and Animal Sciences, Lahore 54000, Pakistan

Periparturient cows adapt physiologically to high nutrient demands; however, a poor transition results in economic losses due to decreased production and increased disease incidence. This study investigated the effects of a control diet (CN) and a negative dietary cation–anion difference (DCAD) diet (ND) during close-up on the postpartum performance of low (LBCS)- and high (HBCS)-body-condition-score (BCS: 1-5) cows. Forty Holstein cows were enrolled at –21 d relative to calving into one of the four treatments (n=10/group): LBCS-CN, LBCS-ND, HBCS-CN, and HBCS-ND. The LBCS and HBCS cows had ≤ 3.00 and ≥ 3.25 BCSs, whereas the DCADs in the CN and ND groups were +100 and –100 mEq/kg of dry matter, respectively. Chlorides and sulfates of Mg and Ca were used, where the DCAD=[(Na+K)-(Cl+S)]. This study was approved by the ethical committee for animal welfare at the University of Veterinary and Animal Sciences, Lahore, Pakistan. Repeated measures analysis was conducted using the GLIMMIX procedure of SAS. Milk production, milk composition, and calf birth weight were not different between LBCS and HBCS groups ($p>0.05$). Prepartum, the ND versus the CN produced numerically a 3.20 kg/d higher amount of milk when fed to HBCS cows, but this increase was only 0.90 kg/d when fed to LBCS cows ($p=0.28$). However, prepartum DCAD level had no interaction with the BCS group of the cows for any of the observed parameters ($p>0.05$). The serum concentrations of β-hydroxybutyrate ($p=0.03$) and free fatty acids (FFA;$p=0.01$) were also increased in the HBCS cows versus those in the LBCS cows over the 9 wk of lactation. Prepartum DCAD level had no effect on pre- and postpartum BCS and daily rumination time ($p>0.05$). The ND decreased postpartum concentrations of serum β-hydroxybutyrate ($p=0.01$) and FFA ($p=0.04$) compared with those under the CN. In conclusion, a negative DCAD during the close-up period is equally beneficial in low- and high-BCS cows in terms of decreased β-hydroxybutyrate and FFA during the postpartum period.

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sciforum-132258: Effects of different lactic acid bacteria in dietary on intestinal flora, morphology,pH and immune organ indexes of Zi geese

Changsheng Bai * and Qiujin Liu

Branch of Animal Husbandry and Veterinary of Heilongjiang Academy of Agricultural Sciences,China

This experiment was conducted to study the effects of different lactic acid bacteria on intestinal flora, morphological structure, pH and immune organ index of Zi geese. Ninety 28 d old healthy Zi geese were randomly divided into three groups with three replicates in each group, with ten geese in each replicate. Geese in the control group were fed a basal diet, and the experimental groups were fed the basal diet supplemented with 10^9 CFU/kg *Lactobacillus plantarum* (ordinary lactic acid bacteria, group I) and 10^9 CFU/kg *Pediococcus acidilactici* B2 (isolated lactic acid bacteria, group II), respectively. The experiment lasted for 28 days. The results showed as follows: (1) The number of lactic acid bacteria in cecum of Zi geese in group II was higher than that in group I and control group (*P*0.01), and the number of *Escherichia coli* and *Salmonella* in cecum of Zi geese in group II was lower than in the control group (*P*0.05). (2) The villus height of jejunum in group II was higher than that in the control group (*P*0.05), the crypt depth was lower than that in the control group (*P*0.05), and the villus height/crypt depth was higher than that in group I and the control group (*P*0.01). The villus height/crypt depth of jejunum in group I was higher than that in the control group (*P*0.05). The villus height and crypt depth of ileum in group II were higher than those in group I and the control group (*P*0.05). (3) The pH of jejunum in group II was lower than that in the control group (*P*0.05). (4) The thymus, bursa of fabricius and spleen index of group II were higher than those of the control group (*P*0.05). It can be seen that the addition of isolated *P. acidilactici* B2 in the diet can maintain the balance of intestinal flora, improve the intestinal morphology and improve the immunity of Zi geese, and the effect is better than that of ordinary *L. plantarum*.

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sciforum-129725: Effects of different lactic acid bacteria on growth performance, serum biochemical indexes, and fecal flora of Zi geese

Qiujin Liu [1,*], Changsheng Bai [1], Hao Tan [2] and Zhongbo Wang [2]

[1] Branch of Animal Husbandry and Veterinary of Heilongjiang Academy of Agricultural Sciences, Qiqihar 161005, China
[2] Yi'an County Animal Husbandry and Veterinary General Station of Heilongjiang Province，Qiqihar 161500, China

This study evaluated the effects of two lactic acid bacteria (LAB) strains on Zi geese. Ninety 28-day-old healthy Zi geese were randomly divided into three groups (n=30/group), with three replicates (pens) per group and 10 geese (5 males, 5 females) per pen. The control group (CON) received a basal diet. Experimental groups received the basal diet supplemented with 10^9 CFU/kg *Lactobacillus plantarum* (LAC) or 10^9 CFU/kg *Pediococcus acidilactici* B2 (PED). The trial included a 7-day pre-test and 28-day test period. The pen served as the experimental unit. Data were analysed by one-way ANOVA using SPSS; significant differences (P0.05) between treatment means were determined by Duncan's test. Compared to CON, the PED group significantly increased average daily gain (ADG) (*P*0.05), while the LAC group showed a non-significant increase (*P*>0.05). Both LAC and PED significantly reduced the feed-to-gain ratio (F/G) (*P*0.05 and *P*0.01, respectively). Serum urea content was significantly decreased in both LAC (*P*0.05) and PED (*P*0.01). Serum alkaline phosphatase activity was significantly decreased in both groups (*P*0.05). Fecal lactic acid bacteria counts (MRS agar) significantly increased in both LAC (*P*0.05) and PED (*P*0.01). Fecal Escherichia coli (MacConkey agar) and Salmonella (SS agar) counts significantly decreased in both groups (*P*0.05 and *P*0.01, respectively). The PED group generally exhibited more pronounced effects than the LAC group. Dietary supplementation with *L. plantarum* and *P. acidilactici* B2, particularly the latter, improved growth performance, modulated serum biochemistry, and enhanced the fecal microflora profile in Zi geese.

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sciforum-132480: Effects of White Grape Pomace Silage on Milk Yield and Economic Return in Murciano-Granadina Goats Over a Full Lactation.

Marina Gálvez López [1,*], Amparo Roca [2], Alberto Atzori [3], Martín Rodriguez [4], Gema Romero [2] and Jose Ramón Díaz [5]

[1] Instituto de Investigación e Innovación Agroalimentaria y Agroambiental - Universidad Miguel Hernández Elche
[2] Miguel Hernández University of Elche, Institute of Agri-Food and Agro-Environmental Research, Ctra. De Beniel, km 3.2, 03312 Orihuela, Spain
[3] Faculty of Agriculture, University of Sassari, Via Italia 39, 07100, Sassari, Italy
[4] Institut de Ciència i Tecnologia Animal, Universitat Politècnica de València, Camí de Vera, S/N, 46022
[5] Miguel Hernández University of Elche, Institute of Agri-Food and Agro-Environmental Research, Ctra. De Beniel, km 3.2, 03312 Orihuela, Spain

Within the UN's Sustainable Development Goal strategy for 2030, the valorisation of by-products and the reduction of inputs to produce high-biovalue food are priorities. Dairy goats contribute significantly to the sustainable conversion of fibrous biomass into high-quality food products for human consumption. At the same time, feed accounts for the highest expenditure on livestock farms. Therefore, incorporating agro-industrial by-products such as white grape pomace into ruminant diets could reduce feeding costs while improving the circular economy. This study evaluated the effects of incorporating white grape pomace silage (WGPS) at 15% of dietary dry matter in the diet of lactating dairy goats on milk yield and composition. The experiment was conducted over an eight-month lactation period and included an economic assessment. Two isoenergetic and isoproteic diets (Control and WGPS) were formulated and randomly assigned to 40 Murciano-Granadina goats, distributed into four groups (2 diets × 2 replicates) balanced by productive performance. At six-week intervals, batch-level samples were collected to assess dry matter (DM) and water intake, while individual measurements were taken for body weight, milk yield, milk composition, and somatic cell count. Variables were analysed using a mixed linear model (PROC GLIMMIX, SAS v9.4), accounting for the effect of the pre-experimental covariate, which proved significant in all cases except for feed efficiency. Goats fed the WGPS diet showed slightly lower DM and water intake and reduced milk urea concentration, without impacting milk yield or body weight. The economic analysis revealed that WGPS inclusion led to an additional margin of EUR 16 per goat over the eight months compared to the control group. It is concluded that white grape pomace silage is a viable forage option for inclusion in dairy goat diets.

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sciforum-128908: Environmental assessment of meat and milk production of sedentary dual-purpose cattle farms in two vegetation zones in Benin using the GLEAM-i model

Pénéloppe G. T. Gnavo [1,*], Rodrigue Vivien Cao Diogo [1, 2] and Luc Hippolyte Dossa [3]

[1] Integrated Production Systems Innovation Lab and Sustainable Land Management (InSPIREs-SLM), Faculty of Agronomy, University of Parakou, PO Box 123 Parakou, Benin
[2] Département des Sciences et Techniques de Productions Animale et Halieutique, Faculté d'Agronomie, Université de Parakou, BP 123 Parakou, Bénin
[3] Laboratoire des Sciences Animales (LaSA), Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, 03 BP 2819 Cotonou Jéricho, Bénin

To cope with the new regulations on pastoralism in Benin, herders shifted from mobile livestock herding towards a more sedentary lifestyle. However, sedentary livestock keeping may lead to severe challenges if feeding and animal health, as well as environmental health, are poorly managed. To provide appropriate recommendations for the sustainability of this land-use system, this study assessed the environmental impact of sedentary cattle farms by estimating their greenhouse gas emissions using the Global Livestock Environmental Assessment Model-interactive (GLEAM-i, Online version). Therefore, three sedentary cattle farm types, namely sedentary zebu (SZF), taurine (STF) and crossbreed (SCF), were selected in two vegetation zones (Sudanian in the North (SZ) and Guineo-Congolian (GCZ) in the South of Benin). Irrespective of the farm type, the animals were exclusively fed on natural pasture. A total of 12 cattle herds were surveyed to collect input data (herd structure, demographic parameters, milk production and composition, and weight data) for the GLEAM-i. The fat and protein content of the milk (determined using a milkotester device), live weight and weight at slaughter of animals were entered into GLEAM-i, which automatically determines the emission intensity values per kg of protein produced. The results revealed that CH_4 was the main GHG emitted (88%) followed by CO_2 (6-7%) and N_2O (6%). The highest and lowest total GHG emissions ($kgCO_2$-eq/year) were recorded in SZF (188,497) and STF (52,003) farms, respectively. With regard to emissions intensity ($kgCO_2$-eq/kg Protein), emissions varied from 506.59 to 3043.73 for meat and from 588.86 to 3043.73 for milk. Overall, preliminary trends suggest lower intensities for taurine in the GCZ and for zebu in the SZ. However, these results would be more meaningful with larger studies with production conditions, zone effects, and controlled allocation. These would allow for drawing firm recommendations for breeding strategies to reduce GHG emissions in Benin.

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sciforum-131680: Expression of MTOR genes and its association with SNPs of gene and feed efficiency in intensive-fattened lambs in Latvia

Daniela Malakovska [1,*], Samanta Plavina [1], Nikole Krasnevska [1], Jegors Paramonovs [1], Daina Kairisa [2], Natalia Paramonova [1] and Ilva Trapina [1]

[1] Genomics and Bioinformatics, The Department of Pharmaceutical Sciences, Faculty of Medicine and Life Sciences, the University of Latvia, Riga, Latvia
[2] Department of Animal Sciences, Latvian University of Life Sciences and Technologies, Jelgava, Latvia

Feed efficiency is an economically important trait in sheep farming, directly influencing productivity and profitability. As a complex quantitative trait, FE is regulated by multiple genes, including the mechanistic target of the rapamycin MTOR gene, which plays a key role in skeletal muscle development, metabolism, and body weight regulation.

This study aimed to investigate the relationship between MTOR gene expression levels and SNP genotypes in sheep with different FE values raised in Latvia. Blood samples were collected from 76 lambs at approximately 81 days of age and 92 lambs at around 150 days, across two intensive fattening groups. About 60% of the lambs represented the Latvian Dark-Head breed. Expression of the MTOR gene and 14 SNPs within the gene were analysed using comparative and correlation analyses.

The results showed that MTOR gene expression increased significantly after the fattening period, suggesting a rising demand for MTOR protein as muscle and body mass increase. In seven SNPs, significant differences in gene expression were observed between genotype groups. Additionally, eight SNPs showed potential associations with increased gene expression during intensive fattening. Statistically significant correlations were found between pre-fattening *MTOR* expression and the Kleiber ratio at 60 days, as well as between post-fattening expression and relative growth rate.

These findings suggest that MTOR gene expression and its associated SNP variants could serve as promising molecular markers in genetic selection for improved feed efficiency. This study provides new insights into the genetic regulation of growth and metabolism in Latvian sheep populations.

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sciforum-132056: From the zoonotic risk to the economic losses: a serosurvey of ten pathogens in pig farms in the Campania region

Gianmarco Ferrara

Department of Veterinary Sciences, University of Messina, Messina, 98168, Italy

Infectious diseases are a major problem for all livestock farming, including swine. They are responsible for numerous economic losses and, in the case of zoonotic diseases, also for public health problems. In this study, the seroprevalence of 10 common swine pathogens was evaluated, evaluating any risk factors related to increased exposure risks. A total of 420 blood samples were collected in the Campania region, southern Italy, and tested with specific commercial ELISAs. The highest seroprevalences were found for hepatitis E virus (HEV, 41.4%), porcine reproductive and respiratory virus (PRRSV, 16.7%), and porcine epidemic diarrhea virus (PEDV, 14.8%). Lower prevalences were found for transmissible gastroenteritis (TGEV, 5.5%), porcine respiratory coronavirus (PRCV, 0.9%), Mycobacterium avium paratubercolosis (MAP, 3.5%), bovine viral diarrhea virus (BVDV, 3%), Schmallenberg virus (SBV, 5.3%), and Coxiella burnetii (4.1%). No animal had antibodies against Brucella suis. Furthermore, statistical tests correlated sex, age, and type of farm with higher exposure to HEV, SBV, PEDV, and TGEV. Therefore, in the study area, exposure to pathogens causing damage to the swine industry economy, such as PRRSV and PEDV, as well as to those with zoonotic potential, such as Coxiella and HEV, was frequent. The results of this study underline the importance of continuous surveillance in swine farming in order to understand the main circulating pathogens, risk factors, and measures to be taken.

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sciforum-131921: Genetic diversity of the Latvian Dark-head sheep breed according to single-nucleotide polymorphisms compared to breeds bred in Latvia

Ilva Trapina [1,*], Maris Martins [2], Samanta Plavina [2], Daniela Malakovska [2], Nikole Krasnevska [2], Jegors Paramonovs [2], Daina Kairisa [3] and Natalia Paramonova [4]

[1] Genomic and bioinformatic laboratory, The Department of Pharmaceutical Sciences, Faculty of Medicine and Life Sciences, the University of Latvia
[2] Genomics and Bioinformatics, The Department of Pharmaceutical Sciences, Faculty of Medicine and Life Sciences, the University of Latvia, Riga, Latvia;
[3] Department of Animal Sciences, Latvian University of Life Sciences and Technologies, Jelgava, Latvia
[4] Genomics and Bioinformatics, The Department of Pharmaceutical Sciences, Faculty of Medicine and Life Sciences, the University of Latvia, Riga, Latvia

Over the past 15 years, thirty different sheep breeds have been raised in Latvia, yet only one, the Latvian Dark-head sheep (*Latvijas tumšgalve*; LT), is a nationally developed breed. With the growing dominance of commercially attractive breeds, there is an increasing risk of losing local genetic resources, especially in small farming communities. The LT breed fully adapts to local environmental conditions and holds cultural significance, contributing to traditional lifestyles, landscape preservation, and regional identity. Therefore, genetic studies on LT are essential to preserve its diversity and inform future breeding programs.

This study aimed to evaluate the genetic diversity within the LT breed and compare it to other commonly raised sheep breeds in Latvia. For the first time, lambs from sire rams representing major breeds in Latvia were genotyped using the Illumina Ovine SNP50 BeadChip®. Genetic diversity was assessed by minor allele frequency (MAF) analysis, and breed-specific markers were identified by locating fixed SNPs (MAF = 0 or 1) unique to each breed.

We identified 47,139 highly polymorphic (MAF 0.3 – 0.5) SNPs in LT breed samples, observing a large genetic differentiation (FST > 0.15) from other breeds. Among all analysed SNPs, 2735 (1540 (3.00%) MAF = 0 and 1195 (2.33%) MAF = 1) were found to be fixed SNPs in the LT breed, while from 55 to 296 SNPs were unique to the LT breed compared to other frequently raised breeds in Latvia.

The OvineSNP50 panel provides a sufficiently informative set of molecular markers for distinguishing the LT breed and monitoring its genetic diversity. Given the high level of polymorphism, the data also holds potential for future studies in genetic selection and breed improvement.

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sciforum-135236: Immunotherapeutic potentials of immunogenic peptides for sustainable livestock production

Isaac Oluseun Adejumo [1,*] and A.O. Akintayo [2]

[1] Department of Animal Science, University of Ibadan, Ibadan, 200005, Nigeria
[2] Department of Aquaculture and Fisheries Management, University of Ibadan, Ibadan, Nigeria

The important roles animal foods, particularly pork and chicken, play across the globe cannot be overstated. However, the high cost of feed ingredients and growing concerns about antibiotic resistance are limiting their sustainable production. With these growing concerns, significant research and investment have focused on identifying sustainable and cost-effective alternatives to feed ingredients and antibiotics. Probiotics have emerged as promising candidates for replacing antibiotics in both human health and livestock production. However, their widespread application is limited, owing to an incomplete understanding of their functional mechanisms. In this study, immunogenic peptides derived from probiotic bacterial species, *Ligilactobacillus saerimneri (*isolated from the cecum of a 20-day-old chicken), *Ligilactobacillus salivarius* (isolated from the feces of swine) and *Lactobacillus acidophilus,* were investigated for their ability to induce interleukin-10 (IL-10), interleukin-13 (IL-13), and interferon-gamma (IFN_γ) using a computational approach, based on their essential functions in immune modulation in this preliminary study. Six peptides each were considered from each organism. Their physico-chemical properties were also assessed. *Ligilactobacillus salivarius*-derived peptides obtained the highest IL-10-inducing capacity, which was statistically similar to *Ligilactobacillus saerimneri*-derived peptides but significantly (p0.05) higher than *Lactobacillus acidophilus*-derived peptides. IL-13-inducing potential was significantly (p0.05) higher for *L. acidophilus*-derived peptides when compared with both *L. salivarius*-derived peptides and L. *saerimneri*-derived peptides. IFN_γ was statistically not different across the groups. The theoretical isoelectric point ranged between 4.00 and 12.01, indicating their potential to be well-accommodated in the gastrointestinal tract. The instability index ranged between -31.32 and 107.81. Out of the peptides considered, four (22%) are regarded as unstable. The peptides can withstand a varied temperature range, with the aliphatic index being generally high. The GRAVY score ranged between -2.065 and 1.110. 22% of the peptides, and based on their GRAVY scores, most are hydrophobic, while the rest are hydrophilic. These findings reveal a deeper understanding of probiotic immune pathways and highlight their potential for sustainable applications as therapeutic feed additives, functional food supplements, and innovative candidates in vaccine development.

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sciforum-139192: In Vitro Gas Production, Methanogenesis, Dry Matter Degradability, and Rumen Metabolites of Ripe and Abscised Unripe Mango Fruits of Three Varieties

Taofik Adam Ibrahim [1,*], Maryam Ismail [2], Muhammad Lawal [3], Danjuma Zahraddeen [2] and Muhammad Rabiu Hassan [2]

[1] Ahmadu Bello University, Zaria 810107, Nigeria
[2] Department of Animal Science, Ahmadu Bello University, Zaria 810107, Nigeria
[3] Department of Agricultural Education, Federal College of Education, Katsina 820212, Nigeria

The nutritional profile of ripe and abscised unripe mango fruits of Alphonso, Mabrouka, and Zill varieties have been reported. This has created a paucity of information on the nutritional quality of the fruits, especially the unripe mango fruits, which are potential dietary ingredients for livestock. Hence, this study evaluated the in vitro gas production, methanogenesis, in vitro dry matter degradability, and rumen metabolites of ripe and abscised unripe mango fruits of the Alphonso, Mabrouka, and Zill varieties. The treatments comprised forage (control), unripe Alphonso, ripe Alphonso, unripe Mabrouka, ripe Mabrouka, unripe Zill, and ripe Zill mango fruits in a CRD. The data were analysed using a general linear model of ANOVA, while significant means were compared using DMRT. The results showed that the total gas production (TGP) and in vitro dry matter degradability (IVDMD) of ripe and abscised unripe mango fruits of Alphonso, Mabrouka, and Zill varieties were similar and higher (P0.05) than the forage. The percentage of CH4 to gas production, TGP/IVDMD, and CH4/IVDMD were higher (P0.05) in the forage than the ripe and abscised unripe mango fruits of the three varieties. The ruminal pH levels were lower (P0.05) in mango fruit treatments compared to the forage, while the ripe mango fruit of the Zill variety had significantly higher (P0.05) volatile fatty acids (mmol/L) and propionic acids, but lower acetic acids production than the forage. There was no difference (P>0.05) observed in the ruminal NH3-N (mg/dL), butyric acid, and iso-butyric acid production among the forage and the mango fruits of the three varieties. The gas production at 3 hours for both the ripe and the unripe mango fruits of the three varieties was higher (P0.05) than the forage. However, at 24 hours, the gas production of the forage was only lower (P0.05) than the ripe Alphonso and Mabrouka, while at 48 hours, no difference (P>0.05) was observed in the gas production of the forage compared to the mango fruit treatments. It can be concluded that abscised unripe mango fruits of Alphonso, Mabrouka, and Zill varieties possess competitive nutritional quality to the ripe mango fruits, outperforming the forage as both livestock and climate-smart dietary ingredients. Also, variety had no effect on the in vitro gas production, dry matter degradability, and methanogenesis of mangos for both the ripe and abscised unripe fruits. It is therefore recommended that the nutritional quality and methane-producing potential of abscised unripe mango fruits of the Alphonso, Mabrouka, and Zill varieties be evaluated in vivo.

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sciforum-134491: Influence Of Different Levels Of Urea Fertilizer Application On The Nutritive Values Of Brachiaria Hybrid (Mulato II)

Abubakar Ahmed

Department of Animal Science and Range Management, Faculty of Agriculture, Modibbo Adama university, Yola. Nigeria

A study was conducted at the Modibbo Adama University Research Farm to evaluate the influence of different levels of urea fertilizer on the nutritive values of Brachiaria hybrid (Mulato II). The trial aimed to address the persistent issue of poor forage quality in tropical livestock systems by improving pasture productivity and nutritional composition through appropriate fertilization. Brachiaria Mulato II was established and treated with four levels of urea fertilizer: 0 kg/ha (control), 50 kg/ha, 100 kg/ha, and 150 kg/ha. Forage samples were harvested at 9- and 11-week post-establishment, and proximate composition was analyzed to determine crude protein (CP), ash, crude fiber (CF), dry matter (DM), ether extract (EE), and nitrogen-free extract (NFE). The results revealed that urea application significantly enhanced the crude protein content and reduced crude fiber across treatments, particularly at 100 kg/ha, indicating an optimal balance between nutrient uptake and growth. The CP values ranged from 8.15% in the control to 14.52% in the 100 kg/ha treatment at 9 weeks, while CF decreased from 31.44% in the control to 23.36% in the 100 kg/ha treatment. Ash and DM contents also improved with moderate fertilization, suggesting enhanced mineral content and biomass yield. However, application beyond 100 kg/ha showed diminishing returns in nutritional gains. The study concludes that applying 100 kg/ha of urea fertilizer to Brachiaria Mulato II enhances forage quality, making it suitable for improving ruminant nutrition in tropical regions. These findings support the integration of moderate fertilization into pasture management practices for sustainable livestock production.

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sciforum-132617: Plant-Based Expression of Foot-and-Mouth Disease Virus Serotype O Antigens in *Nicotiana tabacum* for Livestock Vaccine Development

Rimsha Riaz *, Muhammad Sarwar Khan, Faiz Ahmad Joyia and Ghulam Mustafa

Centre of Agricultural Biochemistry and Biotechnology (CABB), University of Agriculture, Faisalabad, 38000, Pakistan

Introduction

Livestock plays a vital role in Pakistan's agricultural sector, yet recurrent outbreaks of foot-and-mouth disease (FMD), particularly caused by FMD virus (FMDV) serotype O, result in significant economic losses. Existing inactivated and live attenuated vaccines have failed to provide sufficient protection against these outbreaks. This study aimed to generate a cost-effective, biosafe plant-based vaccine targeting FMDV serotype O antigens.

Methods

A synthetic gene construct encoding the *P1–2A* polyprotein and *3C^pro* protease of FMDV serotype O was engineered. To enhance immunogenicity, the cholera toxin B subunit (*CTB*) was genetically fused at the N-terminus of *P1–2A* via a flexible glycine–serine linker. The *bar* gene, under the CaMV 35S promoter, served as a selectable marker. The construct was introduced into young tobacco (*Nicotiana tabacum*) leaves (4–6 weeks old) via biolistic transformation, and transgenic lines were selected on medium containing 1.0 mg/L phosphinothricin (PPT). Wild-type (non-transformed) plants and vector-only transformants were maintained as negative controls.

Results

Multiple putative transgenic plants were regenerated and confirmed by PCR using *P1–2A*, *3C^pro*, and *bar*-specific primers. These lines were acclimatized and progressed to seed set. Segregation analysis and germination assays on medium with up to 3.0 mg/L PPT confirmed stable inheritance of the transgene in the T1 generation. Surviving seedlings consistently tested PCR-positive, validating successful transmission and stable integration of the vaccine construct. Controls (wild-type and vector-only) confirmed that the observed PCR amplifications were construct-specific.

Conclusion

This work demonstrates the generation of genetically stable tobacco plants expressing key immunogenic proteins of FMDV serotype O. The results provide a foundation for subsequent immunological evaluation and highlight the potential of plant-based expression systems in developing cost-effective veterinary vaccines in Pakistan.

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sciforum-128030: Refining freezing techniques to enhance post-thaw sperm functionality in bovine semen

Laura Murillo [1], Francisco Sevilla [1], Ignacio Araya-Zúñiga [1] and Anthony Valverde [2]

[1] Animal Reproduction Laboratory, Costa Rica Institute of Technology (TEC), Alajuela 20101, Costa Rica
[2] Costa Rica Institute of Technology (TEC), Cartago 30101, Costa Rica

Genetic improvement of the Brahman breed is critical for increasing meat production and optimizing farming practices, thereby contributing to sustainable and efficient livestock development. This study evaluates two protocols for bovine semen cryopreservation by analysing post-thaw sperm quality using Computer-Assisted Semen Analysis (CASA) technology. Six bulls, with an average age of 48.6 ± 11.5 months, were used. Two ejaculates were collected from each bull, and semen was diluted with three extenders: Andromed®, BioXcell®, and OptiXcell®. The samples were equilibrated for either four or six hours and frozen using static/manual or controlled programable methods. Results showed significant differences (p0.05) in sperm motility and kinematics based on the extender used. The highest sperm motility was obtained with OptiXcell® (31.61 ± 0.61%). Semen diluted with BioXcell® exhibited a more linear and progressive kinematic pattern, whereas Andromed® resulted in the lowest motility and kinematic values. Bull age had a significant effect (p0.05) on the percentage of fast and medium sperm. Bulls over 48 months showed higher progressive motility, while bulls under 48 months had higher curvilinear velocity (VCL = 80.15 ± 0.43 $\mu m \cdot s^{-1}$). Cooling time did not affect motility variables (p>0.05), but significant differences (p0.05) were observed in progressive motility variables. No differences were found in total motility rate between freezing methods, but significant differences (p0.05) were noted in sperm kinematic variables. The findings suggest that male age, extender type, cooling time, and freezing method significantly influence post-thaw sperm quality in the Brahman breed, with implications for optimizing cryopreservation protocols.

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sciforum-131799: Relationship between the slaughter yield of intensively fattened lambs and genomic loci in sheep breeds raised in Latvia

Elina Leonova [1,*], Daniela Malakovska [1], Samanta Plavina [1], Nikole Krasnevska [1], Jegors Paramonovs [1], Daina Kairisa [2], Natalia Paramonova [1] and Ilva Trapina [1]

[1] Genomics and Bioinformatics, The Department of Pharmaceutical Sciences, Faculty of Medicine and Life Sciences, the University of Latvia, Riga, Latvia
[2] Department of Animal Sciences, Latvian University of Life Sciences and Technologies, Jelgava, Latvia

Improving the economic efficiency of sheep farming depends significantly on increasing animal productivity. In meat sheep breeds, one key productivity indicator is slaughter yield, a trait influenced by numerous biological parameters and regulated by multiple genes involved in diverse molecular pathways. Genetic variation in these pathways can be utilized through molecular marker-assisted selection, especially when markers show significant associations within specific populations.

This study aimed to identify potential molecular markers associated with slaughter yield in intensively fattened lambs of sheep breeds raised in Latvia. A total of 160 lambs (59.5% Latvian Dark-Head breed) from the most common local breeds were included in a controlled fattening program. Slaughter yield (%) was measured (44.45±2.52%) at age 149.65±14.26 days, and genotyping of 57 SNPs across eight candidate genes was conducted. Association and regression analyses were performed to assess the relationship between genotypes and slaughter yield.

Among the analyzed SNPs, 23 (40.35%) showed statistically significant associations with slaughter yield in the Latvian sheep population. The strongest associations were found for two SNPs in the UPC2 gene (rs412180048 A>G and rs405808821 C>T) and two in the MTOR gene (rs419418343 C>T and rs160776285 T>C). In both UPC2 SNPs, the highest slaughter yields were observed in lambs homozygous for the common allele, although this genotype was rare in the Latvian population. In the case of MTOR, the highest yield was found in both homozygous common and heterozygous genotypes, which were present in only 25% of the sampled animals.

These results suggest that SNPs in UPC2 and MTOR genes have strong potential as molecular markers for improving slaughter yield through marker-assisted selection in Latvian sheep breeding programs.

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sciforum-131077: Screening of lactic acid bacteria inhibiting xanthine oxidase and safety evaluation

Qiujin Liu [1,*], Changsheng Bai [1], Junyi Yin [1], Qiufeng Tian [1], Huan Wang [1], Zhanmei Xue [1], Yan Zhang [1], Hao Tan [2] and Zhongbo Wang [2]

[1] Branch of Animal Husbandry and Veterinary of Heilongjiang Academy of Agricultural Sciences, Qiqihar 161005, China
[2] Yi'an County Animal Husbandry and Veterinary General Station of Heilongjiang Province，Qiqihar 161500, China

This study aimed to screen lactic acid bacteria (LAB) strains with potent xanthine oxidase (XOD)-inhibitory activity for potential application in reducing uric acid levels in poultry. A two-tiered approach was employed. First, we performed in vitro screening: The XOD inhibition rates of cell-free extracts (CFEs) from 26 LAB strains were determined. Four high-performing strains (A2, A6, SC, SN) were subsequently evaluated for the inhibition rates of their cell-free supernatants (CFSs). Further in vitro characterization included assessing their tolerance to artificial gastrointestinal fluids and antibiotic susceptibility profiling against 21 antimicrobials. The strains were identified via 16S rDNA sequencing. Subsequently, an in vivo safety study was conducted: mice received daily intraperitoneal injections of bacterial suspensions (10^{10} CFU/mL) for two weeks, with the incidence of mortality and organ lesions monitored. In vitro, the CFEs of strains A2, A6, SC, and SN exhibited XOD inhibition rates of 23.41%, 27.45%, 24.47%, and 27.23%, respectively, while their CFSs showed rates of 14.26%, 17.02%, 22.34%, and 19.57%. All four strains demonstrated high gastrointestinal tolerance, maintaining viable counts of above 10^8 CFU/mL post-digestion. They were sensitive to key antibiotics like cephalosporins, macrolides, and penicillins. Molecular identification classified them as *Lactobacillus paracasei* (A2), *Lactobacillus plantarum* (A6), *Lactobacillus brevis* (SC), and *Lactobacillus rhamnosus* (SN). Critically, the in vivo safety assay revealed no mortality or organ lesions in mice treated with any of the four strains. Four LAB strains with potent in vitro XOD-inhibitory activity and proven in vivo safety were obtained, offering promising candidates for probiotic control of avian hyperuricemia.

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sciforum-138271: Seasonal dynamics of in vitro fermentation of two woody plants *Phylleria media* and *Rubus fruticosus*: Kinetic and methanogenic profiles

Ismahane Bendekoum [1,*], Lamia Mebirouk- Boudechiche [1,2] and Safia Meziani [3]

[1] Laboratory of Epidemiological Surveillance, Health, Production and Reproduction, Experimentation and Cell Therapy of Domestic and Wild Animals, Chadli Bendjedid University, El Tarf, Algeria
[2] Laboratory of Agriculture and Ecosystem Functioning, Chadli Bendjedid University, El-Tarf, Algeria
[3] Laboratory of Animal Production, National Higher Agronomic School El Harrach, Algeria

In Algeria, as in other Mediterranean regions, forage resources, particularly woody forage shrubs, play a crucial role as an alternative and supplementary feed source for ruminants. Their resilience to extreme climatic conditions, their evergreen foliage, and their ability to regrow after grazing make them strategic species in the forage calendar for ruminants in extensive farming systems. It is in this context that we investigated the effect of season on the digestibility of leaves from two forage species in northeastern Algeria: *Phylleria media* and *Rubus fruticosus*. Leaves from these species were collected in spring and autumn. Thus, the fermentation kinetics, methane production, and effect of polyethylene glycol on the fermentation of these leaves were investigated. After 72 h of incubation, the average gas production from *Phylleria media* was higher in autumn than in spring (68.87 vs 61.47 ml/0.2 g DM). In contrast, for *Rubus fruticosus*, the final gas production remained relatively stable between the two seasons (47.04 ml in spring compared to 46.29 ml in autumn). With regard to methane, production was higher in spring for both substrates. The addition of PEG reduced methane production in both *R. fruticosus* and *P. media* during spring. PEG had no significant effect in the autumn. Seasonality modulates fermentation pathways differently: autumn favors CO_2 production, while spring optimizes CH_4 production. These results highlight the importance of seasonal management of woody resources and reinforce the value of woody shrubs in extensive livestock systems, particularly during periods of herbaceous forage scarcity. Their contribution can thus improve food security.

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sciforum-138449: Sericulture for Economic Empowerment: Evidence from Community-Based Projects in Binalonan, Pangasinan, Philippines

Edwina Valdez Garcia [1], Rodolfo Gaon Nillo [2] and Elizabeth Padonan Obra [1,*]

[1] Sericulture Research and Development Institute, Don Mariano Marcos Memorial State University, Bacnotan, La Union 2515, Philippines
[2] Don Mariano Marcos Memorial State University – North La Union Campus, Bacnotan, La Union 2515, Philippines

Sericulture is an agro-based industry that supports rural development, environmental sustainability, and socio-economic upliftment. Recognized for its eco-friendly nature and inclusivity, sericulture provides livelihood opportunities, particularly for marginalized rural communities. The Don Mariano Marcos Memorial State University–Sericulture Research and Development Institute (DMMMSU-SRDI) in the Philippines implemented extension projects in Binalonan, Pangasinan, from 2018 to 2023, supported by the Senator Loren Legarda Fund and DMMMSU-SRDI Regular Fund. These projects aimed to demonstrate sustainable sericulture practices, assess profitability, and promote employment and environmental benefits through pilot farms. The initiative involved sapling and mulberry leaf production, silkworm rearing, and the utilization of sericulture by-products. Best practices included sapling propagation (pot and plot methods), rainfed mulberry establishment (0.9 ha), rearing house construction, synchronized silkworm rearing, and value-adding activities. Over five years, 69 silkworm batches were reared using 52.05 boxes of fourth-instar larvae, fed with over 144,000 kg of mulberry leaves. This resulted in 1,377.19 kg of fresh cocoons, generating PHP 411,320.00 in sales and a net income of PHP 248,164.10 with a return on investment (ROI) of 155.17%. Furthermore, additional income was generated through sericulture by-products (PHP 27,307.00; ROI: 94.93%). Overall, farmer income increased by 131.38%, and the projects created 306.46 person-days of employment valued at PHP 75,372.50. These findings underscore the viability of sericulture as a low-capital, high-return rural enterprise, contributing to agricultural diversification, environmental restoration, and rural socio-economic resilience.

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Session 10. From Field to Consumers: Challenges and Approaches to High- Quality Agricultural Products

sciforum-132539: Grant sparkling wines an identity: a strategy to address the wine sector crisis

Teodora Basile *, Giambattista Debiase, Francesco Mazzone and Maria Francesca Cardone

CREA Research Centre for Viticulture and Enology, Via Casamassima 148, 70010 Turi, Italy

Introduction

The wine industry is facing significant challenges, with only sparkling wine showing growth. Southern Italy is particularly impacted due to its focus on white and full-bodied red wines. To address this, we have created new sparkling wines using the Champenois method and six typical Apulian white grape varieties: Bombino, Antinello, Falanghina, Fiano, Greco Bianco, and Montonico Pinto, along with native yeast strains. The concept of “microbial terroir” highlights the connection between the microbial environment, climate, and production area, linking wines to their cultural and historical roots. Utilizing indigenous yeast strains enhances the wine's identity and ties it to the notions of heritage and terroir.

Methods

Grape, base wines, and sparkling wines were analyzed for conventional parameters (pH, titratable acidity, volatile acidity, alcohol content, and residual sugars). The aromatic profile of final sparkling wines was assessed through GC-MS and sensory analyses. Base wines were produced through sequential inoculation of a native L. thermotolerans (Lt) and a S. cerevisiae strain (VB1, Oenobrands), or only with the commercial S. cerevisiae. For the second fermentation, two different S. cerevisiae strains were used: an indigenous yeast strain (S21) isolated from Apulian vineyards, or a commercial one (18-2007 IOC).

Results

The most appreciated sparkling wines were those made from Antinello, Fiano, and Falanghina in combination with the native S. cerevisiae S21 strain. These wines showed floral and white fruit notes, linked to the chemical compounds identified through GC/MS analysis (alcohols, carboxylic acids, esters, terpenoids, lactones, and others). Additionally, visual characteristics, such as color and perlage, contributed to the positive evaluation of these wines. While native S21 yeast allowed for the production of well-received products, unfortunately, the wines produced with Lt during the first fermentation did not perform well in sensory evaluations.

Conclusion

Offering sparkling wines with a background, based on the use of local varieties and native yeast, can be a strategy to capture consumer interest and drive demand.

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sciforum-119124: In Vitro Evaluation of the Antifungal Effect of Carvacrol-based Essential Oils on Alternaria and Fusarium Fungi

Vasileios Papantzikos *, Georgios Patakioutas and Paraskevi Yfanti

Department of Agriculture, Arta Campus, University of Ioannina, 47100 Arta, Greece

In this work we studied in vitro the antifungal effect of essential oils obtained from the Greek flora aromatic plants of the Lamiaceae family, Satureja horvatii ssp. macrophylla, Coridothymus capitatus, and Origanum vulgare ssp. hirtum, on two phytopathogenic fungi, which cause black spot of tomato fruits (Alternaria sp.) and potato tuber dry rot (Fusarium sp.) during storage. According to the results of Gas Chromatographic–Mass Spectrometry analysis, the essential oils of S. horvatii ssp. macrophylla, C. capitatus, and O. vulgare ssp. hirtum used in the experiments belong to the carvacrol chemotype. The antifungal effect of the essential oils on the phytopathogenic fungi was evaluated by fumigant assay. An essential oil-free treatment was used as a control. After 8 days of fungal growth on the Petri dish, the results showed that some of the essential oils completely inhibited the mycelial growth of the phytopathogenic fungi Fusarium sp. and A. alternata. This effect could be further evaluated in vivo for the fruits' post-harvest protection from phytopathogenic fungi during storage, aiming to improve agricultural products' quality.

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sciforum-126791: Action of rough lemon and sicilian lemon on arabica coffee husk fermentation regarding antioxidant, antimicrobial, and probiotic activities

Wellerson de Oliveira Alves da Silva *, Renata Cassia Campos, Leticia Carvalho Passos, Constância Consentino Teixeira Oliveira and Vitória da Silva Souza

Federal University of Viçosa (UFV); Viçosa, Minas Gerais; 36570-900; Brazil

Coffee husk represents the largest residue from Brazilian coffee cultivation. However, it is rich in bioactive compounds such as chlorogenic acids, trigonelline, and phenolic compounds, which possess significant antioxidant, antimicrobial, and probiotic effects. These characteristics make the husk a natural alternative to synthetic extracts, valued by the food industry. This study aimed to analyze the impact of adding rough lemon (Citrus x limonia) and Sicilian lemon (Citrus limon), at different fermentation times, on the antioxidant, antimicrobial, and probiotic characteristics of coffee husk, aiming for sustainable use of this residue and promotion of additional income for coffee farmers. The coffee husk fermentation methods conducted were as follows: with rough lemon (A), coffee husk only (B), and with Sicilian lemon (C), over periods of 12 (1), 36 (2), and 60 hours (3), totaling nine methods (A1, A2, A3, B1, B2, B3, C1, C2, and C3). After fermentation, the husks were dried to 12.35% moisture content (dry basis) and analyzed for pH, titratable acidity, phenolic compounds, trigonelline, and chlorogenic acids. Additionally, antimicrobial capacity tests of the husks were performed using *Staphylococcus aureus* and *Salmonella enteriditis* as pathogenic microorganisms and *Lactobacillus acidophilus* as a probiotic. The results showed that the addition of lemon during husk fermentation acts as a pH reducer and increases the titratable acidity of the extracts, especially within the first 36 hours of fermentation. In general, phenolic compounds decreased during fermentation, except in treatment B3, which showed a significant increase in phenolic compounds and titratable acidity, indicating an improvement in the husk's antioxidant activity over time. Treatment A3 increased trigonelline content, suggesting higher antioxidant activity, although it reduced phenolic compounds and chlorogenic acids. Treatment C1 showed the best overall results, suggesting the positive effect of Sicilian lemon after 12 hours of fermentation. Regarding microbiological analyses, the addition of lemon provided an antimicrobial effect against the pathogens, but also against the probiotic bacteria. This effect was also observed in treatment B2, suggesting that 36 hours of husk fermentation benefited the antimicrobial effect. None of the treatments benefited the development of *L. acidophilus*. The use of lemon in fermentation proved to be a promising strategy for adding value to coffee residues, offering natural alternatives for industries. However, further studies are necessary to optimize the fermentative process and maximize the utilization of bioactive compounds.

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sciforum-139187: Cadmium accumulation in wild mushrooms from Leicestershire, UK: spatial trends and human health implications

Gurminderjeet S Jagdev, Mark D. Evans, Tiziana Sgamma and Antonio Peña-Fernández *

[1] Leicester School of Allied Health Sciences, De Montfort University, Leicester, LE1 9BH, UK.
[2] Department of Surgery, Medical and Social Sciences, Faculty of Medicine and Health Sciences, University of Alcalá, Ctra. Madrid-Barcelona, Km. 33.600, 28871 Alcalá de Henares, Madrid, Spain.

Cadmium (Cd) is a non-essential and toxic metal with high mobility in soils and strong bioaccumulative properties in fungi. This study presents novel data from an extensive biomonitoring campaign of wild mushrooms collected from 22 urban and rural locations across Leicestershire, UK. A total of 106 mushrooms, representing 14 species, were sampled and analysed by ICP-MS following acid digestion. Species identification was confirmed via DNA barcoding. Cd was detected in 78% of the samples, with concentrations ranging from below the detection limit (0.08 mg/kg) to 13.45 mg/kg dry weight. Contrary to expectations, *Coprinus atramentarius* (poisonous) showed the lowest Cd accumulation, while the edible species *Agaricus bitorquis* exhibited the highest levels (mean: 4.05 mg/kg). Geospatial analysis revealed that mushrooms from the North-West (2.75 mg/kg) and South-West (2.70 mg/kg) quadrants of Leicester contained significantly higher Cd levels compared to the South-East (0.64 mg/kg; p 0.05). In *A. bitorquis*, caps accumulated significantly more Cd than stipes (4.05 vs. 2.20 mg/kg; p 0.001), confirming species-specific tissue partitioning patterns. When benchmarked against the EU Maximum Allowable Concentration (MAC) for Cd in cultivated mushrooms (0.2 mg/kg), 47.2% of urban samples exceeded this regulatory threshold. Nevertheless, updated human health risk assessments (Hazard Quotient and Lifetime Cancer Risk) indicated no significant non-carcinogenic or carcinogenic risk from occasional consumption by either adults or children. These findings expand on previous moss-based biomonitoring studies in Leicester by directly demonstrating cadmium uptake in fungi growing in the same urban hotspots. The results reinforce the value of wild mushrooms as cost-effective sentinels for environmental metal(loid) pollution and underscore the need to integrate multiple bioindicator species in public health and soil management frameworks. Future research should explore seasonal variation, bioavailability, and co-exposure effects with other toxic elements.

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sciforum-126667: Comprehensive Evaluation of Physical Properties of Linseed for determining their Quality and Suitability for Agricultural use

Venkatesh Mishra [1,*], Satyendra Pratap Singh [1] and Vishal Singh Chandel [2]

[1] Department of Physics, Amity Institute of Applied Sciences, Amity University Uttar Pradesh, Noida 201313, India
[2] Department of Applied Science & Humanities, REC, Ambedkar Nagar, 224122, India

A clear understanding of seed physical characteristics is fundamental in designing and operating agricultural equipment involved in sowing, harvesting, processing, packaging, and storage. This investigation explores how varying moisture content influences the physical attributes of linseed. Moisture levels in the seeds were adjusted between 4.5% and 20.5% (wet basis), and several parameters were examined. Results showed that seed length, width, and thickness increased from 4.67 mm to 4.96 mm, 2.27 mm to 2.44 mm, and 0.92 mm to 0.96 mm, respectively, with rising moisture content. In parallel, aspect ratio increased from 0.486 to 0.492, geometric diameter from 2.14 mm to 2.26 mm, and surface area from 12.55 mm^2 to 14.11 mm^2. A minor but consistent rise in sphericity was also noted. Meanwhile, bulk density decreased significantly from 768.4 kg/m^3 to 588.5 kg/m^3, whereas true density showed a modest increase from 1005.2 kg/m^3 to 1024.4 kg/m^3. Porosity expanded from 23.56% to 42.55%, and the angle of repose grew from 24.40° to 31.40°, suggesting a decline in flowability with increased seed moisture. Each parameter exhibited a linear trend with respect to moisture levels. Statistical analysis yielded high regression coefficients ($R^2 > 0.95$) and p-values under 0.05 for all traits, indicating a significant dependency on moisture content. Standard measurement techniques were employed to ensure consistency and accuracy in data collection. The insights gained from this study are essential for engineers and technologists involved in seed processing, as they underline the necessity of considering moisture content when designing storage facilities, handling systems, and machinery. Ultimately, the results emphasize that moisture variations have a marked effect on the physical behavior of linseed, making it a key variable in ensuring product quality and post-harvest efficiency.

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sciforum-139280: Development of a Low-Cost, Solar-Powered Smart Evaporative Cooling Storage System to Extend the Shelf Life of Fruits and Vegetables in Tropical Regions

Md Rayhan Mahmud [1,*], Jamima Tahrin Abanty [1], Kazi Md Mehedi Hasan [2], Md Mamunur Rashid [1], Md Ashikur Rahman [1], Digonta Chandra Roy [1] and Md Shaha Nur Kabir [1]

[1] Department of Agricultural and Industrial Engineering, Faculty of Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh
[2] Department of Mechanical Engineering, Faculty of Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

Postharvest losses of fruits and vegetables remain a major challenge in tropical regions such as Bangladesh, primarily due to a lack of affordable and effective storage solutions. This study presents the design and development of a low-cost, solar-powered smart evaporative cooling storage system aimed at short-term storage of perishable produce while preserving its physicochemical qualities. The system comprises four integrated units: a cooling unit, a controller unit, a storage chamber, and a solar-powered energy supply. The key components include axial cooling fans, a thickened cellulose cooling pad, a submersible DC water pump, and dual exhaust fans. The solar power setup consists of two 150 W photovoltaic panels, a 12/24 V–30 A charge controller, and a 500 W battery system (dual 12V batteries connected in parallel). The insulated storage cabinet has a volume of 2.04 m^3 and utilizes a hybrid evaporative cooling mechanism. Sensors were deployed to monitor the temperature, relative humidity, CO_2, and ethylene (C_2H_4) concentrations, with real-time data transmission to an IoT-based cloud platform for performance analysis. Under no-load conditions, the chamber maintained a temperature range of 26.02–29.45°C and relative humidity of 86.61–93.39%, achieving a cooling efficiency of between 49.71% and 83.86%. Tomato fruits at varying maturity stages were stored and compared against those kept under ambient and conventional refrigeration conditions. The results showed that the developed system effectively reduced physiological and biochemical deterioration, maintaining their postharvest quality and extending their shelf life. This study highlights the potential of developing a sustainable, energy-efficient, and affordable storage technology for smallholder farmers in tropical regions, contributing to reduced postharvest losses and improved food security.

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sciforum-138706: E-Commerce Participation, Land Management Characteristics, and Farmers' Fertilization Behaviors: Evidence from Apple Growers in China

Yanjun Wang [1], Qiuyue Wang [2], Kexin Wang [3], Lijia Zhao [4] and Hangxuan Zhao [5,*]

[1] School of Applied Economics, University of Chinese Academy of Social Sciences, Beijing 102400, China
[2] College of Business, Central South University of Forestry and Technology, Changsha 410004, China
[3] Faculty of Science, Hong Kong Baptist University, Kowloon Tong, Hong Kong
[4] Curriculum, Pedagogy and Assessment, University College London, London, WC1E 6BT, United Kingdom
[5] School of Arts & Humanities, King's College of London, London WC2R 2LS, United Kingdom

As an important distribution channel for agricultural products, rural e-commerce exerts significant influence on agricultural production. Based on a survey of 604 Fuji apple farmers in Shanxi Province, this study empirically examines the effect of participation in e-commerce on farmers' fertilizer application behavior, from the perspectives of increasing the price premium for green products and reducing the cost of green production. To address potential endogeneity, this study proposes an innovative instrumental variable—the distance to the birthplace of Guan Gong—to alleviate the bias caused by unobserved factors. The findings reveal that participation in e-commerce reduces farmers' fertilizer application intensity. This effect is more evident among farmers with larger land operation scales, larger contiguous plots, and a higher degree of production specialization. Furthermore, the analysis shows that farmers with higher levels of digital literacy and green production literacy benefit more from e-commerce participation in terms of reducing fertilizer input intensity. Overall, this study confirms that participation in e-commerce enables green agricultural production while imposing higher demands on land operation scale, production specialization, and farmer literacy, offering new directions for promoting sustainable and environmentally friendly agricultural practices.

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sciforum-138735: Enhancing the Antimicrobial Properties of Garlic Against Human Pathogens Through the Inoculation of Trichoderma Asperellum and Molecular Docking Analysis

Imen Salmi [1,*], Saida Messgo-Moumene [2] and Mohamed Nadjib Boukhatem [2]

[1] University of Blida 1, Blida 09000, Algeria
[2] Department of Biotechnology and Agro-Ecology, Laboratory of Research on Medicinal and Aromatic Plants, University of Blida 1 (Université Saad Dahlab – Blida 1), Blida 09000, Algeria

Introduction

Garlic (Allium sativum) is a widely used spice and is one of the world's oldest and most consumed bulbs. Garlic has been found to contain a multitude of phytochemical compounds, which have been identified as the causative agents for its unique properties.

The inoculation of garlic with endemic microorganisms, such as Trichoderma, has been demonstrated to possess the capacity to facilitate the restructuring and stimulation of plant growth and secondary metabolite production. This process occurs in both optimal conditions and under diverse biotic and abiotic stressors. Nevertheless, further research is required to determine the impact of these microorganisms on garlic's antimicrobial compounds, with a particular focus on their activity against human pathogens.

The present study aims to investigate the impact of the application of endemic microorganisms on the antimicrobial property of garlic extracts against human pathogens. In addition, it aims to investigate the potential mechanism of action of bioactive compounds through molecular docking.

Methodes

The present study involved the cultivation of garlic in a greenhouse and inoculation with three Trichoderma strains, including T1:TMSKOLDZ20, T2:TMS11DZ15, and T3:TMS5DZ15. Following harvesting, the extracts at varying concentrations (100%, 75%, 50%, and 25%) were evaluated for their antimicrobial effect against human pathogens from each sample. The binding capabilities of garlic compounds were studied using in silico molecular docking to inhibit the outer membrane protein of Salmonella typhi.

Results

The T3 and T2 treatments have been shown to possess significantly superior antimicrobial activity in comparison to the other treatments under investigation. Furthermore, among the garlic phytochemicals examined, γ-glutamyl-S-allylcysteine demonstrated the strongest binding affinity against Salmonella typhi. This suggest that Trichoderma asperellum may have the capacity to increase the levels of γ-glutamyl-S-allylcysteine in garlic.

Conclusion

Strains T3 and T2 have the potential to serve as promising sources for the development of natural alternatives to conventional antibiotics.

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sciforum-139179: Evaluating nickel in wild mushrooms: comparison with moss-based biomonitoring in urban Leicester

Antonio Peña-Fernández [1, 2]*, Tiziana Sgamma [2], Mark D. Evans [2] and Gurminderjeet S Jagdev [2]

[1] Department of Surgery, Medical and Social Sciences, Faculty of Medicine and Health Sciences, University of Alcalá, Ctra. Madrid-Barcelona, Km. 33.600, 28871 Alcalá de Henares, Madrid, Spain.
[2] Leicester School of Allied Health Sciences, De Montfort University, Leicester, LE1 9BH, UK.

Nickel (Ni) is a moderately toxic metal emitted primarily by vehicular and industrial activities, with well-documented associations with allergic and respiratory effects. This study presents novel data on Ni bioaccumulation in wild mushrooms from urban parks in Leicester, the UK, and compares these findings with previous Ni data from native mosses used as passive biomonitors in the same locations. A total of 106 mushrooms from 14 species were collected and analysed for Ni by ICP-MS following acid digestion. Due to a limit of detection (LoD) of 3.40 mg/kg dry weight, 56.8% of values were censored. Among detectable samples, Ni concentrations ranged up to 90.50 mg/kg dw, with *Coprinus atramentarius* and *Mycena citrinomarginata* showing the highest mean values (56.36 and 17.40 mg/kg dw, respectively). By contrast, *Agaricus bitorquis* and *Marasmius oreades* showed no detectable accumulation (mean 3.40 mg/kg). Spatially, elevated Ni levels were observed in mushrooms from parks located near high-traffic zones such as Abbey Park and Narborough Road. While previous moss-based studies revealed strong correlations between ambient Ni deposition and traffic exposure, mushroom Ni levels appeared more influenced by species-specific uptake capacity and root-zone exposure, rather than surface deposition alone. Notably, some areas with high Ni in mosses yielded mushrooms with low or non-detectable concentrations, indicating differences in exposure pathways and biological accumulation mechanisms. Although no regulatory thresholds exist for nickel in mushrooms, the concentrations detected in the wild edible species collected were relatively low. Human health risk assessments indicated no concern for occasional mushroom consumers. This study demonstrates the complementary value of active (fungi) and passive (moss) biomonitoring and highlights the importance of integrating multiple organism types when evaluating urban environmental pollution.

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sciforum-127976: Evaluation Of Kamias (Averrhoa bilimbi) Fruit And Leaf Extracts Against Post-Harvest Rotting Fungi On Tomato (Solanum lycopersicum L.) Fruits

Edrian Airwin Silang Olpindo [1,*], Thristan Roi Dangle Dulay [2] and Kyssha Desiree Olpindo Onato [3]

[1] 3rd Year BSEd-Science Student; Don Mariano Marcos Memorial State University – Mid La Union Campus; Agoo, La Union; 2504; Philippines
[2] 3rd Year Bachelor of Medical Technology Student; Lorma Colleges; San Fernando, La Union; 2500; Philippines
[3] 3rd Year Bachelor of Public Administration Student; Don Mariano Marcos Memorial State University – Mid La Union Campus; Agoo, La Union; 2504; Philippines

Fungal rot poses a significant challenge to the post-harvest preservation of tomatoes, leading to substantial losses and reduced shelf life. This study aimed to determine the anti-rot effects of kamias (Averrhoa bilimbi) leaf and fruit extracts on tomato (Solanum lycopersicum L.) fruits in terms of the diameter of the fungal colony and percentage of mycelial growth inhibition. Kamias fruits and leaves were collected, cleaned, dried, and processed into extracts. Tomato fruits were individually dipped in their respective treatment solutions for 20 minutes. The treatments prepared were as follows: T0 - distilled water, T1 - commercial fungicide, T2 - 25% fruit extract concentration, T3 - 50% fruit extract concentration, T4 - 75% fruit extract concentration, T5 - pure fruit extract, T6 - 25% leaf extract concentration, T7 - 50% leaf extract concentration, T8 - 75% leaf extract concentration, and T9 - 100% pure leaf extract.

The researchers used mean and Analysis of Variance and Post Hoc Tukey's HSD to analyze the data. The results showed that kamias fruit and leaf extracts significantly inhibited fungal growth and effectively combated tomato rot. Increasing the concentration of the extracts led to smaller fungal colony diameters, indicating more potent antifungal activity. Interestingly, higher extract concentrations also promoted mycelial growth, suggesting potential protective effects on tomatoes against fungus.

Furthermore, significant differences were observed among the various treatments of kamias leaf and fruit extracts in terms of the tomato fruits' shelf-life duration. Therefore, this study reveals that applying kamias fruit and leaf extracts could serve as a natural and effective method to enhance post-harvest storage and reduce spoilage of tomato fruits.

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sciforum-134264: Exploring The Lived Experiences Of Banana Growers Battling Panama Disease During The Covid-19 Pandemic

Kid Mar Villegas Narido *, Maria Celeste Abadiez Peregrino, Bethel Rose Quilasadio Ortega and Jyan Khit Repizo Sazo

University of Mindanao

The rapid spread of the Panama disease outbreak presented significant difficulties for banana growers during the COVID-19 pandemic ("The 'Banana Pandemic' Destroying the World's Favourite Fruit," n.d.). The growers' insufficient knowledge and skills in cultivating and managing their banana trees worsened the effects of multiple diseases, such as the absence of a definitive cure for Panama wilt disease. This study explores the experiences of banana growers affected by Panama disease during the COVID-19 pandemic. The participants of this qualitative phenomenological study were seven banana growers, and the data were obtained through in-depth interviews. The responses were classified and grouped into themes developed by a data analyst. The findings indicated that financial hardships are a central focus, with growers contending with risks to their livelihoods and diminishing sources of income. Banana growers face heightened emotional strain due to uncertainties, but amidst these challenges, they show resilience and adaptability, highlighting their ability to endure tough times. The researchers found that the participants' concerns must be addressed through targeted interventions, comprehensive mental health approaches, financial support, promoting interdisciplinary collaboration, and resilience-building to support banana growers in the face of persistent challenges. Furthermore, this study encompassed Sustainable Development Goal (SDG) 3, Good Health and Well-being, emphasizing mental health support for banana growers, and SDG 12, Responsible Consumption and Production, promoting sustainable agricultural practices for long-term productivity and environmental health.

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sciforum-138617: Formulation and Evaluation of Biodegradable Edible Coating from *Pleurotus ostreatus* Polysaccharides Integrated with Green-Synthesized Silver Nanoparticles for Postharvest Preservation

Sumaiya Hassan [1,*], Saima Fariha [1], Suraiya Hassan Richi [2] and Sumaiya Jalal [3]

[1] Islamic University, Kushtia 7003, Bangladesh
[2] Khulna University, Khulna 9208, Bangladesh
[3] North Western University, Khulna 9100, Bangladesh

The current study aimed to develop and evaluate a biodegradable edible coating derived from *Pleurotus ostreatus* (oyster mushroom) polysaccharides, incorporating green-synthesized silver nanoparticles (AgNPs), for the postharvest preservation of fruits. Glycerol was used as a plasticizer in the film formulation, and the composite films were characterized using UV–Vis spectroscopy (peak at ~420 nm), X-ray diffraction (XRD), and scanning electron microscopy (SEM) analysis. The coating was applied to tomatoes and guavas and evaluated over 14 days at 25 °C for its impact on weight loss, firmness, decay incidence, microbial load, sensory attributes, vitamin C retention, and biodegradability. The AgNP-enhanced films exhibited improved physicochemical properties, including a reduction in water vapor permeability (from 3.75 to 2.89 $\times 10^{-11}$ g/m·s·Pa) and enhanced antimicrobial activity, with inhibition zones of 16.5 mm for *E. coli* and 19.5 mm for *Staphylococcus aureus*. After 14 days, the coated fruits showed significantly lower weight loss (5.1 ± 0.5%), decay incidence (7%), and microbial load (3.5 CFU/g) compared to both uncoated and polyethylene-wrapped samples. Sensory evaluations showed high acceptability (scores >8.0), and nutritional quality was maintained, with vitamin C retention at 80%. The coating demonstrated approximately 90% biodegradability within 30 days under soil burial conditions and met safety standards regarding nanoparticle migration. These findings highlight the potential of mushroom-based AgNP films as a sustainable, safe, and effective alternative to conventional plastic packaging for extending the shelf life and preserving the quality of fresh produce.

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sciforum-110608: Impact of Environmental Conditions on Fungal Growth and Mycotoxin production in Stored Products

Samuel Alemayehu Lapiso

Department of Biology, College of Natural and Computational Sciences, P.O. Box 231, Mekelle University, Mekelle, Tigray, Ethiopia

Sesame seeds serve as a crucial source of sustenance, nutrition, and economic value in developing nations. Ensuring optimal storage conditions is vital for mitigating the risk of mycotoxin contamination. This study employed regression analysis on historical data to assess the impact of storage environmental conditions on fungal growth and mycotoxin generation in sesame, aiming to enhance the storage practices of smallholder farmers. This research utilized both linear and non-linear regression models to investigate how various environmental factors, including temperature, humidity, moisture content, and gas levels, influence the proliferation of fungi and the production of mycotoxins in sesame seeds during storage. The findings indicate that keeping seed moisture content under 6% and the temperature inside the storage below 20°C effectively reduces aflatoxin levels in hermetically sealed bags. Conversely, in traditional bags, aflatoxin levels tend to rise, primarily due to increased seed moisture. This study also discovered a significant correlation between the rise of Ochratoxin A levels and the presence of *Penicillium* and *Aspergillus* infections in sesame seeds. Notably, Ochratoxin A levels were below 6 ppb when there was a 50% combination of *Penicillium* and *Aspergillus*. This suggests that these fungi play a substantial role in generating Ochratoxin A in stored sesame. Effective management of mycotoxins in stored sesame can be achieved through careful control of abiotic factors, highlighting the crucial role of storage environment in preventing fungal contamination and mycotoxin production.

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sciforum-139154: Insecticidal effect of ethanolic extract from *Zizyphus lotus* L. against *Tribolium castaneum (Herbst) (Coleoptera: Tenebrionidae*)

Nacera Tadjine

Biotechnology and Agro-Ecology, Blida1 University, Laboratory of Biotechnology of Medicinal and Aromatic Plants.

Nacéra TADJINE

Author: Nacéra TADJINE
Laboratory of Biotechnology of Medicinal and Aromatic Plants, Blida-1 University, Algeria
naceratadjine@yahoo.fr

Abstract

The study aims to determine the chemical composition of the ethanolic extract of *Z. lotus* L. leaves, as well as to evaluate its effectiveness in combating *Tribolium castaneum (Herbst)* (*Coleoptera: Tenebrionidae*), a pest of stored products. Rutin, robin, kaempferol, and apigenin have been identified as the main constituents of *Z. lotus* L. The tested ethanolic extract showed pronounced insecticidal activity against this harmful species, proportionally to the applied doses. The ethanolic extract of *Z. lotus* L. demonstrated high efficacy in the various treatments tested on *T. castaneum*. Regarding contact and fumigation assessments, the ethanolic extract of *Z. lotus* L. induced corrected mortality rates ranging from 37.5% to 100% in *T. castaneum*, with corresponding lethal concentrations (LC50) of 13.9 µl/ml and 16.9 µl/l of air, respectively, during contact and fumigation evaluations. Our results indicate that the ethanolic extract of *Z. lotus* L. exhibits very promising insecticidal activity against T. castaneum. The topical toxicity recorded ID10 and ID50 values of 1.45 and 2.77 µg per adult. These results clearly show that the ethanolic extract of *Z. lotus* L. has great potential for the development of new botanical insecticides as safe alternatives for controlling harmful insects.

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sciforum-139183: Lead accumulation in wild mushrooms from Leicestershire, UK: species differences and implications for environmental monitoring

Gurminderjeet S Jagdev, Tiziana Sgamma *, Mark D. Evans and Antonio Peña-Fernández

[1] Leicester School of Allied Health Sciences, De Montfort University, Leicester, LE1 9BH, UK.
[2] Department of Surgery, Medical and Social Sciences, Faculty of Medicine and Health Sciences, University of Alcalá, Ctra. Madrid-Barcelona, Km. 33.600, 28871 Alcalá de Henares, Madrid, Spain.

Lead (Pb) is a persistent neurotoxic metal(loid) with widespread occurrence in urban environments. This study evaluated Pb concentrations in wild mushrooms collected from 22 sites across Leicestershire, UK, with a focus on species-specific accumulation and intra-species tissue partitioning. A total of 106 mushrooms, representing 14 species, were analysed using ICP-MS following acid digestion. Species identification was confirmed through DNA barcoding. Pb was detected in 91% of the samples, with concentrations ranging from 0.30 to 10.57 mg/kg dry weight. The highest levels were observed in *Coprinus atramentarius* (mean: 6.64 mg/kg), followed by *Mycena citrinomarginata* (4.64), *Panaeolus foenisecii* (3.94), *Agaricus bitorquis* (2.37), and *Marasmius oreades* (1.32) (p 0.05). Compared to earlier single-species studies focusing on *A. bitorquis*, this work provides a broader comparative analysis across multiple taxa. In *M. citrinomarginata*, Pb was significantly more concentrated in caps than stipes (4.23 vs. 2.51 mg/kg; p 0.01), supporting known patterns of apical bioaccumulation. Pb concentrations exceeded the EU Maximum Allowable Concentration for cultivated mushrooms (0.3 mg/kg) in 38.5% of the dataset. Geospatial analysis identified elevated Pb levels in samples from the North-West and North-East quadrants of Leicester, consistent with legacy land-use patterns, although differences were not statistically significant. Updated health risk assessments confirmed no significant non-carcinogenic or carcinogenic risk for adults or children from occasional consumption. This study expands previous Pb biomonitoring in mushrooms by identifying additional high-accumulating species and reinforces the value of fungal biomonitors in environmental surveillance. These findings support the integration of wild mushroom data with soil and atmospheric Pb mapping in urban health policy and land management.

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sciforum-137105: Organic Agricultural Production, Consumer Society And Food Waste—A Complex Dashboard For Assessing Quality

Mioara Mihaila

Department of Agroeconomy, Faculty of Agriculture, University of Life Sciences "Ion Ionescu de la Brad"

Food consumption in the last 10-15 years has undergone significant changes, a notable trend in developed countries. The orientation towards different food categories is supported by solid landmarks with strong influence, such as food quality, orientation towards organic products, product diversity, price, promotions, impact on health, etc. Establishing some objectives dedicated to social and economic progress is a real measure of sustainable development, but not a guarantee of sustainability. The development of society, the acceleration of economic growth, and the ever-increasing food consumption constitute an obvious trend. Consequently, the quantity of food waste is also increasing, making it difficult to manage. Although efforts to stimulate the consumption of organic products have been supported, the expected level of success has not been achieved.

This paper addresses the connection between three major issues that influence each other: organic production requirements, food hyper-consumption, and food waste management. All of these involve approaches to quality, which seems to be affected when the objectives of the three directions are opposed. The quantitative increase in food consumption generates commercial benefits, but determines major food waste management problems, and organic production remains limited. So, a complex dashboard is built and analyzed with the three components, with the appreciation of quality as a common denominator . The goal is to identify the causes that generate disruptions between the three components and to propose solutions that can regulate the imbalances highlighted. The analysis is conducted on the North-East Development Region of Romania, with reference data for the last 5 years. The results show that the consumption of organic food is limited, food hyper-consumption is increasingly widespread, being a false sign of well-being, while food waste management is becoming increasingly difficult due to the amount of waste and a socio-economic climate that affects the understanding level of the population regarding the quantity–quality ratio in food consumption.

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sciforum-132377: Quality control of food contamination with pesticides

Miroslava Kuzniarová [1, 2,*], Martina Michálíková [3] and Milena Dömötörová [1]

[1] Public Health Authority of the Slovak Republic, National Reference Center for Pesticide Residues, Trnavská cesta 52, 826 45 Bratislava, Slovak Republic
[2] Department of Analytical Chemistry, Faculty of Natural Sciences, Comenius University in Bratislava, Ilkovičova 6, 842 15 Bratislava, Slovak Republic
[3] Public Health Authority of the Slovak Republic, National Reference Center for Pesticide Residues,Trnavská cesta 52, 826 45 Bratislava, Slovak Republic

Pesticides comprise a broad category of chemical substances with diverse chemical compositions. They are predominantly employed by agricultural producers to protect crops from pests and enhance yields. However, the presence of pesticide residues in agricultural products used for food production represents a potential health risk, particularly for vulnerable consumer groups such as infants and young children. From a safety control perspective, the focus is on pesticide residues that accumulate in agricultural products intended for food production.

According to the World Health Organization, pesticide residue is defined as any substance or mixture of substances found in food for humans or animals, resulting from the application of pesticides. This includes "any specific derivatives such as degradation products, conversion products, metabolites, and reaction products that are considered to be toxicologically significant." The accumulation of such residues can trigger a range of adverse health effects, including sensitivities, allergies, and the onset of serious diseases, including oncological, neurodegenerative, and chronic conditions.

The control of infant food involves the processing and analysis of samples of infant formula for children up to 6 months of age, follow-up formula for children from 6 months to 1 year, cereal-based food products for infants and young children, and samples of fruit- and vegetable-based baby food.

The National Reference Center for Pesticide Residues has established and validated a multi-residue method for detecting over 200 pesticide residues in infant food, employing liquid and gas chromatography coupled with mass spectrometric detection (LC-MS/MS, GC-MS/MS). The samples were pre-treated using the QuEChERS method.

Recent results from official regulatory controls and European monitoring efforts demonstrate the safety of infant food in terms of pesticide residue levels. No tested sample over the past few years has exceeded the legally permissible limit for pesticide residues.

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sciforum-136016: Sustainable Postharvest Preservation: A Novel Edible Coating from Hydroxypropyl Methylcellulose, Chitosan, and Beeswax for Mango Fruits

Nouman Bashir

Government College University Faisalabad, Faisalabad 38000, Pakistan

The increased need for sustainable food preservation has fuelled interest in environmentally friendly, "zero-waste" methods for reducing post-harvest losses. This study created and tested three nanoemulsion-based edible coatings, HCB-OPE (orange peel extract), HCB-APE (apple peel extract), and HCB-SPE (spinach extract), which are made of hydroxypropyl methylcellulose, chitosan, and beeswax and enriched with essential oils and polyphenols derived from agro-industrial byproducts. Mangoes were coated and kept at 4 ± 1°C for 13 days. The bioactivity of the coatings was established using physicochemical characterisation (zeta potential, FTIR, XRD, and AFM), and antioxidant and antibacterial testing (against Staphylococcus aureus and Escherichia coli). By day 13, HCB-OPE outperformed other coatings with lower weight loss (6.8% ± 0.06), higher stiffness (3.70 ± 0.04 kg/cm^2), decreased decay (20.0% ± 0.9), lower ethylene production (5.10 ± 0.05 µg/g/h), and higher phenolic retention (1.12 ± 0.05 mg GAE/g FW). The barrier qualities of beeswax, HPMC, and chitosan, along with citrus-derived polyphenols (e.g., ferulic acid and hesperidin), with significant antioxidant and antibacterial activity, contribute to HCB-OPE's increased efficacy. Overall, our findings provide a sustainable and scalable technique for prolonging mango shelf life while adhering to circular bioeconomy and zero-waste principles.

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sciforum-139151: Towards a Premium Curry Leaf Product: Evaluation of *Murraya koenigii* Variants in Jaffna for Market and Export Readiness

Suvanthini Terensan [1,*], Kanapathy Gajapathy [2], Sellachchamy Priyankan [1] and Imasha Sathsarani [1]

[1] Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka
[2] Department of Zoology, Faculty of Science, University of Jaffna

Curry leaves (*Murraya koenigii*) are highly valued for their culinary and medicinal uses, yet the diversity of local variants remains under-explored. We investigated the morphological and genetic variation of curry leaf trees in Jaffna District, Sri Lanka, and assessed key biochemical properties to evaluate their potential for high-quality export. A survey and field sampling across 128 households (all divisional areas except Delft Island) recorded cultivation practices and plant characteristics. Notably, 83% of households used no fertilizers or agrochemicals, and only 20% reported any pest or disease issues (with occasional sightings of tortoise beetles, mites, ash weevils, and foliar diseases like white spot or leaf curl). Challenges in cultivation included seasonal leaf fall, fluctuations in leaf aroma, water scarcity, and occasional low yields due to pest or disease outbreaks or drought. We identified 22 distinct morphological variants of *M. koenigii*, distinguished by differences in leaf size, shape, texture, color, petiole and rachis coloration, and number of leaflets per rachis. Aroma intensity varied among variants (rated 4 to 9 on a sensory scale). ITS region sequencing revealed two genetic groups among these samples, each defined by a specific nucleotide substitution at positions 199 (C→T) and 434 (C→A) of the 531 bp sequence. Biochemical profiling showed significant variation in phytochemical and nutrient content: total phenolic content ranged from 20 to 50 mg/100 g, iron from 8 to 40 mg/100 g, and phosphorus up to 273 mg/100 g in the most nutrient-rich variant. Sodium, potassium, vitamin C levels, and antimicrobial activity also differed across variants. These findings highlight the rich diversity of Jaffna's curry leaf germplasm and underscore its economic potential. Developing a robust export market for these high-quality curry leaf variants will require effective networking and increased awareness of their unique qualities.

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sciforum-136802: Traditional uses and potential of *Boscia salicifolia* Oliv. in addressing malnutrition in Burkina Faso

Sibiri Jean Claude Ramdé [1,*], Moussa Ganamé [2], Philippe Bayen [3] and Adjima Thiombiano [1]

[1] Laboratory of Plant Biology and Ecology, University Joseph Ki-Zerbo, Ouagadougou, Burkina Faso
[2] Banfora University Center, University Nazi Boni, Bobo-Dioulasso, Burkina Faso
[3] Training and Research Unit in Applied Sciences and Technologies, University Daniel Ouezzin Coulibaly, Dédougou, Burkina Faso

Indigenous leafy vegetables have significant potential for alleviating malnutrition in sub-Saharan Africa. However, despite their well-documented nutritional value, their consumption remains limited due to negative perceptions and lack of awareness regarding their health benefits. This study investigated the traditional uses and local perceptions of *Boscia salicifolia* consumption in Burkina Faso. Data were collected through semi-structured interviews with 137 respondents.

The findings revealed that *B. salicifolia* is mainly found on hillsides (58%) and is primarily valued for its leaves, which are used both as human food and livestock fodder. In addition,roots and bark are used in traditional medicine. Consumption patterns varied by age: young people reported occasional use (54%), whereas older adults, particularly women (39%), consumed the leaves at least three times per week, reflecting greater awareness of their nutritional benefits. Older respondents emphasized health-promoting effects such as kidney cleansing (53%) and facilitating digestion (44%). In contrast, younger respondents mainly highlighted its role in alleviating hunger (70%) and treating stomach discomfort (41%). These age-related differences reveal a significant decline in traditional knowledge across generations.

This study underscores the nutritional and cultural importance of *Boscia salicifolia* and the generational shifts that limit its consumption. Addressing stigma, improving awareness among younger individuals, and conducting further research on its nutritional value are essential. Targeted awareness and community-based valorization efforts could promote its dietary integration, contributing to improved nutrition and food security in sub-Saharan Africa.

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Session 11. Crop Genetics, Genomics and Breeding

sciforum-138946: A pangenome of Vietnamese rice landraces identifies indica–japonica shared variable genes associated with agronomic traits

Nguyen Van Tuan Anh [1, 2, 3,*] **and Takeshi Itoh** [2]

[1] Cuu Long Delta Rice Research Institute, Can Tho city, Vietnam
[2] International College, National Taiwan University, Taipei city, Taiwan
[3] SEARCA scholar, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), College, Los Baños, Laguna, Philippines

Rice is a staple food crop comprising two main subspecies, *indica* and *japonica*, which have diverged through adaptation and domestication. While recent genome assemblies provide high-quality references, a single reference genome cannot capture the full extent of genetic variation in rice. A pangenome constructed from multiple individuals can overcome the limitations of using a single reference genome. In this study, the first Vietnamese rice pangenome was constructed using 20 rice landrace accessions and the IRGSP-1.0 reference genome. The pangenome was constructed using an iterative mapping and assembly approach, spanning 386.89 Mb, and included 13.64 Mb of novel sequences specific to Vietnamese landraces. Genome annotation identified 37,292 genes, including 33,710 core, 3,560 dispensable, and 22 unique genes. Among these, 3,116 genes were variably present across both *indica* and *japonica* groups but were not conserved within either group. From this set of shared variable genes, 122 genes were linked to important agronomic traits. Genes related to auxin and chlorophyll content included *OsMKK6*, *OsMEK1*, *OsDLT10*, *OsPYL10*, *OsPYL3*, and *OsRCAR1*. Genes involved in photosynthesis and transpiration included *REL2*, *OsDLT10*, and *RSD1*. Floral development was associated with *OsbZIP47*, while *OsBOP3* and *OsBSK3* contributed to inflorescence traits. Root development involved *OsNAC2*, *OsCSLC7*, *OsMKK6*, and *OsMEK1*. Grain length, shape, number, and weight were associated with key genes such as *OsBSK3*, *OsCDKF2*, *REL2*, *OsJAZ10*, *OsTIFY11b*, and *OsWRKY19*. Disease resistance genes were also identified, including *OsCEBiP*, *Pikp1*, *Pikm5NP*, *xa47*, and *OsREM20*. These shared variable genes provide valuable genetic resources for future rice improvement and breeding efforts.

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sciforum-139318: Morpho-Physiological And Antioxidant Responses Of African Yam Bean (Sphenostylis stenocarpa Hochst. Ex. A. Rich Harms) Under Drought Stress Conditions

Richard Abantelhe Abu [1,*], Peggy Otu Willie [1] and Blessing Alfred Ngele [2]

[1] Department of Genetics and Biotechnology, The University of Calabar, Calabar - Nigeria
[2] Department of Plants and Ecological Studies, The University of Calabar, Calabar - Nigeria

Drought stress is a major abiotic factor that affects agricultural productivity globally. Drought limits plants growth, physiology, and yield. This study was conducted to evaluate the drought tolerance of nine accessions of African Yam Bean (AYB) (*Sphenostylis stenocarpa*), a nutrient-rich leguminous crop with potentials for food security in drought-prone regions. The experiment was conducted using standard methods in a greenhouse in a completely randomized design (CRD), with three treatments and three replicates: control, mild drought, and severe drought. Morphological, physiological, biochemical, and growth traits were analyzed. Significant reductions ($p \leq 0.05$) were observed in morphological traits under drought stress. Plant height decreased in Ohong (33.3 cm) and Ediba (28.7 cm) relative to control values of 41.3 cm and 29.7 cm, respectively. Leaf area declined in Gakem (32.4 cm^2) and Wula (21.3 cm^2). Shoot fresh weight dropped in Okpoma (1.4 g) and Adadama (1.6 g) from 4.2 g and 3.8 g, respectively. While most accessions recorded negative relative growth rates (RGR), Ediba maintained a positive RGR (0.002). Ediba and Ohong also exhibited higher peroxidase and catalase activities, while Ukwel and Gakem showed the lowest. The root-to-shoot ratio increased under severe drought, with Ohong (0.36) and Okpoma (0.27) showing the highest adjustments. Drought stress response indices (DSRIs) shows Ediba (10.42) and Ohong (10.54) as the most drought-tolerant accessions. These findings suggest that Ediba and Ohong possess higher drought-resilience traits and thus should be further used in breeding programs that are aimed at improving drought tolerance in AYB and other legumes for sustainable agriculture and food security.

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sciforum-139131: Next-Generation Genomic Analysis of NBS-LRR Resistance Gene Family in Rice: Insights into Plant–Microbe Interactions and Disease Management

Md Rezve *, Dr. Mst. Sabiha Sultana and Dr. S. M. Abdullah Al Mamun

Agrotechnology Discipline, Khulna University, Bangladesh

Rice (*Oryza sativa* L.) is a major food crop for half the world's population but is constantly endangered by a variety of pathogens. Nucleotide-Binding Site Leucine-Rich Repeat (NBS-LRR) genes are important genes in plant innate immunity through which plants respond to pathogen effectors directly. The objective of this study was to conduct an extensive next-generation genomic analysis of the rice NBS-LRR gene family to understand its involvement in plant–microbe interactions and for its potential use in crop protection.

We performed an integrative computational analysis with bioinformatics methodologies. Genes were predicted by a database search and the hidden Markov model and confirmed by the conserved domain database. This analysis consisted of gene structure visualization, motif identification with the MEME suite, phylogenetic reconstruction with MEGA, GO term enrichment analysis, protein structure prediction with αFold2, and cis-regulatory element analysis from upstream of the gene.

An analysis showed that there were 10 conserved motifs in whole NBS-LRR: motifs 1, 4, and 5 were important in recognizing pathogens. Phylogenetic analysis revealed eight evolutionary lineages, and gene duplication events were found in Groups 4 and 7. In GO enrichment, similar functions, including the identification of roles in defense responses, ATP binding, and plasma membrane, were verified. Seven OSDRP protein structure predictions were of high confidence (98.2-100%) and were homologous to one LRR receptor-like kinase and six Toll-like receptors. The cis-regulatory study showed wide distribution of MYB and G-box motifs, and the first gene was identified as a transcriptional hotspot.

This detailed study contributes to our understanding of the molecular composition and evolution of rice NBS-LRR genes. The recognition of eight phylogenetic clades and the clustering of regulatory elements provide excellent candidates for the breeding of disease-resistant crops, laying the groundwork for the development of next-generation crop protection strategies.

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sciforum-136824: Systematic Assessment of Seedling-Stage Salinity Tolerance in Rice Genotypes under Controlled Stress Conditions in Ghana

Felix Frimpong [1,2,*], Believer Norsi [3], Mary Otiwaa Osei Asante [4], Kirpal Agyemang Ofosu [3], Daniel Dzorkpe Gamenyah [3], Yameen Huss Cole [3], Richard Kofi Peprah [3], Jacob Kporku [3], Kenneth Korfeator [3], Elizabeth Norkor Nartey [3] and Maxwell Darko Asante [2,3]

[1] CSIR-Crops Research Institute, Kumasi, Ghana. P. O. Box 3785
[2] CSIR-College of Science and Technology, Faculty of Natural Sciences and Environmental Management, Department of Plant Resources Development, Kumasi, Ghana
[3] CSIR-Crops Research Institute, P. O. Box 3785, Fumesua–Kumasi, Ghana
[4] Kwame Nkrumah University of Science and Technology, College of Agriculture and Natural Resources, Faculty of Agriculture, Kumasi, Ghana

Salt stress is a major abiotic constraint limiting rice productivity in coastal and inland regions of Ghana, particularly at the seedling stage, where it severely impairs plant establishment and growth. Despite its significance, to the best of our knowledge, no salt-tolerant rice varieties have been formally released in Ghana. This study aimed to evaluate the seedling-stage responses of ten rice genotypes to varying levels of salinity stress and identify genotypes for future breeding efforts. A 4 × 10 factorial experiment was conducted in a Randomized Complete Block Design (RCBD) with six replications, under rain-sheltered conditions at the CSIR-Crops Research Institute, Kumasi, Ghana. Ten rice genotypes were exposed to four salinity treatments (0, 75, 100, and 125 mM NaCl) for 21 days. Key parameters, including shoot and root length, fresh and dry biomass, leaf area, and salinity tolerance indices, were assessed. Tolerance was determined using visual scoring, an analysis of variance, and eight calculated indices: the Fresh Weight Stress Tolerance Index (FWSI), Dry Weight Stress Tolerance Index (DWSI), Root Length Salinity Index (RLSI), Shoot Length Salinity Index (SLSI), Salinity Tolerance Index (STI), Salinity Susceptibility Index (SSI), Tolerance Index (TI), and Percent Reduction. Significant genotypic variation was observed under salt stress. *ARICA 11* exhibited the highest FWSI (29.19) and STI (1.28), indicating superior tolerance, followed by *LEGON 1* and *HR32051F1-2-33-1*. In contrast, *AGRA* and *AGYAPA* recorded the lowest tolerance indices. Salinity stress substantially inhibited growth, especially at 125 mM, where complete seedling mortality was observed. Survival declined progressively with increasing salinity: six genotypes survived at 75 mM, five at 100 mM, and none at 125 mM, highlighting a threshold for genotype resilience. This study provides evidence of moderate salt tolerance among selected genotypes and confirms the absence of highly tolerant varieties under severe salinity. The findings underscore the urgent need for breeding programs targeting salinity resilience in rice to sustain productivity in salt-prone areas of Ghana.

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sciforum-129090: The Effect of Different Levels of Salinity Stress on Secondary Metabolite Production and Antioxidant Capacity of *Hypericum perforatum* Callus under In Vitro Culture Conditions

Mojgan Soleimanizadeh * and Somayeh Karimi takallo

Department of Horticultural Science and Engineering, Faculty of Agriculture and Natural Resources, University of Hormozgan, Bandar Abbas, Iran

The medicinal plant *Hypericum perforatum* (St. John's Wort) is of great pharmaceutical importance due to its bioactive compounds, such as hypericin and hyperforin, which exhibit antidepressant, anti-inflammatory, and neuroprotective activities (Suryawanshi et al., 2024). However, the natural production of these secondary metabolites is limited and influenced by environmental and genetic factors. In vitro culture techniques, particularly callus culture, offer an effective approach to enhance and regulate their production. Abiotic stresses, such as salinity, can stimulate biosynthetic pathways, increasing the accumulation of phenolic compounds, flavonoids, and antioxidant enzyme activities, which contribute to stress tolerance and cellular defense. Considering this, the present study investigated the effect of different NaCl concentrations on secondary metabolite production and antioxidant activity in *H. perforatum* callus under in vitro conditions. Seeds were surface-sterilized and germinated, and leaf explants were cultured on MS medium supplemented with 0.5 mg/L 2,4-D and 1 mg/L BAP for callus induction. After callus formation and one subculture, calli were transferred to media containing 0, 50, 100, or 150 mM NaCl. Total phenolic and flavonoid contents were measured using standard spectrophotometric methods, and antioxidant capacity was assessed by a DPPH assay. The results showed that salinity elicitation significantly enhanced secondary metabolite accumulation and antioxidant activity. The highest production of phenolics, flavonoids, and antioxidant activity was observed at 150 mM NaCl, while the lowest values were recorded in the control (0 mM). These findings indicate that elicitors can effectively simulate environmental stress and stimulate biosynthetic pathways, enhancing the production of pharmacologically valuable compounds in *H. perforatum*.

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sciforum-137103: Addressing Seawater Intrusion At Different Growth Stages Of Rice (*Oryza sativa L.*) Using Selected Saline-Tolerant Varieties

Crysta Farparan Gaudiel

University of Antique - Hamtic Campus

Survival, growth and yield responses of salt-tolerant rice varieties were evaluated under seawater irrigation at various growth stages. Four *Salinas* (salt-tolerant) varieties (Rc 182, RC 186, Rc334, and RC326), a farmer's variety (Rc 10), and susceptible check (IR 29) were exposed to pure seawater with 50.97 dS/m EC and irrigated with 50 liters per 100 cm^2 for three consecutive days at vegetative (BBCH 21-beginning of tillering), reproductive (BBCH 51-beginning of panicle emergence), and ripening (BBCH 85-soft dough) stages. Treatments flooded with seawater at the reproductive stage (panicle initiation) was most severely affected, with a high number of dead leaves, a lower leaf area, and a fifty percent (50%) reduction in filled grains. Days to maturity was shortened by a week, and sodium accumulation in roots and straw was higher. Exposure to seawater at the vegetative stage delayed maturity by one week compared to control plants. Theh varieties Rc 182, Rc 186, Rc 334, and Rc 326 were found to be suitable in seawater intrusion areas if exposure can be limited at the vegetative and ripening stages. Planting dates, even for NSIC-approved salt- tolerant varieties, should be adjusted to avoid exposure to salinity stress during the critical reproductive stage.

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sciforum-139339: Agro-morphological characterization, phenotypic trait analysis, and breeding potential of horned melon (*Cucumis metuliferus*) germplasm for enhanced food security

Moses Mutetwa *, Pepukai Manjeru, Tendai Madanzi, Clapperton Mapwanyire and Tavagwisa Muziri

Department of Agronomy and Horticulture, Midlands State University, Faculty of Agriculture, Environment and Natural Resources Management, P. Bag 9055 Gweru,

Introduction

Horned melon (*Cucumis metuliferus* E. Mey. ex Naudin) remains an underutilized crop in Zimbabwe, despite its significant potential to bolster food and nutritional security in challenging environments due to its adaptive nature.

Methods

This study, conducted over two growing seasons (2024–2025) at Midlands State University, characterized the agro-morphological diversity of 24 landrace accessions collected from Mashonaland East using a Randomized Complete Block Design (RCBD).

Results

The research revealed substantial phenotypic variation (p 0.001) across all measured traits. Certain accessions, notably Acc5, Acc8, Acc2, and Acc20, demonstrated superior agronomic performance, with Acc5 emerging as a particularly promising candidate for high-yield variety development or hybridization. Furthermore, Acc1 exhibited early maturity, a critical characteristic for developing climate-resilient cropping systems, while Acc24's thornless phenotype offers distinct advantages for handling and marketability. Yield displayed strong positive correlations with vine length (r = 0.58**), individual fruit weight (r = 0.59**), and the total number of fruits (r = 0.76**), underscoring these traits as primary determinants of productivity. A nearly perfect correlation (r = 0.99**) between the timing of male and female flowering indicated a tightly synchronized reproductive phase, which is essential for optimizing yield. Conversely, traits related to germination and seeds showed minimal impact on overall yield. A linear model (R^2 = 0.93) further confirmed that vine length, fruit weight, and fruit count significantly drive yield, while the number of thorns negatively influence it.

Conclusion

Yield is primarily influenced by vegetative vigor and reproductive efficiency. Breeding germplasm, such as high-yielding accessions (Acc5 and Acc8), an early-maturing line (Acc1), and a thornless variety (Acc24), emphasize the need to focus future breeding efforts on enhancing vegetative and reproductive characteristics.

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sciforum-139614: Bigger Pods, Smaller Gene Pools? Trade-offs in *Inga edulis* Cultivation Systems

Fani Tinitana [1], Angel Benitez [1], David Draper [2] and Isabel Marques [3,*]

[1] Universidad Tecnica Particular de Loja (UTPL), Facultad de Ciencias Exactas y Naturales, Loja, Ecuador.
[2] Center for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustainability Institute, Universidade de Lisboa, Lisbon, Portugal. Nova School of Business and Economics, Campus de Carcavelos, Carcavelos, Portugal.
[3] Forest Research Center (CEF) & Associate Laboratory TERRA, Instituto Superior de Agronomia (ISA), Universidade de Lisboa (UL), Tapada da Ajuda, 1349-017 Lisbon, Portugal

Inga edulis Mart. (Fabaceae) is a culturally and economically important fruit tree in Ecuador, valued for its fast growth, nitrogen-fixing capacity, and large, edible pods. Despite its widespread use in traditional agroforestry systems, little is known about how cultivation practices influence its morphological and genetic diversity. In this study, we assessed fruit traits of and genetic variation in *I. edulis* across natural, agroforestry, and home garden populations in southern Ecuador. Trees cultivated in agroforestry systems produced significantly longer (mean = 79.3 cm) and heavier pods (mean = 0.62 g), reflecting a focus on fruit yield. However, these populations exhibited reduced genetic diversity (for instance, the mean number of alleles = 10.1). In contrast, home garden trees retained higher levels of genetic variation (the mean number of alleles = 15.2), despite producing shorter (mean = 39.3 cm) and smaller fruits (mean = 0.51 g). These findings highlight a trade-off between productivity and genetic diversity: while agroforestry promotes pod yield, home gardens function as reservoirs of intraspecific variation. Integrating both systems can enhance sustainable management, conservation, and breeding strategies, ensuring the resilience of crops under changing socio-environmental conditions.

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sciforum-132051: Collection, characterization and conservation of genetic resources of native turmeric (*Curcuma longa.* L*)* landraces from Nepal

Pradip Thapa *, Sandip Bohara and Balkrishna Joshi

National Genebank, Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur 44700, Nepal

Turmeric is a profitable cash crop and the main source of income for the farmers of the tropical midhills in Nepal. A field experiment was carried out at the field genebank block of National Agriculture Genetic Resources Centre (NAGRC), NARC, with the aim of evaluating the agro-morphological traits and assessing the phenotypic diversity of turmeric landraces. This study involved the collection of 136 landraces from 62 districts across Nepal, characterized by an augmented block design. Thirteen quantitative and twelve qualitative traits were recorded and analyzed using R software, version 4.5. The Shannon–Weaver index revealed that qualitative traits exhibited a diversity range from low to high (0.19-0.99), while quantitative traits showed moderate to high diversity (0.38-0.91). The top three principal components accounted for 80.29% of the total phenotypic variation, with two components explaining 72.31%, primarily driven by plant height, leaf lamina length, rhizome breadth, petiole length, leaf lamina width, rhizome length, rhizome girth, rhizome weight and internode length. The cluster analysis divided the 136 accessions into two separate groups, with Cluster-1 being the largest, comprising 62.5% of the accessions, and Cluster-2 being the smaller group, representing 37.5% accessions. The phenotypic path analysis resolved that all of the traits showed a positive linear effect on the total yield except number of mother rhizomes, with an R squared value of 45.5%. The preliminary findings showed that NGRV0251, NGRV0179, and NGRV0219 were candidate landraces for the breeding program, as they were superior in terms of rhizome weight, number of mother rhizomes and total yield.

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sciforum-132385: Development Of A Multiplexed Prime Editing Construct To Disrupt The *Ossweet* Effector Binding Elements For Enhanced Bacterial Blight Resistance In Rice (*Oryza sativa* L.)

Aivan Roi Obdin Camilo [1,*], Nonnatus Bautista [1] and Ian Paul Navea [2]

[1] Institute of Biological Sciences, University of the Philippines Los Baños, Los Baños, Laguna 4031, Philippines
[2] International Rice Research Institute, Los Baños, Laguna 4031, Philippines

Rice (*Oryza sativa* L.) remains vulnerable to bacterial blight, a major yield-limiting disease caused by *Xanthomonas oryzae* pv. *oryzae* (Xoo). This pathogen delivers transcription activator-like effectors (TALEs) that bind to effector-binding elements (EBEs) in the promoters of host susceptibility (*S*) *OsSWEET* genes. Deletions were made to disrupt these EBEs. A multiplexed prime-editing construct was designed to target four critical EBEs with deletions: 13 bp for PthXo1 (*OsSWEET11*), 10 bp for PthXo2 (*OsSWEET13*), and two EBEs in *OsSWEET14* (11 bp for TalC and 24 bp for the shared site of PthXo3/AvrXa7/TalF). The deletions were based on previously validated resistance alleles and optimized to expand TALE resistance. Engineered pegRNAs (epegRNAs) were designed based on previously validated edits and incorporated with new deletions to broaden effector resistance. Each pegRNA included a primer-binding site (PBS), a reverse transcription (RT) template, and a paired nicking guide RNA (ngRNA) for PE3-mediated editing. The epegRNA–ngRNA cassettes were individually cloned into entry vectors using Golden Gate assembly. Colony PCR confirmed insert sizes of 986 bp for pegRNA scaffolds, and 347 bp (PL25025), 351 bp (PL25026), 355 bp (PL25027), and 348 bp (PL25028) for assembled modules. Sanger sequencing validated 100% identity and error-free constructs. All four verified cassettes were assembled into a single binary transformation vector (PL25034) using Multi-site Gateway recombination. LR product confirmation via colony PCR showed the expected 1,580 bp amplicons. Restriction digestion of PL25034 using MIu I produced five distinct bands at 7,617 bp, 5,870 bp, 3,006 bp, 1,140 bp, and ~750 bp, consistent with the expected number of fragments generated. The final construct was transformed into *Escherichia coli* TOP10, yielding over 1,000 colonies per plate. Positive clones were archived in 15% glycerol stocks for long-term storage. This study provides foundational groundwork for modular, multiplexed prime editing of *OsSWEET* EBEs, advancing efforts to develop broad-spectrum, bacterial blight-resistant rice through precise promoter editing.

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sciforum-131708: Distinguishability of Homogeneity Stability in sweet potato genotypes

Fishua José Upuere Dango [1,*], Darllan Santos Oliveira [2], Geissiane Neves Toledo [3], Erika Arroyo Martinez [3], Oscar Carmona Wilches [3], Edvaldo Litos Nhanombe [3] and Pablo Forlan Vargas [4]

[1] Mother Maria Duarte Chissulo and Father José Upuere Dango
[2] Agronomy (Genetics and Plant Breeding). São Paulo State University "Júlio de Mesquita Filho" – School of Agricultural and Veterinary Sciences (FCAV), Brazil
[3] Agronomy (Genetics and Plant Breeding). São Paulo State University "Júlio de Mesquita Filho" – School of Agricultural and Veterinary Sciences (FCAV), Brazil.
[4] Department of Agronomy and Natural Resources, São Paulo State University, VA Nelson Brihi Badur, Vila Tupy, 11.900-000, Registro, SP, Brazil

The sweet potato (*Ipomoea batatas* (L.)) is a herbaceous, perennial plant belonging to the Convolvulaceae family, native to Central America. It is a cosmopolitan plant of worldwide importance. The evaluation of Distinctness, Uniformity, and Stability is an important step for the protection of cultivars, aiming to assess whether the selected genotypes meet technical requirements. These must be clearly distinguishable, with relevant homogeneous characteristics in the population, including standard features and uniformity, to maintain their traits. The objective was to carry out Distinctness, Uniformity, and Stability assessments in sweet potato genotypes for the purposes of registration and protection of cultivars. The trial was set up in an area belonging to UNESP, on the Jaboticabal campus, from September 2022 to December 2023, in a randomized block design with three repetitions. Five experimental genotypes and five sweet potato cultivars were evaluated: Cerat25-01, Cerat35-11, Cerat51-30, Cerat60-22, Cerat60-25, Amélia, Brasilândia Roxa, Beauregard, Gaita, Princesa, and Rubissol. The useful area of the plot corresponded to 40 plants, with 30 central plants being evaluated, and harvesting was performed 90 days after planting. The variables assessed included root shape, flesh color, number of lobes in the leaf, and anthocyanin pigmentation in the internode. Data analysis was conducted using the Genes Software through mean tests. In both the genotypes and the cultivars, there was no significant difference in the means, indicating standard behavior of the genotypes and cultivars. The general shape characteristic of the root was such that 99% of the genotypes showed a table market shape and 1% showed an industrial market shape. Of these, 54% had orange flesh and 46% had white and yellow flesh. Among the evaluated genotypes, 73% had between five and seven lobes and 27% had no lobes. Regarding anthocyanin pigmentation in the internode, 18% of the genotypes had a medium-to-strong presence of pigmentation and 82% had no pigmentation. The results obtained highlight the differences between genotypes and cultivars, meeting the requirements of the Ministry of Agriculture, Livestock and Supply (MAPA) for intellectual protection.

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sciforum-130856: Effect of *Azotobacter chroococcum K2020* on the agronomic performance of cotton (*Gossypium hirsutum* L.)

Gulirukh Bakhromova

Institute of Genetics and Experimental Plant Biology, Academy of Sciences of the Republic of Uzbekistan, 111208 Tashkent, Uzbekistan

In the saline soils of Karakalpakstan, the agronomic potential of the nitrogen-fixing strain Azotobacter chroococcum K2020, isolated from the indigenous microbial community, was evaluated under field conditions. The aim of this study was to assess the effect of this strain on the growth, development, and yield performance of several cotton (Gossypium hirsutum L.) varieties.

Due to its ability to fix atmospheric nitrogen, A. chroococcum serves as a promising tool for sustainable and environmentally friendly agricultural practices. The reduction in the use of synthetic nitrogen fertilizers not only improves soil health but also enhances ecological sustainability.

A field experiment was conducted at the research site of the Institute of Genetics and Experimental Plant Biology using a randomized complete block design (RCBD) with two replications. The tested cotton varieties included “Bukhara-102,” “Gulbahor-2,” “UzRFA-709,” and “UzRFA-710.” Seeds were inoculated with a bioformulation based on the A. chroococcum K2020 strain and compared to non-inoculated controls.

The results demonstrated that inoculation stimulated both vegetative and reproductive development. The highest efficacy was observed in the “UzRFA-710” variety, which showed the greatest plant height and number of bolls. Plant height measurements were as follows:

“UzRFA-710”—125.18 ± 0.81 cm, “UzRFA-709”—118.64 ± 1.22 cm, “Gulbahor-2”—120.22 ± 1.44 cm, and “Bukhara-102”—110.40 ± 1.61 cm.

Improvements in fiber quality and yield were also recorded following inoculation. The observed biological effects are attributed to the strain’s nitrogen-fixing capacity, synthesis of phytohormones (auxins and gibberellins), and enhancement of plant resistance to abiotic stresses.

Thus, the application of Azotobacter chroococcum K2020 represents a promising direction for the development of eco-friendly biotechnologies and may contribute significantly to sustainable cotton production.

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sciforum-129089: Enhancing Callus Growth and Bioactive Compound Synthesis in *Calendula officinalis* through Yeast Extract Elicitation

Mojgan Soleimanizadeh * and Younes Mahmoodi

Department of Horticultural Science and Engineering, Faculty of Agriculture and Natural Resources, University of Hormozgan, Bandar Abbas, Iran

Elicitation is one of the effective strategies in plant tissue culture, which stimulates the production of secondary metabolites in plants using specific compounds. This technique can enhance the synthesis of bioactive compounds, such as alkaloids, flavonoids, and terpenes, by stimulating the plant's defense systems. Yeast extract is recognized as a biotic elicitor, rich in vitamins, amino acids, and growth factors. This extract can directly influence the growth and metabolism of the plant, thereby stimulating the plant's defense mechanisms, which in turn increases the production of secondary metabolites. *Calendula officinalis*, commonly known as marigold, is well-known for its medicinal properties, including anti-inflammatory, antimicrobial, and antioxidant activities. This plant contains bioactive compounds such as flavonoids, carotenoids, and terpenes. The aim of this study was to investigate the effect of *yeast extract* on callus growth, secondary metabolite production, and antioxidant activity in *Calendula officinalis* calli. In this study, *Calendula officinalis* seeds were disinfected and transferred to MS medium. After 20 days, the leaves were transferred to a medium containing 2 mg/L NAA and 1.5 mg/L BAP to induce callus formation. The calli were then cultured in media containing different concentrations of yeast extract (0, 1000, 1200, and 1400 µM). After 4 weeks, various callus characteristics, including fresh and dry weights and callus volume, were measured. Additionally, the phenolic content, flavonoid content, and antioxidant capacity of the calli were measured by extraction and chemical analysis. The results of this study showed that yeast extract significantly increased the production of secondary metabolites in *Calendula officinalis* calli, and notably enhanced both the antioxidant activity and the growth of the callus. These findings could serve as a foundation for the development of novel methods for the production of pharmaceutical compounds from medicinal plants and the improvement of industrial processes for secondary metabolite production in the pharmaceutical and healthcare industries.

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sciforum-133015: Enhancing Genetic Variability and Yield Potential in Chia (*Salvia hispanica* L.) through Gamma-Irradiation-Induced Mutation Breeding

Boraiah KM [1,*], Harisha CB [1], Basavaraj PS [1], Hanumanth M Halli [1], Santosh HB [2], Bhojaraja Naik [3] and Sammi Reddy K [1]

[1] ICAR-National Institute of Abiotic Stress Management, Malegaon-413 115, Baramati, Pune.
[2] ICAR - Central Research Institute for Dryland Agriculture, Santosh Nagar-500059, Hyderabad
[3] ICAR-Indian Institute of Seed Science, Reginal Station, Bengaluru-560065

Chia *(Salvia hispanica* L.*)*, a rich plant-based source of omega-3 fatty acids, is being explored as a climate-resilient alternative crop in India. However, limited genetic variability and the absence of high-yielding cultivars constrain its wider adoption. To address this, a mutation breeding program was initiated using gamma irradiation (400, 500, and 600 Gy) on seeds of two varieties: white-seeded 'Champion' and black-seeded 'Black selection-1'. The M_1 generation evaluation showed that increasing radiation doses led to reduced germination, delayed emergence, and suppressed seedling vigour, particularly in the black-seeded variety. Germination in Champion decreased from 88.50% (0 Gy) to 57.75% (600 Gy), and it decreased from 86.25% to 56.50% in Black selection-1. Successive mutant generations (M_2–M_6) revealed novel phenotypes, including bold seeds, pigmentation changes, crinkled foliage, altered spike architecture, and early flowering. Importantly, several M_6 lines exhibited a superior agronomic performance. Mutant line 94-1-1 recorded the highest yield of 2.46 kg/plot (1094.81 kg/ha), which represented an 80.68% increase over Champion (605.93 kg/ha) and 28.52% over Black selection-1 (851.85 kg/ha), with earlier maturity (104 days vs. 117 and 115 days). Other high-performing lines, such as 94-3-3 and 94-3-1, also showed yield improvements ranging from 65% to 70% over Champion, coupled with moderately reduced maturity durations (111–113 days). These findings highlight the effectiveness of gamma irradiation for inducing stable genetic variability and developing high-yielding, early-maturing varieties. This study underscores the potential of mutation breeding to develop superior Chia cultivars suited to Indian dryland and climate-vulnerable regions.

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sciforum-131677: Enhancing Multi-Trait Genetic Gains in Durum Wheat (*Triticum durum* Desf.) Using Ideotype-Based Selection Indices

Zine El Abidine Fellahi [1,*], Abou-bakr Rabti [2], Abderrahmane Hannachi [3] and Nasreddine Louahdi [4]

[1] University Mohamed El Bachir El Ibrahim of Bordj Bou Arreridj, 34030, Algeria
[2] Institute of Agriculture and Veterinary Sciences, University of Mohamed-Cherif Messaadia, Souk Ahras, 41000, Algeria
[3] National Agronomic Research Institute of Algeria (INRAA), Setif Research Unit, 19000, Algeria
[4] Experimental Farm, Field Crop Institute (ITGC), Farm Road-BP03, Setif 19000, Algeria

Durum wheat is a strategic crop for food security in semi-arid regions such as North Africa, where climate variability increasingly threatens agricultural productivity. Multi-trait selection represents a valuable approach to developing superior genotypes capable of maintaining high performance under such challenging conditions. This study aimed to compare the efficiency of traditional and modern multi-trait selection indices in identifying elite durum wheat genotypes. A total of 59 genotypes were evaluated under field conditions in Sétif, Algeria. Ten traits related to plant growth and agronomic performance were assessed, and a 15% selection intensity was applied. The classical Smith–Hazel (SH) selection index was implemented under two scenarios—retaining multicollinearity (SH_1) and removing multicollinearity (SH_2)—and compared with two modern ideotype-based indices: the Factor Analysis and Ideotype Design-Based BLUP (FAI-BLUP) and the Multi-Trait Genotype Ideotype Distance Index (MGIDI). Among the four indices, the MGIDI and FAI-BLUP achieved the highest total predicted selection gains (36.28%), substantially outperforming SH_2 (30.76%) and especially SH_1 (–35.98%), which was negatively affected by multicollinearity. Modern indices promoted substantial gains in key productivity-related traits, including biological yield (5.64%), grain yield (5.49%), and straw yield (15.1%). Notably, genotypes G42, G10, G26, and G4 were consistently selected across the MGIDI, FAI-BLUP, and SH_2, confirming their superior multi-trait performance and breeding potential. In contrast, SH_1 yielded inconsistent and negative results, highlighting the limitations of applying traditional indices without accounting for multicollinearity. These findings confirm the robustness, efficiency, and practical value of ideotype-based indices—particularly the MGIDI and FAI-BLUP—for multi-trait selection in durum wheat breeding programs, especially under semi-arid environmental conditions.

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sciforum-132690: Establishment and Molecular Characterization of a *Solanum quitoense* (Chila) Germplasm Collection from the Amazonas Region, Peru

Carmen Tarrillo [1], Pedro Rodríguez [1], Marly Guelac-Santillan [2, 3], Luis E. Vargas Cordova [2] and Carlos Arbizu [1,*]

[1] Facultad de Ingeniería y Ciencias Agrarias, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas
[2] Programa de Genética y Mejoramiento Genético de Plantas, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas
[3] Instituto de Investigación para el Desarrollo Sustentable de Ceja de Selva (INDES-CES), Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas

Solanum quitoense Lam., locally known as chila, is an underutilized fruit-bearing species native to the Andean-Amazonian region, traditionally cultivated in home gardens and smallholder farming systems. Despite its high nutritional, agroecological, and climate resilience, chila remains an orphan crop with limited genetic and genomic resources. To address this gap, the Universidad Nacional Toribio Rodríguez de Mendoza (UNTRM) launched a systematic program for the the collection and conservation of *S. quitoense* in the Peruvian Amazon region. The field expeditions, which covered all seven provinces of Amazonas, resulted in the establishment of a germplasm collection consisting of 31 distinct accessions, which are now conserved ex situ at UNTRM. This effort represents the first comprehensive initiative to document the genetic diversity of chila in this region. The accessions are currently undergoing molecular characterization using a combination of short- and long-read sequencing technologies. As part of this effort, we have begun assembling the complete chloroplast genome using long-read data, which will serve as a valuable genomic resource for phylogenetic and population studies. Future efforts will focus on nuclear genome sequencing and the development of molecular markers to support genetic diversity analysis, population structure inference, and the mapping of potential traits. These genomic tools will lay the foundation for pre-breeding and conservation strategies aimed at enhancing the crop's resilience to biotic and abiotic stressors. This work is part of UNTRM's broader program to promote the conservation, valorization, and sustainable use of native orphan crops from the Andean–Amazonian corridor. By unlocking the genetic potential of *S. quitoense*, we aim to contribute to the diversification of food systems, rural innovation, and climate adaptation in northern Peru.

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sciforum-132646: Exploiting Wild Genetic Resources: Characterization of PR Genes from *Sinapis alba* for Resistance to *Alternaria* Blight

Paromita Saikia *, Reshma Ahmed and Priyadarshini Bhorali

Department of Agricultural Biotechnology, Assam Agricultural University, Jorhat, Assam, India

Alternaria blight, caused by the necrotrophic fungi *Alternaria brassicicola* and *A. brassicae*, is one of the most devastating and widespread diseases of oilseed *Brassicas* worldwide. Conventional breeding efforts to develop resistant cultivars have been unsuccessful due to the lack of suitable resistance sources among cultivated species. *Sinapis alba*, a crop wild relative (CWR) of oilseed *Brassica* spp., has been reported to exhibit considerable resistance to *Alternaria* blight. In the present study, we attempted to clone and characterize two important pathogenesis-related (PR) genes from *S. alba*, endochitinase and glucan endo-1,3-beta-glucosidase, and designed constructs for their functional characterization through overexpression. The genes were selected from a transcriptomic dataset of differentially expressed genes (DEGs), generated in a previous study, based on their expression patterns in *S. alba* and *B. rapa* following inoculation with *A. brassicicola*. The differential expression patterns of the PR genes were validated through qPCR. Furthermore, gene ontology analysis and protein–protein co-expression network studies provided insights into the functional roles of these genes in defense against the necrotroph. The complete coding sequences (CDSs) of the genes were then isolated from *S. alba* via PCR amplification, cloned into the pGEM-T Easy cloning vector, and subsequently into the pCAMBIA1301 binary vector. The constructs were validated by transient expression assays through agroinfiltration in *Nicotiana benthamiana* and *B. rapa*, followed by qPCR analysis. The constructs prepared for the overexpression of endochitinase and glucan endo-1,3-beta-glucosidase will further be used for stable transformation in *B. rapa* for functional validation through appropriate bioassays.

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sciforum-132616: Field Emergence and Seedling Performance of Philippine Inbred Rice Variety NSIC Rc 218 (Mabango 3) Exposed to Gamma Radiation using Cobalt 60

Juan Rodrigo Almendral Vera Cruz [1,*], Kim Christian Gaa [2] and Jermaine Rica Ricablanca [2]

[1] Agriculture Research Section, Atomic Research Division, Department of Science and Technology – Philippine Nuclear Research Institute, Commonwealth Avenue, Diliman, Quezon City 1101, Philippines
[2] Our Lady of Fatima University, Valenzuela City 1440, Philippines

Mutation breeding offers a rapid and effective approach to create novel genetic variation in rice (*Oryza sativa* L.) and identify mutants with desirable traits. This study evaluated the radiosensitivity of the long-grain, soft, and aromatic inbred rice variety NSIC Rc 218 (Mabango 3). Seeds were exposed to gamma radiation using a Cobalt-60 source, with doses ranging from 100 to 1000 Gy. For all treatments, 1,500 seeds were irradiated and grown under controlled conditions. Seedling vigor and shoot–root development were assessed at 9, 14, and 21 days after sowing. Our results showed a clear dose-dependent response in early growth traits. Low-to-moderate doses (100–300 Gy) produced variable physiological effects, including slight stimulation of shoot growth at 100 and 200 Gy. In contrast, higher doses (≥500 Gy) caused sharp declines in germination and survival. No seedlings survived beyond 600 Gy, indicating the lethal threshold. Overall survival rates ranged from 59% to 77%, with LD50 estimated at 424.11 Gy. Optimal stimulation of early growth traits occurred between 200 and 300 Gy, suggesting this range as a practical mutagenic window for generating genetic variation while maintaining seedling viability. These findings provide essential baseline radiosensitivity data for NSIC Rc 218. More broadly, such studies strengthen the foundation of mutation breeding in rice and other cereals, where optimized irradiation protocols are critical for developing mutants with improved yield, nutritional quality, and stress resilience. By refining dose–response knowledge across crop species, mutation breeding continues to play a key role in addressing global food security challenges.

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sciforum-137330: Future Prospects of Fruit and vegetable crop Breeding in the Middle East

Vahid Ghahremani

Kahraman Independent Laboratory, Istanbul 34000, Turkey

This study explores the future of fruit and vegetable crop improvement in the Middle East through the integration of traditional breeding techniques with modern agricultural science. Extensive experimental trials were conducted on apricot, sour cherry, tomato, basil, and several other species across diverse ecological zones ranging from the Mediterranean coast (Istanbul) to the mountainous Alborz region (Azerbaijan, Damavand). Soil-based experiments examined the effects of various irrigation types, fertilization regimes, and environmental stress factors. The results revealed remarkable changes in plant resilience, yield quality, and adaptive traits, suggesting that combining ancestral knowledge with modern precision agriculture can significantly enhance crop productivity under shifting climatic conditions. These findings offer strategic insights for future breeding programs aimed at sustaining food security in semi-arid and Mediterranean regions of the Middle East.

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sciforum-139459: Genotype × Environment Interaction and Yield Stability of UiTM Advanced Rice Lines

Nor'Aishah Hasan [1,*], Norfarah Nadhirah Ahmad Noruddin [1], Muhammad Nabil Haqiem Hisham [1], Alif Ihsaan Mohd Akmal Shukri [1] and Abdul Rahim Harun [2]

[1] Universiti Teknologi MARA (UiTM), Shah Alam 40450, Selangor, Malaysia
[2] PERTAMA PAI (Malaysia) Sdn. Bhd., Kedah, Malaysia

Genotype × environment (G×E) interaction plays a pivotal role in determining the stability and adaptability of rice cultivars under diverse agro-ecological conditions. This study evaluated five gamma-irradiation-derived UiTM advanced rice mutant lines and six commercial varieties across 12 locations in Malaysia to assess yield performance, phenotypic variability, and stability. The two-way ANOVA revealed highly significant (p 0.001) effects of genotype, environment, and their interaction on most agronomic traits. Notably, substantial genotypic variation was observed in days to 50% flowering (DTF50), days to maturity (DTM85), number of filled spikelets (NFS), and yield per plant (YLDPLT), while environmental effects were dominant for plant height (PH) and number of spikelets (NOS), highlighting the influence of location-specific factors such as rainfall and soil fertility.

Significant G×E interactions for traits including NFS, YLDPLT, and seed length-to-width ratio (SLSWR) indicated crossover performance among genotypes across environments. Several UiTM mutant lines demonstrated consistent flowering times and stable yield expression, suggesting their suitability for broad or specific adaptation. Descriptive statistics revealed high coefficients of variation in sterile spikelets (CV = 54.91%) and yield traits, indicating environmental sensitivity. The correlation analysis showed strong positive associations between yield components such as NFS, TSW, and YLDPLT, supporting their role as key selection criteria.

The principal component analysis (PCA) identified yield traits as major contributors to phenotypic variability (PC1 = 45.8%), while grain morphology traits loaded strongly onto PC2 (22.8%). The cluster analysis grouped the genotypes into two categories: early-maturing, high-yielding lines and late-maturing types with greater spikelet numbers. These findings emphasize the need for multi-location trials and a G×E analysis to guide varietal selection. The stable performance of the UiTM lines under varying conditions underscores their potential as candidates for climate-resilient rice cultivation in Malaysia.

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sciforum-131600: Highly efficient direct seed transformation protocol for japonica rice (*Oryza sativa* L.) by *Agrobacterium tumefaciens*

Md Maksudul Haque [1,*] and Shin-ichiro Kidou [2]

[1] Doctoral Student (D3), Graduate School of Science, Nagoya City University, Japan Principal Scientific Officer (PSO), Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), Narayanganj, Bangladesh
[2] Graduate School of Science, Nagoya City University, Mizuho-cho, Mizuho-ku Nagoya, Japan. Research Center for Biological Diversity, Nagoya City University, Mizuho-cho, Mizuho-ku Nagoya, Japan.

Molecular breeding and gene function studies in plants require high transformation efficiency. *Agrobacterium*-mediated transformation has contributed significantly to molecular research in many plants, but is inefficient and inconsistent in rice that do not host *Agrobacterium*. Transformation efficiency in rice remains low. Therefore, this study aimed to establish a simple and efficient transformation method for rice using *Agrobacterium*. Two foreign genes (CISP1-GFP and CISP2-GFP) and a *Agrobacterium* strain (EHA105) were used in the experiments. Then, *Agrobacterium* infection of rice seeds that had absorbed water and germinated under reduced pressure infiltration conditions showed that an average of 14% of the seeds formed after growth (12% with CISP1-GFP and 16% with CISP2-GFP) carried the foreign gene, and it was also confirmed by PCR, Western blot, GFP fluorescence and TAIL-PCR. Since this method does not involve callus formation or re-differentiation of rice plants, no special equipment or complicated operations are required, and transformants can be obtained in only three months. Therefore, this method is expected to simplify rice genetic manipulation and promote molecular breeding of rice.

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sciforum-136744: Identification of stripe rust (*Puccinia striiformis* f.sp. t*ritici*) resistance in the Ethiopian wheat landraces

Fikrte Yirga

Ethiopian Institute of Agricultural Research (EIAR), Addis Ababa 2003, Ethiopia

Stripe rust caused by *Puccinia striiformis* f.sp. *tritici* (*Pst*) is threatening wheat production in Ethiopia. Wheat varieties succumb to new *Pst* race(s) soon after their release from research centers. This stusy aimed to determine prevalent *Pst* races and identify resistance sources in the Ethiopian wheat landraces. A total of 44 *Pst* samples were collected for race analysis from the Amhara and Oromia regions. The field test was conducted at Kulumsa and Meraro, while the seedling tests were conducted at Kulumsa in a greenhouse. Seven *Pst* phenotypic races were identified from 44 samples, and *PstS11* was the most frequent (36.4%), whereas three distinct *Pst* races were identified from 24 samples by SSR genotyping. Of the 103 wheat landraces (69 bread and 34 durum), 57 exhibited resistance across both locations and seasons. The 57 Ethiopian wheat landraces that showed field resistance were further exposed to three *Pst* races at the seedling stage, and 32 Ethiopian wheat landraces exhibited seedling resistance to all races. The resistance in these materials will be genotyped and used in the wheat breeding program.

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sciforum-124192: Integration of plant phenomics and morpho-physiological traits to elucidate drought tolerance in pigeonpea genotypes

Basavaraj P S [1,*], Muniswamy S [2], Boraiah KM [1] and Harisha CB [1]

[1] ICAR–National Institute of Abiotic Stress Management (NIASM); Baramati, Maharashtra; 413115; India
[2] University of Agricultural Sciences; Raichur, Karnataka; 584104; India

Drought stress, impacting around 66% of arable land, poses a significant threat to global food security, with estimated losses of USD 37 billions, and is expected to rise due to climate change. Pigeonpea, a key legume crop in semi-arid regions, often suffers yield losses of 40–50% under drought. This study assessed 47 genetically diverse pigeonpea genotypes under well-watered and drought-stressed conditions using morpho-physiological and high-throughput phenomic traits to enhance crop resilience. Drought stress significantly reduced most traits (2.77%–68.76%), while vapour pressure deficit and proline content increased by 1–1.5 times. Phenomics-based traits like projected shoot area, convex hull area, calliper length, and near-infrared reflectance proved effective in distinguishing drought responses. Nine genotypes—ICPX140196-B-1, ICPX140203-B-1, ICPX140213-B-3, ICPX140203-B-1-5, ICPX140203-B-2, GRG-152, ICPX140205-B-4, ICPX140217-B-1, and ICPX140188-B-3—emerged as drought-tolerant, showing stable yield (≤5% loss), efficient photosynthesis, and better water status. Photosynthetic traits were strongly correlated with yield under stress and exhibited high genetic variability (10–46%) with moderate heritability, making them reliable selection criteria. This study highlights the value of integrating phenomics with traditional traits to identify drought-tolerant pigeonpea genotypes and guide future breeding strategies efficiently.

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sciforum-138870: Investigating Genetic Traits in M4 Generations of Lathyrus (*Lathyrus sativus* L.) Cultivar NLK-73

Usman Mohammed Ali [1,*], Vandana S Madke [2], R.M Manwar [2] and B.C Nandeshwar [2]

[1] Department of Plant Sciences, Faculty of Agriculture, Wollega University Shambu Campus, P.O Box 38, Shambu, Ethiopia
[2] Section of Genetics and Plant Breeding, College of Agriculture, Nagpur, PIN 440001, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Abstract

Introduction

Lathyrus (*Lathyrus sativus* L.), an important pulse crop, is valued for its high protein content and resilience to abiotic stresses. However, its cultivation is limited due to the presence of the neurotoxin β-ODAP, which causes neurolathyrism. Mutation breeding offers a viable approach to develop low-toxin, high-yielding varieties. This study aimed to evaluate genetic variability, estimate heritability, and identify superior mutants in M~4~ progenies of Lathyrus cv. NLK-73 for yield and related traits with reduced β-ODAP content.

Methods

Twenty-nine mutant progenies derived from gamma-ray-irradiated NLK-73 seeds, along with checks (NLK-73 and Ratan), were evaluated in a Randomized Block Design with three replications. The data recorded included days to first flowering, days to maturity, plant height, number of branches/plant, pods/plant, 100-seed weight, seed yield/plant, and β-ODAP content. Genetic parameters such as genotypic and phenotypic variance, heritability, and genetic advance were estimated.

Results

Analysis of variance revealed significant genetic variability among mutants for all traits. High genotypic coefficients of variation (GCVs) and heritability were observed for branches/plant (42.06%, 87.46%), pods/plant (20.86%, 48.79%), and seed yield/plant (16.83%, 41.40%). Moderate to high genetic advance was recorded for these traits, indicating additive gene action. Ten superior mutants (e.g., NLM-12, NLM-20, and NLM-23) were identified, exhibiting high yield (>23 g/plant), increased pods/plant (>49), and low β-ODAP content (0.20%).

Conclusions

The study demonstrated the potential of mutation breeding to enhance yield and reduce β-ODAP in Lathyrus. Selected mutants with high heritability and genetic advance can be advanced for further trials, contributing to safer and more productive Lathyrus cultivars.

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sciforum-138192: Molecular mechanisms of fruit ripening—insights from model and non-model systems

Raju Mondal [1,*], Tanya Ahmed Sheik [2], Dr. V. Nishitha Naik [3] and S. Manthira Moorthy [4]

[1] Central Sericultural Germplasm Resources Centre (CSGRC)
[2] CSB-Central Sericultural Germplasm Resources Centre, Central Silk Board, Hosur, Tamil Nadu 635109, India
[3] CSB-Central Sericultural Germplasm Resources Centre (CSGRC), Hosur, Tamil Nady 635 109, India
[4] Central Silk Board, Bengaluru, Karnataka 560068, India

Tomato (climacteric) and strawberry (non-climacteric) are regarded as model systems for comprehending the molecular underpinnings of fruit ripening. Numerous studies have been reported over recent decades that have significantly increased postharvest research efficiency and ensured the quality and productivity of fruits. Recently, minor fruit crops have received attention in unraveling the molecular foundations of fruit ripening. However, factors like genomic complexity (polyploidy), lack of reference genome, poor sequence similarity within the fruit crops as well as with model systems like Arabidopsis, biased functional annotation, cost-prohibitive computational resources, and dependence on bioinformaticians still significantly affect comparative analysis and understanding, even with the abundance of publicly available transcriptome datasets across the diverse fruit crops. In order to gain comprehensive molecular knowledge of fruit ripening, the current work extracted bulk RNA-Seq data from both model (tomato) and non-model (mulberry) fruit crops and processed around 250 Gb of data (taxonomic identity, Trinity, HISAT2, Stringtie, StringtieMerge, GffCompare, Featurecount, DEseq2, Blast) for downstream functional analysis. Despite the heterogeneity of repository RNA-Seq datasets (cross-species, time series, cytotype variation), unique and shared mechanisms associated with fruit ripening have been identified. Identified pathways and associated genes offer the potential target to improve both the quality and quantity of major and minor fruit crops.

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sciforum-132686: Morphological Characterization and Phytochemical Profiling of Specimens from the Peruvian *Solanum muricatum* Aiton Germplasm Bank at the UNSCH

Germán F. De la Cruz Lapa [1,*], Jhon Gutiérrez Fuentes [1], Silmer Ramirez Huaraca [1], Angela J. Requis Quintanilla [1], Eugenia R. Quispe Medina [1], Susan M. Alarcón Romani [1], Juan R. Palomino Malpartida [1], Carlos A. Serrano Flores [2] and Carlos I. Arbizu [3]

[1] Facultad de Ciencias Agrarias, Universidad Nacional de San Cristóbal de Huamanga
[2] Facultad de Ingeniería Química, Universidad Nacional San Antonio Abad del Cusco
[3] Facultad de Ingeniería y Ciencias Agrarias, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas

Solanum muricatum Aiton, commonly known as sweet cucumber, is native to South America and had historical significance in pre-Incan civilizations such as the Moche, Nazca, and Wari. This study presents the morphological and preliminary phytochemical characterization of *S. muricatum* germplasm conserved at the Universidad Nacional de San Cristóbal de Huamanga (UNSCH), Peru. Two germplasm collection events were conducted. The first, in Ayacucho (Gutiérrez, 2023), yielded 24 accessions evaluated using a simple 5×5 lattice design with three replications, including *Capsicum pubescens* as an outgroup. Fifty qualitative and twenty-seven quantitative traits were assessed using IPGRI and COMAV descriptors. Cluster analysis identified four distinct groups, validating differentiation, with *C. pubescens* forming a separate clade. Grouping was also observed based on vegetative phenology, inflorescence, fruit, and seed traits. An ANOVA revealed highly significant differences among the accessions (p 0.01) in agronomic traits such as the fruit count per inflorescence, fruit count per plant, and yield per plant. The second collection (Ramirez, 2024) included accessions from Cusco, Apurímac, Ayacucho, Ica, Lima, Cajamarca, and Lambayeque, contributing 35 accessions. Cluster analysis revealed seven distinct groups, and an ANOVA again showed significant variation (p 0.01). The current ex situ germplasm bank now contains 59 asexually propagated accessions and 77 segregating lines grown from botanical seeds—126 genotypes in total. Phytochemical profiling of fruit peel from 12 morphologically representative accessions, alongside *Physalis peruviana* and *Solanum betaceum* controls, was conducted via HPLC using standards of caffeic acid, rosmarinic acid, cinnamic acid, quercetin, rutin, resveratrol, and chlorogenic acid. The results showed substantial variability in the total phenols (0.55–1.71 mg GAE/100 mg), antioxidant capacity (0.42–0.78 mg vitamin C/100 mg), flavonoids (0.13–0.24 mg quercetin/100 mg), hydroxycinnamic acids (0.25–1.11 mg caffeic acid/100 mg), carotenoids (6.62–33.02 mg/100 mg), and DPPH inhibition (IC_{50}: 103.23–1402.95 µg). Carotenoids and chlorogenic acid were the predominant compounds. These findings reveal significant genetic and phytochemical diversity within *S. muricatum*, supporting its potential for further biotechnological enhancement through genomics, transcriptomics, and metabolomics research at the UNSCH.

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sciforum-131968: Optimized CTAB-Based DNA Extraction from *Cichorium intybus* L.: A Reliable Approach for PCR Applications

Shadab Ahamad

[1] Sri Sathya Sai Sanjeevani Research Foundation, Palwal, Haryana, India
[2] Sri Sathya Sai University for Human Excellence, Kalaburagi, Karnataka, India
[3] G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Background

Cichorium intybus L. (chicory), a perennial herb of the Asteraceae family, is widely recognized for its medicinal value. However, isolating high-quality DNA from chicory remains challenging due to its rigid cell walls and the abundance of polyphenols and polysaccharides, which interfere with conventional extraction methods, often resulting in low yields and degraded DNA.

Objective

Our study aimed to optimize the cetyltrimethylammonium bromide (CTAB) method for efficient DNA extraction from chicory leaves, followed by validation using polymerase chain reaction (PCR).

Methods

Fresh, etiolated young chicory leaves were collected from four regions of Uttarakhand (India) and stored at -80°C before processing. Cell lysis was performed using pre-warmed 1x CTAB extraction buffer, omitting liquid nitrogen. RNase A treatment at 37°C removed RNA, followed by phase separation with a chloroform/isoamyl alcohol (24:1 v/v) mixture and DNA precipitation using isopropanol and 7.5M ammonium acetate. The extracted DNA was dissolved in 1x TE buffer and stored at -20°C. Yield and purity were assessed using a NanoDrop UV–Vis spectrophotometer, and integrity was confirmed via agarose gel electrophoresis. Primers for the 1-SST gene of chicory were designed using Primer3 and amplified by PCR.

Results

Method efficiency was improved by increasing the concentration of CTAB (2%) and polyvinylpyrrolidone (2%), along with the inclusion of 7.5 M ammonium acetate. The pre-warmed CTAB buffer eliminated the need for liquid nitrogen, simplifying the protocol. DNA yield averaged 64.56 ± 30.51 ng/μl, with an $OD_{260/280\ nm}$ of 1.75 ± 0.12. PCR successfully amplified a 2.01 kb fragment of the 1-SST gene in all samples, confirming the protocol's reliability.

Conclusion

To the best of our knowledge, this is the first tailored protocol for DNA extraction from chicory. Compared to costly commercial kits, the optimized CTAB method is cost-effective, reproducible, and suitable for downstream molecular applications, thus advancing genomic research.

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sciforum-122597: Performance Evaluation of Small white common bean (*Phaseolus vulgaris* L.) Varieties at Buno Bedele and Ilu Aba Bora Zones, South-western Oromia

Mohammed Tesiso Gemeda

Oromia Agricultural Research Institute (IQQO), Bedele Agricultural Research Center (BeARC), Bedele 245, Ethiopia

The field experiment was conducted at two districts of Buno Bedele zone (Bedele & Dabo Hana) and one district of Ilu Aba Bor zone (Bure) in south-western Oromia for two years (2023-2024 G.C) under rain-fed conditions. The objective of this study was to select adaptable, stable, higher-yield and disease-resistant small white common bean varieties. In the experiment, six improved small white common bean varieties and one local check were laid out in a randomized complete block design (RCBD) with three replications. Parameters like days to flowering, days to maturity, plant height, number of pod per plant, number of seed per pod and grain yield were collected and analyzed by R-software. Grain yield and yield related traits were significantly affected by variety–environment interactions. The results revealed that there were significant (p 0.001) variations between the varieties for yield, number seed per pod and days to maturity, and significant (p0.01) variations in days to flowering, plant height and number of pod per plant were also observed. Thus, higher grain yield was recorded for Awash mitin (2330.51 kgha^{-1}), followed by Wabero (1878.11 kgha^{-1}), while lower grain yield was recorded for Awash-1 (1261.36 kgha^{-1}). In this study, 40.10% and 12.90% increases in yield were attained using Awash mitin and Wabero variety, respectively, over the local check in the study area. The AMMI analysis showed that 14.92% of the total sum of squares (SS) was attributed to environments (E), 25.76% to the genotypes (G) and 23.08% to GEI effects. Principal components 1 and 2 accounted for 73.80% and 15.01% of the GEI, respectively, with a total of 88.81% variation. Therefore, compared to the others, these two small white common bean varieties are recommended as promising varieties for farmers in areas with similar agro-ecologies for further pre-extension demonstration.

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sciforum-133567: Physiological Responses of Wild and Cultivated Diploid Wheat Genotypes towards Salinity Stress

Mohd. Kamran Khan [1,*], Anamika Pandey [1], Mehmet Hamurcu [1], Zuhal Zeynep Avsaroglu [1], Ali Topal [2] and Sait Gezgin [1]

[1] Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Selcuk University, Konya-42130, Turkiye
[2] Department of Field Crops, Faculty of Agriculture, Selcuk University, Konya 42130, Turkiye

Wheat production is largely reduced by salinity stress around the world. High soil salinity that is likely to worsen with increasing climate change decreases the root–shoot growth and tissues, and, eventually, leads to the destruction of wheat crops. Plants show substantial variation in salinity tolerance depending on the species and growth stages. As Triticum species is mostly sensitive to soil salinity, it is important to develop and grow salt-tolerant wheat genotypes. However, modern hexaploid wheat holds less genetic variation, lacking the potential alleles required for their adaptability towards high salinity. Thus, it is crucial to assess the genetic diversity of different germplasms for the selection of potential genotypes with desirable traits against stressed conditions. Bread wheat comprises A, B, and D subgenomes, where *Triticum boeoticum, T. monococcum,* and *T. urartu* are considered as ancestral species of their 'A' sub-genome. As 'A' genomes of diploid wheat species share homology to 'A' sub-genomes of hexaploid wheat, they can facilitate the transfer of desirable traits in wheat breeding programs. Here, we screened 31 diploid A-genome wheat genotypes belonging to four species to understand their response towards control and salinity stress (150 mM NaCl) conditions in terms of growth parameters. Interestingly, domesticated *T. monococcum* genotypes in the experiment showed higher tolerance to salinity stress compared to genotypes of *T. aegilopoides, T. boeoticum,* and *T. urartu*. Salinity stress equally affected the root and shoot tissues of the studied species. The identified tolerant genotypes may serve as a good candidate to introgress the salinity tolerance trait in different wheat species.

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sciforum-138817: Pigmentation Diversity and Nutritional Profiling of Multicolored Tropical Carrots (Daucus carota L.)

Raman Selvakumar [1,*], Paresh Chaukhande [2], Pritam Kalia [2], Palanisamy Subashni [1] and TM Dhaksesh Raaj [2]

[1] Centre for Protected Cultivation Technology, ICAR-Indian Agricultural Research Institute, New Delhi-110012
[2] Division of Vegetable Science, ICAR-Indian Agricultural Research Institute, New Delhi-110012

The increasing demand for nutrient-rich and visually appealing vegetables has driven efforts to develop innovative carrot (Daucus carota) genotypes. This study focuses on the biochemical profiling of rainbow carrots, with a specific emphasis on black with red, black-yellow, and black-orange carrots, aiming to enhance pigmentation diversity and improve nutritional value. These unique carrot varieties were screened and hybridised under open-field conditions using drip irrigation to optimise growth. The carrot genotypes were analyzed for their biochemical composition, including anthocyanins (280-420mg/100g FW), beta-carotene (3.5-7.5mg/100g FW), lycopene (0.2-4.5mg/100g FW), and lutein (2.5-6.8mg/100g FW) content. The presence of anthocyanins in the black carrots, particularly those with red (328–420 mg/100 g FW), yellow (280–310 mg/100 g FW), and orange (300–330 mg/100 g FW) pigmentation, was explored to understand the diversity in pigment profiles. Selection criteria prioritized pigment intensity, root morphology, and yield potential (18–25 t/ha, 15–20% higher than orange controls), while high-throughput nutritional profiling was used to assess the metabolic composition and nutritional enrichment of the carrots across multiple generations . Advanced lines of these black-coloured carrot varieties were evaluated for stability and adaptability across diverse growing conditions. The trials confirmed superior performance in pigmentation, root quality, and nutritional enrichment, making them viable candidates for commercial production. This study highlights the potential of black with red, black-yellow, and black-orange carrots to meet growing consumer demands for both health-promoting and aesthetically appealing vegetables, thereby contributing to market diversification and improved dietary health.

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sciforum-132688: Population Structure of *Solanum muricatum* Aiton Germplasm from Peru Revealed by GBS-Derived SNP Markers

Germán F. De la Cruz Lapa [1], Susan M. Alarcón Romani [1], Angela J. Requis Quintanilla [1], Eugenia Quispe [1], Juan R. Palomino Malpartida [1], Edgar Neyra [2] and Carlos Arbizu [3,*]

[1] Facultad de Ciencias Agrarias, Universidad Nacional de San Cristóbal de Huamanga
[2] Facultad de Ciencias e Ingeniería, Universidad Peruana Cayetano Heredia
[3] Facultad de Ingeniería y Ciencias Agrarias, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas

Solanum muricatum Aiton, commonly known as “pepino dulce” or “sweet cucumber”, is a native Andean fruit with growing agronomic and nutraceutical importance. Understanding its genetic diversity and structure is essential for conservation and crop improvement strategies. In this study, we employed genotyping by sequencing (GBS) to evaluate the population structure of 96 accessions of *S. muricatum* collected from seven Peruvian departments: Ayacucho, Cusco, Apurímac, Ica, Lima, Lambayeque, and Cajamarca. GBS generated over 500 million raw reads, from which 9.5 million tag sequences were identified. After stringent filtering, 767,166 tags were retained, and 269 high-quality single-nucleotide polymorphisms (SNPs) with minor allele frequency > 0.01 were used for downstream analysis. Phylogenetic inference based on a neighbor-joining tree grouped the accessions into several clusters, with some degree of geographic association, though admixture among populations was evident. Principal Coordinate Analysis (PCoA) corroborated this pattern, showing a central core of genetic similarity with a few outliers, particularly from Ayacucho. The genetic data revealed substantial diversity within and between populations, suggesting the existence of both shared ancestry and local adaptation. Despite the low number of SNPs retained after filtering, clustering patterns were consistent with field-collected agro-morphological data, indicating that even a reduced SNP dataset can be informative for population differentiation in *S. muricatum*. These findings highlight the underexploited genetic diversity of Peruvian “pepino dulce” germplasm and reinforce the relevance of ongoing ex situ conservation and pre-breeding efforts undertaken by national universities in Peru. Our results lay a foundation for more detailed studies involving higher-resolution genomics, association mapping, and the development of molecular markers for agronomic traits in this underutilized crop.

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sciforum-131434: QTL Mapping for Plant Height in the CML52 × B73 Maize RIL Subpopulation: Insights from a Nested-Association Mapping Approach

Ifeoluwa Simeon Odesina

Department of Pure and Applied Biology, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso 210214, Oyo State, Nigeria

Plant height is one of the key agronomic traits used as a variable to model vegetative and developmental growth in crops. It is one of the most salient yet important yield-associated traits that could be utilized in breeding against lodging effects in the maize breeding program. A RIL subpopulation derived from the cross between parental lines, CML52 x B73, from a nested association mapping (NAM) population genotyped with SNP markers for approximately thirty-seven (37) traits was used to identify QTL for plant height. A genetic linkage covering all 10 chromosomes was constructed, and the QTLs affecting plant height were mapped and analyzed by single marker analysis (SMA), interval mapping (IM), and composite interval mapping (CIM) at a LOD score of 3.11, 3.14, and 6.11, respectively. Six (6) QTLs for plant height detected were located at different regions of five chromosomes (2, 6, 8, 9, and 10). The results showed that there were different effect values of QTL on plant height estimated by the different techniques. The percentage of phenotypic variation of single-QTL to plant height varied from 6.49% to 10.24% using IM and 4.14% to 9.16% using CIM. The multiple-QTL estimated an overall phenotypic variation of 17.25% using IM and 22.07% using CIM. Since the CIM detected the highest number of putative QTLs, it can be widely adopted for QTL mapping analysis. The two QTLs, c9.loc93 (chr.9 pos. 93), being consistently identified by most of the techniques, and PZA03728.1 (chr.10 pos. 65.1), having the highest phenotypic variation (10.24%), could be considered in a maize breeding program to lower the lodging effect on taller maize plants.

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sciforum-132501: Screening Moroccan Barley (*Hordeum vulgare* L.) Accessions for Resistance to Crown Rot Caused by *Fusarium culmorum* and Selection of Key Assessment Variables

Hanane EL Wazziki [1,*], Brahim El Yousfi [1] and Ali Sahri [2]

[1] Laboratory of Cereal Pathology, Regional Center of Agricultural Research of Settat, National Institute of Agricultural Research (INRA), Avenue Ennasr, BP 415 Rabat Principal, Rabat 10090, Morocco
[2] INRA GeneBank, Regional Center of Agricultural Research of Settat, National Institute of Agricultural Research (INRA), Avenue Ennasr, BP 415 Rabat Principal, Rabat 10090, Morocco

Crown rot caused by *Fusarium culmorum* is a major fungal disease in cereal crops, particularly wheat and barley, with widespread occurrence in cereal-growing regions worldwide. Its prevalence is increasing in arid and semi-arid zones, where it leads to significant yield and quality losses, threatening food security and the economy. The objectives of this study were twofold: first, to identify a precise, rapid, and practical method for evaluating crown rot severity, and second, to assess the genetic resistance levels in a collection of barley (*Hordeum vulgare* L.) accessions using the selected method. A total of 100 barley accessions from the GeneBank of INRA Morocco were sown and inoculated with an organic inoculum of *F. culmorum* in a completely randomized block with four replications. Several variables were measured, including root severity index, internode severity, total number of spikes, number of sterile spikes, plant height, dry biomass weight at flowering, and biological yield. The principal component analysis (PCA) revealed that internode severity and the percentage of sterile spikes are the most reliable indicators, as they reflect both the pathogen's progression within the plant and its direct impact on yield loss. Crown inoculation was also validated as a reliable screening method. Six accessions were identified as resistant and ranged from high to moderate performance levels. In addition, nine accessions were classified as tolerant, and one displayed resistance but had a low agronomic performance. These indicators and accessions provide practical tools for breeders, as they can be directly integrated into selection programs to develop barley varieties resistant or tolerant to crown rot, thereby supporting sustainable cereal production. These selected accessions represent valuable genetic material that could be used by breeders to develop varieties resistant or tolerant to crown rot caused by *Fusarium culmorum*.

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sciforum-130732: The genetic architecture of morpho-physiological, yield, and grain quality parameters in wheat

Tarun Gaddam [1,*] and Krishan Pal [2]

[1] PhD Scholar, Department of Genetics and Plant Breeding, Guru Kashi University, Talwandi Sabo, Punjab 151302, India
[2] Head & Associate Professor, Department of Genetics and Plant Breeding, Guru Kashi University, Talwandi Sabo, Punjab 151302, India

Terminal heat stress, a significant threat to global wheat production, necessitates a comprehensive genetic analysis of morpho-physiological, yield, and grain quality parameters. This investigation was conducted across two distinct environments: a normal-sown trial in Punjab (Rabi 2023-24) and a late-sown, heat stress trial in Andhra Pradesh (Rabi 2024-25). This study employed 43 diverse wheat genotypes, including three checks, laid out in a Randomized Block Design for field experiments and a Completely Randomized Design for laboratory evaluations. The objectives included assessing genetic variability, determining trait associations, estimating genetic divergence, evaluating grain protein content, and identifying heat stress effects. ANOVA revealed highly significant (P0.01) genetic variability among genotypes for all sixteen field and ten laboratory traits under both conditions, indicating a broad genetic base for selection. Heat stress significantly reduced most traits; the mean grain yield per plant plummeted from 9.02 g to 0.70 g, a decline underscored by a high Drought Intensity Index (DI) of 0.922. Genetic parameter estimates showed high heritability and high genetic advances for key traits. Grain yield per plant (h^2 > 82%, GAM > 41%), number of grains per spike (h^2 > 89%, GAM > 42%), and biological yield per plant (h^2=93.8%, GAM=73.7% in normal conditions) suggested additive gene action. Grain protein content also exhibited high heritability (91-94%) and significant improvement potential (GAM up to 26.6%), with HD 2307 consistently showing the highest content (15.7-15.9%). Correlation and path analysis identified biological yield per plot as having the strongest positive direct effect on grain yield under optimal conditions (P=0.693). Under heat stress, the direct contribution of number of grains per spike (P=0.821) and grain weight per spike became paramount. Earliness (days to flowering) was consistently negatively correlated with yield, highlighting its importance as a heat escape mechanism under stress (rg = -0.390**). Genetic divergence (D^2 analysis) grouped the 43 genotypes into six clusters under normal conditions and five under heat stress. Maximum inter-cluster distance occurred between Cluster II and Cluster VI (genotype G40) in the normal environment (D=33.66) and between Cluster II and Cluster V (genotype G40) under heat stress (D=27.70), indicating these as the most divergent parents. The number of grains per spike (contributing 11.2-19.8%) and test weight (9.3-12.3%) were the largest contributors to divergence. Based on stress tolerance indices, PBW 677 (HSI=1.28), HD 2307 (YSI=0.25), and HD 3386 (HTI=25.13) were identified as superior for heat resilience. This investigation successfully identified significant genetic variability and key traits for targeted selection. This study pinpointed genetically diverse and heat-tolerant parents and identified traits like grain number, grain weight, and biological yield as critical selection criteria, providing a robust framework for developing high-yielding, climate-resilient wheat cultivars.

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sciforum-138179: The polyploid paradox in mulberry: enlarged genome exhibits loss of growth superiority

Tanya Ahmed Sheik [1,*], Raju Mondal [1], V. Nishitha Naik Naik [1] and S. Manthira Moorthy [2]

[1] Mulberry Tissue Culture laboratory, CSB-Central Sericultural Germplasm Resources Center, Hosur, Tamil Nadu, India
[2] Research Coordination Section (RCS), Central Silk Board, Bangalore, Karnataka, India

Mulberry (*Morus* spp.), one of the key sericultural crops, exhibits remarkable cytogenetic diversity, with natural chromosome-level variation ranging from 2n=14 to 2n=308. This broad spectrum—from diploid, triploid, tetraploid and hexaploid to the extreme polyploid decosaploid—offers a unique system to investigate the impact of genome duplication on plant physiology and morphology. We studied the influence of different cytotypes on traits associated with cell division, cell size, and biomass metrics. Principal Component Analysis (PCA) revealed that tetraploids exhibit the most favorable combination of traits, suggesting a vigorous and balanced expression of polyploid advantage. Beyond tetraploidy, many key parameters showed signs of downsizing with increasing ploidy levels, particularly in hexaploid and decosaploid genotypes. Moreover, improved storage capacity coincided with significantly higher LMA and a greater number per stomata. Collectively, inconsistent growth superiority reflects higher ploidy levels, suggesting that phenotypic expression in polyploids is influenced by the lower limit of cell size (stomatal length, stomatal width, and guard cell volume) and rate-limited attributes (leaf length, leaf width, leaf area, and petiole length). These patterns imply a trade-off: while moderate polyploidy (tetraploid) enhances morphological robustness, excessive polyploidy may incur growth penalties due to biophysical and nutrient constraints. Therefore, the current study highlights that benchmarking genome size/ploidy level for parental material selection is a crucial factor that may enhance cellular function and developmental efficiency, thereby maximizing leaf yield. Considering the inverse relationship between ploidy and growth performance, as well as biophysical and nutrient constraints, necessitates a deeper understanding of molecular mechanisms.

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sciforum-139249: Transcriptome analysis for identifying cold-responsive genes in black gram

Keesara Yashwanthi

Acharya N. G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh 522509, India

Black gram (*Vigna mungo* L.) is a vital pulse crop in India, but its rabi season cultivation is constrained by low-temperature stress, particularly during germination and early growth. Developing cold-tolerant genotypes is essential for ensuring stable productivity. This study utilizes transcriptome analysis through RNA sequencing (RNA-Seq) to identify differentially expressed genes (DEGs) associated with cold stress in contrasting genotypes. Leaf tissues from cold-treated and control plants were analyzed, revealing numerous DEGs. Key transcription factors like DREB, MYB, NAC, and WRKY, along with genes involved in antioxidant defense (peroxidases, superoxide dismutase), signal transduction (MAPK, calcium signaling), and osmoprotectant biosynthesis (proline, sugars), were significantly upregulated in the tolerant genotype. GO and KEGG analyses indicated the involvement of complex regulatory and metabolic pathways in cold response. Validation through qRT-PCR confirmed expression patterns of selected genes. These findings offer valuable insights for marker-assisted selection and genome editing, aiding in the development of cold-tolerant black gram varieties suited for rabi season cultivation.

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sciforum-128162: Vacuum Infiltration Enables Efficient Transient T-DNA Delivery in Oil Palm (*Elaeis guineensis*) Seedlings: A Pilot Study

Galuh Permatasari [1,*], Yuli Setiawati [1], Masna Sinta [1], Rizka Saptari [1], Annisa Aksa [1], Imron Riyadi [1], Hayati Minarsih [1], Ernayunita Ernayunita [1], Dini Sari [2] and Riza Putranto [1,3]

[1] Indonesian Oil Palm Research Institute (IOPRI), Jl Taman Kencana no.1 Bogor, 16128, Indonesia
[2] Indonesian Coffee and Cacao Research Institute (ICCRI), Jl. PB. Sudirman 90, Jember 68118, Indonesia
[3] Esa Unggul University, Jl. Arjuna Utara No.9, Duri Kepa, Kec. Kb. Jeruk, Kota Jakarta Barat, Daerah Khusus Ibukota Jakarta 11510, Indonesia

Stable genetic transformation, involving the incorporation of DNA or plasmids, is widely used to develop plant varieties with improved traits. However, transient transformation remains essential for evaluating genetic constructs prior to stable T-DNA integration. In oil palm (*Elaeis guineensis*), the transformation process faces challenges such as low insertion efficiency and limited callus availability, highlighting the need for rapid and scalable alternatives. In this pilot study, we evaluated vacuum infiltration as a method for transient T-DNA delivery using *Agrobacterium tumefaciens* strain C5C81 harboring the OST2-Cas9 construct in PPKS DxP 718 oil palm seedlings. Three incubation durations (1, 5, and 10 minutes) were tested under vacuum pressures of 100 and 200 mbar. Seeds were germinated for approximately 90 days until the first leaf emerged, after which they were surface sterilized and immersed in an *Agrobacterium*-plasmid buffer solution. Following infiltration, seedlings were replanted in sterile soil, incubated at 25 °C for 24 hours, and then transferred to a greenhouse. PCR analysis targeting *Cas9* and the *NPTII* marker at 1, 7, and 30 days post-infiltration (DPI) demonstrated a 100% detection rate of T-DNA. Histological analysis at 1 DPI revealed that infiltration at 100 mbar for 5 minutes significantly expanded multiple tissues, particularly vascular regions, indicating efficient infiltration and potential for molecular transport. These findings suggest that short-duration vacuum infiltration under low pressure can effectively mediate transient T-DNA delivery in oil palm seedlings, offering a promising tool for genetic research and transformation development in this species.

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

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