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11th Edition of Global Conference on

# Plant Science and Molecular Biology

&

6th Edition of Global Conference on

# Agriculture and Horticulture

**September 14-16, 2026**

**Rome, Italy**

**NH Villa Carpegna**

Via Pio IV, 6, 00165 Roma RM, Italy

11th Edition of Global Conference on

# PLANT SCIENCE AND MOLECULAR BIOLOGY

&

6th Edition of Global Conference on

# AGRICULTURE AND HORTICULTURE

HYBRID EVENT

14-16 SEPTEMBER 2026

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# Keynote Speakers

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Ataturk Horticultural Central Research Institute, Turkey

# Welcome Message


## Dachang Zhang

Water & Eco Crisis Foundation, United States


Dear colleagues, innovators, entrepreneurs, policymakers, and friends,

It is my great honor to welcome you to the 6th Global Conference on Agriculture and Horticulture (AGRI 2026), to be held in the vibrant city of Rome, Italy.

Continuing the theme "Frontiers and Advances in Agriculture and Horticultural Science," the conference encompasses a broad landscape: From agricultural and horticultural sciences to soil and water resource management, from philosophical and methodological advances to policy and technological innovation. By bringing together researchers, scholars, industry professionals, and policymakers, AGRI 2026 aims to foster multidimensional dialogue and strategic thinking toward new pathways for global agricultural and water-resource sustainability.

This year, the conference returns to Italy—a land whose brilliant achievements in philosophy, science, and engineering may date back thousands of years and had driven some of the most profound intellectual leaps in human civilization. From the rational inquiries of ancient thinkers to the transformative creativity of the Renaissance, Italy's great heritage reminds us that meaningful progress begins with the elevation of thought. In this spirit, AGRI 2026 invites us to adopt higher perspectives in re-envisioning the future of agriculture and horticulture, and to reshape our strategic vision for sustainable development through innovative, dimension-enhancing ideas.

Within this conceptual framework, I will introduce recent developments in Suitaiology, the strategic study of water situations, and briefly highlight our work on a distributed network of ultra-micro underground storage bodies—Granular Processing Units (GPUs) that offers new possibilities for groundwater situation modulation and regional resilience. Suitaiology seeks to transform destructive hydrological forces into sustainable resources, outlining a pathway from Disaster → Resource → Recovery → Resilience (DRRR).

May AGRI 2026 bring you valuable insights, productive collaborations, and renewed commitment to advancing the sustainable future of global agriculture and horticulture.

# Welcome Message


## Alexandra D. Solomou

Hellenic Agricultural Organization – DIMITRA, Institute of Mediterranean Forest Ecosystems, Greece


Dear Conference Attendees,

It is my great pleasure to welcome you to the 6th Edition of the Global Conference on Agriculture and Horticulture, AGRI 2026. AGRI 2026 provides an important opportunity for researchers, academics, professionals, and stakeholders from different parts of the world to exchange knowledge, present recent scientific advances, and discuss practical approaches related to agriculture, horticulture, biodiversity, sustainability, and the future of resilient agro-ecosystems. In a period marked by increasing environmental pressures, climate-related challenges, biodiversity loss, and the need for sustainable land management, scientific dialogue and international collaboration are more important than ever. Conferences such as AGRI 2026 contribute meaningfully to the exchange of ideas and to the development of solutions that can support both productive systems and environmental conservation. As a researcher working in the field of plant biodiversity and the conservation of Mediterranean and forest ecosystems, I am especially pleased to contribute to this scientific event and to share perspectives on the monitoring, threats, sustainable use, and conservation strategies for plant biodiversity in Greek forest ecosystems. I warmly welcome all participants and wish you a productive, inspiring, and successful conference.

# Welcome Message


## V P S Arora

Kumaun University, India


Distinguished delegates, eminent scientists, policymakers, industry leaders, academicians, researchers, and dear students,

It is with immense pleasure and great pride that we extend a warm and heartfelt welcome to all of you to the 6th Edition of the Global Conference on Agriculture and Horticulture (AGRI 2026). Your gracious presence from different parts of the world truly reflects our shared commitment to strengthening global food systems and fostering sustainable agricultural transformation.

Agriculture and horticulture today stand at a historic crossroads. From climate change and resource degradation to food and nutritional security, the challenges before us are complex and interlinked. At the same time, rapid advancements in biotechnology, precision farming, digital agriculture, protected cultivation, value chain integration, and sustainable practices are opening new pathways for resilience and prosperity.

This conference provides a vibrant platform for: sharing cutting-edge research and technological innovations; discussing policy frameworks and institutional reforms; promoting climate-smart and sustainable farming systems; encouraging entrepreneurship, agribusiness development, and value addition; and strengthening global partnerships and knowledge networks.

We are confident that the deliberations, technical sessions, panel discussions, and interactive engagements over the course of this conference will generate meaningful insights and actionable strategies for advancing agriculture and horticulture worldwide. Beyond the academic and professional exchanges, we hope this gathering fosters collaboration, mutual learning, and lasting friendships across nations and institutions.

We once again welcome you all and wish you a highly enriching, productive, and memorable conference. Thank you, and best wishes for a successful event.

# Welcome Message


## Usha R Palaniswamy

Maria College, United States


Dear Colleagues,

It is my pleasure to welcome you all to the 11th Edition of the Global Conference on Plant Science and Molecular Biology (GPMB 2026) in the historic city of Rome, Italy. This conference brings together leading experts, researchers, academicians, and industry professionals from around the world to share their knowledge, experiences, and future perspectives.

This event offers participants the opportunity to join in person or virtually, where the latest advancements, research, and strategies in plant science and molecular biology will be showcased.

The conference theme this year is "Global Perspectives on Plant Science: Innovation to Impact." Under this theme, let us explore innovative technologies, sustainable plant research, molecular mechanisms, crop improvement strategies, and solutions to global food security challenges.

As we address the evolving challenges in plant science and molecular biology, your active participation will play an important role in fostering meaningful discussions and collaborations. We encourage you to engage actively in our sessions designed to inspire knowledge exchange, further research, broaden horizons and create networking opportunities.

On behalf of the Organizing Committee, I extend my warm welcome and thank you for joining us at GPMB 2026 in Rome. Together, let us work towards advancing plant science and building a resilient future for global agriculture and food systems. I wish you a fruitful and inspiring conference.

# Welcome Message


## Jeremy Sweet

Sweet Environmental Consultants, United Kingdom


Dear Conference Attendees,

It is my pleasure to welcome you to the 11th Edition of the Global Conference on Plant Science and Molecular Biology (GPMB 2026) in the historic city of Rome, Italy. This event offers participants the opportunity to join in person or virtually, where the latest advancements, research, and strategies in plant science and molecular biology will be showcased.

During the conference, we will explore innovative technologies, sustainable plant research, molecular mechanisms, crop improvement strategies, and solutions to global food security challenges. GPMB 2026 brings together leading experts, researchers, academicians, and industry professionals from around the world to share their knowledge, experiences, and future perspectives.

As we address the evolving challenges in plant science and molecular biology, your active participation will play an important role in fostering meaningful discussions and collaborations. We encourage you to engage in our sessions designed to knowledge exchange and further research.

Thank you for joining us at GPMB 2026 in Rome. Together, let us work towards advancing plant science and building a resilient future for global agriculture and food systems. I wish you an inspiring conference.

# Welcome Message


## Edgar Omar Rueda Puente

Universidad de Sonora, Mexico


Dear Colleagues and Distinguished Guests,

I am deeply honored to extend a warm welcome to all participants attending the 6th Edition of the Global Conference on Agriculture and Horticulture (AGRI 2026), gathering here in the landmark city of Rome, Italy, as well as through our global virtual platform.

Today, the agricultural sector stands at a critical crossroads. This conference is designed as a strategic forum to address these challenges head-on by examining groundbreaking scientific discoveries, climate-resilient farming models, and technological innovations capable of transforming global food security. Our collective goal over the coming days is to bridge the gap between academic research and field-level solutions. AGRI 2026 represents a unique synergy of minds, uniting prominent scientists, academic leaders, and industry pioneers from diverse nations. The complexity of modern agricultural systems requires more than isolated efforts; it demands multidisciplinary cooperation. Therefore, your insights, debates, and active participation during these sessions are vital to unlocking new pathways for international collaboration and driving the future of agro-ecosystem sustainability.

I want to express my sincere gratitude to each of you for your dedication to this shared mission. May your time at AGRI 2026 be defined by enriching dialogues, meaningful professional connections, and a renewed commitment to building resilient and secure food systems for generations to come.

I wish you all a highly successful, collaborative, and inspiring experience.

# Welcome Message


## Vijayan Gurumurthy Iyer

Techno-Economic-Environmental Study and Check Consultancy Services, India


Dear Conference Attendees,

It is my pleasure to welcome you to the 6th Edition of the Global Conference on Agriculture and Horticulture (AGRI 2026) on September 14–16, 2026 as a hybrid event (in-person & online) in the city of Rome, Italy. The event will offer participants the unique opportunity to engage in person or virtually at this prestigious event, where the latest advancements, research and development, and strategies in agricultural and horticultural science and engineering will be showcased. During the event we will explore innovative treatments and practical approaches to tackling agricultural science and horticulture science and engineering and promoting quality and productivity for healthier sustainable lifestyles. This congress brings together leading experts, professors, researchers, engineers, scientists, and healthcare professionals from around the globe to share their knowledge, experiences, visions, missions and guiding principles for the future. As we navigate the complexities of agricultural science and engineering and horticulture, your active participation will be crucial in fostering meaningful discussions and collaborations for sustainable development. We encourage you to actively participate in the discussion during our sessions, which are designed to inspire further research and development. Thank you for joining us at the Conference in Rome, Italy. Together, let's pave the way towards a healthier future as the conference's purpose in tackling industry challenges like food security or climate resilience and change, driving impactful changes in the agricultural science and engineering and sustainable horticulture. I wish you a fruitful and inspiring conference!

# Welcome Message


## J C Tarafdar

ICAR-Central Arid Zone Research Institute, India


Dear Conference Attendees,

It is my pleasure to welcome you all for the upcoming excellent conference on Agriculture and Horticulture. We appreciate having you in attendance and look forward to working with you. Our agenda includes in three days covering entire aspects on Agriculture and Horticulture beginning from engineering, biotechnology, economics, safety, employment, nutrition, production, pollution, tourism, bioinformatics, metrology and environmental impact. In addition to the introductory keynote speakers, we have many sessions to understand your goals beside allow you to ask questions during each phase with discussions. This exchange may be a valuable tool in helping all of us to refine our views for advance research in future. This conference also helps all of us for new connections in our interested fields and discovering additional knowledge on our subject of interest. I wish you a fruitful and inspiring conference!

# Welcome Message


## Sadygova Madina Karipullovna

Vavilov University, Russian Federation


Dear Conference Attendees,

It is my pleasure to welcome you to the 6th Edition of the Global Conference on Agriculture and Horticulture (AGRI 2026). This event offers participants the opportunity to join in person or virtually, where the latest advancements, research, and strategies in agriculture and horticulture will be showcased. During the conference, we will explore innovative technologies, sustainable farming practices, crop improvement strategies, and solutions to global food security challenges.

Food security is defined as the state guaranteeing every citizen physical and economic access to safe food products necessary for a healthy life, regardless of external and internal factors. Food accessibility and health-preserving technologies are interrelated approaches aimed at providing the population with high-quality nutrition and improving quality of life. The development of the functional food market and the digitalization of nutrition management are key trends in this area. Health-preserving technologies based on nutritional science are interrelated approaches aimed at maintaining and improving public health and preventing disease through diet and lifestyle optimization. Agriculture is the foundation of any country's food security. Breeding plays a significant role in this process, as the quality of future raw materials is determined at this stage. Together with breeders from the Federal State Budgetary Scientific Institution "Federal Scientific Center of Southeast," we are developing comprehensive agro-food technologies based on modern breeding achievements, determining the designation of varieties based on their technological properties, and defining criteria for selecting raw materials for the production of products with specific properties for a specific population group. Therefore, it's not the quantity of varieties developed that matters, but their quality. I wish the forum fruitful work.

# Welcome Message


## Vasudeva Singh

CSIR - Central Food Technological Research Institute (CFTRI), India


Dear Delegates,

I have great pleasure in welcoming the keynote, invited, and oral speakers, poster presenters, and all the delegates of this conference, 6th Edition of Global Conference on Agriculture and Horticulture, which consists of 36 Technical Sessions. This event is conducted in one of the famous historic cities, Rome, Italy. In this conference, several topics are covered under Agriculture, Agronomy, Agriculture Farming Chemistry, Bio-technology of Agriculture, Horticulture and its number of sub-divisional topics, Food Science and Technology etc. As a speaker I will be talking on the Bio-fortification and Grain Technology in general and concentrating on Rice Technology in specific. It is an occasion for everyone to come in contact with different field experts. I am happy to welcome two speakers from USA, four from India and one from Greece. In this conference, a number of specialized speakers and experts come together and exchange their knowledge and views about various aspects, as informed above. This is a good platform to discuss the topics in depth and plan for collaborative projects, such that various scientists could visit different countries with respect to the exchange of knowledge and expertise. I wish for the good success of this great event for three days, with a good carry-home message by everyone in each faculty.

# Welcome Message


## Richard P. Dick

Ohio State University, United States


Welcome Conference Participants,

This conference provides a unique opportunity to present and discuss current innovations on Plant Science and Plant Biology with fundamental science and applied research focused on developing sustainable agricultural systems and addressing global food security. The diversity of disciplines and the wide global distribution of participants create a dynamic and synergistic environment that fosters collaboration, novelty, and the exchange of ideas across borders and fields of expertise.

We sincerely welcome you to Rome, Italy, for a productive and collaborative GPMB 2026 meeting. Having attended previous GPMB conferences, I am confident that the organizers of this international conference will successfully manage the logistics in a hospitable environment for this conference.

# Welcome Message


## Viktor Fedorovich Vashchenko

Yelets State University, Russian Federation


Dear conference participants!

This distinguished gathering is able to evaluate the contribution of innovations and their validity based on a wide range of observations in Plant Science and Plant Biology, in line with the fundamental conservative principles upon which successful agricultural productivity and food security are based. Production will be provided with the necessary signals for implementation in daily operations. Welcome to Rome, Italy, for a harmonious and productive meeting, for which the organizers of this international conference have carried out extensive and necessary preparatory work!

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# About Magnus Group

About

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

# About
# CPD Accreditation

About

Continuing Professional Development (CPD) credits are valuable for AGRI & GPMB 2026 attendees as they provide recognition and validation of their ongoing learning and professional development.

The number of CPD credits that can be earned is typically based on the number of sessions attended. You have an opportunity to avail 1 CPD credit for each hour of Attendance.

**Some benefits of CPD credits include:**

**Career advancement:** CPD credits demonstrate a commitment to ongoing learning and professional development, which can enhance one's reputation and increase chances of career advancement.

**Maintenance of professional credentials:** Many professions require a minimum number of CPD credits to maintain their certification or license.

**Increased knowledge:** Attending AGRI & GPMB 2026 and earning CPD credits can help attendees stay current with the latest developments and advancements in their field.

**Networking opportunities:** AGRI & GPMB Conference provide opportunities for attendees to network with peers and experts, expanding their professional network and building relationships with potential collaborators.

**Note:** Each conference attendee will receive 39+ CPD credits

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## KEYNOTE PRESENTATIONS


## Alexandra D. Solomou

Institute of Mediterranean Forest Ecosystems (IMFE), ELGO-DIMITRA, Terma Alkmanos, Ilisia, 11528 Athens, Greece


**Biography:** Dr. Alexandra Solomou is a Principal Researcher in Plant Biodiversity of Forest Ecosystems at Institute of Mediterranean Forest Ecosystems (IMFE), ELGO-DIMITRA. Solomou's interests are focused on the monitoring, evaluation, conservation and utilization of plant diversity in Mediterranean and Forest ecosystems. Solomou has published 75 articles in international peer reviewed journals and more than 60 article in National and International conferences. Also, Solomou has participated in 40 national and international research projects funded by various authorities/ organizations/ private companies (European Commission, Greece). Solomou is also a member of the National Committee of Protected Areas "NATURA 2000" and a National Focal Point of FAO organization for Biodiversity for Food and Agriculture.

# Monitoring, threats and conservation strategies for plant biodiversity in Greek forest ecosystems


This study examines the status, pressures and conservation prospects of plant biodiversity in representative Greek forest ecosystems, with an emphasis on mountainous regions. The aim is to assess the effectiveness of existing monitoring practices, identify the main threats and develop integrated conservation strategies through a comparative analysis of two case studies: Mt Oiti (Natura 2000 site) and Mt Parnassos (Natura 2000 site). Systematic vegetation sampling was carried out in selected representative plots, recording species presence and abundance with emphasis on endemic, rare and threatened taxa. The case studies on Mt Oiti and Mt Parnassos revealed a mosaic of high plant diversity but also intense, multifactorial pressures. On Mt Oiti, key threats include the gradual abandonment of traditional grazing, which favours forest encroachment at the expense of open habitats and species-rich grasslands, recurrent wildfires and climate change, which alter elevational distribution patterns and increase stress on sensitive habitat types. On Mt Parnassos, these are compounded by tourism and development pressures (ski resort, road network expansion, second homes), which intensify fragmentation, increase disturbance and degrade sensitive subalpine and forest ecosystems. Based on these findings, we propose targeted conservation strategies that combine strengthened monitoring, spatial planning and participatory governance. Priority actions include: establishment of permanent monitoring plots focusing on plant diversity and climate-sensitive taxa, development of biodiversity and habitat condition indicators to

be integrated into forest and protected-area management plans; regulation of the intensity and spatial allocation of human activities through zoning, biodiversity-friendly infrastructure design and stricter environmental permitting; and support for traditional, biodiversity-friendly land uses such as extensive grazing and close-to-nature silviculture. Particular emphasis is placed on linking scientific monitoring with management policies and local communities. We highlight the potential of citizen-science schemes and locally tailored environmental education programs to enhance awareness, data collection and acceptance of conservation measures. The study concludes that effective protection of plant biodiversity in Greek forests requires integrated, adaptive monitoring systems that combine ecological data, socio-economic parameters and climate-change projections. Mt Oiti and Mt Parnassos function as living laboratories, illustrating both challenges and opportunities for implementing innovative, evidence-based conservation strategies in Mediterranean mountain forest landscapes and providing valuable insights for national biodiversity policy.


## Ashanendu Mandal

Energy Expert and International Speaker, Former Chief General Manager, ONGC, India


**Biography:** Dr. Ashanendu Mandal is a distinguished chemical engineer, energy professional, and researcher with over 34 years of experience at Oil and Natural Gas Corporation (ONGC), India's premier national oil company. Mandal holds a Ph.D. in Chemical Engineering from the University of Calcutta and an M.Tech from the Indian Institute of Technology Kharagpur, and has also acquired an MBA in Finance from IGNOU New Delhi and an Advanced Management Program from the Indian Institute of Management Calcutta. Throughout the career, Mandal has worked extensively in offshore and onshore oil and gas operations, enhanced oil recovery (EOR), reservoir pressure maintenance, petroleum marketing, offshore safety, asset integrity management, and environmental sustainability, and has held several key technical and managerial roles within ONGC and received multiple merit awards and CMD group awards for these contributions. Mandal is also widely recognized for research on wastewater treatment and circular economy approaches, particularly the adsorptive removal of toxic phenol using low-cost biological and industrial waste materials as adsorbents, and has authored numerous international journal publications and delivered invited talks at major global conferences across Asia, Europe, Australia, the Middle East, South Africa and North America. In addition to these industrial achievements, Mandal has actively collaborated with leading academic institutions, served as session chair and panel moderator at international conferences, and contributed significantly to knowledge dissemination in the fields of petroleum engineering, chemical engineering, environmental management, and sustainable energy technologies, and is also a life member of the Indian Chemical Society and the Indian Science Congress.

# Application of solid waste materials for adsorptive removal of toxic phenol from wastewater to protect environment and also to generate circular economy


This research aims for adsorptive removal of phenol from wastewater by solid waste materials viz. guava tree bark, rice husk, neem leaves, activated carbon from coconut coir, rice husk ash, red mud, clarified sludge from basic oxygen furnace and activated alumina. The characterizations of the adsorbents are performed by SEM, XRD, FTIR and BET analyzers. The experiments of phenol removal are carried out in batch process with the variation of initial phenol concentration (5-500 mg/L), initial pH (2-12), adsorbent dose (0.10-20 gm/L), temperature (25-50°C) and contact time (30-600 min). The maximum phenol removal percentage was found with neem leaves used as adsorbent and it was 97.50%. The kinetics study shows that the pseudo-second order model is best fitted for all adsorbents except red mud. The kinetic modeling shows that the adsorption mechanism is supportive of film diffusion, intra-particle diffusion and chemisorption for all adsorbents. The isotherm

analysis suggests that Freundlich isotherm model is best supportive for guava tree bark, rice husk, neem leaves, activated carbon, red mud and activated alumina, whereas Langmuir and D-R isotherm are best supportive for rice husk ash and clarified sludge respectively. The thermodynamics shows the spontaneity, randomness and endothermic/exothermic nature of the adsorption processes. The ANN modelings using Levenberg-Marquardt and Scaled Conjugate Gradient algorithms establish that the experimental and predictive data are within allowable range. The studies of scale-up designs, the regeneration of adsorbents and the safe disposal of used adsorbents show that these adsorbents can be used for commercial applications. Further, the column study of phenol removal is also carried out using the most efficient batch adsorbent neem leaves. The research concludes that all these adsorbents can be used commercially for removal of toxic phenol from wastewater to ensure water recycling in industry. Further the prospective applications of used adsorbents in brick manufacturing can attract circular economy.


## Costantino Paciolla[1]*, Benedetta Bottiglione[1], Silvana De Leonardis[1], Francesco Paciolla[2]

[1]Department of Biosciences, Biotechnology and Environment, Università degli Studi di Bari Aldo Moro, Via Orabona 4, 70125 Bari, Italy

[2]Department of Soil, Plant and Food Sciences (DISSPA), University of Bari, Italy


**Biography:** Dr. Costantino Paciolla studied Biology at the Bari University Aldo Moro, Italia and graduated as MS in 1987. After two years of fellowship of Accademia Nazionale dei Lincei in Agricultural Genetics Studies, Paciolla obtained the position of permanent researcher and then of Associate Professor in Plant Physiology at the same institution. Paciolla's research concerns the study of the redox homeostasis in plant cells under biotic and abiotic stress and the influence of light on antioxidant activity and photomorphogenic growth in plants of food interest, with more than 75 research articles in journals with impact factors present in the Scopus database.

# Modulating plant physiology via LED lighting

Plant growth and development are significantly influenced by environmental factors, including light intensity and quality. In recent years, increasing attention has been given to the use of Light-Emitting Diodes (LEDs) in controlled environments, such as greenhouses. This technology allows the selection of specific light wavelengths and intensities, enabling the identification of “spectral recipes” that help plants to counteract various environmental stressors. In this study, the effects of different light spectra and intensity combinations on the fitness of several plant species under both optimal and stress conditions were evaluated. By monitoring biometric characteristics (root and shoot growth) together with parameters involved in redox homeostasis, including reactive oxygen species, lipid peroxidation, enzymatic and non-enzymatic antioxidant systems, and redox (thiol-disulfide) status of proteins, significant species-specific responses, were observed. The results highlight that LED light quality and quantity differentially modulate the considered biochemical and morphological parameters. Specifically, narrow-band blue and red LEDs affected plant metabolism and defence responses in a different way. Overall, blue light treatment led to lower germination rates, reduced visual quality, and lower biometric and biochemical parameters,

although in some species it positively influences enzymatic and non-enzymatic components such as ascorbic acid and phenols. Furthermore, the gathered data will be analyzed using the analysis of variance (ANOVA), to assess the individual and interactive effects of the lights source (red, blue, and white LEDs), their intensities, and the different species or cultivars considered. Further studies are needed to provide an in-depth analysis on how specific light conditions can strengthen the antioxidant machinery and induce anatomical modifications, ultimately improving crop productivity and stress resilience through sustainable agricultural practices.


## Dachang Zhang

Water & Eco Crisis Foundation, United States


**Biography:** Dr. Dachang Zhang received B.S. and M.S. degrees in Hydrogeology and Engineering Geology from the Changchun Institute of Geology and the Chinese Academy of Sciences in 1982 and 1985, respectively, and subsequently became a researcher at the Chinese Academy of Sciences. Zhang obtained a Ph.D. in Geography from the University of Vienna in 1996, during which significant contributions were made to a national water project in Austria. From 1997 to 2000, Dr. Zhang conducted postdoctoral research at the University of Waterloo, Canada. Zhang later worked as a geological and environmental consultant in Canada and the United States, and has been a Licensed Professional Geologist in the State of California since 2007. Between 2008 and 2014, Zhang served as Professor and Deputy Dean of the Academy for Bijie Experimental Region at the University of Bijie, China, where the work focused on water management and rural development in impoverished mountainous regions. In 2010, Dr. Zhang founded the Water & Eco Crisis Foundation (USA), and currently serves as President. Since 2012, Dr. Zhang and the research team have been developing a new water science framework, Suitaiology (Water-Situation Science). This framework was first officially introduced at the 1st Global Conference on Agriculture and Horticulture (AGRI 2021), and its research progress has been continuously presented at subsequent AGRI conferences.

# Suitaiology: A strategic science for reframing agricultural risks under climate extremes — From water-use efficiency to water-situation wisdom

Climate extremes are increasingly challenging agriculture and horticulture through droughts, floods, waterlogging, soil erosion, groundwater decline, crop stress, and ecological degradation. Although major progress has been made in crop breeding, irrigation technology, soil management, precision agriculture, and biotechnology, many agricultural systems remain vulnerable to compound climate risks. This suggests that some risks cannot be fully understood through single variables, single disciplines, or field-level technologies alone.

This presentation introduces recent progress in Suitaiology, or Water-Situation Science, as a strategic framework for reframing agricultural risks under climate extremes. Suitaiology does not seek to replace hydrology, irrigation science, soil-water research, or agricultural water management. Rather, it builds on these fields and asks a further question: in a water–soil–crop–ecology–engineering–society system, what is water becoming? Hydrology studies how water moves; Suitaiology asks whether water is becoming flood, erosion, and disaster, or soil water, groundwater, ecological support, and agricultural resource.

From this perspective, agricultural climate risk is not only a matter of too much or too little water. It may be better understood as a dynamic mismatch between water situations and agricultural systems. Floods are not only excessive water, but water entering agricultural systems with unfavorable timing, pathways, concentration, and energy. Droughts are not only present water scarcity, but may also reflect earlier failures to retain, infiltrate, store, and transform rainfall into useful water-resource situations. Agricultural resilience, therefore, begins before water reaches the field.

The presentation proposes a shift from water-use efficiency to water-situation wisdom. Water-use efficiency asks how available water can be used more efficiently. Water-situation wisdom further asks how water, before reaching the field, can be slowed, dispersed, infiltrated, stored, regulated, and transformed into resourceful, ecological, and resilience-supporting situations. By connecting agriculture, horticulture, soil, water, ecology, engineering, and management as dynamic systems, Suitaiology offers a cross-disciplinary perspective for climate adaptation and sustainable agricultural futures.

Keywords: Suitaiology, Water-Situation Science, Agricultural Resilience, Climate Extremes, Water-Use Efficiency, Water-Situation Wisdom, Precision Agriculture, Soil and Water Management, Horticulture.

Selenne Yuridia Márquez Guerrero[1], Manuel Fortis-Hernández[1], Pablo Preciado-Rangel[1], Betzabe E. López-Corona[2], Jesús Ortega García[2], Carmen Lizette Del Toro Sánchez[2], Jesús Sosa Castañeda[2], Susana Marlene Barrales Heredia[2], Edgar Omar Rueda Puente[2]*

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[2]Universidad de Sonora, Hermosillo, Sonora, México

**Biography:** Dr. Edgar O. Rueda Puente: Level 3 in the National System of Researchers in Mexico; knowledgeable about the needs of our American Continent, and absolutely consistent with the National Development Plan in the Mexican Republic (2017-2026); awarded with the degree Doctor Honoris Causa by the International Organization for Inclusion and Educational Quality (OIICE). Qualified to audit and implement institutional management systems, under the standards listed below; supported by the institution: which is accredited by the Mexican Accreditation Entity (EMA): ISO 9001:2015; ISO 14001:2015; ISO 21001:2018; ISO 50001; ec0217 Competence Standard - CONOCER. Member of the Intersecretarial Commission on Biosafety of Genetically Modified Organisms in Mexico. Founding Member of the World Seawater Organization (OMAR) and Scientific Committee, based in Madrid, Spain and Antioquia, Colombia.

# Agronomic engineering and human nutrition: The rise of functional medicine in global food sovereignty

Global food production faces the imperative challenge of ensuring plant-based supplies that meet sustainability, quality, and food safety standards. In this scenario, the agronomic engineer emerges as a strategic actor capable of transforming agri-food systems. However, economic pressures have historically diverted sustainability criteria, resulting in agriculture dependent on agrochemicals that compromises consumer health.

This phenomenon finds a parallel in conventional medicine, where the focus has shifted toward commercial interests over the patient's overall well-being. In response, a transformative alternative arises: the convergence of organic and sustainable agriculture with the principles of Functional Medicine and Human Nutrition.

The central proposal of this conference is to redefine the agricultural engineer as a public health agent who, by promoting food sovereignty and reducing pesticide use, directly impacts the creation of health from the ground up. Adopting an approach centered on the individual and the biological quality of food allows us to move from a model that cures diseases to one that generates vital well-being.

This presentation, delivered to the Global Scientific Community, integrates scientific evidence with the wisdom of Functional Medicine and is enriched by the vision of Dr. Beatriz Boullosa, a leading figure in nutrition in Mexico and President of the Mexican Federation of Sports Nutrition. By reorienting agricultural production toward nutritional excellence, we restore the human dimension to our technical and social work.

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# Markers of PM produced by biomass combustion and development of a sampling and analysis technique

Biomass combustion is a relevant source of atmospheric Particulate Matter (PM), contributing to the emission of inorganic species, organic micropollutants and specific molecular markers associated with the thermal degradation of lignocellulosic materials. Among these compounds, levoglucosan, together with its isomers mannosan and galactosan, is widely recognized as a suitable tracer for PM produced by biomass burning, since it originates from the combustion and pyrolysis of cellulose and hemicellulose.

However, the reliability of levoglucosan as a marker strongly depends on the sampling strategy adopted, particularly because of its semi-volatile behavior. This work focuses on the development and evaluation of a fixed-source sampling and analytical technique for the determination of total levoglucosan emitted during biomass combustion. The proposed approach combines an isokinetic sampling probe equipped with a quartz fiber filter, used to collect the particle-bound fraction, with a series of refrigerated impingers filled with Milli-Q

water, designed to trap the volatile fraction passing through the filter. The method was applied to combustion tests performed on two agricultural residual biomasses, rice straw and wheat straw, selected for their global availability and relevance as potential biofuels.

The results showed that a significant fraction of levoglucosan was not retained on the filter but was instead recovered in the impingers. In particular, the volatile fraction represented approximately 30–50% of the total levoglucosan emitted, demonstrating that filter-only sampling can lead to a substantial underestimation of biomass burning markers. Total levoglucosan emission factors ranged from 53.7 to 65.8 mg kg-1 fuel for rice straw and wheat straw, respectively. The backup impinger contained less than 5% of the levoglucosan recovered in the first two impingers, confirming the effectiveness of the sampling configuration. These findings highlight the importance of considering both particle-bound and volatile fractions when assessing PM markers from biomass combustion. The proposed technique represents a methodological improvement for fixed-source emission monitoring and may support a more accurate evaluation of the contribution of biomass combustion to air quality.

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# Production and characterization of hemp fiber-derived biochar for agricultural applications

Industrial hemp (Cannabis sativa L.) is increasingly recognized as a multipurpose crop due to its high biomass productivity and its suitability for fiber, seed, and bio-based material production. However, hemp fiber processing generates considerable amounts of lignocellulosic residues, mainly hurds, whose sustainable valorization remains a relevant challenge within circular bioeconomy strategies. Among the available conversion pathways, pyrolysis represents a promising approach, allowing the production of biochar, a carbon-rich material with potential applications as soil amendment. This study investigates the production and characterization of biochar derived from hemp fiber processing residues, with the aim of evaluating its suitability for agricultural applications. Raw hemp hurds were directly converted through a fixed-bed pyrolysis process performed at 550 °C under nitrogen atmosphere, without preliminary grinding or pelletization. The resulting biochar was characterized through proximate and ultimate analysis, pH determination, elemental and metal content analysis, thermogravimetric analysis, scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy, and phytotoxicity assessment through germination tests on corn (Zea mays L.) seeds. The pyrolysis process produced a solid fraction

of approximately 40.3%, together with gaseous and liquid by-products. The hemp-derived biochar showed a high carbon content, above 75%, an alkaline pH of 9.63, and low H/C and O/C molar ratios, indicating a stable and highly carbonized material. The presence of relevant macro- and micronutrients, particularly potassium, calcium, magnesium, iron, manganese, zinc, and boron, suggests potential agronomic value. Moreover, heavy metal concentrations were below regulatory limits, supporting the environmental compatibility of the material. SEM-EDS analysis revealed a compact but porous structure, with micropores comparable to those observed in woody biomass-derived biochars, potentially favorable for nutrient retention, water holding capacity, and interaction with soil microorganisms. Germination tests showed that low biochar concentrations did not exert phytotoxic effects, with germination index values above 90% at 0.5–1% biochar concentration. Conversely, higher concentrations resulted in reduced germination performance, indicating the need to optimize application rates and further evaluate possible pre-treatments. Overall, the results highlight the potential of hemp fiber-derived biochar as a sustainable soil amendment and demonstrate the feasibility of directly valorizing hemp processing residues through thermochemical conversion. These findings provide a useful basis for future agronomic trials focused on soil fertility, water retention, and crop response.


## Fabio Gresta

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**Biography:** Fabio Gresta is Full Professor of Agronomy and Field Crops at the University of Messina, coordinator of the BSc programme in Agricultural Sciences for Ecological Transition, and member of agroecology networks. Gresta's research focuses on sustainable Mediterranean cropping systems, grasslands and forage crops, legumes, crop diversification, rotations, cover crops, agroforestry, biological nitrogen fixation, and alternative crops. Gresta coordinates international PRIMA projects on sustainable greenhouse systems and the Mediterranean protein transition, integrating productivity, resilience, biodiversity, and agroecological sustainability. Gresta is Editor-in-Chief of Grasses and author or co-author of more than 200 scientific contributions.

# Agroecological practices and their effects on ecosystem services in sustainable Mediterranean cropping systems

Agroecological practices are increasingly recognized as key strategies to improve the sustainability, resilience, and ecological functioning of cropping systems. In the context of climate variability, soil degradation, biodiversity loss, and increasing pressure on natural resources, the integration of ecological principles into crop management can support productive agriculture while enhancing the delivery of multiple ecosystem services.

This presentation will discuss the role of selected agroecological practices, including cover cropping, intercropping, diversified crop rotations, reduced soil disturbance, organic amendments, and integrated nutrient and pest management. These practices can contribute to soil protection, carbon sequestration, nutrient cycling, water regulation, weed suppression, biodiversity conservation, and improved resilience to abiotic and biotic stresses. Cover crops, for instance, may reduce erosion, improve soil organic matter and microbial activity, enhance biological nitrogen fixation when legumes are included, and support weed control through soil cover and competition. Similarly, intercropping and diversified rotations can increase resource-use efficiency, interrupt pest and pathogen cycles, and improve system stability over time.

Particular attention will be given to the potential benefits and trade-offs associated with agroecological practices in sustainable cropping systems. Although these approaches

can reduce dependence on external inputs and improve ecosystem functioning, their effectiveness depends on species selection, pedoclimatic conditions, management intensity, water availability, and farmers' objectives. Therefore, agroecological transition should be considered as a context-specific and system-based process rather than the simple adoption of isolated techniques.

Overall, agroecological practices represent a promising pathway to reconcile crop productivity with environmental conservation. By enhancing ecosystem services and strengthening the resilience of agroecosystems, they can contribute to the development of more sustainable, low-input, and climate-adapted agricultural systems.


## J. C. Tarafdar

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**Biography:** Dr. J. C. Tarafdar did M. Sc. and Ph. D. degrees in Soil Science and Agricultural Chemistry from Indian Agricultural Research Institute, New Delhi and Post Doctorate from Institute of Agricultural Chemistry, Goettingen, Germany. Tarafdar has successfully developed biosynthesized nano-nutrients and nano-induced polysaccharide powder for agricultural use. Developed many new techniques now used in Soil Biology. Dr. Tarafdar published 405 research articles which include 48 book chapters, six books and four patents. Tarafdar has >14000 citations with 56 h-index. Tarafdar has been placed amongst the top 2% scientists, across all sciences in the world, by Stanford University, USA.

# Biogenic nanoparticles: Future for crop production

Nanoparticles (<100nm) made through plants and microorganisms to reduce respective precursor salts into eco-friendly nanomaterials is a green alternative to chemical fertilizers for crop production and plant protection. They often produced in cellular environment with the action of enzymes and phytochemicals to control size and shape at near-room temperature with very eco-friendly and cost-effective synthesis method. They may absorb through plant leaves or roots and fabricate variety of physiological, biochemical and molecular changes to plants resulted improvement in nutrient uptake and efficiency, increases tolerance to adverse environment and protect against pest and diseases. Large number experiments are conducted under field conditions throughout India with important cereals (maize, pearl millet, rice, wheat), legumes (clusterbean, gram, moth bean, mung bean), oilseeds (castor, groundnut, linseed, mustard) and vegetable crops (cabbage, cauliflower, potato, okra) with the biogenic nanoparticles under alluvial, arid, black and laterite soils. The results after two times foliar spray with biogenic nanomaterials represent 13-43% increase in cereal yield, 12-38% build-up of legume yield, 19-24% rise in oilseeds yield and 32-54% gain of vegetable yields over recommended doses of fertilizer. It also helps to increase soil carbon sequestration, beneficial enzyme activities and soil health index. It may assist to overcome soil moisture stress, salinity, temperature stress and UV-radiation besides help in to prevent pathogenic, viral, insect and nematode attack. It shows no adverse effect of any plants with the recommended doses of application. The results clearly indicate biogenic nanoparticles may be the future for higher crop production under any adverse situation and help to protect soil sustainability.


## Jeremy Sweet

Sweet Environmental Consultants, Cambridge, United Kingdom


**Biography:** Jeremy Sweet has spent the last 30 years conducting research on crop improvement and plant diseases. Much of this work was conducted at NIAB Cambridge studying sustainable crop production, integrated disease management, environmental and agronomic impacts of GM crops, and gene flow to crops and wild relatives. Sweet was coordinator of the UK BRIGHT project which studied herbicide tolerance, and also coordinator of the European Science Foundation programme "Assessing the Impact of GMOs" that brought together all the major research groups in this area in Europe. Sweet was a coordinator of the EU SIGMEA project analysing data on gene flow and gene impacts and was a participant in the EU CO-EXTRA programme and the BBSRC Gene flow project, and was work package leader in the GRACE EU project on Systematic Reviewing of the impacts of GM plants. Sweet was a member of the EFSA GMO Panel for 12 years until 2018, providing scientific opinions on the risks associated with GMO applications in the EU, and served as chairman of the Environmental, Post Market Environmental Monitoring and GM Fish Working Groups of the EFSA GMO Panel. Sweet is an author in over 50 scientific papers on GMOs, numerous plant pathology papers and of two books. Sweet developed a consultancy in 2004 and is director of Sweet Environmental Consultants which provides research and advice on GMOs and Plant Health to the European Commission, European governments, FAO/UNIDO/UNEP and scientific organisations and academies of several countries, and is currently involved in the EU COST Action, Diversicrop.

# Applications of RNA interference for crop protection

The use of RNAi to provide crop protection will be discussed. Double stranded RNA can be produced in transformed plants to target specific plant, pathogen or pest genes through host induced gene silencing (HIGS). In addition dsRNA produced in cultures and formulated can be applied externally to plants to silence genes in plants, pathogens or pests. Spray induced gene silencing (SIGS) can be enhanced by novel formulations to improve efficacy and reduce degradation of dsRNA in the environment.

Genetically modified plants expressing dsRNA are regulated under current EU GMO regulations. dsRNA can be very specifically targeted at genetic sequences in targets so that off-target effects are avoided or minimised. The recent increases in available genomic and transcriptomic sequence data allows the specific design of efficient and biosafe dsRNAs, minimizing the risk for off-target effects or silencing effects in non-target organisms. Regulatory systems for dsRNA applied as a pesticide have been developed in some countries (Australia, USA) and are under discussion in EU. Many of the biosafety considerations of HIGS and SIGS are similar but formulation also influences exposure and fate scenarios in SIGS.


## Jorge A. Zavala

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**Biography:** Full Professor of Biochemistry and Agricultural Zoology at the School of Agronomy, University of Buenos Aires and Principal researcher at CONICET, Dr. Zavala studied Agronomy at the University of Buenos Aires, Argentina and graduated as MS in 2000, received a PhD degree in 2004 and completed a two-year postdoc at the Max Planck Institute for Chemical Ecology, Jena, Germany. After a two-year postdoctoral fellowship at the University of Illinois at Urbana-Champaign supervised by Profs May Berenbaum and Evan DeLucia, USA, Zavala obtained the position of Associate Professor at the University of Buenos Aires, School of Agronomy, and has published more than 70 research articles in SCI (E) journals. Zavala is interested in plant defenses against insect attack, and how insects respond to plant defenses, using chemical, biochemical and ecological tools.

# Systemic defenses of soybean seeds within the plant and pods: The role of protease inhibitors against *Nezara viridula* (Hemiptera: Pentatomidae)

Soybean is the main oilseed cultivated in Argentina, constituting nearly half of the country's production. The stink bug complex is the main pest of this crop, among which the Southern Green Stink Bug (*Nezara viridula L.*) stands out. Leveraging the natural resistance of plants can be an important way to reduce insecticide applications. Among soybean's defenses are protease inhibitors (PIs), which deactivate digestive cysteine proteases in N. viridula's guts, and are induced in pods and seeds following herbivory, causing the deactivation of the digestive enzymes cysteine proteases of the bugs. While many studies have explored local defense responses to insect damage, less is known about systemic mechanisms that enhance resistance in undamaged seeds. Stink bug herbivory increased PIs activity in both attacked and unattacked seeds within the same pod and different plant strata. Soybean pods respond systemically to herbivory by synthesizing PIs, even in undamaged seeds. Preference choice experiments showed that N. viridula preferred to feed on unattacked seeds rather than on unattacked but systemically induced pods. The systemic response of soybean alters feeding preferences of N. viridula likely by affecting the activity of their gut proteases, highlighting the potential of PIs in pest management strategies.


## K. R. Aneja

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**Biography:** Prof. K.R. Aneja is the recipient of many awards and fellowships, the major ones including the Vidya-Vachaspati Award (D.Litt./D.Sc.) in March 2025 from Kashi Hindi Vidyapeeth, Varanasi, an Achievement Award, President of the Mycological Society of India (2013), Recorder of ISCA, the INSA-Royal Society Academic Exchange Fellowship, Best Citizens of India, Rashtriya Gaurav, the ISWA lecture award, Shiksha Rattan Samman, and the 2023 Unnat Bharat Shewa Shree Award. Aneja served as the Governor's/ Chancellor's nominee for Teacher's Selection at Punjabi University, Patiala, Member of the Research Advisory Committee of ICAR Weed Research Centre, Jabalpur, M.P., India, and Expert Member of the ICFRE, Dehradun, and obtained B.Sc., M.Sc. and PhD degrees from Kurukshetra University, Kurukshetra. Aneja served the Departments of Botany and Microbiology, Kurukshetra University for 34 years, joined the teaching faculty in the same institute and served as Professor and Chairman for 11 years, supervised 23 PhD scholars and over 35 papers, reviews and chapters and over 60 abstracts, attended over 50 national and international conferences, delivered keynote presentations, lead lectures and chaired several sessions and valedictory addresses, authored or co-authored 16 books, edited 5 books, wrote 2 manuals, and Proceedings of an International Conference published by international publishers (04) and national publishers (19). Aneja is an Honorary Professor and Research Advisor at the Sardar Bhagwan Singh University, Dehradun (Uttarakhand).

# Fungal diversity: Biotechnological exploitation in sustainable agriculture

Biodiversity, also called biological diversity, refers to the variety of life/ living organisms on our planet Earth, including plants, animals, fungi and tiny microorganisms, that keep our ecosystems healthy and resilient. Biodiversity study includes the identification, describing and naming species, including their useful properties, across all habitats around the world. What grows where? Knowledge about where to find particular species in nature must have been key to the survival of humans throughout our evolution. Professor Alexandre Antonelll of Royal Botanic Gardens, Kew in 2023 stated", that to date, we have not been able to answer one of the most fundamental questions in plant and fungal diversity with confidence- namely, how many species are there globally and in different parts of the world?

Fungi, the eukaryotic heterotrophs, occur as uni-to multicellular filamentous microscopic- to macroscopic organisms, across a board range of habitats- within soil or organic materials, in water, on rock, or on living and dead trees, including extreme environments, growing via absorptive nutrition. These elusive organisms, vital in ecosystem functioning, first appeared

around 1.3 billion years ago, are currently considered as the 2nd largest kingdom of eukaryotes after animals. Global fungal diversity is estimated ranging between 2.5 million and 3.8 million with only 1,60,000 species described so far, meaning that the vast majority are still undiscovered. Annually, mycologists describe under 3000 new fungal species and it would take 750-1000 years to fully describe the world' fungi at the current rate.

Fungi are amazing organisms with the potential to be exploited biotechnologically in over 50 ways. For sustainable agriculture, (mycoremediation), controlling weeds (mycoherbicides) and soil borne pathogens (mycofungicides) and growth promoting hormones in enhancing crops production.

Fungi, because of their ability to produce extracellular enzymes can degrade/ decompose crop and forest residues, and has the potential to be exploited in reducing organic matter, conserving precious resources and reducing the generation of waste and greenhouse gas emissions, referred to as "circular economy". The adoption of 3Rs-reduce, reuse and recycle, strategy is highly significant to support sustainability efforts in agriculture, reduce pollution and support biodiversity. Two notable examples are: in situ compost production from parali using Trichoderma- based organo-decomposer; and Pusa decomposer, a consortium of eight fungi, developed by Pusa Institute (IARI), New Delhi, that helps paddy straw into compost within 20 days.

There are over 10000 fungi known to cause diseases on plants- crops, vegetables, weeds, fruit and forest trees. Some of these diseases had been suicidal resulting in complete crop failures. Phytopathogenic fungal diversity is being microorganisms- based formulations for managing notorious weeds, and preferred over synthetic herbicides due to their potential health risks to humans, environment, plants, animals and pollinators. Over 23 mycoherbicides, mainly based upon the fungus Colletotrichum, a hemibiotrophic pathogen, has been developed globally.

Several fungi are known to act as effective biocontrol agents (BCAs) against phytopathogenic fungi. Trichoderma spp. have been developed commercially as fungicides to control fusaria (wilts), *Rhizoctonia, Sclerotium* (root rots) and *Pythium* (damping off), as alternatives to synthetic fungicides. Trichoderma control plant pathogens via mycoparasitism, antagonism, competition or plant defence system induction. Most of the Trichoderma formulations are based upon *T. harzianum*, a soil borne saprophytic ascomycetous fungus, and are being used in several countries, including India for sustainable agriculture.

In this presentation, the emphasis will be on what is biodiversity? Current status of fungal diversity, various ways of exploiting fungi industrially, especially in bioremediation of crop residues, and controlling weeds through mycoherbicides, and soil borne fungal diseases through mycofungicides.


## Kasiviswanathan Muthukumarappan

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**Biography:** Dr. Muthukumarappan is a distinguished professor in the Agricultural and Biosystems Engineering Department at South Dakota State University, and has led multiple research projects and advised students in academic and research activities. Muthukumarappan's research emphasizes food and bioprocessing standards development, resulting in over 200 peer-reviewed publications and 350 presentations. Muthukumarappan has revised three American Society of Agricultural and Biological Engineers (ASABE) standards, participated on various committees, and held leadership roles within the Food and Process Engineering Institute (FPEI), and has received numerous awards for contributions to research and education in food and bioprocess engineering at both national and international levels.

# Current status of precision agriculture in the USA

Precision agriculture has become an important component of modern farming in the United States, supporting more efficient, productive, and sustainable agricultural systems. Technologies such as Global Navigation Satellite Systems, geographic information systems, yield monitoring, variable-rate application, remote sensing, unmanned aerial vehicles, automated machinery, and digital decision-support tools are increasingly used to understand field variability and improve farm management.

The level of adoption varies across regions, farm sizes, crop types, and production systems. Large-scale farms and producers of major field crops have generally adopted precision technologies more rapidly, while smaller farms continue to face challenges related to high investment costs, technical complexity, limited rural broadband access, and inadequate availability of trained personnel. Additional concerns include data ownership, cybersecurity, equipment compatibility, maintenance requirements, and the reliability of digital tools under diverse farming conditions.

Recent developments in artificial intelligence, machine learning, robotics, satellite imagery, real-time sensors, and autonomous equipment are further expanding the capabilities of precision agriculture. These technologies can help optimize the use of seed, fertilizer,

pesticides, water, fuel, and labor while reducing production costs and environmental impacts. However, their long-term value depends on affordability, ease of use, reliability, and measurable benefits at the farm level.

The continued growth of precision agriculture in the United States will require cooperation among farmers, researchers, extension agencies, government institutions, equipment manufacturers, and technology providers. Improved connectivity, practical training, farmer-centered research, and accessible technologies will be essential for wider adoption. Precision agriculture therefore represents a major transition toward data-driven, site-specific, and sustainable agricultural management.

**Keywords:** Precision Agriculture, United States, Smart Farming, Variable-Rate Technology, Remote Sensing, Artificial Intelligence, Farm Automation, Digital Agriculture, Sustainable Agriculture.


## Krishan Kant Tyagi

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**Biography:** After retirement, he served as an International Statistics Consultant with the Food and Agriculture Organization (FAO) from June to July 2015 and subsequently worked as a Consultant with ICAR-IASRI from October 2015 to September 2017. He specializes in conducting pilot and large-scale sample surveys, including field-level data collection in the agricultural sector, with particular expertise in agricultural mechanization. He has 37 years of experience in research and teaching and has taught Sampling Techniques, Survey Sampling, and Statistical Methods to M.Sc. and Ph.D. students. He has also been actively involved in planning and organizing national and international training programmes, coordinating activities in the Division of Sample Surveys, and undertaking research, training, extension, and related professional responsibilities. He has published 65 research papers and has received several honours and recognitions for his contributions. Based on his valuable contributions to teaching at the Indian Agricultural Research Institute (IARI), Pusa, New Delhi, he was nominated by the Dean, P.G. School, IARI, for the Best Teacher Award in Agricultural Statistics in 1998, 1999, and 2000. He also received an appreciation letter from Dr. S. Ayyappan, Acting DDG (Engineering), ICAR, for his contributions to the project entitled "Study Relating to Formulating Long-Term Mechanization Strategy for Each Agro-Climatic Zone/State," funded by the Department of Agriculture and Cooperation, Ministry of Agriculture and Farmers Welfare, Government of India. In addition, he served as the Director General, ICAR's nominee for Departmental Promotion Committee (DPC) meetings concerning the promotion of Agricultural Research Service (ARS) Scientists in Agricultural Statistics at various ICAR institutes.

# Adequacy of the sample sizes at different stages of sampling for estimation of area, yield and production of food grain crops in India

India is a very big agrarian country divided into 28 States and 08 Union Territories (UTs are administered by the President through an Administrator appointed by him/her). Its geographical area is around 329 million hectares. These comprise of approx 800 Districts and a total of approximately 0.639 to 0.667 Villages (639,902 to roughly 667,000 revenue and administrative units). Approximately 62.4% of India's population lives in rural areas in 2026, with the remaining 37.65 residing in urban areas. This equates to roughly 921 million people living in rural villages and countryside communities out of a total national population of over 1.47 billion.

There are good number of food grain crops and non-food grain crops grown during the entire Agricultural Year (01 July to 30 June of subsequent year). An Agriculture Year is divided broadly into three seasons, namely Kharif (July-October), Rabi (November-April), Summer (May-June). For effective planning concerning arranging feeding the vast human population and livestock population, the estimation of total production of food grains and non-food grains is of paramount importance. In India, the estimation of yield rates of food grain crops is done on the basis of Crop Cutting Experiments (CCEs) conducted in majority of States/UTs under the National Programme of Crop Estimation Survey (CES). At district level, the sampling design adopted usually is stratified multi-stage random sampling. Presently, around ninety-five per cent of the total food grains production is estimated on the basis of yield rates obtained from these CCEs conducted on scientific basis spread over various States/UTs. India conducts approximately 1.3 billion (1,300,000) CCEs (of different sizes and shapes – square, rectangular, circular, triangular, etc.) nation-wide across various districts annually. The utilization of these estimates is essential for State-level production data and operationalizing programme like Pradhan Mantri Fasal Bima Yojna (PMFBY) crop insurance scheme.

These CCEs are conducted covering around 52 food crops and 16 non-food crops. Rice, Wheat, Millets, pulses, sugarcane, oilseeds, and Cotton are the 7 major crops. The main purpose is to measure actual crop yield per plot and calculate precise estimates of agricultural production. The conduct of such a large number of CCEs had been in question since long. Accordingly, a high powered committee constituted by Ministry of Agriculture & Farmers Welfare (MoAFW), Government of India (GoI), has recommended for reducing the sample sizes at different stages of sampling, which is highly being criticized and debated.

In India, the Directorate of Economics and Statistics (DES) under Department of Agriculture & Cooperation (DAC), MoAFW, GoI, releases estimates of area, yield and production of main food grain crops, fibers and important commercial and horticulture crops. These crops together account for nearly eighty-seven per cent of the total output of agriculture. The estimates of crop production are obtained by multiplying area estimates by corresponding yield estimates. Therefore, the estimates of area and yield rates assume immense importance in the entire gamut of agricultural statistics.

The need for timely, reliable and comprehensive statistics on area, yield and production of crops assumes special significance in view of the vital role played by the agriculture sector in the Indian Economy. The primary responsibility for collection of statistics of land use and area under crops following prescribed procedures rests with the various State Departments. The yield rates of principal crops are estimated through General Crop Estimation Survey (GCES) conducted by State agencies following scientific techniques of random sampling.

Field Operations Division (FOD) of the National Sample Survey Office (NSSO) under the Ministry of Statistics and Programme Implementation (MoSPI), GoI has the overall responsibility for providing technical guidance to States/UTs in developing suitable survey techniques for obtaining reliable estimates, assistance in training of field staff and exercising supervision. Under the Improvement of Crop Statistics (ICS) Scheme which was taken up during 1973-74 with the objective of locating, through the joint efforts of NSSO and State Governments, the deficiencies in the system of crop statistics by exercising technical supervision over the primary field work and suggesting remedial measures for improving the system. To achieve

this, sample checks on area enumeration, and area aggregation are carried out in a sample of about 10,000 villages in each season and on conduct of around 31,000 CCEs during an agricultural year.

Data pertaining to CCEs for different crops, having smaller sample sizes, pertaining to good number of States under ICS scheme obtained from NSSO was statistically analysed. Estimates of average yield pertaining to various food grain crops along with estimates of their percentage standard errors were worked out. It was observed that estimates of average yield for the two major crops viz. wheat and paddy have been obtained with suitable degree of precision, however, for minor crops like maize, barley, jowar, ragi etc., these were obtained with higher percentage standard errors. Sample sizes at the primary stage of sampling i.e. Villages have been worked out for estimation of average yield of different crops for different levels of margin of errors.

Data pertaining to area for different crops pertaining to different districts (20 survey numbers in a village) of some States under ICS scheme were obtained from NSSO and analysed. Estimates of total area under different crops were obtained with estimates of very high percentage standard errors. However, these have also been worked out, had the sample size would have been increased from 20 survey numbers to 100 survey numbers. In that case, the percentage standard errors decreased significantly for number of crops.

The broader conclusion of this study was that on the basis of smaller sample sizes, the estimates of average yields of two major crops i.e. paddy and wheat may be estimated with suitable degree of precision, in those States in which these crops are being grown as major crop. However, for other crops, these sample sizes may not be adequate for estimating the average yields of these crops with suitable degree of precision. For estimating these with permissible margin of errors, the sample sizes for these crops would have to be increased suitably.


## L. P. Troshin

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**Biography:** Leonid Petrovich Troshin is a Professor at the Department of Viticulture at Kuban State Agrarian University (KubSAU), a plant breeder, Doctor of Biological Sciences, and Academician of the Russian Academy of Natural Sciences, having published 865 scientific works, including 26 books and 40 brochures, and holding 66 patents and 65 inventor's certificates. Under Troshin's supervision, 12 PhD theses have been successfully defended.

# A look into the new era of viticulture

The article examines the specifics of viticulture as a part of crop production during the period from the Neolithic subsistence economy to the emerging digital era of crop production.

Digitalization with elements of artificial intelligence in viticulture can significantly improve the efficiency of the industry. Smart vineyards with digital technologies for monitoring and managing cultivation processes are becoming increasingly popular.

Agroecological mapping of vineyards and allocation of micro-terroirs is carried out using unmanned aerial vehicles to determine, based on "computer vision", the moisture content, the state of plants, the presence of pests-causes of diseases in the fields, etc. This allows for the application of differentiated agricultural techniques, modeling the accumulation of sugars, acidity, and phenolic composition of berries, managing irrigation and plant nutrition, and mechanization and automation of all technological processes in the field without human intervention.

Digitalization replaces intuitive vineyard management with scientifically based, predictive models of programmable yields, methods of creating precise vineyards. Currently, some form of precision agriculture technology is used on 15-40% of large farms in the United States, 20% of farms in Australia and Canada, 85% of farms in Scotland, 43% of farms in Ireland, and 30% of farms in Germany, as well as 68% of small farms in Western Europe.

Australian winemakers are considered to be leaders in the use of "precision" vineyards. Here, increased yields and quality of grapes are achieved with minimal environmental impact and risks by measuring local differences in factors affecting the yield and quality of grapes (soil,

topography, microclimate, vine condition, etc.) and applying appropriate viticulture methods (trellis design, pruning, fertilization, irrigation, harvest timing, etc.).

In California (USA), artificial intelligence was used for the first time in a vineyard. Sensors and cameras on the bushes capture indicators of the vine's condition in real time and transmit them to the research center for analysis using artificial intelligence.

In Burgundy and Bordeaux (France), large chateaux are implementing precision viticulture systems: They install networks of soil and weather sensors, use drones for monitoring, and train algorithms to understand the intricacies of their terrains.

New technologies include vertical farming and hydroponic technologies, which are the most promising for use in urban environments.

In the digital era, the demand for grape-based products is becoming increasingly important. Currently, wine is the primary product derived from grapes. However, current dietary trends are leading to a decrease in alcohol consumption, which will impact the future use of grapes. In addition, research is currently being conducted on the use of plants, and then plant cultivation, in space (the space era of plant cultivation is opening), which opens up new prospects for viticulture as well.

**Keywords:** Plant Cultivation, Viticulture, Digitalization, Precision Viticulture, Smart Vineyards.


## Madhusudan H. Fulekar*, Ashita Rai

Research and Development Cell, Parul University, Gujarat, India


**Biography:** Sr. Prof. M H Fulekar, recognized among the Top 2% Scientists (Rank- 38,162 globally across all fields) in the World by Stanford University and Elsevier (2020 to 2025), is an internationally renowned environmentalist with over 40+ years of teaching and research experience in environmental science, climate change, environmental bio- and nanotechnology. Fulekar has served in key academic leadership roles including Professor & Head (Life Sciences) at the University of Mumbai, Dean and Director (Environment and Sustainable Development) at Central University of Gujarat, and is currently Senior Professor and Research Advisor- Environmental Sciences at Parul University. Fulekar has guided 32 PhD and 22 MPhil scholars, authored over 350 peer-reviewed publications, 400+ NCBI accessions, 17 books and more than 55 book chapters, with an impressive h-index of 48, i-10 index of 120 and 9128 citations. Fulekar also holds 7 patents, reflecting a strong commitment to innovation and applied environmental research. Fulekar has visited for International Assignments to various countries: Australia, Singapore, Bangkok, Hong Kong, Nepal, Dubai, USA etc.

# Climate change green house gas ($CO_2$) impact - Agriculture crop production: Quality improvement

Climate change is a challenge to the environmentalist in developing abetment strategies to achieve sustainable development goal. United Nations framework convention on climate change and Kyoto protocol have acknowledge the climate change in impediments and counter measured promoting the preservation of ecosystem and impacts on global environment. The greenhouse gases: carbon dioxide, methane, nitrous oxide and fluorinated gases has impact on global warming potential to comply with the IPCC recommendation carbon dioxide has been selected for mitigation using rhizosphere a green technology.

In the present investigation climate change chamber has been developed where in the carbon dioxide simulation above atmospheric concentration, humidity, temperature, aeration, specific ultraviolet light has been provided for operation and developed atomization mode. The design of plant growth chamber- patented (design number- 409271-001 dated 01/03/2024). The pot culture technique has been adapted for the growth of selected plants Sorghum bicolor, Eleusine coracana, Triticum aestivum, Hordeum vulgare in developed Rhizospheric soil (1:3, Mycorrhiza: alluvial soil) the plant growth under control of environmental condition continued up to 60 days with growth period 15,30,45 and 60 days. The biochemical

parameters and carbon sequestration studied during this period. The rhizosphere technology has been found effective for the mitigation of greenhouse gases under controlled environment. This technology can be transfer from lab to land and industry for mitigation of climate change.

**Keywords:** Rhizosphere Technology, Greenhouse Gases, Plant Biochemical Parameters, CO2 Mitigation.


## Nedyalka Valcheva

Vocational High School 'Prof. Dr. Asen Zlatarov', town Dimitrovgrad, Haskovo District, Bulgaria


**Biography:** 1990 - Master's degree program of 'Technology of vegetable, food and flavor products' in University of Food Technologies, town Plovdiv, Bulgaria. From 1990 to 2016 - Teacher at the Vocational High School of Chemical and Food Technologies 'Prof. Asen Zlatarov', PhD., town Dimitrovgrad, Bulgaria. 2014 - The dissertation on 'Microflora of healing and spring waters in the Haskovo and Stara Zagora regions' at University of Food Technologies, town Plovdiv with a Ph.D degree. Since 2016 - Senior expert, organizer in Department of Biochemistry, Microbiology and Physics in Trakia University, town Stara Zagora, Bulgaria. 2023 - The dissertation on 'Physical, chemical, and microbiological characteristics of mineral, mountain, and spring waters from Bulgaria, and biological properties of identified microorganisms' at Institute of Cryobiology and Food Technologies, Agricultural Academy, town Sofia, Bulgaria with a DSc. 2024 - Teacher at the Vocational High School 'Prof. Asen Zlatarov', PhD., town Dimitrovgrad, Bulgaria.

# Characterization of isolated strains of microorganisms from mineral, mountain and spring waters from France, Italy, England, South Korea, Japan, Netherlands, Austria, Spain, Singapore, Germany, Switzerland, Greece, Turkey, Dubai and Bulgaria

The aim of the present work is to isolate, identify and investigate the species of bacteria from healing, mountain and spring waters in the area of Paris, France, Rome, Italy, London, England, Busan, South Korea, Tokyo, Japan, Amsterdam, Holland, Vienna and in Bulgaria. 127 bacterial strains were isolated and their colonial and morphological characteristics were determined and the study strains were identified. The data show that the isolated 9 strains from the hypothermal healing spring waters in the Paris area, France were identified as N. Valcheva - *Lisinibacillus pakistanensis, Serratia marcescens* (four strains), *Staphylococcus hominis*, *Staphylococcus haemoliticus, Bacillus pumilus* and *Bacillus cereus*. The isolated strains from thermal healing springs in Saturnia, Tuscany region and Fontana di Trevi in Rome, Italy were identified as N. Valcheva - *Tiobacillus ferrooxidans*, *Staphylococcus cohnii,* from a hypothermal spring in the London area as N. Valcheva - *Aeromonas caviae*, *Pseudomonas chlororaphis,* from a mountain spring in the area of Busan, South Korea, was identified as N. Valcheva - *Bacillus safensis*, *Staphylococcus cohnii, Pseudomonas chlororaphis*, *Staphylococcus cohnii.* From a mountain geothermal spring in the area of Tokyo, Japan, strains were identified as N. Valcheva - *Bacillus safensis, Phellodendron chinense, Aeromonas caviae, Pseudomonas japonica.* The strains identified in the Amsterdam, Netherlands area were identified as N.Valcheva & A.Atanasova -

*Aeromonas viridans*, N.Valcheva & V.P.Panteleev - P. japonica, N.Valcheva & V.V. Panteleev - *Aeromonas salmonicida*, N.Valcheva & A.V. Panteleev - *Aeromonas caviae*, N.Valcheva & L.A.V. Panteleeva - Phellodendrom chinense. Sulfur bacteria of the species N. Valcheva - Chlorobium chlorochromatii were identified from the healing springs in the region of Baden and Vienna, Austria. The strains from Bulgaria were identified from 100 hypothermal, thermal and common springs from 11 regions and belong to the following 14 genera: N. Valcheva - *Bacillus, Brevibacillus, Geobacillus, Aeromonas, Klebsiella, Pseudomonas, Staphylococcus, Stenotrophomonas, Serratia, Nocardia, Trichosporon, Azoarens, Lisinbacillus, Rhodococci.* From the hypothermal salt source in Barcelona, in the area to the Mediterranean Sea, 29 species of organisms were identified N.Valcheva & St.Mihailov - *Pseudomonas shengduensis,* N.Valcheva & V.Marinova - *Bacillus cereus* (3 strains), N.Valcheva & I.D.Valchev - *Shevanella algae* (3 strains), N.Valcheva & D.I.Valchev - Acinetobacter quillouiae, N. Valcheva & N.I.Valcheva - Pseudomonas pseudoalcaligenes, N.Valcheva & I.I.Valcheva - Pseudomonas korensis, N.Valcheva & P.N.Valcheva - *Delftia acidovorans* (2 strains), N.Valcheva & M.P.Pantelev - Citrobacter frendii, N. Valcheva & M.I.Panteleeva - *Pseudomonas rhodesiae,* N.Valcheva & D.Eschkenazy - Pseudomonas chloraphis, N. Valcheva & H.Eschkenazy - *Pseudomonas korecusis*, N.Valcheva - M.Eschkenazy - Pseudomonas chlororaphis, N. Valcheva & G.Dimov - Strenotrophomonas sp., N.Valcheva & M.Naneva - Pseudomonas rhodesiae, N.Valcheva & N.Nanev - *Enterobacter ludwigii,* N. Valcheva & St.Stratiev - Aeromonas caviae (2 strains), N.Valcheva & P. Panteleev - Aeromonas mediae, N.Valcheva & E.Todorovska - Providencia retgerri, N.Valcheva - A.Stoyanova - Myroides odoratiminus, N.Valcheva & R.Moneva - Alcaligenes faecalis. N.Valcheva - Bacillus safensis is the only test that shows a significant reduction in the number of cells by 50% compared to cells in lung cancer A549. Concentration from 100 µg/mL. Metabolomic profiling of crude extracts from N.Valcheva - Bacillus safensis, isolated from a source in Tokyo and a source in Busan, South Korea, near the spring of South China Sea, reveals the presence of known antibacterial and/or anticancer agents such as licorin, angustin, krinamidin, Vaccinol and poulin. N. Valcheva - Acinetobacter guillouiae (born in Barcelona) degradates plasma. With probiotic action from N.Valcheva - *Bacillus subtilis* and N. Valcheva - *Bacillus methylotrophius (*Bulgaria). N.Valcheva & I.I.Valcheva - *Pseudomonas korensis* is used for vaccination. The identified strains from a source in the Singapore area are: N.Valcheva - *Aeromonas caviae, Klebsiella oxytoca, Kurthia gibsoni, Roatella ornithinolitica, Kurthia gibsonii, Pseudomonas aeruginosa, Citrobacter cloacae, Klebsiella pneumoniae, Alcaligens fecalis, Aeromonas veronii, Serratia marcescens, Enterobacter hormchei, Enterobacter cloacae, Citrobacter frendii, Debaromyces hansenii, Pseudomonas putida, Pseudomonas* sp.. The identified strains from a spring in the Berlin, Germany area are: N.Valcheva - Klebsiella, pneumoniae, N.Valcheva & A. Dechev, N.Valcheva & T. Bazaitova Serratia liquafaciens, N.Valcheva - *Aerococcus oxytoca*, *Buttiauxella gaviniae*, *Debaromyces hansenii*. All isolated strains have enzyme, anti-fungal and antibacterial activity. Remediation is used to extract valuable metals or remove metals that are harmful to organisms. All strains have different biological activity. The difference in the type of strains identified can be explained by the influence of the composition of the water, the type of soil and rocks through which it passes, the temperature, the pH of the environment and the different geographical location.


## Rajnish Khanna

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**Biography:** Rajnish Khanna, M.Sc., Ph.D., is a photobiologist and entrepreneur focused on nutrition, health, and sustainable practices, serving as a Senior Investigator at the Carnegie Institution for Science at Stanford University, founder and CEO of the agricultural technology company i-Cultiver, and co-founder and Executive Director of the Urban Green Project, and holding a position as adjunct faculty in biology at Contra Costa Community College. Khanna leads research and development in agriculture, focusing on product efficacy trials and sustainable growing practices, and emphasizes bridging the gap between academic agricultural research and its practical application for farmers. Khanna obtained a Ph.D. in Biological Sciences (Plant Molecular Biology) from Purdue University, applies photobiology to explore the science of consciousness, developed a testable Theory of Spatial Relativity, and is the host of the TerreScience podcast and YouTube channel focused on soil and planetary health.

# Beyond yield: Redefining plant science for human and planetary health

Plant science has been historically centered on maximizing crop yield, the field must now evolve to address complex challenges such as soil degradation, climate change, nutritional insecurity, and health. The role of plant science must expand to support farmers, enable sustainable innovation, and contribute to advances in medicine. Central to this shift is a deeper understanding of the mode of action of fertilizers and plant inputs. By elucidating how these nutrients or stimulants interact with plant physiological, molecular, and microbial processes, plant science can guide the development of efficient fertilizer strategies that enhance nutrient use efficiency, reduce environmental losses, and improve crop resilience.

Such knowledge empowers farmers with science-based solutions that optimize productivity while minimizing costs and ecological impacts. In parallel, advances in plant biology and systems science are driving the development of new sustainable agricultural products, including biofertilizers, biostimulants, and nature-based crop protection tools. These innovations leverage plant–microbe interactions and intrinsic plant defense mechanisms, aligning agricultural practices with planetary boundaries and long-term ecosystem health. Beyond agriculture, plant science is increasingly recognized as a powerful contributor to medical and pharmaceuticalinnovation. Plants serve as sources of bioactive compounds,

therapeutic molecules, and metabolic pathways that inform drug discovery, nutraceutical development, and preventive health strategies. Plant research is relatively more affordable and provides access to genetic and molecular tools that are unmatched in other fields. By connecting fertilizer mode of action  studies, farmer-centered sustainability, product innovation, and medical advancement, this redefined vision positions plant science as a cornerstone of resilient food systems and global health. Moving beyond yield, plant science can simultaneously nourish crops, ecosystems, and human societies in a rapidly changing world. i-Cultiver is a new research focused organization, cultivating novel relationships between industry and academia. Some of our recently published and unpublished work will be presented to show how the future of plant science holds these promises, beyond yield.

Richard Dick[1]*, Zhiping Liu[2], Nicola Lorenz[1], Layne N. Connolly[3], Keyvan Maleki[3], Kristin L. Mercer[3]

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[3]Department of Horticulture and Crop Science, The Ohio State University, Columbus, OH 43220, United States

**Biography:** Richard Dick is an Ohio Eminent Scholar and Endowed Professor of Soil Microbial Ecology at Ohio State University, with research focused on microbial communities in controlling biogeochemical processes and delivering ecosystem services for agricultural and environmental applications; the research program discovered enzyme assays that are sensitive soil health indicators. Dr. Dick has authored 164+ journal articles, 17 invited book chapters, and 2 books as the editor-in-chief, was elected as President and Fellow for the Soil Science Society of America (SSSA), served as editor for several journals, worked as an agronomist for 3 years in Bangladesh, and has led research and development projects for over 20 years in West Africa.

# A novel plant–nifH-gene microbial alliance in aerial roots of Mexican maize landraces to significantly reduce nitrogen fertilizer

Modern and globally grown Zea Mays L. (maize) cultivars require large amounts of nitrogen (N) fertilizer that is costly for farmers, has high energy requirements, and can have detrimental environmental impacts. A novel solution was recently identified in maize landraces from Oaxaca, Mexico. These accensions excrete mucilage in aerial roots, providing ideal habitat for bacteria that fix significant amounts of atmospheric N2. However, little information is available on biological nitrogen fixation (BNF) rates and microbial community composition on aerial roots of these landrace and modern maize accessions. Therefore, the objective was to determine the impact of these cultivars on the diversity of the total bacterial community and the diazotrophic bacterial communities; and BNF of the mucilage of aerial roots. The second objective was to compare rhizosphere soil with mucilage for diversity of total and diazotrophic bacterial communities. The field experiment at Columbus/Ohio, USA was a completely randomized block design that had seven treatments (four replications) that included wild type, Mexican landrace, and modern maize accessions. Bulk soil and rhizosphere soil were collected in June 2024 at the maize V6 growth stage, with mucilage and aerial root collection occurring from August 2 to September 15, 2024. Bacterial community and diazotrophic bacterial diversity in soil and mucilage were determined by high-throughput sequencing of 16S rRNA and cs respectively; and BNF measured in mucilage using a $_{15}N_2$ incubation method. NifH sequencing showed that microbial diversity and amplicon sequence variants (ASVs) were significantly higher in mucilage of heirloom and improved accessions compared to wild and landrace maize types. Furthermore, the community structure of nifH-harboring bacteria significantly differed among various maize accessions, with Pantoea being closely associated with N and BNF in mucilage, while *Skermanella* was solely related to BNF. The

microbial diversity of nifH-harboring bacteria was generally higher in rhizosphere soil – with Mexican landrace maize from the lowlands showing the highest diversity – compared to mucilage and bulk soil. The similarities and differences of N2-fixing bacterial communities in maize mucilage and soil are apparent but the mechanisms related to the genetic diversity of maize varieties in controlling mucilage habit to optimize N2 fixation need further investigation.


## Sadygova[1]* M.K., Magomedov[2] G.O., Tugush[1] A.R., Marinina[1] E.A.

[1]Saratov State University of Genetics, Biotechnology and Engineering named after N.I. Vavilov, Russia

[2]Voronezh State University of Engineering Technologies, Russia


**Biography:** Madina Sadygova graduated from the K.A. Timiryazev Moscow Agricultural Academy in 1987. Sadygova completed professional retraining at Kemerovo State University, specializing in Bread, Confectionery, and Pasta Technology. Doctoral studies – Federal State Budgetary Educational Institution of Higher Education Voronezh State University of Engineering Technologies, 2010-2013, defense of doctoral dissertation on the topic: 'Scientific and practical foundations of the technology of bakery and flour confectionery products using flour from chickpea seeds of Saratov selection'. Through academic mobility, Sadygova teaches at the Almaty Technological University in the discipline 'Technology of specialized flour products'. The results of Sadygova's research and teaching work are published in print and electronic publications of various levels (collections of international and Russian scientific conferences; journals of the Higher Attestation Commission of the Russian Federation and the Scopus database). Sadygova continuously improves professional skills by participating in conferences of various levels.

# End-to-end agro-food technologies based on raw materials bred in Saratov

End-to-end agro-food technologies mean cultivating raw materials with specific properties, optimal for the production of specific products, which, in turn, are targeted at a specific consumer category.

In the 'field-to-fork' chain, the 'breeding' system, where the quality of raw materials is determined, is unfairly overlooked. Breeding a variety isn't enough; it's important to determine its intended purpose. However, the potential of varieties isn't fully realized in production conditions. Therefore, our concept is to develop formulas and technologies for functional products based on modern bioresources bred in Saratov. End-to-end agricultural and food technologies are being developed based on modern advances in plant breeding. Varieties are being designated based on their technological properties, and criteria for selecting raw materials for the production of products with specific properties for a specific population are being defined. The result of this development is the determination of the technological purpose of crop varieties and the scientific and economic justification for the placement of crops capable of producing high-quality raw materials.

In a closed production cycle, the 'field-to-counter' principle is expanded to 'selection-to-field-to-counter', i.e. the main quality of the raw material, laid down by selection with a predetermined technological purpose, is taken into account, and not the actual quality of the raw material, which does not meet the requirements of the technological process. The paper presents the results of our research, developed recipes and product technologies.


## Stefania Toscano

Department of Veterinary Science, University of Messina, Italy


**Biography:** Stefania Toscano obtained a PhD in Crop Productivity from the University of Catania in 2012. Since January 2023, Toscano has been Associate Professor of Horticulture and Floriculture at the University of Messina. In 2022, Toscano was a Visiting Researcher at CEBAS-CSIC, collaborating with the research group of Dr. Sánchez-Blanco M.J. Toscano's research focuses on physiological, morphological, and biochemical responses of horticultural and ornamental plants to abiotic stress, functional quality, biodiversity conservation, and product innovation. Toscano is Topic Board Member and Guest Editor for several international journals and author or co-author of more than 100 scientific contributions.

# Innovative tools for enhancing stress resilience in Mediterranean horticulture

Mediterranean horticulture is increasingly exposed to the pressures of climate change, particularly due to intensified water scarcity and stricter environmental constraints on production. In this context, adopting innovative and sustainable production strategies is essential to ensure crop productivity while reducing resource use and limiting environmental impacts.

Recent research on horticultural systems has focused on enhancing resource-use efficiency and strengthening crop resilience under Mediterranean conditions. Special emphasis has been placed on water-saving technologies and advanced irrigation management practices aimed at improving water use efficiency and mitigating drought-related stress. Precision irrigation, sensor-based monitoring, and optimized irrigation scheduling have emerged as key tools for adapting production systems to increasingly arid environments.

In parallel, plant biostimulants have gained considerable attention as promising solutions for mitigating the effects of abiotic stress and reducing reliance on mineral fertilizers and plant protection products. Their use can support sustainable crop management while maintaining productivity under challenging environmental conditions typical of Mediterranean regions.

Another relevant area of innovation is the development of alternative growing media for soilless cultivation systems. Compost-based substrates derived from organic residues represent a sustainable option for partially replacing conventional materials such as coconut coir and perlite. These renewable substrates contribute to reducing the environmental impacts associated with raw material extraction and transport while promoting the valorization of local organic resources within a circular economy framework.

The integration of water-saving technologies, bio-based inputs, renewable substrates, and precision management practices represents a strategic approach for developing more resilient and resource-efficient horticultural systems. These integrated solutions are particularly relevant in Mediterranean environments, where the sustainable management of water, nutrients, and organic resources is crucial for the future of horticultural production.

Experimental results obtained from trials conducted on different Mediterranean crops will be presented, providing evidence of the effectiveness of these approaches. The findings highlight the synergistic benefits of integrated strategies for improving resource-use efficiency, enhancing crop performance under abiotic stress, and reducing environmental impacts, thus confirming their potential for the sustainable intensification of horticultural systems in Mediterranean areas.


## Usha R Palaniswamy

Maria College, Albany, NY, United States


**Biography:** Dr. Usha Palaniswamy holds a PhD in Plant Science (University of Connecticut, USA), MBA (Webster University, USA) and MEd in educational administration (M.K. University, India). Palaniswamy's academic career includes positions as Faculty of Allied Health and Asian American Studies, and in academic higher administration as the dean and associate dean. Palaniswamy served as a Project Manager at the World Vegetable Center in Taiwan and implemented school gardens in six countries in Asia and Africa, and is a recipient of several teaching, research and volunteer service awards. Palaniswamy is a Technical Advisory Committee member of Prem Nath Agricultural Science Foundation (PNASF) and serves on the PhD Board of Examiners of several Universities in India, has authored four books and published over 55 research articles and several book chapters and review articles, and is the Editor-in-Chief of the Journal of Herbs, Spices and Medicinal Plants (Taylor and Francis, USA).

# Teaching food and nutrition security as a critical concern in higher education capstone

The 2026 edition of The State of Food Security and Nutrition in the World reported that any improvements made on reducing global hunger are fragile, unevenly distributed and insufficient to achieve the Sustainable Development Goals by 2030. The report also examined the cost of healthy diets as a major constraint to achieving dietary quality and nutrition outcomes. A healthy diet should be made affordable and an easy choice to all equally. Global food and nutrition security is affected by climate and non-climate factors. The United Nations' (UN) 2030 Agenda emphasizes the role of education in creating awareness to combat climate change effects “mitigation, adaptation, impact reduction and early warning.” Education is key to creating awareness and cultivating critical thinking skills in students, irrespective of age or class level. Along these lines, the capstone course at Maria College, founded in 1958 by the Sisters of Mercy, focuses on the “need for sustainability of life, supporting both a lifestyle and legislation that acknowledge everyone's right to water and the need to address climate change.” The Earth is one of the five critical concerns of the Sisters of Mercy, while education is among the ways to address the critical concerns. The capstone course connects and demonstrates the interdependencies of the Sustainable Development Goals (SDGs) and connect with the five critical concerns of the Sisters of Mercy: Earth, Women, Violence, Racism and immigration. The assignments in this course familiarize students with the current challenges of food systems at a global level. The students are challenged to analyze the relationships between achieving “zero hunger” and the other SDGs.


## Usha R. Palaniswamy

Maria College, Albany, NY, United States


**Biography:** Dr. Usha Palaniswamy holds a PhD in Plant Science (University of Connecticut, USA), MBA (Webster University, USA) and MEd in educational administration (M.K. University, India). Palaniswamy's career spans academic and administrative roles, project management at the World Vegetable Center in Taiwan, and implementing school gardens across Asia and Africa, and includes multiple teaching, research, and volunteer service awards. Palaniswamy serves as Technical Advisory Committee member of Prem Nath Agricultural Science Foundation and on PhD examination boards at Indian universities. Scholarly contributions include four authored books, over 55 research articles, book chapters, and reviews, and the position of Editor-in-Chief for the Journal of Herbs, Spices and Medicinal Plants published by Taylor and Francis.

# Future foods: Traditions, trends and enabling technologies for impact

With growing urbanization, digital literacy and information technology extending to one and all globally, there is heightened awareness of food provenance and nutritional consciousness. This trend has motivated functional value-based consumption while safeguarding planetary health and looking back at traditions. Innovative technologies enable evolving trends for scaling up and increasing impact. Largely, consumer acceptance of engineered “plant based” meat, genetically modified and fortified foods emerge as a critical factor in driving these innovations. There is an emphasis on the need for a transformative approach to food production, incorporating innovative technologies and sustainable practices to ensure food and nutrition security. On one side, dietary guidelines continue to change proposing models, sources and portions for daily consumption for a healthy body and mind; on the other side, with greater scientific clarity of the biological processes, populations diversifying back and forth between the traditional, mainstream and novel food and practices; the trends are enabled by innovations in technologies for impact. Large shifts in country-specific diets may be needed to achieve food production systems climate targets and nutritional adequacy with specific eating patterns that consider both health and sustainability parameters.


## V P S Arora

Former Vice Chancellor, Kumaun University, Uttarakhand, India and Retired Professor, G B Pant University of Agriculture & Technology, Pantnagar, India


**Biography:** Professor Emeritus (Dr). V.P.S. Arora, AERA (Agricultural Economics Research Association) Fellow, is a distinguished academician renowned for extensive contributions to agricultural economics, agribusiness management, and project management. An alumnus of G B Pant University of Agriculture and Technology in Pantnagar, Arora dedicated over three decades to the institution as a faculty member and academic administrator, playing a pivotal role in its academic growth. Dr. Arora made history as the founding Dean of the College of Agribusiness Management—the first of its kind under the ICAR-SAU system—marking a significant milestone in agricultural education. Over a career spanning 49 years, Arora has enriched both national and international academic institutions. Leadership as Vice Chancellor at Kumaun University and Shri Venkateshwara University in Uttar Pradesh was instrumental in fostering academic innovation and enhancing university governance. On the international stage, Dr. Arora has been a key figure in agriculture, project management, and consulting, lending expertise to prestigious international organizations such as APO, IRRI, OECD, FAO, and ADB. As a dedicated mentor, Arora has supervised 24 PhD scholars and contributed significantly to research through numerous projects and publications. Leadership in various professional societies further cements Arora's legacy in the fields of agricultural economics, agricultural marketing, project management, and agribusiness management. Dr. Arora's remarkable achievements have been recognized with numerous awards and honours, including Dr. Rajendra Prasad Award, Lifetime Achievement Awards (2009 and 2020), the Uttarakhand Ratan Award (2011), the Higher Education Leadership Award (2016), and Outstanding Alumnus Awards from both Pantnagar University (2020) and the College of Agriculture (2019), in addition to several Best Paper Awards. Arora has also served as Conference President of the Indian Society of Agricultural Marketing (2010) and the Agricultural Economics Research Association (2013).

# Advances in Indian agriculture and horticulture

Indian agriculture has undergone remarkable transformation since independence, evolving from a food-deficit system to a globally significant agricultural economy. The Green Revolution marked the first major breakthrough, introducing high-yielding varieties, chemical fertilizers, irrigation expansion, and mechanization, which substantially increased foodgrain production and ensured national food security. In recent decades, advances have extended beyond cereals to include horticulture, dairy, fisheries, and livestock sectors, making India one of the world's leading producers of milk, fruits, vegetables, pulses, and spices.

Technological innovations such as precision farming, biotechnology, improved seed systems, protected cultivation, micro-irrigation, farm mechanization, and digital agriculture platforms have enhanced productivity, resource-use efficiency, and market integration. Government initiatives including PM-KISAN, PMFBY, e-NAM, Soil Health Card Scheme, National Food Security Mission, and the promotion of Farmer Producer Organizations (FPOs) have strengthened institutional and policy support systems. The expansion of agricultural research, extension reforms, climate-resilient agriculture, and sustainable practices such as organic farming and natural farming have further contributed to diversification and resilience.

Despite these advances, challenges persist in the form of small landholdings, climate variability, water stress, price volatility, and regional disparities. The future of Indian agriculture lies in sustainable intensification, value addition, digital transformation, supply chain modernization, and enhanced farmer income strategies aligned with SDGs and climate commitments. Overall, advances in Indian agriculture reflect a shift from subsistence orientation to a technology-driven, market-linked, and sustainability-focused growth trajectory.


## Vashchenko V. F.

Institute of Environmental Problems in Metallurgy, Lipetsk, Russia


**Biography:** Vashchenko Victor Fedorovich earned a master's degree at the Moscow Institute of Agriculture and was a doctoral candidate at Yelets State University, holding the position of associate professor, and has published over 75 scientific articles in journals and two monographs in Europe and the Russian Federation.

# Adaptive organogenesis and compensatory yield structure

During ontogenesis, a plant is forced to adapt to its environment through a sequence of organogenesis, perceiving environmental cues. Deterministic, sequential morphological traits are quantitatively dependent on the environment. The most variable productivity elements are easily adjusted, and during agrobiological diagnostics based on developmental phases, they correspond to yield forecasts. Breeding selects the most conservative morphological and biochemical traits associated with yield.

The transformation of molecules under the influence of secondary metabolism controls the implementation of the program of organogenesis-environment matching and is part of the adaptive and productive potential. As long-standing science and practice have shown, the hormones stimulating organogenesis initiation are balanced, and the corresponding physiological activity is ensured in accordance with the type of weather conditions and the regional climate. Soil type, soil, and agricultural practices have a greater influence on crop yield. These factors correspond to productivity elements in the crop yield structure, which have an order of initiation of stem, branch, and seed growth. Compensation exists, governed by apical alternate dominance in cereals or simultaneous dominance in rapeseed. These elements compensate for each other both in the stem and in the ear and cluster. The most stable element is seed weight. The most variable is the number of stems, branches, and seeds per ear and cluster.

The transformation of molecules under the influence of secondary metabolism, which controls the implementation of the program of correspondence between organogenesis and the environment, which constitutes the adaptive and productive potential. As long-term practice has shown, there is a stimulation of the balance of hormones initiating organogenesis and the corresponding physiological activity in accordance with the type of weather conditions of the region's climate, above the type of soil, soil cultivation and various agricultural practices influencing crop yield. n the yield structure, these correspond to productivity elements with a sequence of growth initiation and compensation, governed by alternate apical dominance in cereals or simultaneous dominance in rapeseed. They have the ability to compensate for each other both in the stem and in the ear and cluster. The most stable element is seed weight. The most variable is the number of stems, branches, and the number of seeds per ear and cluster.

Hormones control the division programs of initial cells and organogenesis in the apex. New developmental programs undergo successive (for cereals) and simultaneous (for rapeseed) apical dominance, or, depending on the dominance of stimulating or inhibitory hormones in the initial cell of the apex. The organogenesis of productive elements depends on the duration of dominance and regulates the duration of the phase and the number of productive elements in accordance with air temperature, precipitation, and nitrogen supply. This signal distributes nutrient flows within the plant. Hormones communicate with the environment through the emergence of dominance status in the initial cell of the primary and secondary meristems. According to scientific and practical evidence, weather factors account for 90% of the variability in yield.

The balance of stimulators is influenced by nitrogen availability and fertilization, as well as all environmental factors and agricultural practices. The duration of the formation phases of each productive element and the combination of optimal average daily air temperature and precipitation over the ten-day periods of the largest crop productivity element determine the yield and serve as an adaptive characteristic for crop placement based on the crop's commercial potential, as well as the basis for crop cultivation and maintenance technologies. This applies to grains, oilseeds, and similar horticultural and vegetable crops.

This growth and development pattern allows for quantitative adaptation to the environment. Stimulating the number of stems in grain crops by inhibiting the dominance of the main apex reduces yield due to a decrease in grain weight. Thousand-grain weight is an integrated indicator of many factors. The structure of biological yield is a prognostic and diagnostic factor in adaptive crop production. Thus, adaptive crop production focuses on realizing the adaptive potential of adapting to climate, weather, and genetic determination of crops and varieties, environmental factors, and agricultural practices. Regulation of adaptive pathways in the metabolism of initial cells and secondary meristems, transfer, and initiation of organogenesis. In the initial cell, there is a balance and dominance of hormones, activation of enzymes via regulatory pathways, using numerous transport and regulatory pathways, perception, transport, and fermentation, and transformation of molecules into functional roles.

The initial cell exhibits a balance of hormonal dominance. The spectrum of adaptive responses is as follows: alfalfa is lodged in the forest-steppe zone, while it is orthotropic in the steppe zone. The difference lies in the dominance of the stimulant ethylene in the former case and auxin in the latter. Adaptive crop placement and agrobiological timing of agricultural interventions are designed to coincide with the environmental influence on the formation of stems, branches, ears, pods, and seeds within them. Apex initiation is stimulated by a balance of stimulating and inhibiting hormones. The sequence and quantity of productivity elements correlate well with yield elements; there is also an optimal climatic productivity in terms of magnitude and compensation between them. Organogenesis is realized through adaptive mechanisms depending on external conditions.


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**Biography:** After retiring from CSIR-CFTRI as Chief Scientist during 2013, worked as an Emeritus Medical Scientist (ICMR) at University of Mysore and served as a Professor, under DBT sponsored Food Science Project, Gauhati University, Gauhati, Assam till April, 2021. Published ~ 85 research papers, inventor of several food technology processes, one Patent was commercialized to 30 industries. Handled several National & International projects. Guided 90-95 B.Tech, M.Tech, M.Sc Food Technology, Food Science and Nutrition, students for their Dissertation and Investigation problems and produced 8 Ph.D candidates, including an INSA Fellow; African UNU Fellows. Faculty member and Course Co-ordinator of M.Sc Food Technology, HRD courses of CFTRI. Recipient of several awards, delivered several invited lectures, innumerable oral lectures, and presented 70-80 posters at National & International level. Serving Food Safety Standards Authority of India, New Delhi, at different capacities. Also served as a member of Research Advisory Committee, ICAR-Central Institute of Post Harvest Engg and Technology, (CIPHET) Ludhiana, Punjab. Life Time Achievement Awardee from the ACCTI, Dehradun; SSDAT, UAS, Raichur, Karnataka, India.

# Bio-fortification and processing of grains in general and rice processing in specific

Bio-fortification involves increasing the nutritional value of crops during plant growth stage. Food fortification involves improving the nutritional content of specific food during processing stage. Various techniques of bio-fortification and some of the examples will be discussed. Benefits of bio-fortification will be conveyed. Importance of hidden hunger will be touched upon. As on 2025, world produces around 3000 Million Tons (MT) of cereals and India produces around 330 MT. 90% of the production includes wheat ~ 800 MT, India produces ~ 115 MT. Paddy rice production in the world is ~ 800 MT, India produces around 170 MT. Coarse grain production in India is ~ 50 MT, maize production in the world is ~ 1250 MT, Bharat produces around 28 MT. Pulse production in the world is ~ 100 MT and our country produces ~ 25-27 MT. Out of 170 MT of paddy rice, ~ 10% goes for the production of rice products viz. expanded, popped and flaked rice. Balance of ~ 80 MT of paddy rice goes for the production of raw rice and balance for the production of parboiled rice. Reason for rice braking, method of production of parboiled rice, quality of rice varieties and products of rice will be discussed. Medicinal rice and its importance in day to day life will be focussed. Rice germ separation and its important properties will also be presented.

## Vijayan Gurumurthy Iyer

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Dictionary of International Biography, 2012, 2000 Intellectuals of the 21st Century, 2011; Great Minds of the 21st Century, 2012; Enlistee in Marquis Who's Who LLC in Asia, 2007, 1st Edition; Who's Who in Asia, 2012, 2nd Ed; Who's Who in Science and Engineering -2016-2017, 12th Ed; Who's Who in Science and Engineering -2011-2012, 11th Ed; Who's Who in the World- 2016, 33rd Ed; -2015, 33nd Ed; -2014, 31st Ed; -2013, 30th Ed; -2012, 29th Ed; -2011, 28th Ed.; -2010, 27th Ed.; -2009, 26th Ed; -2008, 25th Ed, 2023. Who was Who in America 1985-Present. Registered Valuer Plant and Machineries; Competent Person under Factories Act, Registered Engineer Grade-I/ Licensed Surveyor Class-I Greater Chennai Corporation, Chartered Public Administrator (AIPA), Chartered Engineer, Licensed Surveyor, Arbitration Engineer, Professional Engineer. International Society of Development and Sustainability; International Society for Krishna Consciousness, ISKCON, Vrindavan. American Assn. for the Advancement of Science, Indian Society for Technical Education; Aeronautical Society of India; Bioinformatics Institute of India; Mining Engineers' Association of India; Assn. of Scientists, Developers and Faculties. Indian Society for Training and Development; Fellow: Institution of Engineers, India; Institution of Valuers, India; Textile Assn, India; AIMA Assn, International Society for Research and Dev., Bioinfo ACS Society.

# Seed-cotton (or kapas) agricultural pollution and environmental health impact assessment

This paper discusses. The health impacts of projects, plans, programs, policies, or legislative actions should be considered in the planning and decision-making process. Because of these concerns, an Environmental Health Impact Assessment (EHIA) process is proposed. The most of the significant terms are “environmental health inventory,” “environmental health impact assessment (EHIA)” and “environmental health impact statement”. Public health deals with the control of water and air pollution, soil-hazardous waste management, resource protection, and soil and ground water remediation. The significant legislative action is EHIA process and Environmental Quality (EQ) that included for the physical-chemical, biological, (natural or biophysical environment) and cultural, and socioeconomic environments (nan-made environment). Environmental Health Impact Assessment (EHIA) process for public health plants and Psychological Impact Assessment (PIA) process are discussed. The environmental health impacts of agricultural cotton ginning projects, plans, programs, policies, and legislative actions should be considered in the decision-making process Because of the importance of these concerns, particularly post COVID-19 world, an Environmental Health Impact Assessment (EHIA) is proposed. For certain types of projects such as agricultural engineering machinery plants, it may be necessary to address psychological impacts on nearby residents as environmental and social effects change mental health. This paper realizes the hazards of chromium contamination and pollution caused in the use of Chrome Composite Leather-Clad (CCLC) rollers commonly used in cotton roller ginning industries and attempts to eliminate the chromium contamination and pollution during this Environmental Impact Assessment (EIA) process. The cotton roller ginning process is the mechanical separation of cotton fibres from their seeds by means of one or more rollers to which fibres adhere while the seeds are impeded and struck off or pulled loose. Most of the cotton ginning operations are done using roller gins. The CCLC roller coverings contain about 18,000 to 30,000 mg/kg (ppm) as total chromium of trivalent and hexavalent forms which are toxic to human health. When the seed-cotton is ginned, due to the persistent rubbing of CCLC rollers

over the fixed knives, the cotton and its products get contaminated with the total chromium of trivalent and hexavalent forms. Gin mill workers are exposed to the cotton dust and chromium pollution and are susceptible to health hazards such as premature death, cancer, byssinosis, and ulcers in cotton ginning air environment since toxic effects are produced by prolonged contact with airborne or solid or liquid chromium compounds even in small quantities. Noise pollution of agricultural ginning machinery in seed-cotton ginning mills has been found out to be 102-103 dB(A) decibel levels. To offset this problem, pollution-free Rubberized Cotton Fabric (RCF) eco-friendly rollers for both the laboratory and commercial studies have been designed, fabricated and used in experiments in rollers gins. This nullifies chromium contamination and pollution during the complete process. Cotton technological parameters are well proven for commercial acceptance.

The traditional view of viewing an organization is by surveying the vertical dimension by keeping eye of an organization chart. However, work gets done (or fails to get done) horizontally or cross functionally, not hierarchically. A process focus is continuous improvement efforts and a sequence of activities that is intended to achieve result. A function focus is vertical dimension and events intended to achieve some desired result. In the seven years of continuous improvement, quality and productivity in agriculture for cotton ginning plants have improved and defects per 100 plants were decreased and is concerned with the processes. TQM aims to ensure excellence in quantity and quality as per PDCA (Plan-Do-Check-Act) and SDCA (Standardize-Do-Check-Act) cycles in individuals and organizational management levels through the continuous improvement of processes, products and services. The TQM components encompass quality planning, quality control, quality improvement, employee participation, and quality management system practices. The TQM ensures quality in the end products or service. The agriculture cotton ginning plants have improved as it integrates quality in its operations and processes for long term success. It reduces defects and eliminates process waste. TQM improves agriculture cotton ginning plants. The future trends in TQM in agriculture cotton ginning plants have improved organizations involve the adoption of quality management practices with quality focus on planning and decision-making process and integration of TQM that involves the adoption of quality management practices with a focus on data-driven decision making and the integration of TQM with emerging technologies such as artificial intelligence and automation including quality management system standards and environmental management systems and occupation health hazards and safety standards for staying in competitive environment and to comply with QMS.

**Keywords:** Agriculture, Assessment, Environment, Ginning, Seed-Cotton.


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**Biography:** Dr. Vijayan Gurumurthy Iyer, born 10 June 1964 in Mayuram, India, is a Professional Engineer and Director of Techno-Economic-Environmental Study and Check Consultancy Services. Iyer holds a PhD (2003) in Environmental Science and Engineering from the Indian School of Mines University, Dhanbad, along with an AMIE in Mechanical Engineering, diplomas in Mechanical Engineering, Production Management and Automobile Engineering, and a Bachelor's in General Law, and completed post-doctoral research with the World Scientific and Engineering Academy and Society, Greece (2006 and 2011), together with doctorates of Science and Engineering, Letters and Law and an honorary Doctorate of Literature. Iyer has held teaching and administrative appointments at several institutions, including Professor at Dr M.G.R. University, Chennai, Principal of Prince Dr K. Vasudevan College of Engineering and Technology, Professor at Haramaya University, Ethiopia, Dean at Narasaraopeta Engineering College, and Professor at KLEF University. Iyer has over 362 SCI/ISI indexed publications, 60 multilingual eBooks and numerous book chapters and digital books, serves as an editor and reviewer for several international journals and publishers, and has received honours including Bharat Jyothi, Best Citizen of India, Rashtriya Ratna and Rashtriya Gaurav, with recognition in Marquis Who's Who and other biographical directories.

# Importance of total quality management (TQM) in plant science and molecular biology

This paper discusses importance of total quality management (TQM) in plant science and molecular biology.The traditional view of viewing an organization is by surveying the vertical dimension by keeping eye of an organization chart. However, work gets done (or fails to get done) horizontally or cross functionally, not hierarchically. A process focus is continuous improvement efforts and a sequence of activities that is intended to achieve result. A function focus is vertical dimension and events intended to achieve some desired result. In the seven years of continuous improvement, quality and productivity in plant genetics and genomics, molecular breeding strategies, crop biotechnology, bioinformatics, sustainable agriculture, plant physiology, and environmental plant science have improved and defects per 100 plants were decreased. Plant molecular biology is concerned with the processes with information encoded with genome with respect to structural and functional components for sustainable agriculture. TQM aims to ensure excellence in quantity and quality as per PDCA (Plan-Do- Check-Act) and SDCA (Standardize-Do-Check-Act) cycles with all plant science and molecular biological individuals and organizational management levels through the

continuous improvement of processes, products and services. The TQM components encompass quality planning, quality control, quality improvement, employee participation, and quality management system practices. The TQM ensures quality in the end products or service. The plant science and molecular biological organizations integrate quality in its operations and processes for long term success. It reduces defects and eliminates process waste. TQM improves crop yield, stress and strain resistance, and nutritional value through genetic engineering, gene editing, and omics. The future trends in TQM in plant science and molecular biological organizations involve the adoption of quality management practices with quality focus on planning and decision-making process and integration of TQM with emerging technologies such as artificial intelligence, robotics and automation. The upcoming trends in TQM involve the adoption of quality management practices with a focus on data-driven decision making and the integration of TQM with emerging technologies such as artificial intelligence and automation including quality management system standards and environmental management systems standards for staying in competitive environment and to comply with QMS.

**Keywords:** Environment, Gene, Microbiology, Omics.


## Yarub Al-Douri

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**Biography:** Prof. Dr. Yarub Kahtan is a Fellow of the European Academy of Sciences, Fellow of the Islamic World Academy of Sciences, Fellow of the Arab Thought Forum and IETI Distinguished Fellow, winner of the NCPD International Prize 2025, winner of the prestigious Khalifa International Award for Date Palm and Agricultural Innovation 2024, the total awards are 87 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Springer, IF=31.6, Q1) and Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY (Scopus-indexed Q3).

# Characterization of nano-water molecule


The magnetic studies of water are investigated through three different intensities; 0.10, 0.15 and 0.20 tesla. The viscosity, total dissolved solids, hardness and conductivity levels are studied. The purified water surface tension including viscosity is brought down due to magnetic effect. Due to magnetic effect, it is noticed increasing of activation energy and decreasing of water intramolecular energy. Gradual increasing in advancing contact angle is obvious for the four treatments and average contact angle is noticed to be 0.262, 0.261, 0.295 for intensities 0.10, 0.15, 0.20 tesla, respectively compared with tap water 0.249.


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**Biography:** Assoc. Prof. Yasin Ozdemir is an expert in food technology and food science, with a primary focus on fruit and vegetable processing, table olives, olive oil, plant-based foods, and the development of environmentally friendly production techniques. Ozdemir's research integrates product quality, process optimization, and sustainability principles in food systems. Ozdemir serves as a scientific and editorial board member and reviewer for various international journals and congresses in food and nutrition sciences, and has authored and co-authored more than 100 scientific publications presented at international congresses and published in peer-reviewed journals.

# A conceptual product development approach for functional şehriye (a traditional Turkish small pasta product): Prebiotic, high-protein, high-fibre and gluten-free alternatives

The aim of this study is to theoretically develop functional şehriye products inspired by Türkiye's cereal culture. Within this scope, seven different şehriye product concepts are proposed: “Prebiotic Şehriye,” “High-Protein Şehriye,” “Recovery Şehriye,” “Mediterranean Sports Şehriye,” “High-Fibre Şehriye,” “Gut-Friendly Şehriye,” and “Gluten-Free Şehriye.”

“Prebiotic Şehriye” is designed as a formulation based on durum wheat semolina and enriched with barley flour or barley fibre, inulin, and resistant starch. The concept aims to develop a traditional şehriye product containing high levels of dietary and prebiotic fibre. “High-Protein Şehriye” is planned as a product with increased plant-based protein content, considering the needs of individuals with active lifestyles and sports nutrition. “Recovery Şehriye” is designed as a warm and practical post-exercise meal alternative. This formulation is proposed to be developed with roasted thin vermicelli, lentil or chickpea protein, dried vegetables, tomato powder, turmeric, ginger, thyme, and spices.

“Mediterranean Sports Şehriye” combines sensory elements specific to Mardin and Mediterranean cuisine with a functional product development approach. This concept aims to offer a practical meal alternative compatible with sports nutrition, containing plant-based protein and fibre and having a strong regional identity. “High-Fibre Şehriye” is a product concept intended for a broader consumer group and may support daily fibre intake.

“Gluten-Free Şehriye” is a special functional şehriye concept that can be developed for individuals with coeliac disease, individuals with gluten intolerance, and consumers who prefer a gluten-free diet. The proposed raw materials for this concept may include rice flour, corn flour or corn semolina, chickpea flour, red lentil flour, buckwheat flour, potato starch, and texture-modifying ingredients. The commercial value of this concept arises from bringing the traditional use of şehriye together with the gluten-free product market. Although gluten-free pasta products are available on the market, gluten-free şehriye may offer a more local and differentiated product alternative, especially for use in soups, pilafs, and practical home-style meals.

“Gut-Friendly Şehriye” is a functional product by considering gut-friendly nutrition trends. This concept should be positioned with “high in fibre,” “contains prebiotic fibre,” or “supports fibre intake.” The proposed formulation for this product may consist of durum wheat semolina or whole wheat semolina, barley flour or barley fibre, inulin, starch, chickpea flour, lentil flour, psyllium, and oat fibre.

In the evaluation of the products to be developed based on these concepts, parameters such as cooking loss, cooking time, disintegration, stickiness, total dietary fibre, soluble and insoluble fibre ratio, protein content, water-holding capacity, texture, brittleness, colour, sensory acceptability, satiety perception, formulation cost, shelf life, and similar criteria should be analysed. The use of high levels of fibre, protein, and prebiotic ingredients may affect product hardness, mouthfeel, cooking time, and consumer acceptance. Therefore, it is important to preserve the traditional texture of şehriye when developing new products. In conclusion, şehriye may be repositioned beyond being a traditional cereal product and considered as a functional and market-oriented food innovation platform. Further experimental studies are needed to optimise the formulations, verify nutritional improvements, determine consumer acceptance, and evaluate commercial scalability.

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14-16 SEPTEMBER 2026

## ORAL PRESENTATIONS


## Abhishek Bansal

New Era Consultancy Services, India


# Plant-derived bioactive compounds, multi-omics integration, and polypharmacology: A B-PhytoPharma and B-Bioinformatics framework

Plant-derived bioactive compounds play an important role in medicinal plant research, phytopharmacology, nutrition, inflammation modulation, antioxidant response, anticancer mechanisms, and integrative pharmacology. However, their biological effects are rarely limited to a single molecule, single target, or single pathway. Herbal and plant-derived compounds often act through multi-target modulation, synergistic interactions, metabolic transformation, tissue-specific, and system-level biological response. This presentation proposes a B-PhytoPharma and B-Bioinformatics framework for interpreting plant-derived bioactive compounds through multi-omics integration, polypharmacology, and systems-level biological modeling.

The proposed framework connects phytochemical composition, secondary metabolite production, plant stress physiology, compound–target interaction, DNA–phytochemical interaction, protein and pathway modulation, herb–drug interaction, and bioavailability within a unified interpretive structure. B-PhytoPharma is used to model phytochemical pharmacology, herbal synergy, synthetic–herbal drug comparison, anti-inflammatory and antioxidant mechanisms, and ADME-related transport behavior. B-Bioinformatics is used to support geometry-aware analysis of omics data, including genomics, transcriptomics, proteomics, metabolomics, sequence-to-structure mapping, protein–protein interaction networks, gene regulatory systems, and spatial or temporal biological programs.

The presentation highlights how plant-derived compounds may be studied not merely as isolated chemical entities, but as dynamic biological modulators acting across molecular, cellular, tissue, and systemic scales. Multi-omics evidence may be used to connect

phytochemical exposure with gene expression, protein response, metabolic alteration, pathway regulation, and disease-relevant biological state transitions. Polypharmacology is interpreted as coordinated multi-target action, while herbal formulation variability is considered through composition consistency, standardization, batch variability, and interaction geometry.
Through BVidAL Clinical Software Suite (which is a SaMD, Software as a Medical Device), the proposed B-PhytoPharma and B-Bioinformatics framework can be demonstrated as a research-oriented SaMD workflow for organizing and interpreting plant-derived bioactive compounds in relation to biological targets, multi-omics evidence, disease pathways, pharmacological response, and safety monitoring.

## Biography

Abhishek Bansal is an independent consultant, researcher, and amateur scholar whose recent work reflects over 20 years of fully self-funded, self-directed research, and has proposed novel B-Equations and related engineering frameworks for impedance analysis, transformers, inverters, generators, pumps, solar systems, machinery, turbines, batteries, SMPS, and short-circuit analysis. In biomedical science, Bansal has formally claimed the Novel Bansal-NonLinear Theory and Novel Bansal-Biology Theory with nine frameworks, including B-Phy, B-Chem, B-Disease, B-Pharma, B-AI, and B-Prosthetics, and has developed the free BVidAL Clinical Software Suite (beta version) and BVidAL RTOS (Real Time Operating System) for biomedical analysis, simulation, imaging, signals, and medical-device research.

Adoration R Shubane[1,2]*, Kgabo Pofu[2], Antoinette Swart[1], Mariette Marais[1], Zolile Maseko[3], Phatu Mashela[2]

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# Influence of crop rotation and soil temperature on the trophic levels of nematodes and population densities of *Heterodera carotae* in a Highveld carrot producing region of South Africa

The carrot cyst nematode, *Heterodera carotae* Jones, 1950 has been recorded across the European carrot growing regions, along with the Americas and Africa. Estimated carrot crop losses related to *H. carotae* damage range from 20 to 90% across the globe. Since the host range of this nematode is limited to cultivated- and wild carrots, crop rotations are economically and ecologically preferred management strategies, but with limited empirical support data. Following much deliberation on crop rotation cost-benefits, carrot monoculture, brassica, sorghum, wheat and fallow were chosen to monitor the changes in the populations of H. carotae under field conditions in the Highveld region of South Africa during the 2024/2025 seasons. the aim of the study wasto assess whether the use of carrot-monoculture, Brassica sp., sorghum, wheat and fallow in context of crop rotation will reduce nematode population densities of H. carotae and othernematodesunder field conditions and further accessing whether seasonal nematode biodiversity would enhance the possibility of predicting yield in carrot production. The trials were conducted on a 2-ha carrot field in the Tarlton area, with a Hutton Soil Form and a Loamy Sand Soil. Initial nematode population density was established during the first year of planting to carrots. randomised complete

block design with four replications. Four crop rotation cycles, namely carrot, Brassica species, wheat and fallowing with six unknown IP treatments. Soil samples were collected weekly from emergence to harvest or incorporation for 2024/2025 seasons. Ten subsamples were taken per block and combined to make up a composite sample which was eventually processed to extract nematodes. Soil temperatures with two probes were measured at 20 cm depth, using an Aquacheck probe under fallow and crop blocks for the duration of the experiment. During three seasons (winter, spring and summer) of the first year all plots were planted with carrots. During the second year, plots were planted to either brassica, wheat or left fallow, depending on the rotation cycle applied. During the third year, carrots will be cultivated as sole crop during summer, winter and spring. The cultivar Allyance will be used during summer whilst the cultivar Soprano will be used in winter and spring. Generalized Linear Mixed Models with Template Model Builder (glmm TMB) showed that crop rotation had a significant influence on nematode populations across the 2024/2025 seasons. Heterodera carotae was the most dominant plant parasitic species across all crop rotations.Average monthly temperatures had significant influence on the populations of H. carotae, where for every unit increase of temperature, there was a corresponding decrease in the population. Furthermore, the biodiversity of nematode trophic levels was also established where PPN were the most prominent. This were observed across four rotation cycles, with bacterial and fungal feeders contributing respectively. In Conclusion brassica species could be used in crop rotation with carrot to manage population densities of *H. carotae* and average monthly temperature has shown to have a significant influence on the population of *H. carotae*, where for every unit increase of temperature, there was a corresponding decrease in population under different treatments.

## Biography

Adoration Shubane is a researcher in nematology at ARC-PHP, whose role is to identify and characterize cyst nematodes and who is the curator of the national collection of nematodes, currently pursuing a PhD study at the University of Limpopo.

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# Biomass and seed yield of industrial hemp varieties under Mediterranean conditions

Industrial hemp (*Cannabis sativa L.*) has been increasingly recognized as a sustainable agricultural crop, adaptable to different edaphoclimatic conditions and suitable for low-input systems, due to its rapid growth, high water-use efficiency, and reduced need for fertilization and plant protection products. In Mediterranean climate regions, characterized by hot and dry summers, evaluating hemp performance across different growing seasons is particularly relevant, as climatic variability can significantly influence biomass and seed production. The present study was conducted at the National Institute for Agrarian and Veterinary Research (INIAV), in Elvas, Portugal (38°52' N; 7°09' W), in a temperate climate region with annual precipitation between 500 and 600 mm and average annual temperatures ranging from 15.0 °C to 17.5 °C. The trial was established on a loamy-sand soil with a pH between 7.0 and 7.5, considered suitable for hemp cultivation. Four certified commercial hemp varieties—Futura 75, Fibror 79, Mona 16, and Santhica 27—were evaluated over two consecutive growing seasons (2024 and 2025). The experimental design included four replicates per variety, in plots of approximately 12 m2. Sowing was carried out using a row seeder with an inter-row spacing of approximately 15 cm, and irrigation was provided through a drip system. No fertilizers or phytosanitary products were applied. After harvest, plant components—stems, leaves, and seeds—were separated and weighed individually to allow detailed biomass production assessment. The results revealed significant differences between the two growing seasons, with consistently higher biomass production in 2024 and a marked reduction in 2025. This decrease was observed across all plant components and was statistically significant for stems ($p=0.0002175$), leaves ($p=0.000149$), and seeds ($p=0.00047$). Varietal responses to interannual variability differed. While the Mona 16 variety showed a pronounced reduction in leaf and seed production in one replication, Santhica 27 exhibited the highest overall average reduction in stem, leaf, and seed production between

the two years. Seed yield was the most affected component, with reductions exceeding 84.7%, indicating high sensitivity to the environmental conditions recorded during the 2025 growing season. These findings highlight the strong influence of interannual climatic variability on industrial hemp productivity and emphasize the importance of varietal selection and adaptive management practices to enhance crop resilience in Mediterranean low-input agricultural systems.

## Biography

Ana Isabel Cordeiro is an Assistant Professor at the Polytechnic Institute of Portalegre, teaching courses in Biology, Biochemistry, Genetics, Horticulture, Fruit Growing, Agricultural Production Technologies, and Cannabis Breeding. Cordeiro holds a PhD in Biology and Plant Production from the University of Extremadura (Spain) and is a specialist in the Cannabis Industry and Digital Agronomy from the University of Alicante. Cordeiro is the leader of the BGREENER project – Biodiversity and Hemp in the EUROACE area (2024–2026) and the author of several scientific articles in the areas of plant production, Cannabis sativa, and applied microbiology.

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# Antimicrobial potential of Colombian plants for the control of microorganisms associated with skin infections

Skin infections caused by fungi, viruses and bacteria represent the fourth leading cause of morbidity worldwide and affect one-third of the global population. Among these infections, candidiasis caused by *Candida albicans,* cutaneous folliculitis and/or atopic dermatitis caused by *Staphylococcus aureus* and/or Staphylococcus epidermidis and tinea versicolor caused by *Malassezia furfur* stand out. In the search for antimicrobial substances with cutaneous application, plants represent a relevant alternative due to the vast diversity of specialized metabolites they produce and their various biological properties. In light of the fact that Colombia ranks among the world's most biodiverse countries, this study sought to evaluate the antimicrobial potential of some Colombian plant species for the control of microorganisms involved in skin infections. The methodology included the collection of 30 non-timber forest plant species in the department of Chocó (Colombia), which were separated into their corresponding organs and ethanolic extracts were obtained by maceration, for a total of approximately 42 extracts. Antimicrobial activity was evaluated using the microdilution method at an initial concentration of 1000 µg/mL against the strains *S. aureus* (ATCC 28188), *S. epidermidis* (ATCC 12228), *M. furfur* (ATCC 14521), *T. rubrum* (ATCC 28188) and *C. albicans* (ATCC 10231). Extracts showing a percentage of inhibition greater than 70% were considered active, and their minimum inhibitory concentration (MIC) and MIC50 were determined by microdilution over a concentration range of 1 to 2000 µg/mL. Regarding the results obtained, it is noteworthy that 12 extracts were active against C. albicans, 5 were

active against *S. aureus*, 1 extract against *S. epidermidis*, 33 extracts against *T. rubrum,* while 29 extracts showed activity against *M. furfur.* In this sense, against *C. albicans*, the most promising extracts were *Vismea panamensis* (leaves), *Piper aduncum* (leaves) and Bixa orellana (leaves), with an $MIC_{50}$ range between 951 and 1047 µg/mL. For *S. aureus,* the most active extracts corresponded to Solanum psychotrioides (leaves), *Adenostemma platyphyllum* (aerial parts), and *Piper tricuspe* (leaves) with a range of 32 to 140 µg/mL. Against S. epidermidis, *Solanum psychotrioides* (leaves) stood out with an MIC50 ranging from 20 to 60 µg/mL. Against *T. rubrum*, the most active extracts corresponded to Solanum psychotrioides (leaves) and *Cyathula prostrata* (leaves) with an MIC50 ranging from 20 to 100 µg/mL. Finally, against *M. furfur,* the most promising extracts were Piper peltatum (inflorescences) and *Piper* tuberculatum (inflorescences and stems), with MIC50 values ranging from 10 to 100 µg/mL. These findings evidence the potential of certain Colombian plants for the control of microorganisms associated with skin infections. This study was funded by the General Royalties System of Colombia under project BPIN 2023000100047. Research activities on Colombian biodiversity were carried out under the Genetic Resource Access Contract No. 121 of January 22, 2016, and its Amendment No. 21, signed between the Ministry of Environment and Sustainable Development and the National University of Colombia, in compliance with the amnesty established in Law 1955 of 2019.

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# The influence of three winter cover crops on nematode biodiversity and soil health

The practice of regenerative agriculture in Limpopo Province arises from the critical challenges in soil health, food security and climate change. Approximately 60% of South African land degraded and significant greenhouse gas emissions linked to conventional farming, there is an urgent need for sustainable agricultural practices that restore soil quality and enhance ecosystem health. The objective of this study was to establish whether *Vicia sativa, Raphanus sativus* and *Avena strigosa* each as winter (June-August) cover crop/ green manure, will improve soil health under field conditions. A field study was conducted at the University of Limpopo to investigate the effect of winter cover crops, *Vicia sativa, Raphanus sativus* and *Avena strigosa* on soil health and nematodes biodiversity. Each on a block of approximately 10×2 m2, within each block, the samples (soil, roots and shoots) were collected in two subplots of 3 m × 2 m2. Soil organic carbon content, enzyme activity, nematode and bacterial functional diversity data were collected from all the plots. Yield was also recorded per winter cover crop (DW). Based on the results, most of the soil from the samples are from degraded, depleted soil with a high C:N ratio, fungal decomposition pathway and conducive to disease. Some samples were from disturbed, N-enriched soil with low C:N ratio, bacterial decomposition pathway and conducive to diseases. High soil organic carbon content, microbial diversity and enzyme activity were observed in *Raphanus sativus*. In addition, the soils from the samples were dominated by cp-2 nematodes. These nematodes are generally found in most soils and responds well to enrichment and changes in environmental conditions. Yield mass (DW) significantly varied ($P \leq 0.05$) among winter cover crops with *Avena strigosa* plots recording higher yields than *Raphanus sativus* or *Vicia sativa*. Based on the results, the investigated winter cover crops had significant effect on population densities of nematodes, and soil health of the soil and biomass. This study has confirmed that growing *Vicia sativa, Raphanus sativus,* or *Avena strigosa* individually as

winter cover crops (as opposed to using conventional fallow) each successfully enhanced the overall soil health condition profile relative to the control conditions of fallow. Using living covers allowed for a greater degree of biological activation and structural restoration to the soil environment than fallowing and supports long-term ecological resilience.

## Biography

Ms. Ayanda Ngcobo studied Agriculture (Post-harvest) at Tshwane University of Technology, and graduated in 2024 (MSc), worked as a temporary lecturer at Esayidi TVET College and a facilitator at Vhangona Skills Academy in 2024, then joined the research group of GBRCE at the Department of Nematology under the supervision of Prof. Pofu and Mashela as a PhD student at the University of Limpopo, and has published one research article during the MSc journey.

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# Effect of astaxanthin in rich cookies on anti-ageing process associated with expression of the FOXO3 gene in vivo

Natural astaxanthin (ASTA) is a powerful antioxidant due to its unique chemical structure, which traps free radicals in the cell membrane with its long polyene chain. This study aimed to evaluate functional cookies enriched with astaxanthin (ASTA) on anti-ageing activity by investigating liver antioxidant and FOXO3 gene expression in heart. In the *in vivo* experiments, Sprague-Dawley male rats were used to evaluate the effects of ASTA-enriched cookies on liver anti-oxidant enzyme and Foxo3 gene expression. which were divided into five groups and fed cookies enriched with varying concentrations of ASTA (0%, 10%, 15%, and 20%) over a period of eight weeks. At the end of the experiment, liver and heart tissues were collected to analyze antioxidant enzyme activity superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione reductase (GR) as well as FOXO3 gene expression compared to the control group. The results demonstrated a significant increase in antioxidant enzyme activity in all ASTA-treated groups compared to the control group ($p<0.001$). Notably, higher concentrations of ASTA (15% and 20%) showed the most pronounced effects, enhancing the enzymatic activity against oxidative stress. In addition, a significant upregulation of FOXO3 gene expression was observed in the 15% and 20% ASTA concentration, with approximately a two fold in the group consumed (15%) of ASTA increase compared to the control, indicating a potential role in promoting longevity and cellular protection. These findings conducted that ASTA-enriched functional foods may contribute to reducing oxidative stress and modulating key genetic pathways associated with aging. Adding ASTA into commonly consumed food products, such as cookies, presents a

promising strategy for developing functional foods with anti-aging benefits. In conclusion, dietary astaxanthin demonstrates significant potential as a natural bioactive compound capable of enhancing antioxidant defense mechanisms and regulating longevity-related gene expression, supporting its application in both the food industry and preventive health strategies

**Keywords:** Aging Process, Antioxidant Enzymes, Astaxanthin, FOXO3, Gene Expression.

## Biography

Al-Tarifi is a motivated and dedicated professional in Clinical Nutrition and Dietetics, with a strong interest in evidence-based practice and health promotion. Al-Tarifi has been actively involved in organizing academic and health-related initiatives, including awareness campaigns and student-led events, reflecting a commitment to advancing community health and professional engagement. Al-Tarifi has also contributed to establishing collaborations with healthcare and nutrition institutions, supporting the development of training opportunities for students and graduates. These experiences have strengthened skills in communication, teamwork, and leadership within multidisciplinary environments. Areas of interest include clinical nutrition, public health nutrition, and patient education. Al-Tarifi is passionate about continuous learning and aspires to contribute to improving health outcomes through effective and practical nutritional approaches.

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# Determinants of agro processing participation and their influence on smallholder farmers' resilience in Limpopo Province, South Africa

Determinants of agro-processing participation are crucial for understanding how smallholder crop farmers build resilience in vulnerable rural economies. Despite the potential benefits, participation among smallholder crop farmers remains uneven. This study investigates the determinants influencing agro-processing participation and examines their influence on smallholder crop farmers' resilience in Limpopo Province. Primary cross-sectional data were collected through a multi-stage sampling approach, with structured questionnaires administered to 130 smallholder crop farmers (65 participants and 65 non-participants). Kendall's coefficient of concordance was employed to rank the constraints faced by the farmers, while a binary logistic regression model was used to analyze determinants of agro-processing participation. The results revealed a strong agreement among agro-processing participants (W=0.786) and a statistically moderate agreement among non-participants (W=0.663), indicating consistent perceptions of key constraints. The most severe constraints identified amongst both participants and non-participants of agro-processing include unfavourable weather conditions, inadequate storage, poor transportation, and high labour costs. The binary regression results revealed that financial support ($p<0.05$), farm income ($p=0.01$), post-harvest losses ($p<0.01$), farming experience ($p<0.05$), farm size ($p<0.10$), and sources of income ($p<0.10$) significantly influenced agro-processing participation with different coefficient parameter signs. These findings demonstrate that agro-processing participation contributes to income stability and adaptive capacity, thereby enhancing smallholder crop farmers' resilience to various shocks. The study provides empirical evidence to guide policy interventions aimed at promoting inclusive agro-processing and fostering sustainable rural development.

**Keywords:** Constraints, Determinants, Agro-Processing, Resilience, Smallholder Crop Farmers, Limpopo Province.

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# Effects of simulated elevated CO2 concentration and atmospheric temperature on quality formation of *Lycium barbarum* fruits

**Methods:** Three *L. barbarum* cultivars ('Ningqi 1', 'Ningqi 7', 'Ningqi 10') were subjected to the elevated CO2 concentration (eCO2) and atmospheric temperature (eT) in an Open-Top Chamber (OTCs) simulation control system. Fruits were collected at the young fruit stage (YF, treated for 60 days), green fruit stage (GF, treated for 70 days), coloring fruit stage (CF, treated for 80 days), and red fruit stage (RF, treated for 90 days) for measuring morphological characteristics and nutrient composition.

**Result:** 1) Morphological analysis indicated that elevated CO2 concentration significantly increased the longitudinal and transverse diameters of fruits at the CF and transverse diameter of fruits and single fruit weight at the RF of 'Ningqi 1'. The elevated CO2 concentration significantly increased the longitudinal diameter at the GF and the transverse diameter of fruits at the CF of 'Ningqi 7'. The elevated CO2 concentration significantly increased the transverse diameter of fruits at the YF and the single fruit weight at the CF of 'Ningqi 10'. Elevated atmospheric temperature significantly increased the longitudinal diameter of fruits at the CF and RF, as well as the single fruit weight at the RF of 'Ningqi 1'. Elevated atmospheric temperature significantly increased the longitudinal diameter of fruits at the GF and CF, as well as the transverse diameter of fruits and single fruit weight at the CF and RF of 'Ningqi 7'. Elevated atmospheric temperature significantly increased the single fruit weight of 'Ningqi 10' ($P<0.05$). 2) Nutrient component analysis revealed that elevated CO2 concentration increased the levels of galactose, sucrose, betaine, and flavonoids in the fruits of 'Ningqi 1' at four developmental stages, increased the levels of fructose, total sugar, sucrose, polysaccharides, carotenoids, and betaine at the RF of 'Ningqi 7', and increased the

levels of galactose, fructose, glucose, and polysaccharides at the RF of 'Ningqi 10' ($P<0.05$). Elevated temperature treatment significantly increased the levels of galactose, fructose, total sugar, polysaccharides, betaine, and flavonoids at the RF of 'Ningqi 1', increased the levels of galactose, glucose, sucrose, and fructose at four developmental stages, as well as the levels of fructose, total sugar, polysaccharides, carotenoids, and betaine at the RF of 'Ningqi 7', and increased the levels of sucrose, carotenoids, and flavonoids at four developmental stages, as well as the levels of galactose, total sugar, and betaine at the RF of 'Ningqi 10' ($P<0.05$).

**Conclusion:** Elevated CO2 concentration and atmospheric temperature promote the morphological development and nutrient accumulation of *L. barbarum*. Among the three cultivars, 'Ningqi 10' exhibits stronger adaptability, with the largest increase in fruit size, single fruit weight, and 100-seeds weight during the development stage. This research was supported by the National Natural Science Foundation of China (No.32160393, No.32572039).

## Biography

Dr. & Prof. Bing Cao, working at School of Forestry and Grassland Science, Ningxia University. Researching field and interests including Silviculture, No-wood-production Forest, and plant vegetation recovery in arid and semiarid regions.


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# Effect of human-consumed green and black tea decoctions on murine haematopoietic stem cells – A nutraceutical approach

**Background:** While the antioxidant properties of tea are well-documented, its specific role in protecting the HSC niche and modulating lineage differentiation under chemical stress remains largely unexplored. Chemotherapeutic agents like cyclophosphamide often induce severe myelosuppression, a condition characterized by the depletion of haematopoietic stem cells (HSCs) and their progenitors.

**Methods:** This study evaluated the effects of green and black tea decoctions, prepared at concentrations simulating human consumption (2.5g/100ml), on a murine model of cyclophosphamide-induced cellular suppression. BALB/c mice were treated with tea decoctions and cyclophosphamide to assess changes in bone marrow progenitor populations—specifically common myeloid progenitors (CMP), granulocyte-monocyte progenitors (GMP), and common lymphoid progenitors (CLP)—using flow cytometry and gene expression analysis.

**Results:** Both tea types demonstrated protective qualities, but green tea decoction exhibited superior myeloprotection. It significantly safeguarded the GMP population against cyclophosphamide-induced abrogation. The mechanism of action involves a multi-pathway response:

**Oxidative Stress Mitigation:** Induction of the antioxidant enzyme Heme-oxygenase 1 (HO-1) to neutralize reactive oxygen species (ROS).

**DNA Repair Activation:** Significant up-regulation of DNA repair enzymes, including PARP-1, DNA pol β, ERCC4, and XRCC1.

**Metabolic Modulation:** Enhancement of drug-metabolizing enzymes Cyp1a2 and Cyp2b10, facilitating safer processing of chemotherapeutic agents.

**Immunomodulation:** Amelioration of the TLR4-mediated "cytokine storm" by reducing the overproduction of pro-inflammatory cytokines (IL-12, IL-10, TNF-α) through the inhibition of MAPK, JNK, and NFκB pathways.

**Maintenance of Normal HSC environment:** The human-consumption-similar green and black tea decoction didn't show any effect on the HSC population, making it a safe, natural, and preventive therapeutic option.

**Novelty and Therapeutic Potential:** This research identifies a novel role for everyday green tea consumption in maintaining HSC homeostasis. Unlike synthetic drugs that may introduce further side effects, green tea offers a low-cost, non-toxic, and accessible nutraceutical strategy. Its ability to prime the bone marrow's defense mechanisms suggests a significant therapeutic application for cancer patients undergoing chemotherapy, individuals with autoimmune disorders like lupus or rheumatoid arthritis, and patients preparing for stem cell transplants.

## Biography

Biswajyoti Sarkar, PhD, is a microbiologist and researcher specializing in clinical immunology and experimental therapeutics, with a doctorate from West Bengal State University and a high-ranking CSIR-UGC NET JRF credential, and has made significant contributions to understanding the myeloprotective effects of natural products and developing antileishmanial therapies. Currently serving as a Laboratory Officer at Sister Nivedita University, Sarkar bridges the gap between academic research and practical application, and is an expert in flow cytometry and molecular biology with a multidisciplinary background in life sciences and digital communication.

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# Nematode management in vegetables through biopriming

Phytonematodes (PPNs) are ubiquitous browsers on crop plant. Unfortunately, of several effective chemicals, only carbofuran and its derivate carbosulfan are available to the farmers. However, carbofuran has been banned and even otherwise nematodes have created resistance against carbofuran. Hence, biological agents such as *Trichoderma viride* (Tv), *T. harzianum* (Th), *Paecilomyces lilacinus* (Pl) (P*urpureocillium lilacinum*), Pochonia chlamydosporium (Pc), Pseudomonas fluorescens (Pf), *Bacillus subtilis (*Bc) and even bio fertilizers like N fixing Azotobacter, P, K, Zn, Fe, & S solubilising and mobilizing bacteria helped to manage nematodes by having their PGR properties to suppress nematode infection. Out of 3 different bio agents viz., Tv, Th & Pf tried as seed treatment at 5, 7.5 & 10 g/kg seeds in cowpea, seed coating with all three bio agents at 10 g/kg seeds significantly improved plant growth characters with reduced no. of galls & eggs/egg mass and total *M. incognita* population. In okra, Tv, Th, Pc, Pl & Pf tried as seed coating @ 20 g/kg seeds, Pl was more effective and was at par with carbofuran. Pl used as seed treatment @ 20 g/kg seeds + nursery bed treatment with 50 g/m2 and transplanting treated seedlings in field after application of 5 tons FYM enriched with 5 kg Pl (1% WP) had minimum RKI (2.3 & 2.2) and increased tomato fruit yield (18.2 & 17.4%) and 67 & 70% egg parasitism by Pl in 1st & 2nd season over control.

Two years pooled data indicated, combination of BA: Bio All (Mixture of *Azotobacter, Azospirillum*, Phospho Solubilizing Bacteria (PSB) & Potash Solubilizing Bacteria (KSB)) + BM: Bio Micro (Zinc, Ferrous, & Sulphur Solubilizing Bacteria) + ND: Nicoderma 1% WP (*Trichoderma viride*) + BN: Bioniconeema 1% WP (*Purpureocillium lilacinum*) + PA: Power All 1% WP (*Pseudomonas fluorescens)* each @ 20 ml or gm/kg seeds increased seed germination, seedling growth & height, production of transplantable seedlings and decreased root-knot disease to the tune of 53.7, 57.5, 75.2, 117.9 & 34.1% in tomato cv. Abhinav

(ICBR 1: 335) and 60.5, 37.6, 38.3, 130.4 & 25.9 in chilli cv Nisha (ICBR 1: 324). Even in field also, same combination of BA + BM + ND + BN + PA recorded significantly less RKI (2.87) with significantly higher fruit yield (393.9 q/ha) (ICBR 1: 39.1) in tomato and RKI (2.40) with significantly higher fruit yield (194.4 q/ha) (ICBR 1: 30.2) in chilli.

## Biography

Born on June 5, 1944 at village Sapawada, Ta. Idar, Dist. Sabarkantha. Received B.Sc. (Agri.) degree with first class in 1967 and M.Sc. (Agri.) & Ph.D. in Plant Pathology with specialization in Plant Nematology with first class in 1972 & 1976 as in-service. Joined as Senior Research Assistant (Plant Pathology) in Bidi Tobacco Research Station, Institute of Agriculture, Anand on June 28, 1967. Subsequently served as Instructor in Plant Protection, Nematologist, Professor & Head, Dept. of Nematology, In Charge Director of Campus at Anand & Navsari and retired as Principal & Dean, B. A. College of Agriculture, AAU, Anand on June 30, 2004 after serving for 38 years in the fields of education, research, extension education and administration in Agriculture. Published 240 research papers in national and international journals, 9 book chapters, 3 bulletins & 3 review articles. Received 4 national and international trainings in Nematology. Presented 148 research papers in national & international seminars, attended 93 national & international workshops/seminars/symposia, 22 memberships in scientific societies. Received 10 awards/medals, served in more than 24 scientific & educational institutions, worked as President of the Nematological Society of India & Indian Society of Mycology & Plant Pathology. Worked as expert in scientific panels, member of several QRTs, Chairman of QRT on AICRP on Nematodes. Guided 8 M.Sc. (Agri.) and 6 Ph.D. students in Plant Nematology. Delivered several radio talks/Doordarshan programs for farmers. Organized several scientific seminars/workshops/farmer's training programs. Visited USA, UK, Germany, Israel, China, Uganda, Kenya, Malawi, Tanzania, Nepal. Presently working as advisor/consultant in a few firms.

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# Soil solarization – An effective method for economic management of root-knot nematodes in crop nursery

Soil solarization has proven to be an effective non-chemical technique for managing plant-parasitic nematodes while simultaneously improving crop productivity and economic returns. Studies conducted at the Department of Nematology and Bidi Tobacco Research Station (BTRS) under Gujarat Agricultural University, Anand demonstrated that soil solarization using LLDP (Linear Low Density Polyethylene) transparent sheets during peak summer months significantly reduced nematode infestation, weed pressure and enhanced nursery performance in high-value crops.

Soil solarization resulted in a 58–94 per cent reduction in root-knot nematode populations and 70–75 per cent decrease in root-knot index, depending on crop and treatment conditions. In tomato nurseries, solarization led to a 615 per cent increase in transplant production, accompanied by 38 per cent improvement in seedling vigour as measured by fresh weight at first pulling. Weed biomass was drastically reduced by 92 per cent, contributing to lower weeding costs. The root-knot index declined by 66 per cent, indicating effective suppression of nematode infection. Economic analysis revealed a high profitability of the technology with an Incremental Cost–Benefit Ratio (ICBR) of 1:5.65.

In bidi tobacco nurseries, soil solarisation increased transplant production by 412 per cent over non-solarized soil and improved seedling growth and quality by 22 per cent. Nematode infestation was substantially reduced by 75 per cent decrease in root-knot index over control, while weed biomass was declined by 81 per cent. The economic viability of soil solarization in tobacco nursery was reflected by a high ICBR of 1:6.12, indicating substantial net returns despite the initial cost of plastic and labour.

Additionally, soil solarisation favourably influenced soil health by increasing soil organic matter content by 45.5 per cent, total nitrogen by 41.6 per cent, soil porosity by 6.7 per cent, and water-holding capacity by 14.4 per cent, creating a more conducive soil environment for crop growth.

Overall, soil solarization emerges as an eco-friendly, residue-free and economically viable alternative to chemical nematicides, particularly suitable for nursery management and integrated nematode management strategies in high-value cropping systems.

**Keywords:** Soil Solarization, Nematode Management, Root-Knot Nematode.

## Biography

Dr. D. J. Patel was born June 5, 1944, in village Sapawada, India, and earned a B.Sc. (Agri.) in 1967 and M.Sc./Ph.D. in Plant Pathology with nematology specialization in 1972 and 1976. Over 38 years, Patel held positions including Senior Research Assistant, Instructor, Professor & Head of Nematology, and various administrative roles, retiring in 2004. Scholarly output includes 240 research papers in national and international journals, 9 book chapters, 3 bulletins and 3 review articles, along with 148 research papers presented in national and international seminars, 93 workshops/seminars/symposia attended, 22 memberships in scientific societies and 10 awards/medals. Patel guided 14 graduate students, served as president of major scientific societies, chaired research committees, and delivered public education programs, with international travel including USA, UK, Germany, Israel, China, Uganda, Kenya, Malawi, Tanzania and Nepal, and currently works as an advisor and consultant.

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# Visible and invisible: The multi-faceted benefits of plants to humanity

Plants are of enormous importance to humans, having developed alongside each other during co-evolution over millions of years. In fact, the majority of the Earth's organic matter originates from plants, which capture the sun's energy via photosynthesis. Plants provide the vital oxygen we breathe and as it is estimated that the vast diversity of plant organisms produces up to one million bioactive molecules.

Primarily, plants form the basis of the human diet. They synthesize macronutrients—carbohydrates, proteins, and lipids—and, particularly, for meat, plants are indirectly also the foundation via food chains. Humans rely on plants for substances they cannot produce themselves but need as micronutrients for survival, including vitamins as well as essential amino and fatty acids.

Many secondary plant compounds are volatile organic bioactives that often serve as signaling molecules and defense mechanisms for plants. By interactions between various biological systems, they simultaneously can have diverse, positive effects for human health as the following example illustrates.

Citral, a volatile monoterpene consisting of two isomers, is found, among other sources, in the peel of citrus fruits. When ingested, citral influences physiological signaling pathways in humans and displays antioxidant effects. The compound additionally possesses direct antimicrobial properties, can disrupt bacterial membranes, and inhibits fungal growth. It binds with high affinity to viral particles like SARS-CoV-2, thus hindering their entry into cells. In plants, citral acts as a defense and signaling molecule. Depending on its concentration and ecological context, citral can either attract pollinators, such as bees, to play a role in fruit and seed formation, or repel herbivores. These effects are highly concentration-dependent,

demonstrating that biological activity often depends on physiologically relevant concentration ranges and not solely on the presence of a substance.

Combining modern molecular methods with traditional botanical knowledge mechanistically explains these effects, allowing us to decipher the intricate, often invisible dependence of human life on plant biochemistry.

## Biography

Dr. Eva Künnemann is an independent researcher based in Winterthur, Switzerland, whose work explores the multi-faceted benefits of plants to humanity, combining modern molecular methods with traditional botanical knowledge to elucidate the roles of plant bioactive compounds in human health and in plant defense and signaling.

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# Effects of feeding pomegranate peel silage on feed intake and growth performance of Turkey bred sheep

The experiment was conducted to determine the effects of feeding pomegranate peel silage with beet top silage, wheat straw, alfalfa hay, barley, cotton seed cake and mineral plus on feed intake and growth performance of Turkey bred sheep in research farm of Agriculture Faculty, Kabul University. Twelve, two and half years old turkey bred sheep with (57.240 ± 5.28) kg average initial body weight were used in a completely randomized design (CRD). Animals were caged individually in 3 groups and 4 replications. Groups included in this experiment were, first group (Control) or T1 pomegranate peel silage (PPS) 0%, second group or T2 (5% PPS) or 106 g and third group or T3 (10% PPS) or 211 g. In addition, animals were fed with 633 g barley, 633 g alfalfa hay, 211 g cotton seed cake, 106 g beet top silage, 4 g mineral plus with the same amount and wheat straw for control group or T1, T2 and T3, 528 g, 422 g and 317 g in dry matter (DM) basis, respectively once in a day at around 8 am. According to statistical analysis, there was a highly significant difference between groups in feed intake and significant difference in growth performance of sheep. Results of this study suggest that feeding (5%) pomegranate peel silage with wheat straw, alfalfa hay, cotton seed cake, barley, beet top silage and mineral plus affects the feed intake and growth performance of Tukey sheep.

## Biography

Assistant Professor Faiz Rahman Rahmani at Kabul University completed an MS in 2017. Rahmani work as Assistant professor since 9 years at Kabul University. During these studies, Rahmani participated in various educational Agricultural conferences. Rahmani has worked in the country's environmental and greening programs with the (Green Club) projects. In the field of book and articles publication compilation and translation, Rahmani is author of 5 books in the field of agriculture and published one international and 7 national articles.


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# Managed Aquifer Recharge (MAR) – An option for sustainable irrigated agriculture in Punjab Pakistan

Population of Pakistan is increasing tremendously putting more and more stress on water resources due to increasing demands of food and fiber. Pakistan is the 8th largest food producing country where irrigated agriculture contributes more than 90% of Pakistan's food production. Agriculture is the largest single sector which contributes 22% of GDP, employs about 45% of the overall labor force and generates over 60% of foreign exchange. Water has played a vital role in irrigated agriculture in the country. Under the global climatic changes water resources in the country are under severe threats both in quantitative and qualitative contexts. Groundwater globally is used 60% for agriculture, 20% for domestic and 20% for industry. Pakistan is 4th largest user of groundwater after India, USA and China. In Punjab province groundwater is meeting more than 90% drinking water demands, more than 80% industrial water requirements and 40% irrigation water requirements. About 1.4 million tubewells in Punjab are extracting about 50-60 MAF annually due which groundwater budget is negative. Groundwater provides an opportunity for sustainable irrigated agriculture in the Punjab province of Pakistan. Groundwater resources are being utilized on unsustainable basis. Low water use efficiency, lack of capacity and awareness, unplanned extraction, complex nature, multiple users are major challenges for groundwater management and global climatic changes are major concerns for groundwater in the province. These challenges are further aggravated with climatic changes. Punjab government has implemented a managed aquifer recharge by diverting flood through 144 recharge well in the bed of an old abandoned canal. During flood season of 2025, about 12000 acre-feet of surplus flood water have been recharged. This project has improved the water availability for sustainable irrigated agriculture in the area

**Keywords:** Irrigated Agriculture, Managed Aquifer Recharge (MAR, Groundwater, Punjab, Pakistan.

## Biography

Mr. Ghulam Zakir-Hassan is working as Director Research at Punjab Irrigation Department Lahore, Pakistan. Zakir-Hassan obtained M. Engg, degree from Asian Institute of Technology, Thailand and currently is a PhD scholar at Charles Sturt University, Australia. Zakir-Hassan has more than 25 year experience in the applied and basic research fields related to a wide spectrum of water sector issues. Has international exposure by visiting different countries including Thailand, PR China, Saudi Arabia, Australia, Iran, India, UAE, Nepal, Indonesia. Mr. Zakir is member of different national and international professional organizations like Pakistan Engineering Council, Institution of Engineers Pakistan; EWRA, Pakistan Engineering Congress; AIT Alumni Association; Aus-Awards Pakistan; ILWS-CSU, IAH; International Water Resources Association (IWRA).


## Giuseppe Mannino

Department of Life Sciences and Systems Biology, University of Turin, Italy


# The future of plant biostimulants: Are we ready to move beyond the hype?

Over the past fifteen years, plant biostimulants have evolved from a niche area of agronomic research to one of the most dynamic sectors of agricultural innovation. The exponential increase in scientific publications, the rapid growth of the market, and the introduction of specific regulatory frameworks all attest to an unprecedented level of interest. However, behind this success lies a fundamental question: do we truly understand how biostimulants work?

For a long time, research focused primarily on demonstrating positive effects on plant growth, productivity, and tolerance to abiotic stress. Today, however, the sector is facing a paradigm shift. Demonstrating that a biostimulant works is no longer sufficient: it is necessary to understand why, how, and under what conditions it is truly effective.

This presentation offers a critical reflection on the evolution of the sector, highlighting the new perspectives offered by plant physiology, metabolomics, multi-omic approaches, and artificial intelligence, tools that are progressively transforming the way we interpret the plant-biostimulant interaction. We will also discuss the main limitations that still hinder the transfer of knowledge to agronomic practice, including a lack of standardization, difficulties in defining mechanisms of action, regulatory challenges, and the variability of responses observed in the field.

Rather than asking whether biostimulants work, this presentation aims to address a more ambitious question: what science is needed for biostimulants to become truly predictable, reproducible, and indispensable tools for the agriculture of the future? Through a vision that integrates biological, technological, regulatory, and socio-economic aspects, the presentation will offer insights into the challenges and opportunities that will shape the

next generation of biostimulants and their role in the transition toward more resilient and sustainable agricultural systems.

## Biography

Giuseppe Mannino is Assistant Professor of Plant Physiology at the University of Turin, Italy, where research focuses on plant physiology, metabolomics, sustainable agriculture, and the development of plant biostimulants, combining fundamental and applied research with particular emphasis on the biochemical and molecular mechanisms underlying plant responses to biostimulants and abiotic stresses. Mannino has authored more than 70 peer-reviewed publications in international journals, including highly cited reviews and original research articles, and currently coordinates and participates in several national and European research projects promoting innovation for sustainable and resilient agricultural systems.

Gulara Huseynzade*, Diana Di Gioia, Daniele Alberoni, Saida Aliyeva

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# Sustainable use of siderophore-producing rhizobacteria to enhance iron nutrition, chlorophyll stability, and stress tolerance in tomato plants

Iron (Fe) is an essential micronutrient for tomato (*Solanum lycopersicum*) growth, regulating chlorophyll biosynthesis, photosynthetic efficiency, respiratory metabolism, and key defense responses. However, Fe availability in soil is often extremely limited due to rapid oxidation and precipitation, which makes tomato plants highly susceptible to iron-deficiency chlorosis and associated stress sensitivities. Siderophore-producing plant growth-promoting rhizobacteria (PGPR) represent a sustainable biological strategy to overcome this constraint by mobilizing sparingly soluble Fe forms and improving plant nutrient acquisition under both optimal and stress-induced conditions.

In this study, tomato plants were treated with selected siderophore-producing PGPR strains isolated from tomato rhizosphere soils. Comprehensive evaluations—including chlorophyll content (SPAD), phenological progression, biomass accumulation, and visual symptom scoring—were conducted under controlled greenhouse conditions. PGPR inoculation significantly enhanced Fe uptake, reduced chlorosis symptoms, and increased chlorophyll stability compared with uninoculated controls. Siderophore-rich strains also improved plant performance under abiotic stress scenarios, suggesting a dual benefit in nutrition and stress tolerance.

Molecular analyses indicated the activation of Fe-related transport pathways and potential modulation of defense-associated genes, supporting an integrated physiological response induced by bacterial siderophores. Overall, our findings demonstrate that siderophore-producing microorganisms offer a promising, eco-efficient tool for improving Fe nutrition, boosting stress resilience, and enhancing overall vigor in tomato plants. This work contributes to developing sustainable microbial-based strategies for horticultural crop production.

## Biography

Gulara Huseynzade is a PhD candidate in Food and Environmental Microbiology at the University of Bologna, Italy, studying within a joint doctoral project between the Azerbaijan Diplomatic Academy (ADA University) and the University of Bologna. Huseynzade's work focuses on plant–microbe interactions, with particular emphasis on siderophore-producing plant growth-promoting rhizobacteria (PGPR) and their role in improving iron uptake, chlorophyll stability, and stress tolerance in horticultural crops, especially tomato (*Solanum lycopersicum*).

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# Integrated water and nutrient management in tropical rainfed agroecosystems: A systematic review of yield responses and resource use efficiency

Tropical rainfed agriculture supports over one billion people, yet yields remain below 30% of genetic potential due to interconnected water and nutrient constraints. Understanding which integrated water-nutrient management approaches generate consistent benefits across diverse contexts remains poorly synthesized, limiting evidence-based intensification strategies. This meta-analysis synthesized 43 field studies (1990-2024) selected through ROSES guidelines from Scopus and Dimensions. Inclusion required experimental trials combining water conservation and nutrient management in tropical rainfed conditions with yield data across multiple seasons. Random effects models estimated mean effects by intervention category, with meta-regression identifying moderating factors. Studies from South Asia (44%) and East Africa (28%) generated 53 intervention comparisons across seven categories: conservation tillage, integrated fertilization, organic fertilization, topographic modifications, mineral fertilization, cropping systems, and mulching. Here we show that integrated fertilization combining organic and mineral sources demonstrated superior robustness (1.34 t ha-1; 95% CI: 0.37 to 2.30), consistently outperforming mineral-only approaches (0.60 t ha-1; 95% CI: 0.07 to 1.12) despite substantial heterogeneity ($I^2$=98.4%). Study duration emerged as the primary moderator ($F_{1,27}$=15.90; $p<0.001$), with meta-regression revealing 0.063 t ha-1 additional gain per season ($R^2$=0.23; $p<0.001$). This is the first quantitative synthesis demonstrating that short-term trials (≤4 seasons, 77% of studies) systematically underestimate cumulative benefits. These findings provide evidence-based guidance for sustainable intensification while highlighting those long-term experimental trials exceeding ten seasons are essential to capture cumulative soil fertility improvements in tropical rainfed systems.

## Biography

Tchiche has expertise in systematic reviews and meta-analysis with a passion for advancing sustainable intensification in tropical rainfed agriculture. Tchiche's quantitative synthesis approach based on ROSES guidelines creates new pathways for evidence-based agricultural policy in resource-constrained environments. Tchiche has built this analytical framework after extensive work in integrated water-nutrient management research across West African farming systems. The methodological foundation draws on meta-analytical techniques and moderator analysis, which synthesizes heterogeneous experimental evidence to identify context-specific intervention strategies. This approach is responsive to agro-ecological diversity and emphasizes temporal dynamics of soil fertility improvements for sustainable crop productivity enhancement.

Imen Abidi*, Ghada Charfi, Imad Mourtaji
Akkodis, France

# MAIASA: A meta-learning framework with automated model selection, ensemble stacking, and explainability for precision irrigation optimization and crop yield prediction

Optimizing irrigation scheduling and predicting crop yield remain critical challenges for sustainable precision agriculture. Existing decision support systems (DSS), including AquaCrop-OS, Irriwatch, and Cropwise Irrigations, lack automated model selection, adaptive ensemble learning, and transparent explainability, limiting their adaptability across diverse agro-climatic contexts. We present MAIASA (Meta-Learning AI for Adaptive and Sustainable Agriculture), a seven-layer meta-learning framework that integrates multi-modal agro-climatic data ingestion, automated machine learning model selection, and post-hoc explainability to deliver optimized irrigation recommendations and accurate crop yield predictions.

MAIASA introduces four core innovations. First, a weighted meta-learner automatically selects the optimal predictive model — from XGBoost and Random Forest to deep neural architectures — by scoring each candidate algorithm along accuracy, computational efficiency, robustness, and interpretability axes, directly addressing the benchmark finding that no single algorithm dominates across agronomic scenarios. Second, the novel ET×SWR meta-feature encodes the coupling between actual crop evapotranspiration (ETa/ETc) and soil water reserve depletion ((TAW – RAW)/TAW) into a single physiologically grounded descriptor computed following the FAO-56 dual crop coefficient framework. Third, Optuna TPE hyperparameter optimization with structured pruning ensures efficient, fully reproducible model calibration across 100 trials with a PostgreSQL-backed persistence layer. Fourth, an adaptive SLSQP ensemble stacking layer combines optimized candidate models with non-negative constrained weights minimizing validation RMSE, coupled with SHAP (TreeExplainer) and LIME post-hoc explainability to provide transparent, agronomically interpretable attribution of predictions to soil, climate, and satellite variables.

Evaluated on a 1,999-sample winter wheat dataset from northern France integrating ERA5-Land climate reanalysis, LUCAS Topsoil v2.0 soil data, and Sentinel-2 NDVI time series, MAIASA achieves $R^2 = 0.9800$ and RMSE = 0.312 t• $ha^{-1}$, outperforming standalone XGBoost

($R^2$ = 0.9612), BiLSTM-CNN-Attention deep learning ($R^2$ = 0.9749), the EuroCropsML MAML meta-learning benchmark ($R^2$ = 0.9523), and calibrated AquaCrop-OS ($R^2$ ≈ 0.92). The ET×SWR meta-feature accounts for 34.1 % of SHAP global feature importance, confirming its value as the primary agro-climatic discriminator. The SLSQP-optimized ensemble achieves a simulated water use reduction of 23.4 % relative to a conventional fixed-schedule baseline, while maintaining a simulated yield improvement of 11.7 % through precision irrigation timing aligned with FAO-56 phenological Kc stages.

These results demonstrate that integrating automated model selection, physiologically grounded meta-features, adaptive ensemble stacking, and transparent explainability into a unified pipeline substantially advances the state of the art in data-driven precision irrigation and yield forecasting.

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# Responses of nightshade (*Solanum retroflexum*) to planting density and irrigation interval under the IDIS water-saving system for smallholder production systems

The water-saving platform, Integrated Drip Irrigation System (IDIS), and the 3S planter – capable of raising from one to nine plants per drip hole- were developed and funded by a grant from the Water Research Commission as a water-saving platform in smallholder farming systems, where the availability of irrigation water is among the major limiting production factors. Nightshade (*Solanum retroflexum*) is an indigenous leafy vegetable rich in beta-carotene, vitamin E, folic acid, ascorbic acid, calcium, iron, and protein. However, as an underutilised crop, the plant grows in the wild with limited information on its basic agronomic requirements.

Determination of the influence of planting density and irrigation interval under IDIS on harvest foliage yield and nutrient elements. The eight treatments, replicated 6 times, were arranged in a split-plot design (Main plot was irrigation interval as geometric series of 2 days; subplot being planting densities ranging from 1 to 9 plants/hole drip irrigation). Harvesting was done twice (H1 = 6 weeks after transplanting, H2 = 6 weeks after H1) for both summer and winter experiments. During each harvest leaves were oven-dried, and leaf mass determined, but leaves were collected mineral content (Ca, P, K, Mg, Na, Fe, Zn, Mn and Cu) at H1 summer, prepared using the digestion method and quantified through the ICPE-9000.

Data were assessed for normality and those that complied subjected to ANOVA using SAS software. Although planting density × irrigation interval interactions were significant for both plant growth and the accumulation of minerals, the partitioning of their sum of squares (SS) showed that the contribution to the total treatment variation was negligent and thus effects of the main factors were assessed exclusively. Irrigation interval and planting density each had significant effects on dry mass yield at both harvests regardless of the season, except that the irrigation interval had no significant effects on mass yield at H2 during summer.

Irrigation interval had highly significant effects on Ca, Mg, P, K, Na, Fe, Zn, Mn and Cu in leaf tissues at H1 during summer, whereas planting density had no significant effects for all mineral nutrients except for Ca, P and K. The observed quadratic relations allowed the computation of the optimum values for the main factor using the relation:

$x = -b1/b2b2$

The study's findings provided insights into optimising planting density or irrigation interval to derive the optimal benefits from *S. retroflexum* when produced using the water-saving IDIS platform.

## Biography

Professor Kgabo Martha Pofu is employed by the University of Limpopo as a Senior Researcher at the Department of Plant Production, Soil Science and Agricultural Engineering. Pofu's area of expertise is Plant Nematology, specializing in integrated nematode management strategies that are climate smart, and Pofu is also engaged in a community engagement project in urban agriculture at the City of Polokwane, Limpopo Province, South Africa, aimed at ensuring sustainable production of crops using vertical farming systems.

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# Effects of post-harvest losses on food security status of tomato value chain actors in Kano and Kaduna States, Nigeria

Post-harvest losses (PHL) in tomatoes represent a major challenge within agricultural value chains, reflecting inefficiencies in handling, storage, transportation, and marketing systems. These inefficiencies undermine market performance, reduce incomes, and weaken the food security of actors involved in the tomato value chain. This study examined the effects of post-harvest losses on the food security status of tomato value chain actors in Kano and Kaduna States, Nigeria.

A multistage sampling procedure was employed to select respondents. Four Local Government Areas (LGAs) were purposively selected from each of Kano and Kaduna States due to their prominence in tomato production. Respondents were then randomly selected across value chain categories in proportion to their population sizes, yielding 380 respondents comprising 308 producers, 35 marketers, and 37 processors. Primary data were collected using a structured questionnaire covering socioeconomic characteristics, production activities, post-harvest handling practices, marketing conditions, and household food security.

Data analysis employed descriptive statistics (frequency counts, percentages, means, and standard deviations), Post-Harvest Loss Index (PHLI), Two-Stage Least Squares (2SLS) estimation, Tobit regression, and Ordered Logit Regression (OLR). Household food security status was assessed using the United States Household Food Security Survey Module (US-HFSSM).

Results showed that most producers (93.2%) and marketers (94.3%) were male, whereas the majority of processors (81.0%) were female. The mean age was 45 years for producers, 47

years for marketers, and 43 years for processors. Most actors were married, representing 87.3% of producers, 94.6% of processors, and 91.4% of marketers, with average household sizes of 9, 8, and 9 persons respectively. Access to credit remained limited, with only 14.3% of producers, 32.4% of processors, and 28.6% of marketers reporting credit access.

Market structure analysis indicated a perfectly competitive market with a four-firm concentration ratio (CR4) of 1.47 and a Herfindahl–Hirschman Index (HHI) of 27.18. The Lerner index (0.068) suggested low price mark-ups and weak market power. The 2SLS results confirmed strong instrument validity (F=39.6) and showed that post-harvest losses, inadequate storage facilities, and limited market access significantly influence market performance.

PHLI results indicated that 51.3% of producers experienced moderate losses, while processors (100.0%) and marketers (94.3%) largely recorded low loss levels. Tobit estimates showed that post-harvest training significantly reduced losses among producers, processors, and marketers, while high transportation costs significantly increased losses across actor groups.

## Biography

Alexander Kuku is an agricultural and consumer economist whose research examines food systems, value chains, and food security in developing economies. Kuku's work focuses on post-harvest losses, market efficiency, and the welfare implications of agricultural value chains, with particular attention to tomato production systems in Nigeria. Through empirical research, Kuku seeks to generate evidence to inform policies and practical interventions that reduce food losses and improve livelihoods for value chain actors. Kuku's research interests include agricultural markets, food policy, and value chain development, reflecting a commitment to strengthening sustainable and resilient food systems in Sub-Saharan Africa.


## Kurbonali Partoev

Institute of Botany, Plant Physiology and Genetics, National Academy of Sciences of Tajikistan, Tajikistan


# The role of breeding in the creation and conservation of agrobiodiversity with climate change in Tajikistan


The article provides information on the role of breeding in the creation and conservation of agro biodiversity under climate change in Tajikistan. The Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan (IBFGR NAST) has combined classical breeding methods and modern biotechnology to produce new promising varieties of important field crops such as wheat (*Triticum aestivum L*), potato (S*olanum tuberosum L.*), Jerusalem artichoke (*Helianthus tuberosus L.*), corn (Moise L.), sunflower (Helianthus annus L.), cotton (*Gossypium hirsútum L)*, oats (*Avena sativa L.*), sorghum (*Sorghum L.)*, Chicory (*Checorium L.*), legumes (*Legumes L.*), vegetables (Vegetable) and other crops, which are more adapted to climate change when they are cultivated in various agro ecological conditions of Tajikistan. These crops play an important role in ensuring food security in the republic and enriching their gene pool and preserving them for future generations is one of the main goals and objectives of scientists in Tajikistan. In this regard, scientists at the IBFGR NAST Laboratory of Genetics and Breeding widely use breeding methods such as genetic screening and the introduction of new useful genotypes, hybridization of valuable source forms, and natural and artificial mutagenesis. In particular, when using the selective breeding method - targeted selection back in 2010 among the plant population of the local wheat variety "Zafar", valuable modified plants were identified, which differed significantly in leaf color, height of the main stem, precocity and yield. Further study of these altered genotypes for more than 12 years has shown that the isolated wheat samples differ significantly from the maternal “Zafar” variety in a number of genetic features. We have established that these altered traits are of a genetic nature, based on the natural process of mutagenesis in the conditions of the experimental site of the IBFGR NAST. The new modified forms of the plant were studied and propagated during 2011-2021 in various breeding nurseries. Thus, in 2022, based on the decision of the IBFGR NAST Scientific Council, the new wheat line was named

the “Bakhti Istiklol” (“Happiness of Independence”) variety and transferred to the State Commission for Variety Research and Protection of New Varieties of Agricultural Plants under the Ministry of Agriculture of the Republic of Tajikistan. Thus, it was found that the new wheat variety "Bakhti Istiklol" significantly exceeds the maternal wheat variety "Zafar" in such genetic characteristics as the length of the ear, the weight of the aboveground part of the plant, the weight of the ear, the number of grains in the ear, the weight of the grains of one ear, the weight of 1000 grains and other morphological characteristics.

**Keywords:** Breeding, Variety, Field Crops, Wheat, Oats, Potatoes, Jerusalem Artichoke.

## Biography

Kurbonali Partoev is Head of the Laboratory of Genetics and Breeding at the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, Doctor of Agricultural Sciences and Professor, whose research applies classical breeding methods and modern biotechnology to develop climate-adapted varieties of important field crops in Tajikistan.


## Kurbonali Partoev

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# The role of breeding in the mountainous area of Tajikistan to improve food security and human health in the face of climate change

In the mountainous conditions of Tajikistan, at an altitude of 1,800-3,000 m above sea level, scientists from the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan conduct their scientific research on the breeding of agricultural plants. For more than 30 years, they have been able to create new high-yielding varieties of crops such as wheat, potatoes, corn, sunflower, jerusalem artichoke, sorghum and fodder crops that are more adapted to mountainous conditions and grown on an area of more than 10 thousand hectares. The population of mountainous regions, (more than (57,000 people, farmers, women, youth in the mountainous zone), thanks to the cultivation of these varieties bred by scientists of our institute, annually receive high-quality food, improve their health against the background of climate change in the republic. Thus, thanks to the joint activities of scientists and rural farmers in the mountainous area, a sustainable system has been established to create a base for food security and preserve human health in mountainous conditions with climate change in the future. Tajik scientists plan to continue these important studies in the future by attracting scientists from other regions of Central Asia and mountainous countries of the world.

## Biography

Kurbonali Partoev is Head of the Laboratory of Genetics and Breeding at the Institute of Botany, Plant Physiology and Genetics of the National Academy of Sciences of Tajikistan, Doctor of Agricultural Sciences and Professor, whose research develops high-yielding crop varieties adapted to mountainous conditions to support food security and human health under climate change.

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# Leaf anatomy and histochemistry of *Piper* species from the Colombian Andes

The genus *Piper* (Piperaceae) comprises more than 2,000 pantropical species and represents one of the most diverse lineages of basal angiosperms. Species of *Piper* produce a remarkable diversity of specialized metabolites, including volatile terpenes, phenylpropanoids, amides, piperolides, lignans, neolignans, and flavonoids. This compounds mediate chemical defense and pollinator/disperser attraction, and exhibit anti-inflammatory, antimicrobial, antitumor, and antioxidant activities. Their production is modulated by environmental factors, organ type, developmental stage, tissue type, and the presence of specialized secretory cells. Consequently, integrated anatomical and histochemical studies of *Piper* organs provide valuable insights into both taxonomically informative characters and the tissue-level localization of specialized metabolites. Despite their ecological and economic importance, the anatomy of *Piper* species from the northern Colombian Andes (Boyacá and Cundinamarca) remains poorly documented.

This study characterized quantitative and categorical anatomical traits, along with histochemical features, of the leaf blade in 17 *Piper* species from Boyacá and Cundinamarca. Leaf blades from the third node, in the basal third of wild shrubs, were fixed in FAA and processed using standard histological protocols (dehydration, paraffin embedding, 5–8 µm sections, staining with acidified Astra blue and basic fuchsin). Characters of the dermal, ground and vascular tissues were recorded, with particular emphasis on secretory structures, including oil cells associated with epidermis, hypodermis, parenchyma and vascular bundles. Histochemical analyses of fresh material were performed to detect terpenes (NADI reagent), phenolics (ferric chloride and potassium dichromate), flavonoids (aluminum chloride), and tannins (vanillin). Anatomical data were analyzed using principal component analysis, revealing distinct patterns of secretory tissue differentiation among species.

*Piper fusagasuganum* was distinguished by a markedly higher abundance and larger size of secretory cells in the vascular bundles and parenchyma of the midrib, suggesting an enhanced capacity for metabolite accumulation in central vein tissues. In contrast, *P. reticulatum* exhibited more numerous and larger size of secretory cells in the adaxial hypodermis and abaxial epidermis, together with thicker palisade parenchyma, reflecting distinct investment in dermal secretory tissue and photosynthetic parenchyma. *P. peltatum* showed comparatively low development of these traits, while species such as *P. grande, P. aequale, P. aduncum,* and *P. auritum* displayed more homogeneous anatomical patterns without pronounced tissue specialization. These findings identify anatomical characters of potential taxonomic value associated with the distribution and morphology of secretory structures and provide a framework for future studies on the environmental and developmental regulation of specialized metabolite production in *Piper.*

This research was funded by the Colombian General System of Royalties (Sistema General de Regalías, under project BPIN 2023000100058), and by the "Convocatoria para el Apoyo al Desarrollo de Tesis de Posgrado (Maestría de Investigación y Doctorado) de la Facultad de Ciencias Sede Bogotá de la Universidad Nacional de Colombia 2025, Modalidad 1" (Call for Support of Graduate Thesis Development, Universidad Nacional de Colombia, 2025), Código Hermes 66084. Research involving Colombian biodiversity was conducted under Genetic Resource Access Contract No. 121 (22 January 2016), and Amendment (Otrosí) No. 21, entered into between the Ministry of Environment and Sustainable Development and the Universidad Nacional de Colombia.

## Biography

Laura K. Rodríguez-Sánchez is a biologist and Ph.D. candidate in Science – Biology at the Universidad Nacional de Colombia, where Rodríguez-Sánchez also earned an M.Sc. in Biotechnology. Research interests bridge plant anatomy, histochemistry, and phytochemistry, with a particular focus on specialized metabolites and their ecological and applied roles. Building on this integrative approach, the doctoral research focuses on evaluating the potential of Piper species from the Colombian Andes for the sustainable management of phytopathogenic fungi affecting commercial Passiflora crops. Rodríguez-Sánchez has published scientific articles and presented research at national and international conferences.

Lisa Huybrechts
Harvestis, Belgium

# The use of CHP condensate water in greenhouse cultivation

Ensuring access to sufficient high-quality irrigation water is crucial for hydroponic greenhouse cultivation, especially when recirculation systems are applied. Water demand of greenhouse cultivation per square meter is expected to continue increasing due to the intensification of crop production and as a result of external factors such as climate change. To meet this growing demand, growers are looking toward alternative water sources. An alternative water source is condensate water from the Combined Heat and Power (CHP) installation. Preliminary research indicates that CHP condensate water could supply 5 to 10% of the total water requirement of a hydroponic greenhouse cultivation. Depending on the material, design and specific working conditions of the CHP installation, this condensate water might contain heavy metals. Furthermore, the pH can vary from 4 to 6. In this study, 10% unpurified or purified (via a Lubron filter unit) CHP condensate water was added to the fertigation schedule of a year-round tomato crop. This was compared with a control where the fertigation schedule was based off 100% rainwater. Although differences were not significant, yield was slightly higher for the control. The purified CHP water treatment produced 8% less with a slightly lower fruit weight. The unpurified CHP water treatment produced 11% less with a slightly lower fruit weight. Plant characteristics did not differ significantly. More importantly, there was no accumulation of heavy metals in the fertigation water or fruits, even when unpurified condensate water was used. Nevertheless, purification is still recommended as CHP condensate water quality varies between installations.

## Biography

Lisa Huybrechts (°1998) has completed a Master in Bio-engineering at the Catholic University of Leuven. In 2025, Huybrechts joined the research team of Proefstation voor de Groenteteelt vzw, focusing on practical research in sustainable water use in soilless horticulture crops and cucumber cultivation. Huybrechts serves as the project coordinator for the LA trajectory OptiWAIE (Optimization of Water use in greenhouse horticulture using Alternative Internal and External water sources), within which the presented research is conducted.

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# Flavonoids from *Piper longicaudatum* as antifungal agents against *Passiflora* phytopathogens

In Colombia, the cultivation of Passiflora species such as gulupa (*Passiflora edulis f. edulis*), sweet granadilla *(P. ligularis*) and yellow passion fruit (P*. edulis f. flavicarpa*) represents an economically important agricultural sector, supported by increasing demand in international markets, particularly in the European Union. However, crop productivity and fruit quality are frequently affected by phytopathogenic fungi throughout pre- and post-harvest stages. Disease management relies largely on synthetic fungicides, whose intensive use may generate environmental impacts and challenges associated with pesticide residues and export requirements. Consequently, there is a growing need to identify effective and sustainable antifungal alternatives from natural sources. This study aimed to evaluate the antifungal potential of Piper longicaudatum against phytopathogenic fungi associated with Passiflora crops. An ethanolic extract obtained from the inflorescences of *P. longicaudatum* was evaluated against *Colletotrichum colombiense, Fusarium triseptatum, Alternaria alternata,* and C*ladosporium cladosporio*ides using mycelial growth inhibition assays. The crude extract was subsequently fractionated, and the resulting fractions were evaluated under the same experimental conditions. The ethanolic extract inhibited the growth of all evaluated phytopathogens, with half-maximal inhibitory concentration ($IC_{50}$) values ranging approximately from 100 to 600 µg/mL, indicating differences in susceptibility among fungal

species. Fractionation enhanced the antifungal response, and the dichloromethane fraction exhibited the most promising activity, with $IC_{50}$ values in the approximate range of 75–170 µg/mL. This fraction was therefore selected for purification by flash chromatography, leading to the isolation and identification of four active flavonoids belonging to the dihydrochalcone and flavanone subclasses. The isolated metabolites showed variable antifungal effects, with mycelial growth inhibition ranging approximately from 30% to 100% against the evaluated susceptible phytopathogens. To further investigate the structural features associated with antifungal activity, a structure–activity relationship analysis was performed by comparing the isolated metabolites with six additional flavonoids previously obtained from other *Piper* species or through chemical synthesis. The comparative analysis indicated that the flavonoid scaffold and oxygenation pattern substantially influenced antifungal activity, with selected flavanone structures displaying greater inhibitory potential than structurally related dihydrochalcones. These findings highlight *P. longicaudatum* as a promising source of antifungal flavonoids and provide a basis for the development of natural alternatives for the management of fungal diseases affecting *Passiflora* crops. Ongoing studies are focused on expanding the chemical series through synthesis and determining the antifungal potency of individual compounds to further establish structure–activity relationships. This study was funded by the Sistema General de Regalías of Colombia under project BPIN 2023000100058. Research activities on Colombian biodiversity were conducted under Genetic Resource Access Contract No. 121 of January 22, 2016, and its Amendment (Otrosí) No. 21, executed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Luis Sebastián Becerra Camargo holds a bachelor's degree in Chemistry from District University. Becerra Camargo's research interests center on the study of natural products as sustainable alternatives for agricultural protection. Currently a master's student, Becerra Camargo focuses on the phytochemical potential of species within the genus Piper. This scientific work aims to develop innovative phytosanitary solutions for the control of fungal phytopathogens that severely affect passionfruit (Passiflora) crops, contributing through chemistry to the care and sustainability of agriculture.

Myagmarsuren Purevdorj*, Badam Battulga, Batgerel Davaakhuu, Urgamal Magsar, Amar Erdenechimeg

Research Institute of Animal Husbandry, Mongolia

# Effects of Australian Merino introgression on wool quality traits of Orkhon wool sheep breed

This study evaluated the effects of Australian Merino introgression on selected wool quality traits of Orkhon fine-wool sheep under Mongolian production conditions. Wool samples were collected from 142 sheep representing two genetic groups: F1 Merino × Orkhon crosses produced by artificial insemination using frozen semen from Australian Merino rams (1–2 years of age) and purebred Orkhon fine-wool ewes aged 3–6 years. Greasy fleece weight, scoured wool yield, fiber composition, fiber length, and fiber diameter were analyzed using standard laboratory methods. Data were analyzed using a General Linear Model to assess the effects of genotype, age, and their interaction.

Scoured wool yield ranged from 57.63% in F1 yearling rams to 62.32% in adult purebred ewes and was significantly affected by age ($p<0.05$), whereas the genotype effect was not significant ($p>0.05$). F1 Merino × Orkhon sheep exhibited a significantly higher proportion of fine fibers and finer down fiber diameter (20.58–21.21 μm) compared with purebred Orkhon sheep (22.14–26.00 μm) ($p<0.05$). Fiber diameter increased progressively with age, indicating age-related fiber coarsening. A significant genotype × age interaction was observed for fiber diameter, demonstrating that the influence of Merino introgression was more pronounced at younger ages.

The results confirm that the use of frozen semen from Australian Merino rams is an effective strategy for improving wool fineness in Orkhon fine-wool sheep without adversely affecting scoured wool yield. These findings provide a scientific basis for further genetic evaluation and the development of sustainable fine-wool breeding programs in Mongolia.

## Biography

Associate Prof. Myagmarsuren Purevdorj is the Head of the Animal Science Division and Senior Researcher at the Institute of Animal Husbandry, Mongolia. Purevdorj earned a Doctorate in Animal Science from the Mongolian University of Life Sciences and completed postdoctoral training in Austria in livestock breeding and genetics. Purevdorj's research focuses on reproductive biotechnology, genetic evaluation, and breeding strategies for sheep, goats, and cattle. Purevdorj has led national and international projects, supervised graduate students, and published over 30 scientific papers, receiving multiple national awards.

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# Residual bacteria in cucurbitacin-containing phytonematicides: Molecular identification, performance mechanisms and sustainability

Cucurbitacin phytonematicides are potent eco-friendly alternatives to synthetic chemical nematicides, which have been withdrawn from the agrochemical markets. The products are manufactured through the fermentation process using effective microorganisms which *comprise at least six bacteria – each with a specific role, but without information on the residual* bacteria and mechanisms involved in promoting the stability and sterility of the products, along with how the test bacteria sustain themselves without compromising the active ingredients of the products. The research focused on identifying bacterial strains associated with the residual bacteria post the active fermentation process and their potential role in avoiding contamination and thus enhancing product sterility and stability, along with related energy pathways. Using a ZymoBIOMICS™ DNA Miniprep Kit for DNA extraction and 16S rDNA primers for PCR amplification. The study identified a dominant Lactobacillus species, with high genetic similarity to the Spanish *Lactobacillus* strains (HG794492). Phylogenetic analysis clustered the South African *Lactobacillus* with L. vini and L. mobilis, with nucleotide sequence similarities ranging from 85 to 87%. Results indicate that *Lactobacillus* species dominated the mature stage, eliminating the other microbial constituents in the original EM. The study also explored the biochemical processes involved in fermentation, emphasizing the role of *Lactobacillus* in reducing pH and enhancing product sterility. Additionally, the research examined cucurbitacin degradation under different storage conditions, noting that temperature significantly influenced product stability, with tropical conditions extending the shelf-life, whereas chilled conditions had the opposite effect. The homolactic fermentation pathway at maturity, highlighted the production of copious lactic acids, hydrogen peroxide and adenosine triphosphate (ATP) molecules. In conclusion the findings suggest that the identified *Lactobacillus* species plays a crucial role in maintaining the efficacy, sterility and stability of cucurbitacin phytonematicides. Further, the study recommends whole-genome sequencing of the identified *Lactobacillus* species to refine bacterial classification and explore its bioremediation potential.

## Biography

Professor Mashela studied MS and PhD in Nematology at the University of Florida, Gainesville, USA from 1988 to 1992, supervised by Professor Robert McSorley and Professor Larry Duncan respectively. After completion, Mashela entered politics in South Africa at the dawn of democracy and joined the University of Limpopo, where a large number of PhD students from South Africa and the African continent were trained, with collaborators from various universities in Belgium, and, together with students, has over 300 published research articles.

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# Elevated methionine improves the nutritional quality of seeds and alters epigenetic landscapes in Arabidopsis

The key methionine biosynthetic enzyme cystathionine γ-synthase (CGS) was expressed under the control of the seed-specific phaseolin promoter in Arabidopsis, tobacco, and soybean. This led to a marked accumulation of amino acids and sugars in seeds, resulting in significantly elevated levels of protein and starch, which are important for nutritional value. These metabolites are hypothesized to originate from leaf-derived translocation. Transcriptome profiling of Arabidopsis leaves revealed increased expression of genes involved in DNA methylation and chromatin remodelling. Since methionine is the precursor of S-adenosylmethionine (SAM)—the primary methyl donor for DNA and histone methylation, its elevated levels are expected to influence the epigenome. While low SAM levels have been associated with DNA hypomethylation, the consequences of increased Met/SAM remain poorly understood. To explore this, we analysed the mto1 mutant, which accumulates high methionine and SAM due to a mutation in CGS. Whole-genome bisulfide sequencing (WGBS) revealed widespread hypermethylation, particularly in non-CG contexts (CHG, CHH) within pericentromeric heterochromatin. Although gene body methylation (gbM) was also altered, it showed only a weak association with gene expression changes. Downregulation of transposable element-associated genes (TEGs) and stress-responsive genes suggests that elevated methionine/SAM suppresses genome plasticity by silencing TEs. Genes in sulphur assimilation and aspartate family pathways, which contribute to methionine biosynthesis, were downregulated, while methionine catabolic genes were upregulated. Overall, these findings establish a mechanistic link between methionine metabolism, the sulphur assimilation pathway, epigenetic regulation, and nutrient allocation, highlighting the influence of sulphur metabolic status on the plant epigenome and genome stability.

## Biography

Rachel Amir's lab focuses on improving the nutritional value of plants by increasing levels of essential amino acids, especially methionine, which is often limiting and reduces plant nutritional quality; recently, a link has been shown between methionine, the precursor to S-adenosylmethionine, a contributor of plant methyl groups, and epigenetic changes that affect gene expression and growth. Amir is a full professor and the dean of the Faculty of Life Sciences at Tel-Hai University, with about 100 publications.

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# Climate-resilient small ruminant production from pasture lands: Challenges and opportunities for sustainable family farming in Bangladesh

Small ruminants—particularly goats and sheep—play a pivotal role in Bangladesh's rural economy by contributing to income generation, nutritional improvement, and women's empowerment. Representing about 54% of the nation's total ruminant population, these animals supply essential food and non-food products including meat, milk, skin, and manure. Pasture-based rearing systems, prevalent in char, coastal, and fallow lands, are cost-effective for smallholders but face growing challenges from climate variability, feed scarcity, and land-use changes. Such pressures threaten both the productivity and sustainability of small ruminant farming systems. This paper explores the nexus between pasture-based small ruminant farming and sustainable development within the framework of the UN Sustainable Development Goals (SDGs). The sector contributes directly to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 13 (Climate Action), and SDG 15 (Life on Land). Climate-smart practices—such as rotational grazing, fodder banking, and promoting drought- and salinity-tolerant forage species—should be prioritized to strengthen adaptive capacity. Government and NGO interventions, including those led by the Department of Livestock Services (DLS), Bangladesh Livestock Research Institute (BLRI), and FAO-PKSF initiatives, demonstrate promising pathways for resilience-building. Evidence from char regions highlights how goat and sheep farming provides climate-adaptive livelihood options and strengthens household economic security. To ensure long-term sustainability, integrated policies on pasture management, veterinary service delivery, and microfinance support must be embedded in national adaptation frameworks. These strategies will enhance productivity, ensure food security, and foster climate-resilient family farming systems in Bangladesh.

**Keywords:** Small Ruminants, Pasture Management, Climate Resilience, Family Farming, Bangladesh, SDGs, Food Security.

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# Empowering next-gen women in agriculture: Strategies for sustainable transformation in India through the 5E's framework

India is at a critical juncture in addressing the interconnected challenges of food security, environmental sustainability, and economic growth, especially as the global population is expected to reach nearly 10 billion by 2050. Agriculture, a vital component of the Indian economy—contributing around 15.5% to GDP and employing a large segment of the rural workforce—must evolve to meet these challenges. The role of women, particularly the emerging Generation Z (born 1997-2012), is increasingly vital in shaping a transformative agricultural landscape. This demographic, referred to as "Next-Gen Z Agri Women," is marked by digital fluency, a climate-conscious perspective, and purpose-driven ambitions. This review paper addresses the pressing challenges within India's food systems, including rapid population growth, climate variability, land degradation, and market volatility. Although India possesses surplus food grain stocks, issues of equitable access, nutritional security, and sustainable agricultural practices persist. Regional disparities and climate risks complicate these challenges, necessitating innovative, inclusive approaches that prioritize the engagement of women and youth.

Historically, women have been pivotal in agriculture, contributing to crop cultivation, livestock management, and the preservation of agro-biodiversity and traditional knowledge. However, they face significant barriers, including limited land ownership, restricted access to credit and insurance, and societal norms that often marginalize their contributions. Recent initiatives have bolstered female labor force participation, yet transitioning from participation to leadership and economic independence remains a substantial hurdle. Recognizing the distinctive traits of Next-Gen Z Agri Women is crucial, as they leverage technology and social

media to redefine agriculture as a platform for innovation, entrepreneurship, and community impact.

In response to these dynamics, this study introduces a framework of the 5Es—Entrepreneurship, Educationalism, Environmentalism, Empowerment, and Economic Resilience—as a strategic tool to enhance the capabilities of Gen Z women in agriculture. Entrepreneurship emerges as a central focus, promoting a shift from traditional subsistence agriculture to market-oriented practices that foster agro-startups and value-added agribusinesses through enhanced access to finance and mentorship. Educationalism highlights the necessity for comprehensive training in formal education and digital literacy, empowering women with skills in precision agriculture and online business management. Environmentalism taps into Gen Z women's commitment to sustainability, encouraging their leadership in climate-smart agricultural practices. Empowerment encompasses social, economic, digital, and political dimensions, underscoring the necessity for women to play active roles in agricultural decision-making. By integrating these components, this study aims to illuminate pathways for Next-Gen Z Agri Women, enabling them to transcend existing barriers and become drivers of sustainable agricultural transformation in India. The implementation of the 5Es framework aims to enhance their leadership and innovation, contributing to a resilient agricultural economy that promotes inclusivity and sustainability.

## Biography

Dr. Senaka Lalith Dharmasri Amarathunga is a distinguished Agricultural Extensionist and Environmentalist, recognized as "Asia's Best Innovative Researcher in Agricultural Extension – 2024/2025" within the Asia Research & Scientist & Professor & Teaching Academic Awards category. This accolade underscores Amarathunga's lifelong commitment to academic excellence and to promoting sustainable agricultural practices. Amarathunga holds a Ph.D. in Agricultural Extension, specializing in Public-Private Partnership Extension in the tea sector, from the University of Peradeniya (2015), an M.Sc. in Environmental Science with a focus on climate change impacts on tea productivity from the University of Colombo (2000), and a B.Sc. in Agricultural Sciences from the University of Ruhuna. Amarathunga's academic journey is characterized by remarkable achievements and a deep commitment to research.


## Senaka Lalith Dharmasri Amarathunga

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# Revitalizing indigenous technical knowledge: A pathway to climate resilience

As the effects of climate change intensify, communities worldwide face unprecedented challenges manifested through escalating temperatures, erratic weather patterns, and the depletion of key natural resources. While contemporary scientific methodologies are crucial for tackling these issues, the valuable insights offered by Indigenous Technical Knowledge (ITK) — refined over centuries through deep-rooted relationships with local ecosystems — must not be overlooked. This study investigates the potential of revitalizing ITK as a foundational strategy for climate resilience and mitigation.

Focusing on exemplary ITK systems across regions such as Sri Lanka, India, and Africa, the research highlights practices such as the tank cascade system (Ellanga) for sustainable water management, the Chauka irrigation system aimed at arid land restoration, and Zaï pits for enhancing soil fertility. Additionally, the study examines the field of ethno-climatology, revealing how communities employ bioindicators—such as animal behavior and plant phenology—to foresee and respond to extreme weather events. These traditional practices not only enhance resource efficiency but also promote collaborative adaptation efforts, exemplified by the establishment of communal seed banks.

Despite its demonstrated effectiveness, ITK is increasingly threatened by knowledge erosion and prevailing policies that prioritize industrial approaches. This research advocates for a strategic revitalization of ITK, emphasizing the importance of scientific validation, comprehensive documentation, and the incorporation of indigenous methodologies into national climate policies. Ultimately, the findings suggest that harmonizing indigenous knowledge with modern scientific approaches is essential for devising sustainable, culturally resonant, and robust strategies to combat the mounting challenges posed by climate change.

**Keywords:** Indigenous Technical Knowledge (ITK), Climate Change Mitigation, Resilience, Sustainable Agriculture, Traditional Wisdom, Community-Based Adaptation.

## Biography

Dr. Amarathunga is recognized as Asia's Best Innovative Researcher in Agricultural Extension - 2024/2025 within the Asia Research & Scientist & Professor & Teaching Academic Awards category. Amarathunga holds a Ph.D. in Agricultural Extension from the University of Peradeniya (2015), specializing in Public-Private Partnership Extension in the tea sector, an M.Sc. in Environmental Science from the University of Colombo (2000) focusing on climate change impacts on tea productivity, and a B.Sc. in Agricultural Sciences from the University of Ruhuna. Amarathunga's career is marked by academic achievements and a commitment to advancing research and sustainable agricultural practices.

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# Drought-induced cavitation event in xylem

When water moves through thesoil-plant-atmosphere continuum under a negative pressure, cavitations often occurs.

Many studies have confirmed that air bubbles caused rought-induced cavitation in xylem. However, the spread of embolisms is poorly understood.

Cavitation involves air bubble activity in xylem sap. Studying bubble activity: including the radii of bubbles at equilibrium, the stability of equilibrium, and bubble development, leadstwotypesof cavitationtobe obtained.Oneis thegrowth oftheair bubbles, existing in conduit sap previously; the other is air seeding, defined as the sucking of air bubbles from already gas-filled place.

Providedthatthereisanairbubblesteadilyinaconduitofradius $r_c$. Ifxylem absolute pressure $P_l$=0, the bubble of the radius $r_o = \frac{\sqrt{3}}{2}\sqrt{nRt^2 / 2\pi\sigma}$ is in stable equilibrium. Along with the drop of P, it will expands teadily and would explode at xy lempressure $P = 1,\ P_l^* = -\frac{8\sigma}{9}\sqrt{\frac{2\pi\sigma}{nRT}}$ with radius $r = r_* = \frac{\sqrt{3}}{2}\sqrt{nRt / 2\pi\sigma}$ If $r_* > r_c$ before exploding the bubble has become long shaped. In this way the bubble only expands and elongates gradually to form embolism. This is the first method of cavitation: An airbubble expands gradually. Only $\text{if } r_* < r_c$, can the bubble explode at its $P_l^*$ to form long shaped, and continues to elongates lowly. This is the second method of cavitation: An air bubbles teadily expands, explodes suddenly, becoming long shaped, and continues to elongate gradually.

For air seeding in the range of xyl empressure $-2Po < P_l < Po$ ($Po$ is atmospheric pressure),

if an air seed enters a conduit of radius $r_c$ through a pore of radius $r_p > 0.487\mu\mathrm{m}$ Its radius should $r_0^{'}, r_o$ or $r_1$ be in which the bubble all are instable equilibrium. As $P_1$ decreases, it will enlarge steadily like the growth of apre-existent Air bubbles, presenting the first or second method of cavitation but with air reservoirs In the range of $P_1 \le -2P_0$, soon after an air seed enter second unit through a pore of radius $r_p \le 0.487\mu\mathrm{m}$, it will breakup immediately, letting the conduitto be full of the seed air instantly. This is the third method of airseeding: As soon as an air seed enters a conduit, it breaks up immediately and the air in it filling the conduit instantly.

The natural drying processes of xylem slices of *Platycladusorientalis L.* were observed under light microscopy. Three phenomena were obtained, which correspond to the three methods of air seeding. Synchrotron X-ray microscopy was used to capture cavitati one vents in intactvessel elements of cornandri celeaves. In the experiments, gas instantly filling conduits was more easily obtained, which should becaused by exploding event. But when we searched for gradual expansion of bubbles, it was almost invisible. We considered that the vessel elements of the leaves of cornandrice were intact, air only entered the conduits at $\mathrm{P_1} \le -2\mathrm{P_0}$ through the pores of radii $r_p < 0.487\mu\mathrm{m}.$ And it was very difficult for air to enter the conduits of the sample leaves in the range of xylem pressures $-2P_0 < P_1 < P_0$, leading the absence of gradual expansion.

In drought cases for whole plant the third method of air seeding should be apriority. Thus, the spread of embolism could be understood.

## Biography

Shen Fanyi is a professor at Beijing Forestry University, born in 1943, who graduated with a master's degree from the Department of Physics, Beijing Normal University, and worked at Beijing Forestry University as a teacher from 1982 until retirement. Working in a forestry university, Shen explored the application of physics in tree physiology and discovered that water rising up in the xylem of a tree is a physical process, then proposed the theory of cavitation and used two experimental methods to confirm the theory.

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# Integrated single-cell transcriptomics, cis-element profiling, and quantitative functional assays for mining maize bundle sheath cell-specific promoters

Maize (*Zea mays L.*) is a representative C4 crop in which carbon assimilation through the Calvin cycle primarily takes place in bundle sheath cells (BSCs). Identifying promoters capable of driving strong and specific gene expression in BSCs is of paramount importance for elucidating C4 photosynthetic mechanisms and advancing genetic engineering to improve crop yield. However, experimental validation and systematic activity comparison of promoters corresponding to BSC-enriched genes remain limited, hindering their application in C4 photosynthetic engineering.

To address these challenges, this study established an integrated pipeline combining multi-source single-cell RNA sequencing (scRNA-seq) datasets with molecular, physiological, and biochemical approaches to systematically mine and functionally characterize maize BSC-associated promoters. First, 10 upstream promoter sequences (~2000 bp) of previously reported BSC marker genes (including PCK1, ME1, PRK2, SHBP1, RBCS1/2, RCA2, FBPA1/2, and MDH) were cloned. Quantitative dual-luciferase assays in maize protoplasts revealed that the PCK1 and SHBP1 promoters exhibited the highest transcriptional activities, while PRK2 showed relatively lower baseline activity. To clarify their cell-type expression specificities, stable transgenic maize plants carrying promoter-GUS reporter constructs were generated. Tissue section analysis demonstrated that the PRK2 promoter conferred strict BSC-specific expression, whereas the SHBP1 promoter exhibited non-specific activity across epidermal cells.

To expand the repertoire of BSC candidate promoters, three published maize leaf scRNA-seq datasets were integrated, resulting in 81 conserved overlapping genes. Developmental expression profiling identified three candidate genes (Zm00001d041819, Zm00001d046786,

and Zm00001d023376) with sustained high transcript abundance across leaf development stages. Dual-luciferase transient assays confirmed strong promoter activities for all three candidates, with Zm00001d041819 displaying the highest expression strength. Furthermore, by analyzing cis-regulatory motifs within known marker promoters, 15 core conserved motifs and 31 core transcription factor families were identified. A weighted regulatory scoring model incorporating core motif density and binding ratios was constructed, effectively screening 21 high-confidence BSC candidate promoters from the 81 overlapping genes. Finally, a cell-isolation workflow separating BSCs and mesophyll cells (MCs) was optimized, coupled with RT-qPCR to validate the cell-type-specific expression patterns of these candidate promoters.

In summary, this study provides a quantitative activity ranking of classic BSC marker promoters and establishes an end-to-end framework of mining maize BSC-specific promoters integrating "scRNA-seq mining – cis-motif modeling – functional activity assay – cell isolation validation." These findings supply essential genetic tools for C4 photosynthetic engineering and Plant Synthetic Biology.

## Biography

Shukai Fan, a graduate from China Agricultural University, earned a Professional Master's Degree in Agronomy and Seed Industry with a focus on Synthetic Biology, under the supervision of Prof. Jinsheng Lai and co-supervisor Prof. Durval Dourado Neto. Fan's research focuses primarily on molecular genomics, C4 photosynthetic mechanisms, and targeted transcriptional regulation in crops, and during the master's degree integrated single-cell transcriptomics, bioinformatic predictive modeling, and functional reporter assays to identify novel bundle sheath cell-specific promoters in maize (*Zea mays L.*), providing robust promoter tools and theoretical frameworks for C4 photosynthesis engineering and photosynthetic efficiency enhancement in cereal crops.


Sixolise Manciya[1]*, Misery Mpuza Sikwela[2], Natasha Cronje[3] and Zoleka Ncoyini-Manciya[4]

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# Assessing the competence of extension officers on equipping banana farmers and perception to adapt to climate change: A case study of KwaZulu-Natal and Eastern Cape provinces smallholder farmers


Developing countries, due to their limited adaptive capacity and various challenges, are anticipated to be severely impacted by climate change. Thus, it is crucial for the farming communities in these regions to gain a deeper understanding of climate change and its potential effects. To explore this, it is essential to evaluate the knowledge of extension officers, who serve as the primary information source for many small-scale farmers. This study gathered data from 61 extension officers advising on crop production across the Eastern Cape and KwaZulu-Natal provinces. Specifically, 31 extension officers from the Ugu district in KwaZulu-Natal and 30 from the OR Tambo district in the Eastern Cape participated. The data were collected via questionnaires, coded, and entered an Excel spreadsheet before being analysed using SPSS version 29. Various analyses were conducted to obtain descriptive statistics, aiming to assess the extension officers' understanding of climate change, the factors driving current climate changes, their methods of staying informed about climate change, the primary climatic variables affecting banana farmers, and the

conservation agriculture adaptation measures being promoted. Additionally, the study examined the uptake of these measures by small-scale farmers. The findings indicate that extension officers need training as the most effective method for enhancing their skills. They require further training in weather forecasting, climate change impact recording and reporting, and information communication technologies. Both training sessions and farmer days were identified as the most effective capacity-building strategies in the Ugu and OR Tambo districts.

**Keywords:** Climate Change, Extension Officer, Banana, Production.

## Biography

Dr. Sixolise Manciya began a professional journey as an educator, specializing in Agricultural Studies at Imingcangathelo High School in Alice under the Department of Education. A passion for agriculture and rural development later led to a transition into the role of Agricultural Economist with the Department of Agriculture and Environmental Affairs in KwaZulu-Natal (KZN). Manciya is currently a lecturer at Mangosuthu University of Technology, within the Department of Agriculture, teaching Agricultural Extension and Agricultural Economics. Dr. Manciya is committed to developing future agricultural professionals and contributing to sustainable agricultural practices. Manciya holds a PhD in Sustainable Development from the University of the Free State. Manciya's research focuses on climate change, agricultural advisory systems, and smallholder farmer resilience.


## Stephen Jennewein

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# Improving food system awareness with agritourism: The Tour de Farm in Duval County, Florida

Agritourism strengthens community connections to local food systems by increasing awareness of where and how food is produced. In Duval County, Florida, the Tour de Farm exemplifies how farm tours can effectively promote agricultural literacy and appreciation among urban and suburban residents. Organized collaboratively by Slow Food First Coast and UF/IFAS Extension Duval County, the program promotes the appreciation of Northeast Florida's agriculture.

Through guided farm tours, on-site markets, and interactive experiences, participants engage directly with farmers to learn about sustainable practices, local food production, and the environmental and economic value of supporting local agriculture. Over the years, Tour de Farm has successfully adapted to many challenges, including logistics, volunteer management, the global pandemic, and local ordinances. Despite these obstacles, the Tour de Farm remains one of the region's most impactful agritourism events and protects agriculture by raising awareness.

Between 2023 and 2025, approximately 300 participants attended three Tour de Farm events featuring 25 farms and 5 local restaurants that source ingredients from nearby producers. Surveys revealed that participants improved awareness of their local food system with 96% of respondents reported discovering new local farms, with 44% having been unaware of any of the featured operations prior to the tour. Furthermore, 100% of respondents indicated a heightened appreciation for the importance of agriculture in the region, and 93% reported an increased understanding of how and where their local food is produced.

These outcomes demonstrate the effectiveness of agritourism as an educational vehicle for enhancing food system awareness. By connecting residents directly to farmers, the Tour de Farm contributes to a more resilient and community engaged local food system in Duval County and the surrounding region.

## Biography

Jennewein works with the University of Florida and City of Jacksonville as the Small Farms and Alternative Enterprises extension agent in Duval County, Florida, USA. Born and raised in South Florida, Jennewein attended University of Central Florida and obtained a Bachelor of Science degree in Biology. Following graduation Jennewein worked for the USDA's Agricultural Research Service in Canal Point, Florida, developing sustainable agricultural practices on organic soils. Jennewein continued the work at the University of Florida for graduate studies, obtaining a Master of Science degree in Agronomy, and a Doctorate in Soil and Water Sciences.


## Subhas Chandra Datta

Department of Zoology, Visva-Bharati, West Bengal, India

Kanchannagar D. N. Das High School (HS), West Bengal, India


# Agriculture and horticulture enrich biomedicine in high-diluted forms, preventing plant pathogens

The “Cultivating Innovation in Agriculture and Horticulture” sector faces global challenges like food security, climate change, resource efficiency, and sustainable rural development. Recently, farmers and food producers have been worried about pests and diseases becoming more resistant. Chemical pesticides are often effective, but they cause residual toxicity. As global temperatures rise, rainfall patterns change, and extreme weather happens more often, pests and plant pathogens thrive in ways that disrupt traditional farming practices. Thus, it's essential to focus on solutions that tackle global issues such as food security, climate change, resource efficiency, and sustainable rural development for overall well-being. The main goal is to protect human health, safeguard ecosystems, and ensure the long-term viability of agricultural systems. It has been observed that using plant parts, whole plants, or plants themselves as biomedicines in humans, agriculture, and horticulture effectively prevents diseases by triggering a natural immune response in people and inducing systemic resistance in plants to defend against pathogens before infections occur.

To address this, the main objective is to use Cina, prepared from *Artemisia nilagirica*, high-diluted (HD) biomedicines used in agro-homeopathy provide an eco-friendly approach centered around the nutritional agriculture kitchen garden of Kanchannagar D. N. Das High School in Burdwan, West Bengal, India. This aims to understand the use of ‘PM PMPOSHAN’ biomedicine in the midday meal of students under the National Education Policy 2020 & 2023 of India. It focuses on a "Project-Based Learning Gardening Eco-System for Nutrition, School Health, Nutritious Food Science and Technology, and well-being” through “Cultivating Innovation in Agriculture and Horticulture" on the school campus. Here, multiple plans, such as vegetables and fruit plants, are cultivated. The plants are amaranth, cucumber, cowpea, and okra, infected with root-knot and mosaic virus pathogens that cause plant diseases.

After harvesting of these Cina-treated four plants, amaranth and cucumber received the maximum infection in terms of root galls and mosaic virus. The lowest infection occurs in okra. On the other hand, amaranth, okra, cowpea, and cucumber from the nutritional garden are used as biomedicines in the 'Mid-Day Meal menu to measure the impact of the 'PM POSHAN Scheme and have various positive impacts, such as on growth, obesity, malnutrition, colds, cold and flu, and eye diseases.

The use of Cina high-diluted (HD) 'PM POSHAN' biomedicines is prevalent in agro-homeopathy and presents an eco-friendly approach to agriculture. By diluting and succussing substances sequentially, these low-dose remedies stimulate the innate immune system of crops, inducing systemic resistance against viral, bacterial, and nematode pathogens. Research shows that these highly diluted extract preparations provide several key benefits: Disease Suppression, No Residual Toxicity, Improved Plant Vigor, and Pathogen-Derived "nosodes." This demonstrates that HD Cina 'PM POSHAN' biomedicine can be applied in agriculture and farming for high yields, healthy plant growth, soil water retention, and as a pesticide. Cina reduce incidence of root-knot disease, powdery mildew, and leaf spot like different disease causing plant pathogens. It will fulfill the (AGRI 2026) under the theme "Frontiers and Advances in Agriculture and Horticultural Science." The conference attracts a diverse audience, including agricultural scientists, horticulturists, researchers, academicians, industry professionals, and policymakers, creating a vibrant community for sharing insights and advancing the field of agriculture and horticulture worldwide.

Keywords: Agriculture-Horticulture, Enrich, Biomedicine-High-Diluted-Forms, Preventing, Plant-Pathogens.

## Biography

Dr Subhas Chandra Datta, M.Sc., PhD, President Awardee, as an Innovative Researcher in various fields from 1993, Assistant Teacher of Ajodhya High School, and Headmaster of Kanchannagar at D.N. Das High School (HS) from 1996 to 2007 to date. Dr Datta has expertise in evaluation and a passion for improving health and wellbeing. Datta's research interests are in Agriculture, Horticulture, Plant Protection, Pathology, Healthcare, biomedicine, Physiology, Education, Environment, Allelopathy, and Homoeopathy. Datta's open and contextual evaluation model based on responsive constructivism creates new pathways for improving healthcare. Datta's 1st-plant-based biomedicines in homoeopathic forms 'Cina' achieve the 'World's Top Most Articles' in the 'Public Medical Health of WHO'. Datta's valuable work received a Patent under the Central Silk Board (CSB) in 2005. Datta is the honorary Member of different prestigious organisations, and has published more than 146 papers in reputed journals and has been serving as an editorial board member of repute.

Sukirti*, Rajendra K. Meena, Maneesh S. Bhandari

Genetics & Tree Improvement Division, ICFRE-Forest Research Institute, Dehradun, Uttarakhand 248195, India

# Deciphering stand structure and conservation pathways for the habitat restoration of *Indopiptadenia oudhensis,* an endangered species, endemic to the Terai-Bhabhar ecotone

*Indopiptadenia oudhensis* (Brandis) Brenan is a monotypic, endangered forest tree species endemic to the Terai-Bhabhar ecotone along the Indo-Nepal border. This ecologically sensitive transitional landscape, recognised by the IPCC as highly vulnerable to climate change, remains inadequately represented in systematic biodiversity assessments, thereby constraining evidence-based conservation and restoration planning. While the species' evolutionary history underscores its considerable scientific and phylogenetic value, its ecological roles, habitat preferences, and potential economic significance remain enigmatic, highlighting critical lacuna and suggesting the urgent need for comprehensive research and targeted conservation efforts.

The present study adopts a restoration-ecology framework to assess stand structure, regeneration dynamics, and conservation pathways for *I. oudhensis*, with a particular focus on identifying recruitment bottlenecks and informing habitat restoration interventions. Field surveys conducted in the Tuligad and Sukhidhang beats of the Champawat Forest Division (Uttarakhand, India) revealed severe anthropogenic disturbances, notably lopping, recurrent fire incidences, and extraction pressure. Current population density was critically low (~7 trees ha-1) compared to earlier reports (~440 stems ha-1), indicating pronounced stand depletion. Diameter-class distribution exhibited a conspicuous deficit of individuals in intermediate size classes, suggesting poor conversion of seedlings into saplings and adult trees, and consequently, disrupted stand continuity.

Despite structural decline, seeds collected during May demonstrated high viability, achieving 100% germination under controlled incubator conditions and approximately 80% germination in nursery trials when sown within one week of harvesting. Satisfactory natural seedling emergence was also observed in forest sites. However, high post-germination mortality and low recruitment success indicate that regeneration failure is primarily driven by post-establishment constraints rather than seed limitation. To mitigate this risk, conservation seed storage was undertaken, and a germplasm repository was established to safeguard genetic resources and support future restoration and assisted regeneration programmes.

The study also highlights the importance of integrating seed-based conservation, belowground biodiversity, facilitative plant interactions, and root network dynamics into science-driven habitat restoration frameworks. Incorporating such ecological processes is essential for enhancing recruitment success and designing climate-resilient forest management strategies. These preliminary insights further underscore the importance of long-term ecological monitoring to assess restoration outcomes, track population recovery, and ensure the long-term persistence of *I. oudhensis* within the Terai-Bhabhar landscape.

## Biography

Sukirti is a dedicated Forest Science professional currently pursuing a Ph.D. in Forest Genetics at the Forest Research Institute. Sukirti's research interests centre on genetics, seed biology, and forest genetic resource conservation, with a strong focus on sustainability and biodiversity conservation, and include contributions to Springer book chapters on advanced biotechnological approaches for seed germplasm conservation and molecular markers for seed traceability, and published work on the conservation of the critically endangered *Indopiptadenia oudhensis*. Sukirti has also worked on seed source variation and the domestication of wild fruit species, and was recently awarded Best Poster at the India International Science Festival and recognised for work in molecular genetics.

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# Role of natural plant derived-baicalein on neurogenesis and brain remodelling in endothelin-1 ischemic stroke model

Ischemic stroke is a major cerebrovascular disease that leads to mortality and adult disability worldwide. Recently, multipotent neural stem cell (NSC) grafting has emerged as potential therapy to regenerate the damaged brain tissue. However, the hostile microenvironment in the ischemic brain region is challenging for the survival of transplanted cells. In this regards, NSC culture was optimized with baicalein, a neuroprotective active compound, extracted from *Oroxylum indicum* plant to enhance the NSC therapeutic potential prior to transplantation into ischemic brain. *O. indicum* is a versatile medicinal herb plant reported to possess a wide range of pharmacological activities due to its high content of secondary metabolites such as flavonoids. Baicalein is one of the major flavonoids present in *O. indicum* with high potential as a neuroprotective agent. In this study, ischemic stroke rat model was established using endothelin-1 (ET-1) vasoconstrictor which constrict the middle cerebral artery (MCA) to induce ischemic damage in the brain. In vitro expandable NSCs were preconditioned with baicalein-enriched fraction (BEF) extracted from the O. indicum plant at optimum dosage of 3.125 µg/ml for 48 hours prior to transplantation into the ET-1 induced ischemic stroke rats. Rat behaviours and stroke severity were observed and recorded for 14 days. Results showed improvements in stroke behaviours occurred within 14 days after the transplantation of BEF-preconditioned NSC compared to non-preconditioned NSC transplantation group. Through TTC staining, the BEF-preconditioned NSC-treated group showed significant reduced brain infarct (11.535 ± 1.44%), compared to non-preconditioned NSC-treated group (17.784 ± 2.33%) and non-treated group (23.807 ± 2.60%). BEF-preconditioned NSC-treated group also showed significantly induced angiogenesis and reduced neuronal degradation, cell necrosis and inflammation, compared

to the other groups. In addition, total RNA transcriptomic profiling also was performed using microarray assay to identify the key genes and pathways underlying the ischemic stroke recovery induced by the preconditioned-NSC transplantation. Based on the microarray result, it was found that GABRA6 (362.11-fold), CBLN3 (103.94-fold) and NEUROD1 (37.9-fold) were significantly downregulated while FCGR3A (17,26-fold), LCN2 (15.65-fold) and MS4A12 (9.02-fold) were significantly upregulated in animals treated with BEF-preconditioned NSCs, compared to those treated with non-preconditioned NSCs. In brief, this study provided novel knowledge regarding the underlying mechanism of BEF-preconditioned NSCs therapy to treat ischemic stroke based on the significant main expression of genes using microarray analysis.

## Biography

Dr. Tan obtained a B.Sc. (honours) in Biotechnology at School of Science and Technology, Universiti Malaysia Sabah with First Class Honour and was selected as the only recipient of Royal Academic Award (non-indigenous category) of the year 2007. In 2008, Tan obtained full scholarship from Ministry of Higher Education, Malaysia to pursue a PhD at Department of Physiology, Anatomy and Genetic (DPAG), University of Oxford. Upon graduation in 2011, Tan was appointed as Senior Lecturer of Biomedicine in Universiti Sains Malaysia. Dr. Tan received several academic recognitions/awards including appointed as the Exco Member of Young Scientist Network (YSN) by Academic Science of Malaysia (ASM) which represent the young scientists in Malaysia; selected as Malaysian Young Scientist Representative for 68th Lindau Nobel Laureate Meetings in Lindau, Germany; selected as Malaysian Fellow for 47th Asia Pacific Advanced Network Meeting in Daejoen, South Korea; Travel award from International Society of Heart Research in 2010; Student award from Green Templeton College, University of Oxford in 2010; Competitive bursary from both British Society for Cardiovascular Research and Oxford Stem Cell Institute in 2011 and so on. Currently, Tan's research focuses on developing a reliable natural product and stem cell-based therapeutic technique to treat human neurological diseases such as brain cancer and stroke.

Teja Vengala
Rare Earth Genomics, United States

# Inducing potential mutants in industrial hemp (*Cannabis sativa L.*) via chemical mutagenesis

Cannabis sativa is a multi-use crop with applications in food, fiber, construction, and medicinal industries. In the US, Cannabis plants with low THC concentrations (hemp) have recently been decriminalized according to the 2018 farm bill but farmers are still hesitant about its legality. To avert the risk and constant regulatory pressures due to potential THC contents, we aim to develop a compliant hemp variety using chemical mutagenesis. We selected EMS as the chemical mutagen and identified the LD50 doses for two hemp varieties. Hemp seeds were treated with the LD50 dosage of the mutagen to produce mutant M1 populations. The M1 plants displayed a wide array of mutant phenotypes and were tested for their trichome profiles. Selection of M1 plants was done based on mutant phenotypic traits and trichome production, followed by self-hybridizations to produce $M^2$ seeds. The obtained lines are expected to be 100% compliant with all regulations. These promising lines present a new, versatile, and sustainable crop with applications in food, fiber, and construction industries, addressing the growing needs of the nation.

## Biography

Teja Sri Vengala is an Agricultural Plant Scientist and innovator at Rare Earth Genomics, specializing in industrial hemp breeding, genetics, and genomics, with a Master of Science in Agricultural and Horticultural Plant Breeding from Texas A&M University. Vengala has led multiple research projects, including the development of heat and drought tolerant hemp and compliant hemp, recently launched a major international collaboration between REG-TAMU and India's premier hemp research institute CSIR-NBRI, has presented at leading national and international conferences, and is committed to bridging global hemp innovation with real-world agricultural impact.

Xien Zhou[1]*, Zehong Chen[1], Zhenlin Wang[1], Daozong Sun[1,2,3], Lihong Yang[1], Guoqi Yan[1], Shuran Song[1,2,3]

[1]South China Agricultural University, China

[2]Guangdong Engineering Research Center for Monitoring Agricultural Information, China

[3]Guangdong Laboratory for Lingnan Modern Agriculture, China

# Effects of soil moisture and leaf diurnal rhythms on pesticide droplet absorption and utilization efficiency

Leaf pesticide spraying is the predominant method for crop protection, yet its efficiency is often severely limited by poor droplet absorption after deposition, leading to substantial pesticide waste and environmental contamination. While significant research has focused on maximizing droplet deposition on leaf surfaces, the critical post-deposition process of absorption—particularly for hydrophilic systemic pesticides—remains underexplored. The pesticide droplet absorption efficiency of leaves is related to environmental factors and plant growth status during pesticide application. In field environments, irrigation-based soil moisture content regulation is a key plant growth status adjustment method. A theoretical pesticide droplet leaf absorption model was established to study the effects of soil moisture content on droplet absorption. Controlled environment experiments were carried out to investigate the absorption of pesticide droplets, and a chi-square test was used to verify the model reliability. The results showed that pesticide droplet leaf absorption flux first increased and then decreased with increasing soil water content. The diurnal leaf water potential and stomatal conductance variations indicated intrinsic diurnal rhythms, resulting in diurnal variations in the pesticide droplet leaf absorption flux. Under the same soil water conditions, the absorption flux first increased and then decreased from 8 am to 6 pm (Beijing Time). Effective application of pesticides can be significantly enhanced by controlling soil moisture content and selecting the appropriate spraying time. The best spraying combination improved the application effectiveness nearly threefold over that of the worst combination. This finding is pivotal for improving pesticide use efficiency, as enhanced absorption directly translates to reduced pesticide runoff and volatilization, thereby mitigating environmental pollution. By elucidating the interplay between soil management and plant physiology, this research provides a practical framework for precision agriculture. It empowers growers to move beyond merely maximizing deposition and towards optimizing the entire absorption

process, enabling more effective, economical, and environmentally responsible pesticide applications through informed irrigation and targeted spraying schedules.

## Biography

Dr. Xien Zhou works at South China Agricultural University. Research fields and interests include precision spraying technology and intelligent agriculture.

Eman Barkat[1], Xin (Bob) Du[1,2]*, Jun-Ran Kim[3], Zhengyan Wang[2,4], Byung-Ho Lee[5], Abrar Uaraboa[6], Esra Uaraboa[6], Bong-Su Kim[3]

[1]Harry Butler Institute, Murdoch University, Australia
[2]School of Environmental and Life Sciences, Murdoch University, Australia
[3]Department of Plant Quarantine, APQA, Republic of Korea
[4]Henan University of Technology, China
[5]Gyeongsang National University, Republic of Korea
[6]Curtin University, Australia

# A novel approach for fungal control with ethyl formate in barley and its impact on germination

Fungi can degrade grain quality, produce harmful mycotoxins, and hinder germination in the post-harvest stage, resulting in significant economic losses. Ethyl Formate (EF) is an efficient and eco-friendly fumigant for controlling pest insects in grains, horticulture, and quarantine treatments. However, there is a lack of research on the antifungal activity of EF and its degradation products on barley seeds. In this study, fifteen fungal species, predominantly *Alternaria infectoria,* were isolated and identified from seven Australian barley samples. Efficacy results indicated that EF significantly inhibited fungal growth at a commercial concentration of 2.4 mmol/L, except for *Penicillium* sp. 2, *Fusarium chlamydosporum,* and *Rhizopus arrhizus*. To control these EF-tolerant fungal species, the EF concentration was increased to 5 mmol/L, which achieved a 100% inhibition rate. The degradation product of EF, formic acid, effectively inhibited all EF-tolerant fungi, requiring only 0.08 mmol/L in the in vitro study. There were no significant differences in vigor and germination rates in barley treated with EF at concentrations of 2.5, 3.7, and 5 mmol/L. Additionally, EF treatments led to a significant increase in the barley root length from an average of 9.1 cm in the control group to 13.2, 13.6, and 12.3 cm at 2.5, 3.7, and 5 mmol/L. The findings suggest that EF could be a suitable alternative fumigant to safeguard grain from fungal infestation, particularly in the context of advancing agricultural practices and improving seed germination quality. The degradation compound, formic acid, may contribute significantly to the overall antifungal function of ethyl formate fumigation, particularly in high-humidity environments.

## Biography

Dr Xin (Bob) Du is the lab manager at Murdoch University, overseeing the Post-harvest Biosecurity and Food Safety Laboratory with NATA accreditation and SAI Global certification. With a strong academic background, Dr Du has built a distinguished career in the fields of biosecurity, food safety, and grain pest technology. Du's expertise extends to areas such as fumigant, fumigation and other chemical technology (regulation, chemistry, application, monitoring and analysis of chemical residues in agricultural commodities); methyl bromide alternative and technology for durables, timber and soil; quarantine treatment, non-chemical technology, methyl bromide alternatives, and eradication; food flavour, aroma, and texture analysis of Australian grain products; and integrated chemical analytical platform, including FTIR, GCMS, HPLC, GC-O-MS, and AA, and quality control. Du has authored over 35 publications on biosecurity, fumigation, and grain storage and has played a key role in the development of management and commercialisation strategies for grain pest technology.

Zenzile Khetsha[1]*, Lubabalo Bila[1,2]
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# Using yield and yield parameters to predict the essential oil biosynthesis of hydroponically grown rose geranium: Exploratory study

Association between the yield and the yield parameters with the essential oil biosynthesis has been reported extensively; however, no scientific studies have reported the association between these parameters, particularly on rose geranium (*Pelargonium graveolens* L'Hér.) grown hydroponically. A Bourbon-type variety was grown in a 72 m² plastic-covered greenhouse tunnel using a Completely Randomised Design during the 2017, 2018, and 2019 growing seasons to explore the prediction possibilities using Pearson's correlations, ANOVA, MANOVA, and data mining algorithm approaches for rose geranium essential oil biosynthesis. Although the study was based on limited data, Pearson's correlation coefficient and ANOVA partially revealed that higher OY and quality (C:G ratio) in rose geranium are possibly responsible for the shorter, bushier plants with smaller leaves. These yield and yield traits have shown that the possibility of foliar fresh mass exceeding 1129 g could possibly yield approximately 2.7 g of essential oil. Interestingly, the PCA also demonstrated that the C: G ratio (essential oil quality) could be associated with the OY and FFM, corroborating the possible validity of the models applied. Although these findings marginally corroborate the effect of yield and yield parameters on essential oil biosynthesis, the size of the data remains a limitation to this study. Future research should focus on expanding sample sizes and further exploring data mining techniques, particularly the MARS algorithm, to enhance predictive modelling of essential oil yield and quality in rose geranium.

## Biography

Zenzile Khetsha is an Associate Professor in the Department of Agriculture in the Faculty of Health and Environmental Sciences, Central University of Technology, Free State (CUT), extensively involved in postgraduate supervision in Crop Science, with a primary area of research in the development of mitigation strategies for horticultural plants affected by biotic and abiotic stresses using plant biostimulants, plant growth regulators, and bioremediation of contaminated soil and water. Khetsha is registered as a certified natural scientist with SACNASP, a recognised fertilizer advisor with FERTASA, and a recognized member of the ISHS.`

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## POSTER PRESENTATIONS

Paula A. Arguello-Quevedo[1,2]*, Oscar J. Patiño-Ladino[1,2], Juliet A. Prieto-Rodríguez[3]

[1]Grupo de Investigación en Bioprospección y Modelado Molecular en el Diseño, Síntesis y Exploración Racional de Productos Naturales (BioMolUN), Universidad Nacional de Colombia, Sede Bogotá, Colombia

[2]Grupo de Investigación en Química de Productos Naturales Bioactivos (QuiProNaB), Departamento de Química, Facultad de Ciencias, Universidad Nacional de Colombia, Sede Bogotá, Colombia

[3]Grupo de Investigación de Fitoquímica Universidad Javeriana (GIFUJ), Departamento de Química, Facultad de Ciencias, Pontificia Universidad Javeriana, Sede Bogotá, Colombia

# Contribution to the chemical and biological standardization of a *Piper aduncum L.* extract for the management of gulupa (*Passiflora edulis f. edulis*) phytopathogens

Gulupa (*Passiflora edulis f. edulis*) is an important Colombian export crop whose productivity and fruit quality are significantly affected by phytopathogenic fungi, including species of *Fusarium, Cladosporium*, and *Colletotrichum.* Conventional disease management relies heavily on synthetic fungicides; however, the emergence of resistant fungal populations, environmental concerns, and increasingly stringent pesticide-residue requirements in international markets highlight the need for effective and sustainable phytosanitary alternatives. Species of the genus *Piper* (Piperaceae) are recognized as promising sources of antifungal specialized metabolites, although the chemical variability inherent to botanical extracts may compromise batch-to-batch reproducibility. Therefore, establishing standardized extraction procedures and chemical markers is essential for advancing their development as plant-based crop protection products. This study aimed to contribute to the chemical and biological standardization of *Piper aduncum L.* extracts with antifungal potential against phytopathogens associated with gulupa crops. Ethanolic extracts from leaves, stems, and inflorescences of two *P. aduncum* accessions were initially obtained by maceration and

percolation and compared in terms of extraction yield and reproducibility. Antifungal activity was evaluated against selected *Fusarium, Cladosporium*, and *Colletotrichum* strains using mycelial growth inhibition assays and concentration–response analysis. An HPLC-DAD method was simultaneously developed to establish the chromatographic profile and identify potential chemical markers. Subsequently, a 2 × 3 × 3 full factorial design was used to evaluate the influence of ethanol–water composition, plant material-to-solvent ratio, and extraction time on process performance. Maceration showed greater reproducibility than percolation, with coefficients of variation generally below approximately 4%, whereas percolation reached values close to 7%. The factorial analysis confirmed that solvent composition, solid-to-solvent ratio, and extraction time significantly influenced extraction yield ($p < 0.001$), allowing the identification of a defined operating region combining hydroethanolic solvent systems, relatively high solvent-to-plant ratios, and extended extraction times. Among the evaluated plant organs, leaf extracts showed the strongest antifungal response, with mycelial growth inhibition exceeding 90% and approaching complete inhibition against the most susceptible phytopathogens. Chromatographic profiling revealed three predominant signals consistently detected in extracts from aerial tissues, which are currently being investigated as potential markers for chemical standardization. Overall, these findings demonstrate that controlled maceration conditions can generate *P. aduncum* extracts with reproducible yields, consistent chromatographic profiles, and strong antifungal activity. These results provide a foundation for further marker identification, extract standardization, and development of sustainable botanical alternatives for the management of fungal diseases in gulupa crops.
This study was funded by the Sistema General de Regalías of Colombia under project BPIN 2023000100058. Research activities on Colombian biodiversity were conducted under Genetic Resource Access Contract No. 121 of January 22, 2016, and its Amendment (Otrosí) No. 21, executed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Paula Alejandra Arguello Quevedo holds a Bachelor of Science in Chemistry from Universidad Distrital Francisco José de Caldas and is currently pursuing a Master of Science in Chemistry at Universidad Nacional de Colombia. Arguello Quevedo's research focuses on natural product chemistry, specifically the phytochemical and biological evaluation of species within the genus Piper, with an emphasis on identifying bioactive metabolites for potential application in the development of bio-inputs for sustainable agriculture.

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# Cultivating green wisdom: Urban horticulture techniques for home vegetable cultivation in small spaces for older adults

Home vegetable cultivation has been widely recognised as an urban horticulture practice capable of promoting physical, mental, and social benefits, particularly among the elderly population. Interaction with plants and contact with the natural environment contribute to stress reduction, mood improvement, strengthening of autonomy, and encouragement of healthier dietary habits. However, many older adults face difficulties in implementing home vegetable cultivation, mainly due to limited space, lack of technical knowledge, and restricted access to appropriate materials. In this context, this study aimed to identify practical and accessible techniques for small-space home vegetable cultivation targeted at the elderly population, as well as to develop educational material to support the adoption of home horticulture practices. The study was conducted in the city of Feira de Santana, located in the Brazilian semiarid region, characterised by high temperatures, irregular rainfall patterns, and frequent drought periods. The city has experienced rapid urban expansion and presents notable socioeconomic inequalities, with a significant portion of the elderly population living in areas with limited physical space and restricted access to resources for food production. In this context, small-scale urban horticulture initiatives represent important strategies for promoting food security, environmental sustainability, and improvements in quality of life. The methodology initially involved a literature review on urban horticulture and its benefits for the health and well-being of older adults. This was followed by a field stage that included visits to a home horticulture project developed with elderly women living in the Doutor Milton Gomes da Costa housing complex, located in the Queimadinha neighbourhood in Feira de Santana, Bahia, Brazil. During these visits, cultivation practices, commonly grown species, and the main challenges faced by participants were observed. Based on these observations,

a questionnaire consisting of 16 open-ended and multiple-choice questions was developed and administered to 30 elderly participants from the extension programme "Open University for the Third Age (UATI)" at the State University of Feira de Santana (UEFS). The questions addressed interest in home vegetable cultivation, availability of physical space, perception of its benefits, and the need for technical guidance. The results indicated that most participants expressed interest in practising home vegetable cultivation and recognised its benefits for health and well-being. However, the main limitations identified were limited available space and lack of specific technical knowledge related to soil preparation, species selection, and proper management. Participants highlighted the need for practical and accessible guidance to enable cultivation in restricted environments. Based on the collected data, an educational booklet entitled "Harvesting Well-Being" was developed, providing step-by-step guidance on vertical and horizontal home vegetable cultivation in small spaces, selection of adapted species, reuse of materials, and sustainable horticulture practices. The material was made available in digital format and disseminated in academic and community environments, expanding access to information. It is concluded that educational materials adapted to the reality of older adults represent an effective strategy to encourage home vegetable cultivation, promote autonomy, and contribute to healthier and more sustainable food practices.

## Biography

Consuelo Lima Navarro de Andrade holds a Doctorate in Geology (2011–2015) from the Federal University of Bahia (UFBA), with a Master's degree in Geochemistry: Petroleum and Environment (2009–2011) and a Bachelor's degree in Biology (2005–2009), also from UFBA. Navarro de Andrade is an Associate Professor at the State University of Feira de Santana (UEFS), Department of Exact Sciences, teaching Geosciences, particularly Palaeontology and Pedology, and is a permanent lecturer in the Professional Master's Programme in Environmental Science Education (PROFCIAMB/UEFS), supervising research in environment and sustainability. Research interests also include Organic Geochemistry, Organic Petrography, Palynology, and palaeoenvironmental interpretations. Navarro de Andrade also collaborates with the POSPETRO/UFBA postgraduate programme.

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# Integrating winter cover crops to enhance soil organic matter, weed suppression, and nutrient cycling in organic management systems

Organic farming emphasizes ecological balance, biodiversity conversation, and long-term soil health by eliminating synthetic chemicals and genetically modified organisms. However, weed pressure and nutrient unavailability remain persistent constraints in organic crop production. Cover crops are widely promoted as a sustainable strategy to enhance soil health and productivity. This study evaluated winter cover crops for biomass production, weed suppression efficiency, carbon (C), and nitrogen (N) contributions. A two-year (Yr. 2023-2025) field trials were conducted at certified organic farm at Tennessee State University, Nashville, TN, USA. The experiment followed a randomized complete block design with four replications, and included legume cover crops (crimson clover, while clover, medium red clover, mammoth red clover, Austrian winter peas, hairy vetch), grasses (barley, winter rye) and brassicas (tillage radish, daikon radish), and a no-cover crop control. Above-ground cover crop and weed biomass were quantified by 1-ft2 quadrant sampling, and dried biomass was analyzed for carbon and nitrogen concentrations using near-infrared spectroscopy. Data were analyzed using ANOVA with Tukey's HSD test and Pearson correlation. Cover crop species differed significantly ($p<0.05$) in all parameters. Fresh biomass was highest in hairy vetch (92,347 lb/ac) and lowest in barley (20,042 lb/ac), while hairy vetch also accumulated the highest dry biomass (15,682 lb/ac) and tillage radish exhibited the lowest (7,405 lb/ac). Weed biomass was lowest under hairy vetch (44 lb/ac) and highest in barley (1,045 lb/ac) and winter rye (915 lb/ac). Pearson correlation observed a strong negative relationship of -0.72 to -0.47 between cover crop and weed biomass. Nitrogen concentration was higher in legumes (3.2-4.0%) than in grasses and brassicas (1.2-2.0%), while carbon concentration ranged from 44-47% across species. These findings demonstrate that cover crop species selection strongly influences weed suppression

and nutrient cycling, with high-biomass legumes providing superior multifunctional benefits for sustainable organic farming systems.

## Biography

Dr. Nandwani is a Professor of Organic Agriculture at Tennessee State University with over 25 years of experience in organic and sustainable agriculture. Nandwani provides leadership in programs such as the Transitional to Organic Partnership Program (TOPP), Urban Agriculture, and Sustainable Cropping Systems. Nandwani has organized numerous scientific conferences and training programs for farmers, researchers, and extension professionals and served as Chair, Organic Tropical and Subtropical Fruits workgroup of International Society of Horticultural Science (ISHS). Dr. Nandwani serves on several national and international boards, has edited multiple academic books, published over 300 articles, secured more than $25 million in grants, travelled globally and is a Fellow of the American Society for Horticultural Science.

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# Antifungal potential of *Piper* essential oils against *Fusarium triseptatum* associated with gulupa crops

Fusarium species are important phytopathogens responsible for vascular and tissue-associated diseases that can substantially reduce crop productivity and quality. In gulupa (*Passiflora edulis f. edulis*), infections caused by *Fusarium* represent a relevant phytosanitary constraint, while their management relies largely on synthetic fungicides. The intensive use of these products is associated with the selection of resistant fungal populations, environmental impacts, toxicity concerns, and pesticide residues that may compromise compliance with international market requirements. These limitations encourage the search for alternative antifungal agents with greater environmental compatibility. Essential oils from the genus *Piper* constitute a chemically diverse source of volatile specialized metabolites with potential antifungal activity, particularly through vapor-phase exposure. This study evaluated the in vitro antifungal potential of 14 essential oils obtained from Piper species collected in Boyacá and Cundinamarca, Colombia, against *Fusarium triseptatum* isolated from symptomatic gulupa stems. Essential oils were obtained by steam distillation, and their antifungal activity was initially assessed using a vapor-phase assay at 183 µL/L of air by measuring mycelial growth inhibition. Oils producing at least 60% inhibition were selected for concentration–response assays, and half-maximal inhibitory concentrations (IC50) were estimated by nonlinear regression. Bioactive oils were characterized by GC-MS using columns of complementary polarity, with compound identification supported by mass spectral data and linear retention indices. Nine of the 14 essential oils met the established activity criterion, with $IC_{50}$ values ranging approximately from 27 to 64 ppm. The strongest antifungal responses were observed for oils from Piper divortans, *P. marginatum, P. subflavum var. espejuelanum, P. Piper fusagasuganum* and *P. aduncum,* with $IC_{50}$ values below 40 ppm. Chemical profiling revealed marked compositional diversity among the active oils. Hydrocarbon sesquiterpenes predominated in several

samples, whereas phenylpropanoids and oxygenated sesquiterpenes characterized others. Differences in antifungal potency were also observed between oils from the same species collected in different geographic locations, suggesting that provenance-associated chemical variability may influence biological activity. Overall, these findings highlight Colombian *Piper* essential oils as promising sources of volatile antifungal agents and provide a basis for developing natural phytosanitary alternatives for the management of *F. triseptatum* in gulupa crops. Further studies should address mechanisms of action, phytotoxicity, ecotoxicological safety, formulation, and efficacy under controlled and field conditions. This study was funded by Colombia's Sistema General de Regalías under project BPIN 2023000100058. Collection of plant material and access to genetic resources and their derived products were conducted under Genetic Resources Access Contract No. 121 of January 22, 2016, and its Amendment (Otrosí) No. 21, signed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Dolffi Rodríguez Campos is a third-year doctoral student in Biological Sciences at the Pontificia Universidad Javeriana (PUJ). Rodríguez Campos's research focuses on the chemical, biological, and ecotoxicological evaluation of essential oils from Piper spp. as biofungicide candidates against phytopathogens associated with gulupa (passion fruit) crops. This work is carried out within the framework of the General Royalties System project "Utilization of species of the genus Piper for the development of fungicides applicable to the control of phytopathogenic agents associated with passionflower crops in the Central-Eastern region," in which the Phytochemistry Research Group of Javeriana University (GIFUJ) and the Research Group on the Chemistry of Bioactive Plant Natural Products of the National University of Colombia (QUIPRONAB) are participating. This research aims to contribute to the development of sustainable alternatives for the phytosanitary management of passionflowers.

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# A novel functional stay-green barley cultivar reveals genotype-specific cytokinin dependence during leaf senescence

Leaf senescence determines the duration of photosynthetic activity and constitutes a major factor limiting carbon assimilation and yield stability in cereal crops. Although cytokinins are established antagonists of senescence, the extent to which their protective effects depend on genotype and endogenous cytokinin metabolism remains poorly understood. Here, we combined physiological and molecular analyses to dissect cytokinin-mediated regulation of dark-induced senescence in three barley (*Hordeum vulgare L.*) cultivars exhibiting contrasting senescence behavior.

The winter cultivar Bursztyn displayed a previously uncharacterized functional stay-green phenotype, retaining chlorophyll and protein content while preserving photosynthetic competence during senescence. In contrast, the spring cultivar Carina underwent rapid chlorophyll loss and photosynthetic decline but exhibited pronounced responsiveness to exogenous cytokinin treatment, whereas Lomerit showed an intermediate phenotype.

Application of benzyladenine (BA) attenuated senescence-associated deterioration across all cultivars by maintaining PSII photochemical efficiency, sustaining electron transport, and suppressing excessive non-regulated energy dissipation. Importantly, delayed senescence was accompanied by preservation of photosynthetic machinery integrity, including Rubisco, Rubisco activase, PsbA, PsaB, and light-harvesting antenna proteins. Despite only partial recovery of net CO2 assimilation, BA maintained ribulose-1,5-bisphosphate regeneration capacity and stabilized photosynthetic performance. Furthermore, cytokinin treatment completely suppressed accumulation of the senescence-associated cysteine protease SAG12, indicating inhibition of proteolytic processes linked to nitrogen remobilization.

Comparative analysis of endogenous cytokinin biosynthesis using lovastatin-mediated inhibition of the mevalonate pathway prior the onset of senescence revealed marked genotype-specific differences in cytokinin dependence. Endogenous cytokinin pools contributed most strongly to delayed senescence in Lomerit, moderately in Bursztyn, and only marginally in Carina, suggesting differential reliance on mevalonate- and methylerythritol phosphate-derived cytokinin biosynthesis pathways.

Collectively, our findings demonstrate that cytokinin-mediated stay-green phenotypes are underpinned by maintenance of photosynthetic integrity rather than chlorophyll retention alone. The identification of Bursztyn as a novel source of functional stay-green traits in barley highlights distinct regulatory networks governing senescence progression and provides a promising framework for developing climate-resilient cereal cultivars with enhanced photosynthetic longevity and improved yield stability.

## Biography

Ernest Skowron, PhD, is an Assistant Professor at the Department of Environmental Biology, Jan Kochanowski University of Kielce, Poland, whose research focuses on the physiological and molecular mechanisms regulating photosynthesis, leaf senescence, and stress acclimation in crop plants. Using integrative physiological, biochemical, and molecular approaches, Skowron investigates cytokinin signalling, stay-green traits, oxidative stress, and plant responses to environmental factors, aiming to bridge fundamental plant biology with crop improvement strategies and contribute to the development of climate-resilient crops with enhanced productivity, nutritional quality, and yield stability.


## Franco Paolinelli

SAP: Silvicultura Agrocultura Paesaggio (NGO), Rome, Italy; Ordine degli Agronomi e dei Forestali of Rome, Italy


# Roman urban wood, an opportunity

URBAN TREES' WOOD: AN UNKNOWN RESOURCE: Wood is made of Carbon polymers. Security implies urban trees' management. Wood is necessarily produced, and must be disposed of. Actually ends, mainly, in landfills. Here is destroyed. Trees' main benefit, reducing atmospheric Carbon, is nullified. Planting these trees, for climate change control, was useless. To prevent this process their Urban Wood should be used, in solid ways. Rome is very rich in green areas and tress. Then, may have an Urban Wood Economy. Portable saw mills; new ideas for interior and exterior design; garden, parks and playground furniture; wooden house, art and crafts, educational and therapeutic activities made with Urban Wood... may help. Research along all phases, from selecting fast growing, carbon stock accumulating plants...., up to landscape projects, arboriculture methods, design, communication and regulation..., is needed. S.A.P. imported in 1995 a tool that converts a simple machine saw in a portable saw mill. Since then, S.A.P. did pilot projects in all possible application fields. Conclusion: Problem: Urban Wood produced in urban forests management rapidly returns his Carbon to atmosphere, as CO2. Opportunity: Urban Wood multifunctional economy: less pollution, more creativity, more jobs...

Pilot projects are needed.

## Biography

Franco Paolinelli, born in Rome in 1954, graduated in Forestry (1980) at the University of Florence, with master degrees in Urban Forestry (1984, University of Toronto), Social Agriculture (2006, University of Tuscia), and Integral Ecology (2024–2025, Pontifical Gregorian University). Alongside work as an urban trees' consultant, Paolinelli participated in development projects in Africa and the Middle East, founded the S.A.P. NGO (Silviculture, Agriculture, and Landscape) in the early 1990s, and since 1995 has promoted Roman Urban Trees Wood, in line with the American Urban Wood Network, through production projects and educational workshops.

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# Antimicrobial potential of *Solanum psychotrioides* Dunal from Chocó against *Staphylococcus aureus* and *Staphylococcus epidermidis*

Antimicrobial resistance among skin-associated opportunistic pathogens, including *Staphylococcus aureus* and *Staphylococcus epidermidis,* limits the effectiveness of conventional treatments and highlights the need to identify new antimicrobial agents. In this context, *Solanum psychotrioides*, a Solanaceae species from the Colombian Chocó region, represents a promising source of bioactive compounds, supported by the region's exceptional biological and ethnopharmacological diversity. This study aimed to evaluate the in vitro antimicrobial activity of an ethanolic extract of *Solanum psychotrioides* Dunal, collected in Chocó, Colombia, against reference strains of *Staphylococcus aureus* and *Staphylococcus epidermidis*, and to identify its major secondary metabolites. The crude extract was obtained by ethanolic maceration. Antibacterial activity against reference strains of *S. aureus* ATCC 25923 and *S. epidermidis* ATCC 12228 was evaluated by broth microdilution. Minimum inhibitory concentrations (MICs) were determined, and concentration–response data were used to calculate $MIC_{50}$ values. The extract was fractionated by vacuum liquid chromatography (VLC) and flash chromatography, and isolated constituents were characterized by nuclear magnetic resonance spectroscopy. Our findings demonstrate that the ethanolic extract possesses moderate but notable inhibitory activity against both staphylococcal species exhibiting a MIC below 400 mg/L and a $MIC_{50}$ inferior to 60 mg/L for each bacterium. Preliminary chemical

analysis of the four fractions obtained from VLC indicated that dichloromethane fraction was the one with the highest activity against both strains. In this fraction, two saponin-like metabolites with a steroidal nucleus were predominant, which correlates with other reports of the presence of saponin-like metabolites in the family Solanaceae. This finding suggest that these compounds may be the bioactive candidates responsible for the observed antimicrobial effect of the extract. Collectively, these results position *S. psychotrioides* as a promising source of lead compounds for the development of novel anti-staphylococcal agents, warranting further investigation into its mechanism of action and in vivo applicability. Nevertheless, it is critical to acknowledge that these preliminary findings represent an early stage in a long translational pipeline, where future studies on cytotoxicity, pharmacokinetics, and formulation development will be essential to translate this promising bioactivity into tangible therapeutic solutions. This study was funded by the Sistema General de Regalías under project BPIN 2023000100047. The collection of plant material and access to genetic resources and their derived products were covered by Contract No. 121 of 22 January 2016 and Otrosí No. 21, signed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia, as well as by the amnesty established under Article 6 of Ley 1955 de 2019.

## Biography

Ileana Barrera Montero is an undergraduate Chemistry student at Universidad Nacional de Colombia (73.8% completed) and an active member of the QUIPRONAB research group, having begun as a research seedbed participant and currently an undergraduate investigator linked to the Sistema General de Regalías project, working with natural products from Chocó, Colombia. Barrera Montero's research focuses on evaluating antimicrobial and enzyme inhibitory activity through in vitro assays, as well as characterizing bioactive compounds using chromatography and NMR techniques.

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# Genetic parameters, path analysis, and morphometrics of floral, fruit, and seed traits for the conservation and breeding of *Lagenaria siceraria* (Molina) Standl. in the Colombian Caribbean

*Lagenaria siceraria* (Molina) Standl., locally known as Bangaño, is an underutilized cucurbit of vital socioeconomic, cultural, and ecological importance for resource-poor farming communities in the Neotropics. Despite its high adaptability to humid tropical conditions, scientific information regarding its genetic architecture, floral biology, and morphometric trait associations remains limited, threatening its genetic conservation. This study evaluated 12 accessions from the Caribbean region of Colombia using a completely randomized design with 10 replicates to estimate genetic parameters, phenotypic/genotypic correlations, and path coefficients across floral, fruit, and seed characters. Analysis of variance revealed highly significant differences ($p \leq 0.01$) among accessions for 18 out of 19 biometric variables, highlighting extensive phenotypic diversity. High broad-sense heritability (h2A: 83–99%) combined with genetic-to-environmental variance ratios (CVg/CVe> 1) was recorded for key yield traits. Expected genetic gains were exceptionally high for fresh fruit weight (151%) and seed dimensions (108–118%). Phenotypic and genotypic correlations demonstrated robust associations between fruit size and seed yield components. Path analysis identified total seed weight per fruit and fruit profile length as the primary direct contributors to overall fruit biomass. The integration of floral morphometry confirmed that variation in corolla diameter and pistil-to-stamen ratios directly influences fruit set and seed fill. Provenance Tierradentro (TDM) exhibited superior performance for fruit weight (4491.2 g) and seed metrics. These findings confirm structured genetic variation in landrace populations, providing actionable selection indices and breeding ideotypes to enhance crop productivity, safeguard phytogenetic resources, and support rural food security under changing climate scenarios.

**Keywords:** Cucurbitaceae, Broad-Sense Heritability, Path Coefficient Analysis, Phytogenetic Resources, Underutilized Crops, Yield Ideotypes.

## Biography

Iván Javier Pastrana Vargas is an agronomist with a Master's degree in Agronomic Sciences and a Ph.D. candidate in Agricultural Sciences. A full-time professor at the Universidad de Córdoba (Colombia), Pastrana Vargas has over 18 years of research experience in plant breeding and plant biotechnology in crops such as sweet potato, cotton, cowpea, caña flecha, and cannabis. Pastrana Vargas has co-authored two books, two book chapters, published more than 25 indexed scientific articles—with over 600 academic citations—and participated in the registration of 12 crop varieties with the Colombian Agricultural Institute (ICA).

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# Utilizing extension services to broaden the impact of research in communities

Extension systems bring the knowledge of the university directly to communities. In the United States, Extension systems fulfil the land-grant university's mission by interpreting knowledge and research developed by faculty and staff so communities can use the scientifically based information to better their lives, businesses and communities.

The Extension system is the world's largest non-formal educational system. Extension's hallmark is programming delivered by professionals to address the needs of the local community while also addressing state, national, and global issues. Extension's practical educational programs combine the needs of local citizens and communities with new research and technical information. Extension provides practical advice, sensible solutions, and realistic down-to-earth answers for agricultural producers, families and youth.

Effective Extension programs rely on a deep understanding of the fundamental principles of communication. Especially in fields like agriculture, youth development and family science. Effective communication is not merely information transfer; it is the process of fostering meaningful connections to drive tangible change within communities. The communication process typically involves five core elements: the communicator, the message, the channels, the audience, and feedback, each playing a crucial role in converting knowledge into actionable practices.

Presenters will highlight how Extension systems share research and will help conference participants build those partnerships. We will highlight the five core elements of Extension communication to help agricultural researchers understand the value of using Extension systems to disseminate research and information. Effective Extension communication for

behavior change requires the harmonious integration of the five key elements. Presenters will discuss how this integrated approach is what transforms information sharing into a process that influences behavior. The success of this process relies on the relationship between a credible communicator and an audience whose needs and values are understood.

## Biography

Jason A. Hedrick, Professor with The Ohio State University Extension, works as a 4-H Youth Development Educator and administrative leader, with 32 years of experience leading and directing youth programs, volunteer training, and conducting youth development research, and specializes in youth safety, youth retention/workforce issues and 4-H programming. Dr. Mark D. Light, Associate Professor with North Carolina Agricultural & Technical State University Extension, works in the area of 4-H STEM (science, technology, engineering and math) and is the statewide lead of a new national effort to bring AI education and exploration to 4-H youth, educators, and communities nationwide.

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# Screening antifungal potential in the genus *Piper*: Analytic Hierarchy Process (AHP) selection and phytochemical profiling of active fractions in *Piper lanceifolium*

The high chemical diversity of the genus *Piper* offers considerable opportunities for the discovery of antifungal compounds with potential agricultural applications. However, the large number of species and extracts available for evaluation makes the identification of the most promising candidates a major challenge in plant bioprospecting. This is particularly relevant for passion fruit crops, including sweet granadilla *(Passiflora ligularis)*, gulupa (*P. edulis f. edulis*), and yellow passion fruit (*P. edulis f. flavicarpa*), whose productivity and fruit quality are frequently affected by fungal diseases caused by species of *Fusarium, Colletotrichum, Cladosporium,* and Botrytis. The limitations associated with intensive synthetic fungicide use further support the search for more sustainable phytosanitary alternatives. Accordingly, this study integrated

antifungal screening, metabolomic profiling, multivariate statistics, multicriteria decision analysis, and bioassay-guided phytochemistry to prioritize *Piper* species with potential for the management of phytopathogens associated with *Passiflora* crops. A total of 79 ethanolic extracts obtained from 65 *Piper* species were screened against four fungal phytopathogens using agar-based mycelial growth inhibition assays. The extracts were chemically profiled by LC-ESI-qTOF-MS, and metabolic and bioactivity datasets were integrated through supervised multivariate analyses, including OPLS-DA and S-plots. This strategy enabled the prioritization of 17 species for concentration–response assays and determination of half-maximal inhibitory concentrations ($IC_{50}$). An Analytic Hierarchy Process (AHP), incorporating metabolomic, statistical, and antifungal activity criteria, was subsequently applied to rank the most promising candidates. Several species achieved high multicriteria scores, and *Piper lanceifolium* was selected for further phytochemical investigation based on its favorable biological and chemical profile, together with the limited information available on its secondary metabolism. The ethanolic leaf extract of *P. lanceifolium* was fractionated by vacuum liquid chromatography into dichloromethane, ethyl acetate, isopropanol, and ethanol–water fractions. Among them, the dichloromethane fraction showed the strongest antifungal response, with mycelial growth inhibition exceeding 94% against all four evaluated phytopathogens. Based on this activity, the dichloromethane fraction was selected for successive flash chromatographic separations, resulting in the isolation of five specialized metabolites belonging to different structural classes, including benzoic acid derivatives, a phenylpropanoid, a chroman, and a flavonoid. Their structures were established by NMR spectroscopy and comparison with reported spectroscopic data. Biological evaluation of the isolated compounds is currently underway to identify the metabolites primarily responsible for the antifungal activity observed in the dichloromethane fraction. Overall, this study demonstrates the value of integrating metabolomics and multicriteria decision-making with bioassay-guided phytochemistry to improve the efficiency of plant bioprospecting and supports *P. lanceifolium* as a promising source of antifungal metabolites for sustainable crop protection. This study was funded by the Sistema General de Regalías of Colombia under project BPIN 2023000100058. Research activities on Colombian biodiversity were conducted under Genetic Resource Access Contract No. 121 of January 22, 2016, and its Amendment (Otrosí) No. 21, executed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Javier Andrés Matulevich Peláez holds a B.S. in Chemistry from Universidad Distrital Francisco José de Caldas and an M.Sc. in Biological Sciences from Pontificia Universidad Javeriana. Currently in the fourth year of a Ph.D. program in Chemical Sciences at Universidad Nacional de Colombia, Matulevich Peláez focuses on the rational search for phytosanitary agents from the genus *Piper* to control phytopathogens affecting passion fruit crops. This research experience centers on natural products chemistry—specifically the extraction, isolation, and chemical characterization of secondary metabolites with potential biological activity—as well as analytical chemistry for the development and standardization of chromatographic and spectroscopic methods.

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# Biocontrol of *Fusarium* and other fungal diseases of cereals using bacterial compounds and plant extracts

The development of biological alternatives to synthetic fungicides is increasingly urgent in the context of the progressive withdrawal of chemical active substances by the European Commission and growing concerns about environmental accumulation, resistance development, and food safety. Biological preparations, including plant extracts and fermentation-derived bacterial products, offer low environmental-risk alternatives that do not accumulate in soil, carry no mutagenic risk, and are compatible with integrated pest management (IPM) and organic farming frameworks. While synthetic fungicides provide high disease control efficacy, biological preparations are therefore best positioned as complementary tools within a hybrid protection model.

The in vitro and greenhouse studies aimed to evaluate biological preparations for controlling wheat diseases caused by fungi of the Fusarium genus as well as diseases affecting the stem base. Plant extracts (garlic - *Allium sativum*, Jerusalem artichoke - *Helianthus tuberosus)* and supernatant (fermentation broth) obtained with the *Paenibacillus* and *Enterobacter* bacteria were tested at three concentrations. In laboratory experiments, the degree of inhibition of the growth of the mycelium of the tested fungal species was determined, while in greenhouse studies, the effectiveness in limiting the development of stem base diseases and the impact of the applied biopreparations on plant growth were evaluated.

Among the plant extracts, *H. tuberosus* demonstrated superior antifungal activity, achieving up to 100% inhibition of R. cerealis mycelial growth at 10% concentration and reducing disease severity by 34.3% compared to the untreated control under greenhouse conditions. Results indicate that *H. tuberosus* extract and *Paenibacillus* sp. supernatant represent promising candidates for further field evaluation as components of sustainable wheat protection programs.

## Biography

Dr. Joanna Horoszkiewicz conducts research on chemical and non-chemical methods of protecting agricultural crops against disease caused by pathogens. Horoszkiewicz is the author of approximately 150 scientific publications, has published research results in numerous scientific and popular-science journals, actively participates in research grant projects, and leads a project funded under a targeted grant from the Polish Ministry of Agriculture and Rural Development.

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# Phytochemical screening and antioxidant capacity of 48 plants from the Chocó department, Colombia: A correlative study between bioactive compounds and radical scavenging activity

Reactive oxygen species (ROS) are continuously generated during normal cellular metabolism, and an imbalance between their production and the body's endogenous antioxidant defenses leads to oxidative stress, a condition implicated in cancer, cardiovascular disorders, neurodegenerative diseases, and premature skin aging. Plants constitute a valuable source of phenolic compounds and flavonoids capable of scavenging free radicals, and there is growing interest in replacing synthetic antioxidants such as BHA and BHT with natural alternatives. Colombia, and in particular the department of Chocó, remains largely unexplored despite its megadiverse flora. The objective of this study was to evaluate the antioxidant activity of plant species from Chocó using DPPH, FRAP, and ORAC assays, and to establish their correlation with total phenolic content (TPC) and total flavonoid content (TFC). The plant material was obtained from the Quibdó market in the department of Chocó, and the ethanolic extracts were prepared by maceration in 96% ethanol. Antioxidant activity was evaluated using the DPPH radical scavenging assay, the FRAP, ORAC, and ABTS assays, while total phenolic and flavonoid content was determined using the Folin-Ciocalteu and aluminum chloride colorimetric methods, respectively, as well as through statistical analysis.

Regarding DPPH radical scavenging, approximately one-fifth of the extracts exceeded 90% inhibition, and approximately one-third exceeded the 70% threshold considered indicative of good antioxidant activity, while a comparable proportion showed low activity (<50%). For FRAP, the most active extracts reached values above 400 µmol Trolox/g, while the least active extracts fell below 100 µmol Trolox/g, demonstrating wide variability in iron(III) reduction capacity across the collection. The total flavonoid content (TFC) ranged from 227.0 to 3,011.9 mg QE/g,

and the total phenolic content (TPC) ranged from 0.2 to 137.6 mg GAE/g. The most bioactive extracts consistently belonged to families such as Malvaceae, Meliaceae, Hypericaceae, and Arecaceae, among others represented in the collection. Pearson's correlation analysis (N = 45 extracts) revealed statistically significant associations ($p < 0.001$) among all pairs of assays, with the strongest correlations observed between DPPH–FRAP ($r = 0.845$) and FRAP–ORAC ($r = 0.772$), confirming that phenolic and flavonoid content is the primary determinant of free radical scavenging capacity.

Principal component analysis and hierarchical cluster analysis independently converged on the same classification of four groups ("Elite," "High," "Moderate," and "Low"), with the "Elite" cluster (n = 4) occupying an isolated region of the ordination space and comprising the extracts with the highest overall antioxidant potential and the highest phenolic and flavonoid content. These findings position the biodiversity of the department of Chocó as an exceptional and largely unexplored reservoir of natural antioxidants with strategic potential for the pharmaceutical, cosmetic, and food preservation industries. This study was funded by Colombia's General Royalties System under project BPIN 2023000100047. Research activities on Colombian biodiversity were conducted under Genetic Resource Access Agreement No. 121 of January 22, 2016, and its Amendment No. 21, signed between the Ministry of Environment and Sustainable Development and the National University of Colombia, in compliance with the amnesty established in Law 1955 of 2019.

## Biography

Lida Vanessa Hernández Moreno is a biologist from Universidad de La Salle (Bogotá, Colombia), with an MSc in Pharmaceutical Sciences from the Universidad Nacional de Colombia, and holds Junior Researcher recognition from Minciencias (Call 957, 2024). Hernández Moreno currently serves as Technical Activities Coordinator of the SGR-INGREDIENTES project at Universidad de La Salle, a multi-institutional consortium with the Universidad Nacional de Colombia, Pontificia Universidad Javeriana, and BIOINNOVA, focused on developing natural cosmetic and food ingredients from non-timber forest products of the Chocó biodiversity hotspot. Hernández Moreno's research integrates phytochemistry, antioxidant and antimicrobial bioassays, and quorum sensing inhibition, with particular expertise in bioactive compounds from Piper species and their role in modulating virulence factors and biofilm formation in Pseudomonas aeruginosa. Hernández Moreno has co-authored publications in Molecules, Plants, and Antibiotics, and has presented work at more than ten national and international scientific conferences across Latin America and Mexico.

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# Beyond *Fusarium oxysporum*: Multilocus phylogeny reveals hidden Fusarium diversity in cultivated *Passiflora* species in Colombia

*Passiflora* fruit crops are economically important in Colombia, especially in the Andean departments of Boyacá and Cundinamarca, but production is limited by diseases commonly attributed to *Fusarium oxysporum* and *Fusarium solani sensu lato.* Because morphological traits and the internal transcribed spacer region alone provide insufficient resolution within *Fusarium* species complexes, the diversity associated with diseased *Passiflora* plants may be underestimated. This study isolated and characterized *Fusarium* from purple passion fruit *(Passiflora edulis f. edulis*), yellow passion fruit (*P. edulis*), and granadilla (*P. ligularis*) crops showing vascular wilt, collar rot, or foliar symptoms. Targeted surveys were conducted in commercial fields in Boyacá and Cundinamarca. Vascular wilt was the predominant syndrome, while collar rot was observed at only one site. Fourteen isolates were recovered from internal stem tissues with vascular discoloration and from foliar tissues, then characterized using colony and microscopic features. Most isolates displayed morphology compatible with *F.*

*oxysporum*. Molecular identification was then performed using concatenated phylogenetic analyses of ITS, translation elongation factor 1-alpha (TEF1), and beta-tubulin (TUB2). Multilocus analysis revealed substantial taxonomic diversity across the F. oxysporum, *F. incarnatum-equiseti, F. sambucinum,* and *F. graminearum* species complexes. Five isolates were identified as *F. triseptatum*, two as F. nirenbergiae, one as F. incarnatum, one as F. weifangense, one as *F. sambucinum,* and three as F. venenatum. One isolate remained unresolved at species level but was assigned to the F. graminearum species complex. Although several isolates belonged to the *F. oxysporum* species complex, none corresponded to *F. oxysporum sensu* stricto. No isolates belonged to *Neocosmospora,* formerly considered the *F. solani* species complex, despite the occurrence of collar-rot symptoms. Therefore, the predominance of *F. oxysporum*-like morphology concealed considerable species-level diversity, including cryptic lineages that could only be resolved by multilocus phylogenetic analysis. Since recovery from symptomatic tissue does not establish disease causality, pathogenicity tests focused on *F. triseptatum* 3141, *F. nirenbergiae* 2141, and *F. venenatum* 3241-1, isolated directly from vascular tissues of plants with representative wilt symptoms. The isolates were inoculated into two-month-old purple passion fruit plants under greenhouse conditions, and disease development was assessed using a severity scale. Isolates 3141 and 3241-1 induced symptoms consistent with vascular wilt and were reisolated from symptomatic inoculated plants, fulfilling Koch's postulates. One pathogenic isolate originated from granadilla, indicating that pathogenic potential was not restricted to the original host. These results challenge the routine attribution of *Passiflora* vascular wilt to *F. oxysporum* based mainly on morphology and demonstrate the importance of multilocus identification for resolving etiologically relevant *Fusarium* diversity. This evidence supports disease diagnosis, epidemiological surveillance, and development of sustainable management strategies for *Passiflora* crops. The resulting collection provides a taxonomically informed basis for selecting representative isolates in future pathogenicity studies and evaluating *Piper* spp. extracts as potential sources of biofungicidal compounds within the SGR-funded project BPIN 2023000100058. Research activities were conducted under Genetic Resource Access Contract No. 121 of January 22, 2016, and its Amendment (Otrosí) No. 21, executed between Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Luisa María Bravo Herrera holds a degree in Industrial Microbiology and is currently pursuing a master's degree in Biological Sciences at Pontificia Universidad Javeriana, Colombia. Bravo Herrera works as a research assistant in a project funded by Colombia's Sistema General de Regalías (SGR) that explores the potential of Piper species as sources of plant-derived products for the control of fungal pathogens causing disease in cultivated *Passiflora* species in Boyacá and Cundinamarca. Bravo Herrera's research focuses on plant–pathogen interactions, particularly the use of Piper-derived treatments to induce systemic resistance in purple passion fruit (*Passiflora edulis f. edulis*) against Fusarium-associated diseases.

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# Antifungal potential of *Piper* species for the control of *Trichophyton rubrum* associated with dermatophytosis

Dermatophytosis is a superficial fungal infection caused by keratinophilic fungi that primarily affects the skin, hair, and nails. *Trichophyton rubrum* is the most prevalent etiological agent and represents a persistent clinical challenge because of diagnostic limitations, recurrent infections, prolonged treatments, adverse effects associated with conventional antifungals, and the increasing emergence of resistant strains. These limitations highlight the need to identify new antifungal agents with improved efficacy and safety profiles. Plant-derived natural products constitute a valuable source of structurally diverse bioactive compounds. In this context, the genus *Piper* (Piperaceae) is of particular interest because of its broad geographic distribution, traditional medicinal uses, chemical diversity, and wide range of reported biological activities. Nevertheless, numerous species remain insufficiently investigated regarding their

phytochemical composition and antifungal potential. This study aimed to evaluate the in vitro antifungal activity of six *Piper* species against *T. rubrum.* Plant material was collected in the department of Chocó, Colombia, and ethanolic extracts of leaves, stems, and inflorescences were obtained by maceration. Preliminary antifungal screening was performed using the broth microdilution method at a concentration of 1000 µg/mL. Extracts producing at least 70% inhibition of fungal growth were considered active and selected for concentration–response assays over a range of 1–2000 µg/mL to determine their half-maximal inhibitory concentrations (IC50). The evaluated extracts showed species- and plant-organ-dependent differences in antifungal activity. The most active samples exhibited $IC_{50}$ values below 50 µg/mL, while the remaining active extracts showed values broadly distributed between approximately 30 and 300 µg/mL. Overall, extracts from *P. peltatum* displayed the strongest inhibitory activity, whereas extracts from *P. aduncum, P. umbellatum, P. tuberculatum, P. tricuspe, a*nd *P. squamulosum* exhibited varying degrees of activity against the dermatophyte. To the best of our knowledge, this study provides the first comparative evidence of the antifungal activity of extracts from these species against *T. rubrum*. These findings support the potential of Piper species as sources of bioactive compounds for the development of antifungal agent *s. Further* phytochemical and pharmacological studies are required to identify the metabolites responsible for the observed activity, elucidate their mechanisms of action, and assess their potential for the development of phytopharmaceutical alternatives for dermatophytosis management. This study was funded by the Sistema General de Regalías under project BPIN 2023000100047. The collection of plant material and access to genetic resources and their derived products were covered by Contract No. 121 of 22 January 2016 and Otrosí No. 21, signed between the Ministerio de Ambiente y Desarrollo Sostenible and the Universidad Nacional de Colombia.

## Biography

Mariana Segura holds a Bachelor's degree in Chemistry from the Universidad Distrital Francisco José de Caldas. Currently pursuing a Master's degree in Chemical Sciences at the National University of Colombia, Segura conducts research within the QUIPRONAB Research Group. This research focuses on evaluating the antimicrobial potential of Colombian plant species against microorganisms associated with skin diseases through the extraction, characterization, and fractionation of plant extracts, as well as the identification of bioactive compounds with potential applications in the development of new therapeutic alternatives. Segura's research experience is centered on natural products, with an emphasis on phytochemistry, microbiology, and the evaluation of the biological activity of plant extracts and natural metabolites.

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# Insights into cell wall architecture of developing nettle bast fibers through immunohistochemical analysis

*Urtica dioica L.* (stinging nettle) is increasingly recognized as a valuable fiber crop, combining agronomic adaptability with the production of bast fibers possessing remarkable mechanical properties. The performance of these fibers is closely associated with the structure and composition of their cell walls, which undergo extensive modifications during differentiation. To gain insight into the dynamics of cell wall assembly during fiber development, we investigated the spatial distribution of selected pectic and hemicellulosic polysaccharides in developing nettle bast fibers using immunohistochemical techniques.

Transverse stem sections obtained from apical and basal internodes, representing elongating and fully differentiated fibers, respectively, were analyzed with monoclonal antibodies targeting homogalacturonans with different degrees of methyl esterification (JIM5 and JIM7) and xyloglucan epitopes (LM25). Distinct developmental changes in cell wall polymer distribution were observed.

In elongating fibers, the JIM7 epitope corresponding to highly methyl-esterified pectins was detected throughout the cell wall, with localized regions exhibiting enhanced fluorescence intensity. Following fiber maturation, JIM7 labelling remained prominent and extended across the entire gelatinous layer (G-layer), revealing an unexpected persistence of highly methyl-esterified homogalacturonans in mature cell walls. Low methyl-esterified pectins, identified by JIM5, displayed a punctate pattern in young fibers but became strongly enriched at fiber–neighbor cell interfaces in basal internodes. Immunolabelling with LM25 showed a developmental shift from a predominantly junction-associated localization in elongating fibers to an intense and widespread distribution throughout the walls of mature fibers.

The observed changes indicate that bast fiber differentiation in U. dioica involves substantial remodeling of cell wall polysaccharide organization. In particular, the extensive occurrence of highly methyl-esterified pectins within the mature G-layer suggests previously underappreciated structural complexity and raises new questions regarding their contribution to fiber mechanics and cell wall functionality. These findings provide further insight into the developmental biology of nettle fibers and may support future efforts aimed at optimizing fiber quality for sustainable industrial applications.

## Biography

Dr. Penelope Sotiriou is a plant biologist and laboratory teaching staff member at the National and Kapodistrian University of Athens, Greece. Sotiriou's research interests focus on plant cell wall biology, plant development, and morphogenesis. Sotiriou has extensive experience in the study of cell wall polysaccharides, including their biosynthesis, distribution, and role in plant cell differentiation. Sotiriou's publications have addressed topics such as cell wall regeneration in protoplasts, mesophyll and pavement cell morphogenesis, and the spatial organization of cell wall matrix components in higher plants. Through both research and teaching, Sotiriou contributes to the advancement of plant biology and the understanding of how cell wall architecture influences plant structure and function.

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# Facilitative root associations of endemic *Indopiptadenia oudhensis* (Brandis) Brenan: Implications for biodiversity restoration and forest ecosystem services in central Himalayan riverine forest

Species capable of forming positive ecological associations often display enhanced adaptability, enabling persistence in fragmented and resource-limited landscapes. In the Anthropocene, where climate change and anthropogenic pressures continuously redefine ecological thresholds, such facilitative interactions offer an alternative pathway to classical "survival of the fittest," promoting niche expansion, structural complexity, and ecosystem resilience. This study reports a novel commensal ecological association involving the endemic and endangered tree *Indopiptadenia oudhensis* (*Fabaceae*), *Murraya koenigii,* and *Celtis tetrandra* within the Terai region of Sohelwa Wildlife Sanctuary (SWS), Uttar Pradesh, India. Field investigations conducted in December 2024 revealed the emergence and establishment of *M. koenigii* and *C. tetrandra* seedlings from the lateral root zones of a mature *I. oudhensis* individual, indicating a stable, non-parasitic interaction in which the host tree provides a favourable microsite for germination and early growth without observable detriment to its vitality.

Microscopic examination of I. oudhensis root samples, following Trypan Blue staining, confirmed the presence of Arbuscular Mycorrhizal Fungi (AMF). This finding suggests that AMF-mediated Common Mycorrhizal Networks (CMNs) may facilitate nutrient transfer, moisture availability, and physiological support to associated species, thereby enhancing seedling survival under stressful edaphic and climatic conditions. These processes underscore the importance of integrating microecological interactions into biodiversity restoration and forest management frameworks. These belowground networks can strengthen

forest ecosystem services, such as nutrient cycling, soil stabilisation, and climate resilience, thereby contributing to adaptive, science-based restoration strategies in rapidly changing subtropical forest landscapes.

**Keywords:** Commensalism, *Indopiptadenia oudhensis*, *Murraya koenigii, Celtis tetrandra,* Facilitative Root Architecture, Biodiversity Restoration.

## Biography

Sukirti is a dedicated Forest Science professional currently pursuing a Ph.D. in Forest Genetics at the Forest Research Institute. Sukirti's research interests centre on genetics, seed biology, and forest genetic resource conservation, with a strong focus on sustainability and biodiversity conservation. Sukirti has contributed to Springer book chapters on advanced biotechnological approaches for seed germplasm conservation and molecular markers for seed traceability, and published work on the conservation of the critically endangered Indopiptadenia oudhensis. Sukirti has also worked on seed source variation and the domestication of wild fruit species. Recently, Sukirti was awarded Best Poster at the India International Science Festival and recognised for work in molecular genetics.

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# Soil quality in different agroecosystems: A chromatographic analysis

This study investigated soil health and quality in different agroecosystems within the Rio Seco Agroecology Center (CEARIS), located in the municipality of Amélia Rodrigues, Bahia. The main objective was to analyze how agroecological management influences soil vitality, using a comparative approach that integrates conventional scientific methods and agroecological techniques.

The methodology involved soil sampling in three areas: secondary forest, an Agroforestry System (AFS), and a fallow area. The samples were subjected to laboratory chemical analysis and Pfeiffer Chromatography. For the chromatographic technique, the soil was solubilized in a caustic soda solution (1% NaOH), followed by the impregnation of a circular filter paper previously sensitized with silver nitrate (0.5% $AgNO_3$). The capillary rise of the soil solution on the paper allowed the development of color patterns and radial zones (central, inner, intermediate, and outer), reflecting the integration of minerals, organic matter, and microbiological activity. The comparison between the two analyses was fundamental to this study, as laboratory analysis provides quantitative data on the isolated availability of nutrients, while chromatography reveals the biological quality and the level of organization of these elements within the ecosystem. This comparative approach enables a comprehensive reading of soil fertility, linking laboratory data to real vitality and the dynamism of biological processes observed in the field.

The synthesis of the results reveals a strong connection between the two techniques. While laboratory analysis quantified high levels of phosphorus (P) and potassium (K) in the AFS compared to the other areas, Pfeiffer Chromatography made it possible to visualize the integration of these minerals with organic matter and microbial activity. The chromatograms of the AFS showed well-defined radial zones and vibrant colors, indicating a biologically active soil

undergoing regeneration. In contrast, the fallow area and the forest, although exhibiting good structural characteristics, showed chromatographic patterns suggesting lower immediate nutrient availability or reduced mineral integration, thereby validating the numerical laboratory data.

Finally, the study highlights the importance of chromatography as a technique of peasant biopower. As a visual, low-cost, and practical method, it democratizes access to technical information. This tool makes soil diagnosis accessible and understandable for family farmers, restoring their autonomy over land management and strengthening technological sovereignty in rural areas.

## Biography

Tainã Cádija Almeida de Mamede holds a degree in Biology, a Master's degree in Environmental Geochemistry, and a PhD in Soils and Plant Nutrition. Mamede's research focuses on Soil Science, with emphasis on agroecological soil management, agroecology and ecologically based production systems, soils in agroforestry systems in semi-arid regions, soil quality indicators, and regenerative agriculture in semi-arid environments. Mamede also works on topics related to family farming and strategies for living with drought, soil education and teaching, traditional communities (farmers, peasants, and quilombola communities), and soil spectral analysis.

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# Soil quality indicators sensitive to regenerative agriculture management in the Brazilian semi-arid

Soil quality is as essential as air and water quality for sustaining life and ecosystem functioning. Therefore, studies aimed at identifying practices that promote soil regeneration are particularly important, especially in regions vulnerable to desertification. Agroecology-based regenerative agriculture incorporates management practices that may contribute to the identification of sensitive indicators of soil quality.

This study aimed to identify soil quality indicators in sandy soils that are responsive to agroecology-based regenerative management in a semi-arid region of Bahia, Brazil, where desertification processes are a major environmental concern. To achieve this objective, areas under regenerative management for different time periods were selected. Soil samples were collected and subjected to chemical analyses related to soil fertility, physical analyses (particle-size distribution, soil bulk density (BD), particle density (PD), total porosity (TP), penetration resistance (PR), flocculation index (FI), and mineralogical analysis), and biological analyses, including heavy organic matter (HOM), particulate organic matter (POM), and light organic matter (LOM).

The results indicated that the indicators most sensitive to regenerative soil management practices were potential cation exchange capacity (CEC), soil organic matter fractions (C-POM, C-LOM, and C-HOM), penetration resistance (PR), flocculation index (FI), and total porosity (TP). Among the four areas evaluated, the site managed under regenerative practices for ten years (MR10) exhibited the most favorable performance in terms of soil quality indicators.

Overall, the physical, chemical, and biological indicators evaluated proved effective in distinguishing sandy soil areas under different durations of regenerative management. These

findings suggest that agroecosystems managed through agroecology-based regenerative agriculture promote a gradual improvement in soil quality over time.

## Biography

Tainã Cádija Almeida de Mamede holds a degree in Biology, a Master's degree in Environmental Geochemistry, and a PhD in Soils and Plant Nutrition. Mamede's research focuses on Soil Science, with emphasis on agroecological soil management, agroecology and ecologically based production systems, soils in agroforestry systems in semi-arid regions, soil quality indicators, and regenerative agriculture in semi-arid environments. Mamede also works on topics related to family farming and strategies for living with drought, soil education and teaching, traditional communities (farmers, peasants, and quilombola communities), and soil spectral analysis.

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## Insecticidal potential of páramo species against the whitefly (*Bemisia tabaci*) associated with bean crops

The objective of this study was to evaluate the insecticidal potential of 14 plant species from the páramo against the whitefly (*Bemisia tabaci*), a pest that affects short-cycle crops such as beans. The chemical composition of the species was preliminarily characterized through phytochemical analyses and the quantification of secondary metabolites, revealing a higher abundance of polyphenols and a lower concentration of flavonoids. Additionally, the presence of phenolic compounds, tannins, and carotenoids was confirmed. An insecticidal bioassay was standardized by spraying plant material leaves with ethanolic extracts from 14 páramo plant species at a concentration of 35 mg/L. The results identified insecticidal activity against *Bemisia tabaci* and prioritized the species *Scutellaria coccinea* and *Macleania rupestris*, with the latter standing out for exhibiting a 58% corrected mortality rate 24 hours after exposure. Additionally, the Analytic Hierarchy Process (AHP) was used to prioritize the species based on criteria of mortality, distribution, and chemical profiles. The *Macleania rupestris* extract was selected for fractionation by vacuum liquid chromatography, yielding fractions of varying polarity. The ethyl acetate fraction exhibited the highest insecticidal activity (100% at 24 hours) and was therefore analyzed by gas chromatography coupled with mass spectrometry, which allowed for an assessment of its chemical composition through the tentative identification of secondary metabolites of interest, including lupeol acetate and isocitronellol, as well as other compounds such as palmitic acid and ethylene brasilate. The results suggest that the compounds present in the medium- and high-polarity fractions of the páramo plant species could contribute to their insecticidal activity, demonstrating their potential as a source of biopesticides for the sustainable management of agricultural pests and the reduction of agrochemical use.

## Biography

William Fernando Castrillón Cardona is a chemist from the National University of Colombia, holds master's degrees in Environmental Sciences and Educational Research, and is a specialist in Computer Science. Castrillón Cardona is a professor at the Francisco José de Caldas District University. Castrillón Cardona's professional and research career has focused on the chemistry of natural products, phytochemistry, and environmental education, and has included directing theses and research projects, participating in scientific events, and publishing articles and books. Castrillón Cardona has experience in the isolation and characterization of secondary metabolites and in the study of plant species in Colombian ecosystems.


## Tytus Berbec

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# Assessment of spraying effectiveness using heavy-duty agricultural UAVs in high-growing crops-Spray deposition and canopy coverage efficiency

This study, conducted at the Institute of Soil Science and Plant Cultivation – State Research Institute (IUNG-PIB; Poland), investigates the operational efficacy of Unmanned Aerial Vehicles (UAVs) in precision agriculture. The research evaluates spray deposition, coverage uniformity, and drift potential, comparing a high-growing crop model (*Nicotiana tabacum L.*, cv. HYV 35) with a bare-ground control. The primary objective was to validate the hypothesis that rotor-generated downwash enhances canopy penetration and significantly mitigates off-target drift in high-biomass environments relative to open-field conditions.

**Materials and Methods:** Experimental trials were conducted using a DJI Agras T50 UAV platform equipped with rotary atomizers to ensure precise droplet size regulation. The study employed a randomized complete block design evaluating three variable operational parameters: flight altitude (1.5 m and 3.0 m above the target), application rate (30, 60, 150, and 300 L/ha), and droplet size spectra (ranging from fine at 100 µm to coarse at 350 µm).

**Key Results and Discussion:** Results indicated a statistically significant reduction in spray drift facilitated by the vegetative canopy. At an application rate of 30 L/ha (100 µm droplet size), drift measured 2.5 m from the swath edge was 7.87% on bare ground, compared to 3.40% within the tobacco canopy. This substantiates the canopy's function as an effective mechanical barrier, attenuating environmental contamination risk by over 50% in the immediate buffer zone.

Reducing the flight altitude to 1.5 m induced pronounced rotor downwash, yielding divergent aerodynamic effects dependent on the surface matrix. In the vegetated environment, the lower altitude significantly enhanced the penetration of the lower canopy strata. At 300 L/ha

(100 µm), a coverage inversion was recorded in the middle leaf tier, where abaxial (underside) coverage (19.5%) surpassed adaxial (upper) coverage (14.7%). This phenomenon provides substantial agronomic utility for targeting pests residing on abaxial leaf surfaces. Conversely, on bare ground, these identical parameters triggered a "ground effect," wherein the deflected airstream dispersed the spray cloud. Target zone coverage diminished to negligible levels (~3.7%), denoting a critical loss of deposition control in open terrain.

Fine droplet spectra (100–150 µm) exhibited limited efficacy on bare ground due to acute susceptibility to drift and evaporation (yielding <3% coverage at 300 L/ha). In contrast, the crop canopy effectively intercepted fine droplets, resulting in satisfactory deposition. Coarse droplets (300–350 µm) afforded the highest operational safety margin. At 60 L/ha, increasing droplet size from 100 µm to 300 µm reduced near-field drift from 12.0% to <2.0%. Furthermore, coarse droplets (350 µm) applied at 150 L/ha achieved maximum target coverage efficiency (40.1%) under test-range conditions.

**Conclusions: Canopy Interception:** High-biomass canopies significantly attenuate spray drift. Consequently, operational parameters prone to off-target movement over open ground (e.g., fine droplet spectra) remain agronomically viable in dense vegetation due to enhanced foliar interception.

**Altitude Optimization:** Low-altitude applications (1.5 m) are advisable exclusively for dense crop architectures to maximize abaxial leaf penetration. This approach is strictly contraindicated for bare or low-canopy environments due to severe drift exacerbation driven by ground-effect turbulence.

**Droplet Size Selection:** For broad-spectrum UAV applications, medium-to-coarse droplets (200–300 µm) deliver an optimal equilibrium between coverage uniformity and drift mitigation. Fine droplet applications should be strictly confined to high-volume treatments in dense canopies necessitating deep structural penetration.

## Biography

Berbec is an Assistant at the Department of Bioeconomy and Agrometeorology at IUNG-PIB, specializing in agrometeorology, agronomy, climate change, and the impact of meteorological factors on crops. Berbec has over 10 years of experience in conducting field experiments, including the supervision of field trials at Agricultural Experimental Stations, and more than 10 years of experience in executing tasks for the Agricultural Drought Monitoring System, managing data and developing and supervising a network of agrometeorological stations (approximately 200 weather stations nationwide). Berbec is an expert in the application of new technologies in agriculture (holding a pilot license for all types of unmanned systems), Agriculture 4.0, and Agriculture 5.0 (the use of artificial intelligence in agriculture). Berbec's expertise also encompasses the analysis of meteorological data, assessing the impact of various weather factors on the growth and development of plants and their pathogens, and agricultural water management (water retention on farms). Berbec is an author of publications and chapters in the SiR monograph, and participates as a project manager and principal investigator in national projects carried out at IUNG-PIB, statutory activities of the Institute,

targeted subsidies from the Ministry of Agriculture and Rural Development (MRiRW) regarding the application of drones in agriculture, and the Agricultural Drought Monitoring System commissioned by MRiRW.

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# Exploring introduced plant species from Chocó as sources of anti-inflammatory agents for skin applications

The skin is the primary protective interface between the human body and the external environment, and disruption of this barrier can promote inflammation, impair tissue homeostasis, and interfere with repair processes. Although inflammation is essential during the early stages of wound healing, an excessive or prolonged inflammatory response may delay progression toward the proliferative phase and compromise tissue restoration. Plant-derived natural products represent a valuable source of structurally diverse specialized metabolites capable of modulating processes associated with inflammation. In this context, introduced plant species occurring in the department of Chocó, Colombia, remain comparatively underexplored and may constitute an alternative source of bioactive compounds for cutaneous applications. This study aimed to evaluate the in vitro anti-inflammatory potential and cytotoxicity of ethanolic extracts obtained from selected introduced plant species from Chocó. Plant materials were acquired from local markets, dried, ground, and extracted by maceration with ethanol. Anti-inflammatory potential was investigated using complementary assays based on inhibition of protein denaturation, protease inhibition, and nitric oxide (NO)-scavenging activity, the latter assessed through nitrite quantification using the Griess reaction. Extracts were initially screened at 1000 µg/mL, and those exhibiting more than 60% activity were selected for concentration–response assays and determination of half-maximal inhibitory concentrations ($IC_{50}$). Cellular safety was additionally assessed in RAW 264.7 macrophages

and HaCaT keratinocytes at 100 and 1000 µg/mL. The most promising extracts displayed $IC_{50}$ values in the approximate range of 390–510 µg/mL in the protein denaturation assay and 130–840 µg/mL in the NO-scavenging assay, demonstrating differences in activity among the evaluated plant materials and experimental models. In contrast, no relevant protease inhibitory activity was observed under the tested conditions. Importantly, the evaluated extracts did not produce significant reductions in cell viability in either RAW 264.7 or HaCaT cells at the assessed concentrations. Overall, these findings identify introduced plant species occurring in Chocó as potential sources of metabolites capable of modulating inflammation-related processes while showing a favourable preliminary cellular safety profile. The results provide a basis for subsequent bioassay-guided fractionation, chemical characterization, and identification of the metabolites responsible for the observed activities. Further studies using cellular inflammatory models and in vivo approaches will be required to clarify mechanisms of action and establish their efficacy and safety for the development of innovative topical or dermocosmetic formulations aimed at skin care and inflammation management. This study was funded by Colombia's Sistema General de Regalías under project BPIN 2023000100047. The collection of plant material and access to genetic resources and their derived products the research activities were covered by the amnesty established under Article 6 of Law 1955 of 2019.

## Biography

Yohum Steven Lozada Diaz holds a bachelor's degree in chemistry education and a master's degree in chemical sciences. Currently a PhD student at the Pontificia Universidad Javeriana, having completed approximately 40% of the doctoral program, Lozada Diaz is an active member of the Grupo de Investigación en Fitoquímica Universidad Javeriana (GIFUJ), where the research career began as an undergraduate research trainee. Within this group, Lozada Diaz completed both undergraduate and master's research projects, each receiving meritorious distinction. The current doctoral research is conducted within a project funded by Colombia's Sistema General de Regalías and focuses on the study of natural products derived from plant resources from the department of Chocó, Colombia, involving the evaluation of anti-inflammatory and wound-healing potential using in vitro models, together with the isolation and structural characterization of bioactive specialized metabolites using chromatographic and nuclear magnetic resonance (NMR) techniques. Lozada Diaz also contributes to the development of a topical formulation prototype aimed at modulating inflammatory processes and supporting cutaneous wound repair.

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