



International Symposium on Agriculture & Environment 2025

Driving Innovations in Agricultural Technologies
for Climate Action & Sustainability

Proceedings



Faculty of Agriculture
University of Ruhuna

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**Proceedings of the
International Symposium on
Agriculture and Environment (ISAE)
2025**

**“Driving Innovations in Agricultural Technologies for
Climate Action & Sustainability”**

**2nd September 2025
Faculty of Agriculture
University of Ruhuna
Sri Lanka**

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON AGRICULTURE AND ENVIRONMENT 2025

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Preface

With great pleasure and enthusiasm, the Editorial Board is honored to present the Proceedings of the International Symposium on Agriculture and Environment (ISAE 2025), held under the timely and inspiring theme **“Driving Innovations in Agricultural Technologies for Climate Action & Sustainability.”** As the Editor-in-Chief, it is both a privilege and a responsibility to introduce this volume, which compiles innovative research, insightful discussions, and forward-looking perspectives shared at ISAE 2025 on 2nd September 2025.

In the face of accelerating climate change, increasing resource constraints, and the growing need for sustainable food systems, innovation in agricultural technologies has become an urgent necessity. This year’s theme emphasizes the vital role of science, technology, and collaboration in transforming agriculture into a climate-resilient and sustainable sector. By adopting new tools, practices, and approaches, we can not only mitigate the impacts of climate change but also create opportunities for sustainable livelihoods, food security, and environmental stewardship.

ISAE 2025 highlights solutions that enhance productivity, resilience, and sustainability, aligning scientific advancement with societal needs. Accordingly, the symposium encompasses five diverse session themes: **(1) Engineering Climate-Smart Technologies for Sustainable Agriculture, (2) Crop and Soil Management for Climate-Resilient Agriculture, (3) Innovations in Food Production and Plant Breeding for Climate Change Adaptation, (4) Animal Husbandry for Sustainable Livestock Production, and (5) Sustainable Food Systems and Supply Chains: Economic and Technological Perspectives.** These themes capture the breadth of current agricultural challenges and the innovative pathways being pursued to address them. The symposium features contributions from researchers, practitioners, policymakers, and industry experts, offering practical solutions, theoretical insights, and case-based evidence that collectively pave the way for climate action and sustainability in agriculture.

Beyond the main technical sessions, ISAE 2025 continues its proud tradition of fostering the next generation of agricultural scientists and professionals. **The Young Graduates’ Forum (YGF)** provides a platform for recently graduated scholars, selected as the best presenters from each department, to showcase their final-year research projects. Complementing this, the **Three-Minute Industrial Training Session (3MIT)** highlights the reflections of undergraduates on their industrial training experiences, offering a unique glimpse into the practical application of their academic learning. These forums not only celebrate youthful innovation and enthusiasm but also bridge academia and industry, creating synergies vital for the future of agriculture.

The Proceedings of ISAE 2025 embody the spirit of innovation, resilience, and collaboration. Each paper and presentation contribute to a growing body of knowledge dedicated to reimagining agriculture in a world of climatic uncertainties. From novel technologies and adaptive farming practices to economic strategies and policy frameworks, this collection reflects our shared commitment to sustainability, climate action, and the advancement of agricultural sciences.

On behalf of the Editorial Board and Publication Committee, I extend my deepest appreciation to the chief guest, guest of honor, keynote speakers, session chairs, and above all, the authors for their invaluable scholarly contributions. The success of this symposium owes much to the tireless efforts of the coordinator, Dr. (Mrs.) M.G.G. Awanthi, along with the members of the Publication Committee and Editorial Board, whose dedication ensured the high quality of this volume.

As we look forward to the knowledge exchange and collaborative dialogue that ISAE 2025 will foster, let us remain steadfast in our commitment to driving innovations in agriculture

innovations that will serve not only as tools for climate action but also as building blocks for a sustainable and equitable future.

It is our hope that ISAE 2025 inspires meaningful dialogue, collaboration, and innovations that guide agriculture toward a sustainable and equitable future.

Prof. Wathugala G.D. Lakmini

Editor-in-Chief

Proceedings of ISAE 2025

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Message from the Vice Chancellor
University of Ruhuna, Sri Lanka

It is with great pleasure that I extend my warmest greetings to all participants of the International Symposium on Agriculture and Environment (ISAE2025), organized by the Faculty of Agriculture, University of Ruhuna.



The theme of the symposium for this year, “Driving Innovations in Agricultural Technologies for Climate Action and Sustainability”, is both timely and vital. The global community is currently confronted with immense environmental challenges brought to a significant level by climate change, which threaten food security, biodiversity, and the livelihoods of millions. Agriculture, being the heart of human survival and development, is uniquely positioned at the intersection of these challenges. It serves in many local contexts not only as the foundation of food production but also as a major driving factor of rural economies, cultural traditions, and national development.

Harnessing technological advancements, such as precision agriculture, biotechnology, artificial intelligence, and smart farming practices offers pathways to mitigate climate risks while enhancing productivity and resource efficiency. By merging scientific discoveries with practical applications, society could be supported to reimagine agricultural systems that not only respond to the current climate crisis but also ensure the well-being of future generations.

I am confident that ISAE2025 will serve as a vibrant forum for meaningful dialogue, collaborative research, and capacity building. By fostering cross-disciplinary partnerships and knowledge transfer, the symposium will contribute to advancing agricultural practices that not only improve productivity but also safeguard our environment for future generations.

As the Vice Chancellor, I take this opportunity to commend the Faculty of Agriculture for its continued commitment to academic excellence and for providing leadership in addressing global challenges through research and innovation. I also wish to express my sincere appreciation to all participants, keynote speakers, and collaborators for their invaluable contributions to making this event a success.

Senior Professor P. A. Jayantha
Vice Chancellor
University of Ruhuna

Message from the Dean

Faculty of Agriculture, University of Ruhuna, Sri Lanka

It is my profound honour, as the Dean of the Faculty of Agriculture at the University of Ruhuna, to warmly welcome all participants to the International Symposium on **Agriculture & Environment 2025 (ISAE 2025)**. Since its inception in 2008, ISAE has grown into a landmark event on the academic and professional calendar, drawing together scientists, researchers, practitioners, policymakers, entrepreneurs, and students from Sri Lanka and around the globe. As the leading agricultural faculty in Sri Lanka, we have a proud history of spearheading academic excellence, groundbreaking research, and impactful outreach that shapes both policy and practice. Over the years, this platform has fostered collaboration across continents, disciplines, and sectors, an achievement that speaks to the unwavering commitment of our faculty and the enduring importance of our mission. The theme for this year, ***“Driving Innovations in Agricultural Technologies for Climate Action & Sustainability”***, reflects both the urgency of our times and the opportunities that lie ahead.



Agriculture remains at the heart of national and global well-being. In Sri Lanka, it sustains rural livelihoods, underpins food and nutrition security, and serves as a cornerstone of cultural identity. Globally, agriculture feeds nearly eight billion people, supports economies, and shapes landscapes. Yet, we are meeting at a moment when the sector is under unprecedented pressure. The combined effects of climate change, resource depletion, population growth, and shifting consumer expectations are transforming agriculture into one of the most complex and critical arenas for innovation. If we are to ensure that future generations inherit a planet capable of sustaining life in dignity, agriculture must evolve, not incrementally, but transformatively.

The challenges before us are formidable. Climate instability manifests in erratic rainfall, prolonged droughts, intensified floods, and rising temperatures, placing severe stress on crops, livestock, and ecosystems. Resource constraints such as soil degradation, declining biodiversity, and water scarcity are eroding the foundations of productivity. Global population growth expected to reach nearly 10 billion by 2050, demands that we produce more food with fewer inputs, while addressing malnutrition and ensuring equitable access. Simultaneously, agriculture must confront its role as both a contributor to and a potential mitigator of greenhouse gas emissions. These intersecting realities underscore the need for bold, science-driven, and technology-enabled solutions.

In this context, the 21st century offers unprecedented tools to reshape agriculture. Artificial intelligence and machine learning now enable predictive modelling of weather patterns, early detection of plant diseases through image analysis, and real-time optimization of resource use. Digital agriculture, powered by IoT sensors, drones, and blockchain, provides transparency, efficiency, and traceability across entire value chains. Smart farming systems—featuring autonomous machinery, automated irrigation, and precision nutrient management—allow farmers to maximize yields while reducing environmental footprints. Coupled with regenerative practices, renewable energy integration, and circular bioeconomy models, these technologies pave the way for climate-smart agriculture capable of both adaptation and mitigation.

Sri Lanka has begun to explore and apply these innovations in ways that blend global advances with local wisdom. From community-based climate-smart paddy cultivation to digital advisory platforms for smallholder farmers, our nation is demonstrating that technology can be harnessed inclusively and sustainably. The Faculty of Agriculture at the University of Ruhuna has played an

active role in these transformations, contributing research on sustainable crop systems, water management, renewable energy in farming, and AI-based pest and disease diagnostics. ISAE 2025 is a natural extension of this work, a forum where these achievements can be shared, critiqued, and expanded in dialogue with international peers.

This symposium has been designed to encourage deep, interdisciplinary engagement. Technical sessions will explore innovative crop and soil management strategies, climate-resilient livestock systems, advanced food processing technologies, and sustainable supply chains. Keynote addresses by global leaders will highlight breakthroughs in agricultural engineering, digital farming ecosystems, and policy frameworks that enable innovation at scale. I am especially proud of the **Young Graduates' Forum (YGF)**, which empowers our undergraduate students to step confidently into the global research arena by presenting their research findings and engaging with peers and experts from around the world. Equally noteworthy is the **Three Minutes Industrial Training (3MIT)** event, where undergraduates share the essence of their industrial training experiences in just three minutes. This format challenges them to communicate effectively, reflect on their internship learning, and highlight the practical applications of their academic knowledge. Both YGF and 3MIT exemplify our commitment to developing graduates who excel in academic inquiry, industry engagement, and professional readiness.

Our success in driving agricultural innovation depends on the active participation of all stakeholders. To researchers and academics, I call upon you to continue pushing the frontiers of knowledge, integrating advanced technologies with ecological principles. To our students and young innovators, I urge you to embrace curiosity, interdisciplinarity, and the courage to experiment with new ideas. To industry and technology partners, your collaboration in scaling innovations and making them accessible to farmers is indispensable. To policymakers and funding agencies, I appeal for your vision in creating enabling environments where sustainable, technology-driven agriculture can thrive. And to farmers and rural communities, your resilience, traditional wisdom, and adaptability are the grounding forces that ensure our innovations remain relevant and impactful.

ISAE 2025 is more than an academic gathering; it is a catalyst for action. The discussions, partnerships, and networks forged here will ripple far beyond these two days, influencing research agendas, policy decisions, and farm-level practices for years to come. In the face of climate change and global uncertainty, we have an opportunity, and a responsibility, to harness innovation for the collective good. Let this symposium remind us that sustainability is not a distant ideal but an urgent imperative, and that the technologies we shape today will define the agricultural landscapes of tomorrow.

I extend my deepest appreciation to the organizing and editorial committees for their tireless dedication in bringing ISAE 2025 to life, and to all our participants for committing your time, expertise, and energy to this important cause. May your experience here be intellectually stimulating, professionally rewarding, and personally inspiring. Together, let us chart a path toward a future where agriculture drives climate action, sustains communities, and safeguards the planet for generations to come.

Prof. Guttilla Yugantha Jayasinghe

Dean

Faculty of Agriculture

University of Ruhuna

2 September 2025

Message from the Coordinator

International Symposium on Agriculture and Environment (ISAE) 2025

With utmost respect and gratitude, I extend my warmest greetings on the occasion of the 15th International Symposium on Agriculture and Environment (ISAE) 2025, organized by the Faculty of Agriculture, University of Ruhuna, Sri Lanka. Over the years, ISAE has evolved into a flagship academic event, now recognized as a prestigious platform for researchers, academics, policymakers, industry experts, and other stakeholders to exchange knowledge, present cutting-edge research findings, and engage in meaningful discussions. The symposium has become a hub for fostering innovation, promoting sustainable practices, and building collaborations that address global challenges in agriculture and environmental management. This growing reputation reflects the dedication and enthusiasm of our scientific community, whose contributions continue to elevate the quality and impact of ISAE year after year.



The theme of ISAE 2025, “Driving Innovations in Agricultural Technologies for Climate Action and Sustainability,” underscores the critical role of innovation and research in addressing the challenges posed by climate change while promoting sustainable agricultural practices. The symposium program features five technical sessions covering climate-smart technologies, crop and soil management, food production and plant breeding, sustainable livestock production, and sustainable food systems and supply chains. In addition, the Young Graduate Forum and the 3-Minute Industrial Training (3MIT) Competition provide undergraduate students with an invaluable opportunity to present their research and innovative ideas. Complementing the main program, interactive sessions, live demonstrations, and a series of pre-webinars have been conducted to enhance knowledge sharing and engagement.

I am privileged to welcome Hon. Dr. Harini Amarasuriya, Prime Minister of Sri Lanka, as the Chief Guest, whose vision and leadership continue to inspire advancements in sustainable development and agriculture. We are equally honoured to have Mr. Indika Gunawardhana as the Guest of Honour, whose presence underscores the importance of industry collaboration and support for innovative agricultural initiatives. We are also delighted to feature a keynote address by Prof. Buddhi Marambe, Senior Professor, University of Peradeniya, along with seven distinguished session keynote speakers, whose expertise and insights will significantly enrich discussions on agricultural sustainability, technological innovation, and climate-resilient practices. We sincerely thank all of them for graciously accepting our invitation and for their invaluable contributions to making ISAE 2025 a truly inspiring and impactful event. As the Coordinator of ISAE 2025, I am confident that the discussions, insights, and collaborations initiated here will promote meaningful action, strengthen partnerships, and inspire innovative approaches to the pressing challenges in agriculture and environmental management. Together, let us embrace this opportunity to make impactful contributions to climate action, food security, and sustainable development at both national and global scales. On behalf of the organizing committee, I extend my sincere appreciation to committee members, reviewers, sponsors, partners, students, and staff, whose dedication and hard work have been essential in making this event a success. I am confident that ISAE 2025 will provide valuable insights, foster new collaborations, and inspire participants to contribute meaningfully to the advancement of sustainable agriculture and environmental management. I extend my warmest wishes to all participants for a rewarding, engaging, and inspiring experience at ISAE 2025

Dr. (Mrs) M.G.G. Awanthi

Conference Coordinator - ISAE 2025

Message from the Chief Guest

I extend this message on the occasion of the 15th International Symposium on Agriculture and Environment (ISAE 2025), organized by the Faculty of Agriculture, University of Ruhuna. This symposium, held under the theme ***“Driving Innovations in Agricultural Technologies for Climate Action & Sustainability,”*** serves as a platform to examine the challenges facing global agriculture in the context of climate change and environmental sustainability.



Sri Lanka, like many other countries, is at a stage where agricultural development must progress alongside environmental protection. Agriculture remains central to our economy, food security, and livelihoods, yet it faces increasing risks from climate variability, resource limitations, and changing socio-economic demands.

The theme of this year's symposium highlights the importance of aligning science, technology, and policy to achieve climate action and sustainability. Advances in precision agriculture, digital technologies, sustainable food systems, and renewable energy will play a decisive role in meeting both national and global goals, including food security, improved nutrition, and climate resilience. The discussions at ISAE 2025 will make a valuable contribution to these efforts.

I acknowledge the Faculty of Agriculture, University of Ruhuna, for its continued work in research, education, and knowledge exchange. By bringing together researchers, policymakers, industry leaders, and students, ISAE has developed into a recognized platform for collaboration. Such initiatives strengthen academic partnerships and promote practical solutions that support farmers, rural communities, and wider society.

The Government of Sri Lanka is committed to promoting climate-smart agriculture, sustainable food systems, and resilient rural economies. Events such as ISAE 2025 complement national priorities of innovation, food sovereignty, and the well-being of our people.

I congratulate the organizers of ISAE 2025 and extend best wishes to all participants and contributors. May this symposium foster constructive dialogue, innovative ideas, and effective partnerships that advance sustainable and climate-resilient agriculture in Sri Lanka and beyond.

Dr. Harini Amarasuriya

Prime Minister of the Democratic Socialist Republic of Sri Lanka

Message from the Guest of Honour

It is indeed a privilege to be invited as the Guest of Honour for the International Symposium on Agriculture and Environment (ISAE) 2025, organized by the Faculty of Agriculture, University of Ruhuna. I truly appreciate the organizers for creating this vital platform to foster collaboration among academics, researchers, policymakers, and industry stakeholders in addressing one of the most pressing challenges of our time.



The theme, *“Driving Innovations in Agricultural Technologies for Climate Action and Sustainability”*, is both timely and significant. As the global community strives to meet the demands of a growing population while safeguarding natural resources, innovation in agricultural practices and technologies will play a pivotal role in shaping the future.

This symposium provides an important forum to exchange ideas, share research breakthroughs, and inspire actionable solutions that can transform challenges into opportunities. As innovative private sector stakeholders, our responsibility is to introduce and promote commercial products with proven effectiveness that can help mitigate the impacts of climate change. By leveraging innovation, we can deliver solutions that are not only commercially viable but also environmentally sustainable.

Many of these innovative products align with the United Nations Development Programme’s (UNDP) Sustainable Development Goals, and through proper adaptive research, they can be effectively utilized to benefit our communities. I extend my best wishes to all participants for productive and meaningful collaborations. May the insights and partnerships formed here contribute to building a more resilient, inclusive, and sustainable agricultural sector both in Sri Lanka and beyond.

Mr. Indika Gunawardhana

Deputy Chairman
Agstar PLC

Keynote Speech of the Inaugural Session

Driving Innovations in Agricultural Technologies for Climate Action and Sustainability

Buddhi Marambe

Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka.



The agriculture sector, including crops, livestock, poultry and aquaculture, in South Asia has evolved over centuries, and Sri Lanka is not an exception. Advancements in technology aimed at enhancing production and minimizing food costs have led to a significant increase in food and agricultural productivity. Input intensification in the agriculture sector has been the key mechanism in achieving this growth. Despite an increase in land productivity, such intensification has led to various types of environmental imbalances, including pollution, weakened soil health, and changes in the natural flora and fauna.

The early trends of biological and chemical sciences have led to the gradual reduction of labour in the production and processing of agricultural products. However, an inappropriate balance in chemical and biological technologies used in agriculture would negatively affect the ecosystem, ecosystem services, and threaten its sustainability. Sustainable agriculture primarily targets site-specific applications while ensuring environmental health, financial viability, and social equity. Further, sustainable agriculture ensures that the current needs of humans are fulfilled while meeting the demands of future generations. Sustainable innovations and technologies are a must in the agriculture industry to meet the challenges of enhancing agricultural productivity in resource-limited conditions. The interdependence between food production and environmental protection is a crucial issue that must be addressed. Several agricultural practices impede long-term sustainability. Conventional farming methods often result in the misuse of water, fertilizers, and pesticides, leading to soil degradation, water pollution, loss of biodiversity, and climate change.

In response to these challenges, the discovery of innovative methods to develop and manage agricultural systems is imperative. In this context, precision agricultural technologies are of prime importance, which use modern technologies such as satellite imagery or field mapping to improve crop quality and profitability. Moreover, it optimizes the use of traditional resources. Therefore, this agricultural management system contributes to the development of sustainable agriculture, enabling the solution of both economic and ecological problems, which are becoming more acute.

Precision agriculture (PA) technologies dramatically improve the efficiency of agricultural systems, optimize the soil and preserve its quality, enabling a stable food supply, and save financial costs while increasing production. The PA technologies leverage advanced technologies such as remote sensing, satellite navigation systems, and geographic information systems, providing ample opportunities for practitioners to track and analyze various factors. This data-driven approach empowers policymakers and practitioners to make informed decisions about planting, fertilizing, harvesting, and achieving their economic goals, leading to more sustainable and profitable farming enterprises.

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Message from the Secretary

International Symposium on Agriculture and Environment (ISAE) 2025

It is a great honor to share this message on the occasion of the 15th International Symposium on Agriculture and Environment (ISAE 2025), organized by the Faculty of Agriculture, University of Ruhuna, Sri Lanka. Over the years, this annual symposium has served into a distinguished platform that fosters collaboration among academics, researchers, industry professionals, and policymakers in the fields of agriculture, food, and the environment.



The theme of ISAE 2025, *“Driving Innovations in Agricultural Technologies for Climate Action & Sustainability,”* underscores the urgent need to address the multifaceted challenges posed by climate change while promoting sustainable agricultural practices, technology-driven solutions, and resilient food systems. The success of this endeavor, and of the symposium itself, has been made possible through the invaluable contributions of many distinguished individuals and partners, whose support I gratefully acknowledge.

I wish to extend my heartfelt gratitude to our Chief Guest, Hon. Dr. Harini Amarasuriya, Prime Minister, for gracing this occasion with her esteemed presence, and to our Guest of Honour, Mr. Indika Gunawardhana, Deputy Chairman of Agstar PLC, for his invaluable support and encouragement. I also express my sincere appreciation to Snr. Prof. Buddhi Marambe of the University of Peradeniya for delivering the keynote address, as well as to our distinguished session keynote speakers for enriching the symposium with their expertise and insights.

My deep appreciation also goes to Snr. Prof. P.A. Jayantha, Vice Chancellor of the University of Ruhuna, for his esteemed presence and continuous encouragement. Furthermore, I extend heartfelt thanks to Snr. Prof. G.Y. Jayasinghe, Dean of the Faculty of Agriculture, University of Ruhuna for his unwavering support and dedicated commitment, which have been instrumental to the success of this year’s event.

A special word of thanks goes to the Organizing Committee of ISAE 2025, whose tireless efforts, dedication, and teamwork have been the driving force behind the success of this symposium. I gratefully acknowledge the contributions of the reviewers, sponsors, session chairs, conveners, evaluators, faculty members, students, and non-academic staff. Most importantly, I extend my appreciation to all authors and participants for their active engagement, which lies at the heart of ISAE 2025.

As Secretary, it is my sincere hope that ISAE 2025 will inspire meaningful dialogue, strengthen collaborations, and pave the way for innovative solutions in agriculture and environmental management for a more sustainable future. I wish all participants a rewarding and enriching experience at ISAE 2025.

Dr. Anushka Bandara

Conference Secretary – ISAE 2025

International Symposium on Agriculture and Environment (ISAE) - 2025

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International Symposium on Agriculture and Environment (ISAE) 2025

Scientific Sessions



Animal Husbandry for Sustainable Livestock Production

Oral Presentations



Keynote Speech

Industry Competitiveness and Policy Environment: Value Chain Lens to Study Dairy Industry in Three Contrasting Economies

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Dairy industry across three contrasting economies is examined. The Australian dairy industry is a significant component of its agricultural economy, ranking as the third-largest rural industry and fifth globally in dairy exports, accounting for 4% of total world dairy trade. A pivotal milestone in its global competitiveness was the deregulation in 2000, which aimed to improve market efficiency by removing state-based price controls. This policy led to a one-third reduction in dairy farms, a doubling of average herd size, and a near halving of total dairy cattle, with aggregate milk production decreasing by approximately 2.1 billion litres. Large-scale processors, export-oriented farmers, and retailers have been beneficiaries of this deregulation. In contrast, Pakistan boasts the world's fourth-largest dairy industry, with livestock contributing nearly 15% to its GDP and supporting over 8 million rural households. Despite its size, Pakistan faces critical challenges, including low animal productivity, poor animal health, and a lack of formal market integration. The formal processing industry holds a negligible 5% market share, with informal supply chains dominating. These informal chains, though raising quality concerns, are pro-poor, generate extensive employment opportunities, and are sustained by a unique financing system providing regular cash flows and interest-free loans to the chain participants at different tiers. However, price-setting mechanisms and a lack of uniform quantity and quality standards hinder efficient growth. At the farm gate, formal processors exert oligopolistic buying power. At the retail end, the government sets fresh milk prices, thus obstructing clear market price signals to the producers.

Sri Lanka's dairy industry is nationally significant for nutrition and rural livelihoods, with livestock contributing 1.4% to GDP. Nevertheless, local milk production meets only 40% of national requirements, leading to heavy reliance on imported milk powder. This dependency not only strains foreign exchange reserves but also undermines local producers, who face lower prices due to cheap imports. Although consumers prefer local fresh milk, imported powdered milk is often chosen due to its lower cost, higher availability, consistent quality, and established brand reputation. Quality deterioration along milk value chains is another significant challenge.

Both Sri Lanka and Pakistan face similar fundamental challenges, warranting attention in three key areas:

- Need to increase milk yields (productivity per milking animal) for local breeds.
- Provide a level playing field for local farmers to compete with cheaper imported powdered milk and ensure farm-gate milk prices reflect local consumer preferences.
- Focus on improving product quality from farm to market and establishing stringent quality standards.

Keywords: Dairy, Industry, Value Chains

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Influence of agricultural land use on limnology of Sri Lankan reservoirs during rainy season

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Abstract:

Reservoir limnology is closely linked to land use and land cover (LULC) in their upper catchments, particularly during peak rainy-season runoff. Understanding these interactions is key to sustainable catchment and reservoir management. This study investigates how agricultural land use influences water quality (WQ) and sediment quality (SQ) in ten Sri Lankan reservoirs: Karavita-wewa (7.57°N, 79.85°E), Kiulekada (8.32°N, 80.81°E), Kottukachchiya (7.93°N, 79.95°E), Mahawilachchiya (8.47°N, 80.20°E), Mahagal-wewa (6.40°N, 81.04°E), Pudumurippukulam (9.36°N, 80.35°E), Unnichchai (7.61°N, 81.54°E), Urusita-wewa (6.33°N, 80.93°E), Vadamunai (7.90°N, 81.27°E), and Vijayakatupotha (7.72°N, 79.90°E). Bimonthly surface water and sediment samples were collected from each reservoir between February 2023 and April 2024, covering before-rainfall, during-rainfall, and after-rainfall periods. WQ parameters included temperature, dissolved oxygen (DO), conductivity, pH, oxidation-reduction potential (ORP), Secchi depth, chlorophyll-a, alkalinity and hardness, measured using YSI-ProDSS and APHA standards. SQ parameters included ORP and pH, while total nitrogen and phosphorus were measured in both water and sediment samples using sodium salicylate and ascorbic acid methods. Catchment characteristics, LULC and reservoir morphometry (surface area and perimeter) were derived using QGIS. Statistical analyses were conducted in RStudio using Pearson's correlation, Shapiro-Wilk tests and t-tests. Agricultural area (AA) showed strong positive correlations ($p < 0.001$) with built-up area ($r = 0.96$, $R^2 = 0.92$) and water extent ($r = 0.87$, $R^2 = 0.76$), however a negative correlation with forest cover ($r = -0.69$, $R^2 = 0.48$). During and after rainfall, significantly higher conductivity, hardness, and alkalinity ($p < 0.001$) were observed in reservoirs with higher AA:SA ratios. After-rainfall, sediment phosphorus was positively correlated with AA:SA ($r = 0.70$, $R^2 = 0.49$) and alkalinity ($r = 0.59$, $R^2 = 0.35$) and negatively correlated with DO ($r = -0.75$, $R^2 = 0.56$), all with $p < 0.001$. These results demonstrate that agricultural runoff is a major driver of limnological changes, leading to elevated nutrient and dissolved ion concentrations in reservoir waters. Although water is essential for agriculture, intensive land use, if not properly managed, may compromise reservoir health. The findings underscore the urgent need for integrated agricultural watershed and reservoir management to preserve water quality and ecosystem function.

Keywords: Culture-based fisheries; Nutrient runoff; Reservoir management; Sediment quality; Water quality; Watershed management

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ID 113

Farmer attitude on pregnant sow management and welfare in Gampaha district, Sri Lanka

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Abstract:

Proper management of pregnant sows supports the welfare and health of both the sow and her neonatal piglets. However, negative farmer attitudes toward sow welfare often led to a poor human-animal relationship, resulting in reduced humane management practices. In this study, farmers' attitudes towards key practices in pregnant sow management and welfare were assessed using a questionnaire in a face-to-face interview with fifty-eight swine farmers, covering all 13 veterinary divisions of Gampaha District. Attitudes of farmers were tested using a five-point Likert scale. Data were statistically analyzed using SPSS version 23.0. The majority of farmers were Catholic/Christian (83%) and 76% were fully engaged in small-scale, pig farming, managing 50 pigs or less. Overall, 44% of the farmers had over 20 years of experience in swine farming and 76% were aware of the term "animal welfare". All farmers agreed that sow should handle with more care during pregnancy. In overall, 93% farmers provided farrowing pen and 98% agreed on protecting sow from rain and sharp sunlight. Identified critical risk factors affecting the welfare of pregnant sows included uncertainty (24%) and disagreement (15%) regarding the facilitation of natural behaviors, disagreement (21%) over the provision of comfortable lying substrates and uncertainty (53%) on whether farrowing is painful, while 35% believed it is not. Moreover, 55% of farmers perceived pigs as greedy and smelly animals, while 67% believed that pigs are not emotional. In pregnant sow management: feeding swill feed (79%), lack of feeding concentrates (22%), lack of immediate treatments in poor health or injury (17%), and lack of provision of bedding material (36%) were identified as key welfare issues. Farmers' experience did not affect the tested negative attitudes toward pigs (smelly, greedy, unpleasant) and no correlation was found with the involvement (full time/part time) or the level of farming satisfaction ($P>0.05$). Further improvement in positive welfare attitudes of swine farmers toward pregnant sow management in the studied district is suggested.

Keywords: Farmer attitudes; Management practices; Pregnant sow; Welfare

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ID 124

Enhancing hive microclimate of *Apis cerana* colonies using passive thermal insulation techniques

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Abstract:

Apis cerana, the native honeybee species of Sri Lanka, plays a pivotal role as a primary pollinator in both agriculture and biodiversity. However, environmental stress, particularly fluctuations in temperature (T) and relative humidity (RH), can negatively affect colony health and hive stability, increasing the risk of colony migration. Passive thermal insulation offers a potential low-cost, eco-friendly solution, yet it remains understudied in *Apis cerana* management. This study evaluated the influence of internal and external temperature and RH on *Apis cerana* colonies and assessed the effectiveness of passive insulation. Ten healthy colonies of similar strength were housed in eight-frame hives and randomly assigned to treatments. Colonies were maintained under identical conditions within the same apiary. Two natural insulating materials, wood shavings and clay brick particles, were applied around hive walls and beneath the roof. Temperature and RH were recorded using digital sensors (DHT22) placed centrally inside the hives. Colonies were inspected one day intervals, and photographic monitoring was conducted biweekly to assess the brood area, bee coverage and comb construction. Optimal internal T and RH conditions for colony stability were identified as 33–36 °C and 60–70%, respectively. Statistical analysis was performed using one-way ANOVA to compare internal and external environmental conditions. Hives with wood shavings maintained an average internal temperature of 33.51 ± 0.11 °C and RH of $76.66 \pm 2.03\%$, with significant differences from external conditions (temperature $p = 0.00397$; RH $p = 3.37 \times 10^{-10}$). Hives with brick insulation recorded an average temperature of 34.43 ± 0.12 °C and RH of $75.73 \pm 0.24\%$, also showing significant differences (temperature $p = 0.00048$; RH $p = 0.00034$). These findings confirm that passive insulation effectively regulates hive microclimate and reduces environmental stress, supporting its application in sustainable, low-cost beekeeping, particularly for rural communities, while contributing to the growth of Sri Lanka's apiculture sector.

Keywords: *Apis cerana*; Colony health; Passive thermal insulation; RH regulation; Temperature

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ID 132

Geospatial innovations in livestock farming: Enhancing animal husbandry through GPS and remote sensing technologies

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Abstract:

Livestock farming in South Asia, including Sri Lanka, is vital for food security, rural livelihoods and economic stability. However, it faces escalating challenges such as climate variability, land degradation and disease outbreaks, leading to notable declines in global livestock productivity and resource efficiency. Traditional animal husbandry methods often lack precision, contributing to unsustainable practices and lower outputs. This study explores the integration of Global Positioning System (GPS) and remote sensing technologies to establish a sustainable framework for livestock management. The applied research methodology highlights a mixed-methods approach applied across varied agro-ecological zones, incorporating satellite imagery, GPS-based animal tracking and spatial analysis of grazing patterns, water access, vegetation coverage and land use trends. Analysis revealed strong links between livestock well-being and proximity to water sources and vegetation-rich areas, while movement data highlighted optimal grazing routes. Remote sensing also enabled early identification of overgrazed zones and potential disease-risk areas, supporting targeted interventions such as rotational grazing and stress mitigation strategies. These findings demonstrate how geospatial tools can support evidence-based decision-making, enhance resource allocation and improve animal welfare by reducing environmental impact. By applying geospatial analysis, livestock systems can shift toward precision farming models that are both economically and ecologically sustainable. The study underscores the importance of adopting digital tools in animal husbandry to boost productivity and resilience. Policymakers and stakeholders are encouraged to invest in affordable geospatial technologies, capacity building and open-access data systems to scale these innovations across rural livestock communities. This research contributes to the growing body of knowledge on digital agriculture and highlights the transformative potential of geospatial innovation in fostering resilient and data-driven livestock farming systems.

Keywords: Animal welfare; Geospatial analysis; GPS tracking; Precision livestock farming; Remote sensing; Sustainable agriculture

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ID 154

Optimizing grading frequency to enhance growth, survival, and size uniformity of GIFT tilapia fry in pond-based nursery systems

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Abstract:

Grading is a critical management practice in Genetically Improved Farm Tilapia (GIFT) nursery systems to reduce size variation, cannibalism and competition among fry. This study aimed to assess the effect of different grading frequencies on the growth performance, survival rate and size uniformity of GIFT fry reared in pond-based nursery systems. The pond had a surface area 56m² surface area with a depth of 4 feet. The experiment was conducted in Aquaculture Development Centre Iranaimadu. over 30 days using four treatments: T1 (no grading), T2 (grading every 7 days), T3 (grading every 10 days) and T4 (grading every 14 days), each with three replicates. Fry were initially stocked at a uniform density and fed a commercial diet at 10% of their body weight. Parameters, including final weight, total length, survival rate and coefficient of variation (CV) for size uniformity were recorded and statistically analyzed. Results revealed that grading frequency had a significant ($p<0.05$) impact on all evaluated parameters. Fry in T2 showed the best performance, with a final average weight of 2.70 g, total length of 5.40 cm, survival rate of 92% and the lowest size variation (CV 12.5%). In contrast, ungraded fry (T1) recorded the poorest performance, with significantly lower weight, higher mortality and greater size disparity. The findings suggest that weekly grading effectively reduces size hierarchies and cannibalism, enhances feed access and promotes uniform growth and survival in GIFT tilapia fry. Longer intervals between grading or no grading increase competition and mortality. Therefore, implementing a 7-day grading interval is recommended for optimal fry performance and uniformity in pond-based nursery systems, particularly in small-scale aquaculture settings aiming for high survival and consistent growth. These insights contribute to improving nursery management strategies for sustainable tilapia farming.

Keywords: GIFT tilapia; Grading frequency; Growth performance; Nursery rearing; Size uniformity

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Engineering Climate-Smart Technologies for Sustainable Agriculture

Oral Presentations



Keynote Speech

Machine Learning-Driven Nondestructive Diagnosis of Mineral Deficiencies in Plants

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Mineral nutrient imbalances silently erode crop productivity long before visible symptoms appear, making early detection essential for effective intervention. Current diagnostic methods rely on destructive tissue analyses that take hours to days, limiting their use for rapid decision-making in the field. A nondestructive approach that is both fast and physiologically informative would bridge this gap, enabling proactive nutrient management at scale.

We introduce a diagnostic framework that integrates chlorophyll fluorescence and P700⁺ absorbance with interpretable machine learning. Using one-shot and conventional two-shot saturation-pulse protocols, the method captures photosystem II and I dynamics directly from intact leaves. Because these photochemical dynamics are conserved across green plants, the approach is transferable beyond wheat and is relevant to crops cultivated in regions such as Sri Lanka.

We hydroponically cultivated wheat and induced single-nutrient deficiencies by withholding one essential mineral from Hoagland's solution for one week. Chlorophyll fluorescence and P700⁺ absorbance was recorded using either a single 300 ms saturating pulse (one-shot) or two pulses (two-shot). We then developed multiclass classification models for diagnostic assessment. Partial least squares discriminant analysis (PLS-DA) was ineffective. In contrast, linear discriminant analysis (LDA) without principal components analysis distinguished 13 classes of mineral status, or 11 classes when controls were grouped with Mo- and B-deficiency, surpassing 81% across all five-macro metrics: precision, recall, specificity, accuracy, and F1 score. The one-shot protocol showed only a slight decrease in performance relative to two-shot, yet markedly shortened acquisition time (two-shot ≥ 10 s per measurement versus a single 300 ms pulse), enabling substantially higher throughput. Applying the LDA models to outdoor, soil-grown leaves demonstrated practical utility as well as limitations. In multiple-deficiency scenarios the models tended to predict a dominant deficiency or misassign the class, delineating requirements for multilabel or quantitative calibration in field deployment.

Beyond classification, the use of transparent, interpretable algorithms provides physiological insight into nutrient-stress mechanisms reflected in photosystem responses, a property that black-box models do not readily afford. The combination of rapid optical acquisition, reliable multiclass diagnosis, and mechanistic interpretability outlines a realistic path toward field-ready nutrient monitoring that scales across species and environments, supports earlier intervention, and promotes more precise and sustainable fertilizer management.

Keywords: Dual-PAM, Linear discriminant analysis, Plant nutrient diagnosis, Shapley additive explanations value

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ID 11

Deep learning-based detection of rubber (*Hevea brasiliensis*) leaf diseases for sustainable cultivation

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Abstract:

The rubber industry is a vital component of the Sri Lankan economy, supporting thousands of livelihoods. However, leaf diseases can reduce rubber yield by up to 45%, posing a significant threat to productivity and income. Traditional methods of disease detection are time-consuming and inaccurate, leading to delayed interventions and increased crop losses. To address this issue, this research investigates the use of deep learning for automated rubber leaf disease diagnosis, enabling quicker and more accurate identification to minimize losses. The study evaluates multiple Convolutional Neural Network (CNN) models including YOLOv8, VGG16 and ResNet50, using a dataset of rubber leaf images collected from Sri Lankan plantations. Data augmentation techniques were applied to enhance dataset diversity, while preprocessing steps were used to optimize model performance. Transfer learning was used to improve efficiency and reduce the need for extensive training data. Among the models tested, VGG16 demonstrated the most balance of accuracy (93.65%), F1-score (0.9333) and computational efficiency, making it the optimal choice for real-world deployment. YOLOv8 also performed competitively, offering fast inference times (7.65s) with a lightweight architecture (1.44M parameters). These findings highlight the potential of AI-driven disease detection to improve farm management, reduce crop losses, and enhance agricultural sustainability. This research contributes to climate-smart agriculture by providing an innovative, data driven solution for early disease detection, helping rubber farmers adapt to climate-induced disease pressures. By incorporating deep learning into agriculture, this study supports resilient and sustainable rubber cultivation in Sri Lanka and other comparable agro-climatic zones.

Keywords: Climate Resilience; Deep Learning; Rubber Leaf Disease; Sustainable Agriculture; VGG16

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ID 134

Blockchain-based decentralized secure ecosystem for IoT-driven smart agriculture

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Abstract:

The rapid adoption of IoT technologies in agriculture has enhanced real-time monitoring, automation and data-driven decision-making, leading to the emergence of smart agriculture. However, this transformation also introduces significant cybersecurity risks, including data breaches, unauthorized access, and vulnerabilities arising from centralized data systems. To address these challenges, we propose a novel multi-layered security framework specifically designed for IoT-enabled smart agricultural environments. The framework consists of three core components: (1) An adaptive access control mechanism combining Attribute-Based and Role-Based Access Control with OAuth to enable fine-grained authentication for users and devices. This component introduces a novel secure communication protocol with a lightweight key establishment scheme and unified authentication, specifically designed for resource-constrained IoT devices. (2) A decentralized storage layer combines Hyperledger Fabric with the Interplanetary File System to provide tamper-proof, privacy-preserving data sharing across agricultural stakeholders including farmers, sellers, and third-party services. The novelty lies in the integration of blockchain access control with IPFS storage, enabling scalable, secure sensor data management without reliance on centralized infrastructure an approach rarely applied in agricultural IoT systems. (3) A hybrid intrusion detection system integrates Snort's signature-based detection with a cloud-deployed Random Forest model trained on the NF-ToN-IoT-v2 dataset to identify both known and emerging threats. This component is novel in its architecture, combining edge-level rule-based detection with cloud-based ML inference, offering high detection accuracy (99.39%) while minimizing false positives and preserving performance in constrained environments. A real-time dashboard supports transparent monitoring of agricultural IoT networks and enables rapid incident response. Designed for scalability, resilience and interoperability, this framework delivers a robust cybersecurity foundation tailored for smart agriculture and holds potential for broader application across other IoT-enabled farming infrastructures.

Keywords: Access control; Blockchain; Decentralized storage; Intrusion detection; IoT security; Smart agriculture

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ID 148

Development of an IoT-based real-time monitoring and control system for a prototype infrared paddy dryer

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Abstract:

This study focuses on developing an Internet of Things (IoT)-based real-time monitoring and control system for a laboratory-scale infrared paddy dryer to enhance the precision and efficiency of the drying process. Traditional drying systems often lack real-time feedback mechanisms, making it challenging to maintain optimal drying conditions, which can lead to over- or under-drying, energy inefficiencies and deterioration of grain quality. Integrating IoT technology provides a promising approach for automating and optimizing drying operations through continuous monitoring and controlling of key process variables. The developed system included an ESP32 microcontroller as the primary unit for processing sensor data and controlling operations. Temperature within the drying chamber was continuously monitored using a DS18B20 digital temperature sensor and real-time feedback was used to regulate the drying environment. Solid-state relay modules controlled the operation of the ceramic infrared heaters, while a NEMA17 stepper motor drove the rotary feeding mechanism to achieve the desired final moisture content. Sensor data were transmitted in real time to a cloud-based platform (Blynk), enabling remote monitoring and analysis of drying conditions. A user-friendly web interface was developed to display dynamic dashboards and generate automated alerts, supporting efficient remote supervision and control of the drying process. The prototype was tested using freshly harvested paddy with an initial moisture content of 22% (wet basis). During operation, the system maintained the drying chamber temperature within $\pm 2^{\circ}\text{C}$ of the set range of 40°C to 80°C . Moisture content reduction was evaluated across varying paddy feeding rates to assess system responsiveness and consistency. Sensor calibration confirmed measurement accuracy, with deviations remaining within acceptable limits ($\pm 0.4^{\circ}\text{C}$ for temperature). Reliability tests indicated stable data transmission over extended continuous operation, with no observed signal dropouts. The proposed system establishes a foundation for real-time monitoring and control for intelligent postharvest management, with scope for future integration of predictive control and energy optimization.

Keywords: Automated drying system; ESP32 microcontroller; IoT; Infrared drying; Paddy drying

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ID 179

Exploring artificial intelligence applications in agricultural water management in South Asia: Techniques, challenges, and future directions

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Abstract:

South Asia faces severe water stress from rapid population growth, uneven rainfall and outdated irrigation systems, with efficiency often below 40%. Integrating Artificial Intelligence (AI) into water management can improve irrigation efficiency and decision-making. This systematic literature review examines the transformative role of AI in agricultural water management, highlighting cutting-edge practices and the challenges impeding its widespread application between 2009- 2025, focusing on India, Bangladesh, Sri Lanka and Pakistan. The review involved a Google scholar search using the keywords “Artificial Intelligence,” “Agricultural Water Management,” “Irrigation” and “South Asia”, screening publications from 2009 to 2025. Studies were categorized based on AI techniques, challenges and future directions. Most studies employed machine learning models such as Support Vector Machines (SVM), Random Forest (RF), Artificial Neural Networks (ANNs) and deep learning models like Long Short-Term Memory (LSTM) to optimize irrigation scheduling and predict critical parameters. AI-driven tools, including drones, robotics, remote sensing and systems like Arduino and Raspberry Pi, enable real-time monitoring of soil moisture and water distribution. Nonetheless, technical and socio-political challenges remain. The adoption of AI technologies is constrained by inadequate infrastructure, including limited sensor networks, poor internet coverage and a dearth of data analytics platforms, along with financial limitations, low digital literacy, historical inequalities, weak institutional capacity and ethical concerns. AI's role in agricultural water management is advancing towards more effective, data-driven practices. To enhance productivity, efforts must focus on overcoming systemic obstacles through strategic investments, regional partnership, policy innovation and inclusive digital capacity building.

Keywords: Agricultural water management; Artificial intelligence; Data analytics; Digital capacity building; Machine learning; Remote sensing; South Asia

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ID 180

Quantifying the joint effects of background material and light polarization on hyperspectral reflectance for enhanced internal biochemical prediction in postharvest lettuce

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Abstract:

Hyperspectral imaging (HSI) is a powerful tool for nondestructive quality assessment of fresh produce, providing pixel-level spectral and spatial information. However, its performance strongly depends on imaging configuration illumination geometry, background material, and light polarization specifically in optically complex, highly scattering samples such as leafy vegetables. Nevertheless, no clear criteria exist for tuning HSI setups according to sample type or analytical goal. This study investigates six short-wave infrared (SWIR, 1000-1700 nm) HSI configurations combining three polarization states (parallel, cross, and non-polarized), each paired with either a black or white background, to examine their effects on reflectance spectral quality and ascorbic-acid content interpretability in lettuce (*Lactuca sativa* L.) stored under 5°C, 20°C and 35°C for 6 days. Partial least-squares regression models were built from spectra acquired under six configurations; informative wavelengths were selected with variable-importance-in-projection (VIP) scores > 1. Spectra recorded against a black background consistently outperformed those from a white background. Across polarization states, predictive power ranked cross-polarized > non-polarized > parallel-polarized, with the cross-polarized/black-background setup achieving the best performance ($R^2 = 0.61$, RMSE = 0.69 mg 100 g⁻¹). This was attributed to the suppression of background reflection interference and surface glare, enhancing isolation of internal spectral information. Notably, the non-polarized/black-background configuration also yielded favorable performance, suggesting the potential benefits of integrating both surface and subsurface spectral information. Conversely, under white background conditions, re-entering reflected light and surface interference were found to reduce model accuracy. These results demonstrate that optimizing HSI configurations in accordance with the optical properties of the target sample improves the accuracy of non-destructive biochemical analysis. Configurations that minimize recursive reflection and surface glare, thereby isolating internal spectral signals derived from internal components, were validated as most effective. These findings make a significant contribution to the advancement of sensing technologies in postharvest engineering from general HSI toward application-specific biochemical assessment.

Keywords: Ascorbic acid; Hyperspectral imaging; Lettuce; Polarized light spectroscopy; Short-wave infrared

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Crop and Soil Management for Climate-Resilient Agriculture

Oral Presentations



Keynote Speech

Crop and Soil Management for Climate-Resilient Agriculture

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Soil is the foundation of climate-resilient agriculture, serving as a living system that sustains crops, ecosystems, and livelihoods. Current challenges such as erosion, nutrient depletion, and overuse of chemicals threaten soil health and long-term productivity. Regenerative practices—including minimal tillage, cover cropping, green manuring, agroforestry, and biochar application—can restore soil vitality while enhancing crop yields.

Equally critical is strategic crop management. Crop diversity, climate-resilient varieties, and sustainable frameworks, such as India's Palm Oil Sustainability (IPOS) program, demonstrate how productivity can be aligned with ecological stewardship and farmer empowerment. Diversified cropping systems, including soybean, cotton, millets, and horticultural crops, support nutrition, climate adaptation, and rural prosperity. Integration of regenerative soil practices with diversified cropping contributes to the achievement of Sustainable Development Goals (SDG 2, SDG 13, and SDG 15).

Technological tools such as AI-based soil monitoring, weather advisories, and blockchain-enabled traceability can further enhance decision-making and resilience. However, lasting transformation requires trust, training, and active farmer participation as co-creators and innovators.

Building climate-resilient agriculture requires a systems approach, combining soil stewardship, crop management, technology, supportive policies, and regional collaboration. By cultivating soils and crops thoughtfully, we can achieve sustainable agriculture that feeds, heals, and sustains future generations.

Keywords: Climate Resilience; Crop Diversity; Regenerative Agriculture; Soil Health

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ID 09

Effect of Rhizobium inoculation and inorganic fertilizer levels on growth, yield and shelling percentage of two groundnut varieties

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Abstract:

Optimizing groundnut yield through effective use of biological and inorganic inputs is essential for sustainable production. This study evaluated the effect of Rhizobium inoculation and different levels of inorganic fertilizer on the growth, yield, and shelling percentage of groundnuts in the Killinochchi District from May to September 2024. A two-factor factorial experiment was conducted in a randomized complete block design with three blocks. Within each block, 12 treatment combinations were applied. The first factor included six fertilizer treatments with or without Rhizobium inoculation: (F₁ (0% Rhizobium + 100% Fertilizer), F₂ (Rhizobium + 0% Fertilizer), F₃ (Rhizobium + 100% Fertilizer), F₄ (Rhizobium + 75% Fertilizer), F₅ (Rhizobium + 50% Fertilizer), F₆ (Rhizobium + 25% Fertilizer). The second factor was the groundnut variety (V₁: ANKG2 (Lanka Jambo) and V₂: Tissa.). All agronomic practices followed the Department of Agriculture, Sri Lanka guidelines, except for the fertilizer levels. Data on growth parameters, number of active and inactive nodules, yield components, and shelling percentage were collected and analyzed using ANOVA in SAS 9.1, with mean separation by Duncan's Multiple Range Test. The interaction effect between the two factors was non-significant. However, both factors significantly ($p < 0.05$) affected plant growth, yield and shelling percentage. Total nodule number and active nodules were significantly higher in ANKG2. This variety also showed superior yield metrics, including 100-seed weight and shelling percentage. while Tissa variety recorded the highest pod count. Significantly the highest dry weight at harvest, yield and shelling percentage were observed in F₃ (Rhizobium + 100% Fertilizer), while F₂ (Rhizobium + 0% Fertilizer), recorded the lowest. No significant difference was found between F₄ (75% fertilizer + inoculation) and F₁ (conventional practice). It can be concluded that the combination of ANKG2 with rhizobium inoculation and 100 % recommended fertilizer is the most effective for maximizing yield in Kilinochchi District followed by F₄ (75% fertilizer + Rhizobium inoculation) as a more input-efficient alternative.

Keywords: *Rhizobium*; Fertilizer levels; Growth; Groundnut, Yield

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ID 43

Effect of different nutrient solutions on the growth and yield of water spinach (*Ipomoea aquatica*) and mint (*Mentha spicata*) under the non-circulating hydroponic system

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Abstract:

Leafy vegetables are an essential component of a balanced diet due to their rich nutritional profile. However, producing high-quality leafy vegetables without the use of harmful agrochemicals remains a significant challenge in sustainable agriculture. In hydroponic systems, nutrient solutions like Albert's solution offer controlled growth, but are costly and rely on non-organic inputs, limiting their compatibility with organic cultivation. This study evaluated the effectiveness of different organic nutrient solutions on the growth and yield of leafy vegetables (water spinach and mint) in a non-circulating hydroponic system. The experiment was conducted in a Completely Randomized Design with six treatments: Albert's solution (T₁, control), Fish tonic (T₂), Seaweed nutrient solution (T₃), Jeewamruta (T₄), Vermiwash (T₅), and Vegetable waste nutrient solution (T₆), each with four replicates. Growth parameters (plant height, number of leaves and branches, root length), quality parameter (chlorophyll content), and yield parameter (fresh weight of shoot) were recorded and analyzed using ANOVA in SAS 9.1. Among the treatments, both Albert's solution and Jeewamruta showed statistically similar and superior performance in water spinach for key growth parameters, except root length and overall biomass accumulation. Vermiwash resulted in the longest root length. In case of mint, Albert's solution and Vegetable waste nutrient solution showed similarly high values for key growth parameters except root length and overall biomass accumulation, with no significant differences between them. Again, Vermiwash recorded the longest root length in mint. In water spinach, Jeewamruta showed comparable effectiveness to Albert's solution. Similarly, the Vegetable waste nutrient solution proved equally effective as Albert's solution in enhancing growth performance in mint. These findings indicate that Jeewamruta and Vegetable waste nutrient solution can be suggested as cost-effective, sustainable, and environmentally friendly alternatives to synthetic hydroponic nutrient solutions, particularly for the cultivation of water spinach and mint.

Keywords: Growth; Leafy vegetables; Non-circulating hydroponics; Organic nutrient solutions; Yield parameters

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Assessment of soil erosion and deposition using fallout radionuclide technique under different land uses and its relationship with soil chemical properties in the Gregory Lake catchment, Nuwara Eliya

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Abstract:

Removal of the topsoil layer reduces soil health, water retention capacity, and carbon sequestration ability while contaminating reservoirs and increasing runoff and flooding. Therefore, accurate assessment of soil erosion is very important for sustainable land management and building a climate-resilient environment. This study was conducted to quantify soil erosion rates using the Fallout Radio Nucleotide (FRN) technique in the Gregory Lake Catchment. The study further investigated the relationship between soil chemical properties and soil erosion under selected land uses including natural forest, tea land, vegetable land, grassland and municipal area. Sediment samples from Gregory Lake were also analyzed. Three soil samples (0 – 40cm) were collected from each land use and analyzed for radioisotopes of ¹³⁷Cs and ²¹⁰Pb activities using High Purity Germanium Gamma detector. These radioactivity values were converted to soil erosion/deposition rates using the mass balance model. Soil samples were also tested for chemical properties such as pH, EC, available phosphorus, exchangeable potassium and organic matter content. Using Turkey's mean separation, differences ($p < 0.05$) in erosion estimates and chemical properties among land uses were identified. The study revealed that soil erosion rates vary significantly with land use type. The highest soil erosion was observed under vegetable cultivation (43.56t/ha/yr), which is highly influenced by human activities and a high rate of sediment deposition was observed in Gregory Lake (16.53t/ha/yr). There was a significant negative correlation between soil erosion and soil organic matter percentage. Since there was a strong correlation between soil erosion rates measured using ¹³⁷Cs and ²¹⁰Pb methods both Cs and Pb radioisotopes can be used to measure soil erosion rates with comparable accuracy. This method aids long-term erosion assessment in highland catchments by quantifying soil erosion rates, identifying suitable conservation methods, locating critical erosion-prone areas and preventing degradation of agricultural lands, tea plantations and forests.

Keywords: ¹³⁷Cs; Fallout Radio Nucleotide (FRN); Mass balance model; ²¹⁰Pb; Soil chemical properties; Soil erosion

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ID 57

Bio efficacy evaluation of a formulated botanical pesticide for rice leaf folder (*Cnaphalocrocis medinalis*) under laboratory and field conditions in Sri Lanka

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Abstract:

Rice (*Oryza sativa* L.) is the staple food in Sri Lanka, but various pests cause significant losses. Rice leaf folder (RLF; *Cnaphalocrocis medinalis*) is one of the major rice pests. While synthetic pesticides are commonly used, they pose environmental concerns. This study aimed to evaluate the bio-efficacy of a formulated botanical pesticide (nano-emulsion) for RLF management under laboratory and field conditions during the 2024 Yala season. Laboratory experiments were conducted at the Rice Research and Development Institute, Batalagoda with nine treatments; T1 nano-emulsion I at 80 ml/16 l, T2 nano-emulsion I at 100 ml/16 l, T3 nano-emulsion I at 120 ml/16 l, T4 nano-emulsion II at 80 ml/16 l, T5 nano-emulsion II at 100 ml/16 l, T6 nano-emulsion II at 120 ml/16 l, T7 Azadiractin at 7.5 g/l EC, T8 Chlorantraniliprole at 200 g/l SC and T9 untreated control. Experiments were laid out as a Completely Randomized Design with three replicates. Results showed that T6 and T7 treatments had 80% mortality, followed by T8 with 100%. Based on laboratory results, five treatments were selected for field evaluation: T3 (T1), T6 (T2), T7 (T3), T8 (T4) and T9 (T5) were selected for field evaluation. Field trials were conducted in farmers' fields in the Kurunegala district using a Randomized Complete Block Design (RCBD) with three replicates per treatment. Each plot measured 500m². Live larval counts were recorded from 25 damaged leaves at 3, 5 and 7 days after treatment. Data were analyzed using CATMOD in SAS, with mean comparisons performed using Tukey's test at p<0.05. The highest larval count was recorded in T5 (45) and the lowest larval count was count in T4 (0). T1 recorded a higher larval count (11) than T2 (5) and T3 (5). This study suggests that the tested botanical pesticide; nano-emulsions, represent a sustainable alternative to synthetic chemicals.

Keywords: Botanical pesticide; Integrated pest management; Nano-emulsion; Rice; Rice leaf folder

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ID 80

Effect of urea-intercalated coir dust biochar on growth and yield of onion (*Allium cepa*)

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Abstract:

Nitrogen fertilizers are essential for boosting crop yields, but conventional urea often suffers from rapid nutrient loss through leaching and volatilization, resulting in low nitrogen use efficiency and environmental pollution. This study investigates an innovative approach using urea-intercalated biochar (UIBC) as a slow-release nitrogen source to improve the performance of onion (*Allium cepa*). A pot experiment was conducted to evaluate the effectiveness of UIBC, which was produced from coir dust biochar via a simple capillary absorption method. The resulting UIBC had a nitrogen content of 40.13 ± 0.51 %. The experiment included seven treatments: T1 (control), T2–T4 (100 %, 75 % and 50 % urea) and T5–T7 (100 %, 75 %, and 50 % UIBC), arranged in a completely randomized design ($P < 0.05$) with four replicates. Plant height was measured at two-week intervals, the weight of sprinkles at 45 days, and bulb weight at harvest. The results demonstrated that UIBC treatments, particularly at full application (100% UIBC), consistently improved plant growth and yield compared to conventional urea. Notably, 100% UIBC increased fresh bulb weight (26.53 ± 1.57 g) and dry bulb weight (3.25 ± 0.21 g), outperforming conventional urea (21.81 ± 0.21 g fresh and 2.78 ± 0.04 g dry). Meanwhile, 75% UIBC achieved bulb yields compared to 100 % urea (20.63 ± 2.33 g fresh and 2.61 ± 0.05 g dry), indicating higher nitrogen use efficiency and the potential to reduce fertilizer input without compromising productivity. Overall, UIBC treatments improved the growth and yield of *Allium cepa*, highlighting its potential as an efficient slow-release fertilizer for sustainable farming.

Keywords: Capillary-method; low-release nitrogen-fertilizer; Urea-adsorption; Urea-intercalated biochar

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ID 173

Parameter sensitivity in photosynthetic temperature response functions in terrestrial biosphere models: Evaluating the effects of fixed vs. estimated deactivation energies

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Abstract:

Photosynthesis is a central process in the terrestrial carbon cycle and a key determinant of predicting plant responses to climate change. Terrestrial biosphere models (TBMs) commonly simulate the temperature response of C_3 photosynthesis using the peaked Arrhenius function, which relies on parameters including V_{cmax} (maximum rate of Rubisco activity), J_{max} (potential electron transport rate), K_{25} (process rate at 25 °C), E_a (activation energy), ΔS (entropy), and H_d (deactivation energy). To minimize overfitting, many models assume a fixed H_d value, though the consequences of this assumption remain underexplored. We analysed a global dataset of plant photosynthetic temperature responses to evaluate differences in parameter estimates and photosynthesis predictions between models with fixed and estimated H_d . Maximum rate of Rubisco activity at 25°C (K_{25}) and E_a were generally higher with fixed H_d models, with ΔS showing higher or similar values and strong correlations. Potential electron transport rate at 25°C (K_{25}) and E_a were also higher with fixed H_d , though E_a varied more, while ΔS showed higher values with weaker alignment, indicating greater inconsistency, suggesting J_{max} is less sensitive to model structure compared to V_{cmax} , which exhibits consistent trends across parameters with fixed H_d assumptions. Percentage decline in modelled photosynthesis between fixed and estimated H_d assumptions was evaluated at optimum temperature (T_{opt}) and ± 5 °C from the optimum. Models with fixed H_d consistently estimated higher T_{opt} values and lower declines, suggesting that fixed- H_d models may overestimate thermal tolerance. These results highlight that while fixed H_d assumptions may be acceptable for estimating K_{25} , they risk misrepresenting temperature responses of E_a , ΔS , and photosynthetic performance under warming. Incorporating variable H_d improves model flexibility and enhances the realism of TBM projections under climate change.

Keywords: Deactivation energy; J_{max} ; Peaked arrhenius; Temperature response; V_{cmax}

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Sustainable Food Systems and Supply Chains: Economic and Technological Perspectives

Oral Presentations



**ISAE
2025**

Keynote Speech

Circular Economy Principles in Agri-Food Systems: Pathways for Resource Efficiency, Climate Resilience, and Policy Innovation in Sri Lanka and Beyond

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The transformation of agri-food systems through circular economy principles is increasingly recognized as an effective strategy for addressing interlinked challenges of resource inefficiency, food insecurity, and climate change. Globally, the food sector contributes significantly to greenhouse gas emissions, biodiversity loss, and marine pollution, with approximately one-third of food produced lost (from production up to wholesale) or wasted (from retail up to households). In Sri Lanka, these issues are compounded by systemic inefficiencies along supply chains and a growing reliance on single-use plastics, positioning the food sector as both a driver of environmental degradation and a sector with high potential for systemic transformation through the adoption of circular economy principles that would drive scaling up investments for impactful solutions. Circular economy approaches offer a framework for improving resource efficiency by preventing and reducing food loss and waste at source, valorising former foodstuffs as feed, and utilising by-products through nutrient recovery, composting, and biogas production. Importantly, circularity requires setting systemic boundaries to safeguard human nutrition by ensuring that safe and nutritious food is prioritised for consumption rather than being diverted to non-food applications. This paradigm moves beyond incremental technical solutions towards new business models that integrate social, environmental, and economic targets, cross-sectoral governance, and multi-actor knowledge platforms that stimulate private sector investment, academic research, and public policy development. Circular economy approaches offer a framework for improving resource efficiency by preventing and reducing food loss and waste at source, valorizing former foodstuffs as feed, and utilizing by-products through nutrient recovery, composting, and biogas production. Importantly, circularity requires setting systemic boundaries to safeguard human nutrition by ensuring that safe and nutritious food is prioritized for consumption rather than being diverted to non-food applications. This paradigm moves beyond incremental technical solutions towards new business models that integrate social, environmental, and economic targets, cross-sectoral governance, and multi-actor knowledge platforms that stimulate private sector investment, academic research, and public policy development. Sri Lanka has taken initial policy steps through the Road Map on Urban Food Waste Prevention and Reduction (2022) and the National Action Plan on Plastic Waste Management (2021). Yet, the challenges it faces for implementation mirror those across Asia and the Pacific, where rapid urbanization, resource-intensive consumption patterns, and vulnerability of small island states exacerbate food system risks. Embedding circular economy principles in food systems directly contributes to global frameworks, including the Paris Agreement, the 2030 Agenda for Sustainable Development, and national climate commitments (Nationally Determined Contributions - NDCs).

The EU Global Gateway Strategy supports the transition to a circular economy by mobilizing strategic investments in agri-food innovation. Within this framework, the Circular Economy in the Food Sector (CIRCULAR) project (2024 - 2027) in Sri Lanka exemplifies how the Global Gateway principles are operationalized on the ground. This approach strengthens local capacities

for climate resilience and the bioeconomy. CIRCULAR also seeks to enhance socio-economic resilience by promoting financial and food literacy and access to business development resources (for youth and supply chain actors).

The Circular Economy in the Food Sector (CIRCULAR) Project (2024 - 2027) is supported by the European Union (EU) Global Gateway Strategy, through the EU Delegation in Sri Lanka. CIRCULAR is a collaborative initiative between the Government of Sri Lanka and the Implementing Organizations: FAO, GIZ, and Expertise France (EF).

Keywords: Circular economy; Climate resilience; FAO; Food loss and waste; Food systems; Plastic pollution; Resource efficiency; Sustainable packaging

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Keynote Speech

Unlocking the True Potential of Sri Lanka's Agricultural Production

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Context and Rationale

Sri Lanka's agriculture sector has long been a backbone of rural livelihoods, national food security, and foreign exchange earnings. However, despite its natural advantages including fertile soils, diverse climatic zones, and proximity to key export markets, the sector has not yet achieved its full potential in competing in high-value global markets.

Over 80% of the nation's fruit and vegetable production is channeled to consumers or the processing industry through the network of economic centers. While this system plays a central role in connecting farmers to buyers, it also exposes deep structural inefficiencies. Conventional post-harvest handling and transportation methods contribute to significant quantitative and qualitative losses estimated at 30–40% reducing both profitability and the overall volume available for trade.

The industry is further constrained by:

- High labor usage and rising labor costs, reducing competitiveness against regional producers.
- Excessive fertilizer and agrochemical application, often disqualifying Sri Lankan produce from premium markets, particularly in Europe, where stringent safety and residue standards apply.
- Low adoption of climate-smart, high-tech agriculture, limiting off-season and non-conventional cultivation that could fill global supply gaps.
- Significant price fluctuations and inconsistency in the supply of produce to the market.

While the private sector has piloted successful climate smart precession agriculture models in both open-field and greenhouse farming, adoption among small and medium-scale farmers remains low. Barriers include limited access to knowledge, inadequate financing, poor targeting of past donor-funded projects, and weak extension services. Moreover, many farmers continue to cultivate without securing buyers in advance, resulting in unsold produce and financial losses.

To overcome these constraints, Sri Lanka must transition towards an integrated, market-oriented agricultural model that ensures production is guided by demand, prices are stable and competitive, and buyers commit to long-term procurement partnerships.

Strategic Recommendations

Step 1: Assess market-competitive crops and feasible price ranges: A comprehensive market intelligence initiative should be launched to identify fresh and value-added products with strong potential in targeted global markets. This should include mapping seasonal supply gaps, analyzing consumer preferences, meeting phytosanitary and certification requirements, and establishing feasible price bands to ensure profitability. Such intelligence would guide both public policy and private investment priorities.

Step 2: Identify and empower market-oriented agripreneurs and select farmers, with the capacity and willingness to commit to market-driven production. Strengthen their capabilities through continuous, hands-on training in climate-smart, precision agriculture via state

agricultural extension services and research institutions. Training should also address Precession farming, post-harvest practices, quality grading, and compliance standards for export markets.

Step 3: Facilitate financial support and risk management establish, affordable credit schemes through banks with repayment schedules tied to harvest cycles, backed by comprehensive crop insurance. Encourage private-sector investment in processing and value-added product manufacturing by fostering integrated value chains that link farmers directly with buyers.

Step 4: Strengthen infrastructure and logistics invest in cold storage, modern packaging units, and efficient logistics networks connecting farms to markets and export hubs. Public-private partnerships should be encouraged to accelerate infrastructure rollout and ensure long-term sustainability.

Expected Outcomes

If implemented effectively, these measures will:

Reduce post-harvest losses from 30–40% to under 10%, increasing marketable volumes.

- Expand farmer participation in global markets by aligning production with demand and international quality standards.
- Enhance foreign exchange earnings through increased exports of both fresh and value-added products.
- Create rural employment opportunities in farming, processing, logistics, and aggrotech services.
- Strengthening resilience to climate variability through climate-smart production systems.

Conclusion

Sri Lanka stands at a decisive point in its agricultural journey. Resources, climate, and market opportunities exist, but structural inefficiencies and outdated practices continue to hold the sector back. By adopting a market-oriented, value-chain-based approach supported by targeted financing, farmer empowerment, modern infrastructure, and robust market intelligence the country can transform its agricultural sector into a globally competitive, sustainable engine of economic growth.

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ID 46

A comparative analytical study on the role of banana peel in enhancing the physical, mechanical, and functional properties of starch-based bioplastic

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Abstract:

As the world shifts away from petroleum plastics, starch-based bioplastics emerge as a promising green alternative, though they continue to face challenges in strength and performance. This study explores the impact of incorporating banana peel into starch-based bioplastics, aiming to enhance their physical, mechanical and functional properties by comparing formulations with three treatment types: bioplastic developed from starch (SB₀) as control and starch-based bioplastic prepared with 30% (SB₃₀) and 60% (SB₆₀) banana peel incorporation. The results revealed significant variations among SB₀, SB₃₀ and SB₆₀ across multiple parameters. Moisture content increased from SB₀ (18.4±0.3%) to SB₆₀ (35.37±0.35%), while total solids content decreased from 81.6±0.19% (SB₀) to 70.58±0.35% (SB₆₀). Ash content rose from 0.21±0.03% (SB₀) to 3.77±0.02% (SB₆₀) with banana peel addition. Density and Thickness values for SB₀, SB₃₀, and SB₆₀ were 1.21±0.02 g/mL, 1.15±0.11 g/mL, and 1.1±0.03 g/mL, and 0.35±0 mm, 0.72±0.01 mm, and 0.95±0.01 mm, respectively. Tensile strength decreased from 5.04±0.08 MPa (SB₀), to 2.32±0.12 MPa (SB₆₀), while elongation rates increased from 10.24±0.12% (SB₀), to 18.37±0.08% (SB₆₀). Biodegradation rates steadily improved over time and with increased banana peel addition, reaching 43.2±0.003% for SB₆₀ on day 20. Polyphenol content and antioxidant activity were significantly higher in SB₃₀ and SB₆₀ samples, with gradual reductions observed over time; SB₆₀ exhibited the highest initial antioxidant activity (62.16±0.27), compared to 28.06±0.68 in SB₃₀ and 0.63±0.21 in SB₀. SB₃₀ exhibited the highest water solubility (45.16±2.68%), while SB₆₀ demonstrated the lowest (27.84±0.45%). Water vapor permeability and water vapor transmission rate were lowest in SB₆₀ ($2.33 \times 10^{-12} \pm 0.19 \text{ kgm}^{-1}\text{s}^{-1}\text{Pa}^{-1}$ and $6.23 \times 10^{-12} \pm 0.53 \text{ kgs}^{-1}\text{m}^{-2}$, respectively), indicating enhanced barrier properties. Overall, these findings suggest that the incorporation of banana peel significantly improves the performance of starch-based bioplastic films, supporting their potential application in sustainable packaging.

Keywords: Antioxidant activity; Banana peel; Bioplastic; Packaging; Starch

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ID 51

Physiochemical properties of leather manufacture from yellowfin tuna (*Thunnus albacares*) fish skin

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Abstract:

Yellowfin tuna (*Thunnus albacares*) skin is a primary by-product of the tuna filleting industry in Sri Lanka. It holds the potential for valorization due to its distinct scale patterns. Traditional chromium-based tanning used in the leather industry may pose significant environmental problems. The present study was conducted to evaluate the physicochemical properties of yellowfin tuna skin leather with two vegetable tannins: tea leaves (*Camellia sinensis*) and kumbuk bark (*Terminalia arjuna*). Fish skins were cleaned and proceed with chemical pre-treatments including soaking, liming, degreasing and pickling. Pre-tanned skins were tanned separately with solutions prepared from tea leaves and kumbuk bark over two weeks. After tanning, the skins were dyed, fat liquored and dried. Physical characteristics (tensile strength, elongation, strain), color values (L^* , a^* , b^*) and microbial resistance were tested. Kumbuk-tanned leather had greater tensile strength (269.20 ± 3.19 N force-break; 19.83 ± 0.34 N/mm² stress-break) and elongation (48.34 ± 2.6 mm at break) compared to tea-tanned leather (159.80 ± 1.31 N; 11.04 ± 0.12 N/mm²; 22.94 ± 0.66 mm). Strain-break values also revealed the superior strength of kumbuk tanned leather ($201.41 \pm 10.94\%$). Sensory evaluation with 30 untrained panelists rated kumbuk-tanned leather as superior in color, texture and acceptability (4.00 ± 0.79 to 3.97 ± 0.77) compared to tea-tanned leather (3.33 ± 0.76 to 3.27 ± 0.64). Microbial evaluation showed less bacterial colonizing on kumbuk-tanned leather ($7.17 \times 10^6 \pm 0.11$ CFU/g vs $8.6 \times 10^6 \pm 0.57$ CFU/g). According to the findings, kumbuk bark, enhances leather strength, elasticity and microbial resistance, making it a suitable agent for transforming yellowfin tuna fish skins into quality leather. The study paves the way to convert fish skins into value-added products, addressing ecological and economic gaps in the leather industry.

Keywords: Natural leather; Tuna filleting; Vegetable tanning; Yellowfin tuna leather

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ID 123

Behavioral and structural determinants of colony development in *Apis cerana*: insights into foraging efficiency under tropical field conditions

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Abstract:

Sustainable development of *Apis cerana* colonies is highly influenced by nutritional adequacy and efficiency of pollen foraging. Due to limited scientific research on *Apis cerana* in Sri Lanka, a systematic understanding of its nutritional dynamics is essential for ensuring sustainable beekeeping practices. This study was conducted over two months, from March to May 2025, in the Kalutara District (Low Country Wet Zone), Sri Lanka, to assess the impact of protein availability and pollen collection on colony development stages across eight *Apis cerana* hives under tropical field conditions. Pollen collection was quantified at one-day intervals using repeated one-minute forager counts conducted in the mid-morning. A forager was defined as a worker bee returning with visible pollen loads, averaged over four replicates per hive. Concurrent photographic inspections were conducted every two weeks to evaluate the Colony Status Index (CSI), based on total brood area, honey reserves and pollen stores, providing a comprehensive measure of colony health and growth. Results demonstrated a strong positive correlation between total brood area and pollen foraging activity, described by the regression model $y = 0.1285x$ with a determination coefficient (R^2) of 0.814, indicating that pollen collection rate is closely linked to brood development. Colonies with brood areas greater than 774 cm² showed significantly higher pollen collection rates (>20 loads/min), while those below 322 cm² displayed lower rates (<12 loads/min). Higher CSI scores were associated with increased brood density and honey storage, validating pollen intake as a key driver of internal colony productivity. Simple linear regression and one-way ANOVA were used to analyse these relationships, with regression emphasized for model fitting and prediction. This research highlights the predictive power of integrating behavioural data (pollen foraging) with the Colony Status Index to evaluate and forecast colony sustainability. The findings emphasize that maintaining continuous pollen availability could enhance colony performance and long-term sustainability in artificial *Apis cerana* hives.

Keywords: Colony Status Index; Forager; Pollen Foraging; Pollen loads

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ID 142

Is magnetic susceptibility a supporting tool in assessing the toxicity of urban road dust?

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Abstract:

Urban road dust (URD) is a complex matrix of geogenic and anthropogenic particles, posing significant ecotoxicological and human health risks. It contains heavy metals (Ba, Cd, Co, Cr, Cu, Mo, Ni, Pd, Zn, etc.), polycyclic aromatic hydrocarbons (PAHs), phthalates and microplastics, originating from vehicular emissions, industrial activities, pavement abrasion and atmospheric deposition. This study collected road dust and slag samples from five locations representing conventional roads and without tramlines, highways with high traffic, residential areas and a waste slag heap from a ferrochromium industry in Wrocław, Poland. Acute toxicity of the road samples was assessed using *Daphnia magna* (LC50) which indicates the concentration of a pollutant that causes 50% mortality in tested population. Although a few studies have examined magnetic susceptibility (χ) and its spatial and seasonal variations in URD, no study has investigated the association between toxicity and χ . This study was conducted to determine whether the χ can be used as a tool for toxicity assessment. According to the results, both the highest χ and the highest LC50 were detected in road dust samples from the same high-traffic highway, despite the sample containing significantly low concentrations of typical magnetic metals such as Fe, Ni and Co. This may be due to nanoscale magnetite (Fe₃O₄) generated from brake and tire wear, which contributes to high χ while its minimal mass fraction can lead to underestimation of total Fe content in bulk chemical analysis. Pearson's correlation analysis revealed no statistically significant correlation between LC50 and χ ($r = 0.24$, $p = 0.697$). The former industrial slag heap, was characterized by the highest concentrations of Cr, Sb and Hg compared to other sites, likely originating from ferrochromium slag, explaining its high toxicity despite low magnetic susceptibility. The road with tramlines showed the elevated levels of Fe, Cd, Cu and Ni, and the presence of these metals was possibly caused by wear of tram rails, in addition to traffic-derived emissions. These findings indicate that magnetic susceptibility is not a supporting tool for interpreting the toxicity in URD, while highlighting the significance of heavy metals and organic pollutants (ex: poly aromatic hydrocarbons, phthalates, microplastics, etc.).

Keywords: *Daphnia magna*; Ecotoxicity; Heavy metals; Magnetic susceptibility; Urban Road dust

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ID 177

Evaluation of the nutritional composition of selected commercially grown berries in Sri Lanka and jam prepared from these berries

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Abstract:

Berry fruits are consumed because of their attractive color and characteristic taste, and they are considered one of the richest sources of nutrients and natural antioxidants. Their consumption has been linked to the prevention of chronic and degenerative diseases. The term 'berry fruits' encompasses the 'soft/pulpy fruits', primarily strawberry, currants, gooseberry, blackberry, raspberry, blueberry and cranberry. This study investigates the physicochemical, proximate and mineral composition of fresh and processed berry fruits grown in Sri Lanka, including blackberry (*Rubus fruticosus*), blueberry (*Vaccinium corymbosum*), raspberry (*Rubus idaeus*) and strawberry (*Fragaria ananassa*) along with jam prepared from these berries. The analysis focused on brix values, pH, titratable acidity, moisture, ash, fat, protein, crude fiber, carbohydrates and mineral content (Ca, Fe, Mg, P, K, Na). Among fresh berries, blueberries recorded the highest brix ($13.53 \pm 0.33\%$), while strawberries showed the lowest ($6.73 \pm 0.13\%$). For jams, blackberry jam had the highest brix ($67.73 \pm 0.89\%$), with raspberry jam the lowest ($64.20 \pm 0.24\%$). pH ranged from 2.63 ± 0.02 in fresh blueberries to 3.29 ± 0.01 in fresh strawberries; in jams, the lowest was 2.60 ± 0.01 in blueberry jam, and the highest was 3.24 ± 0.01 in strawberry jam. Moisture content varied significantly, with fresh strawberries having the highest ($89.44 \pm 0.57\%$) and blueberry jam the lowest ($14.90 \pm 0.43\%$). Fresh raspberries recorded the highest protein ($2.68 \pm 0.05\%$) and crude fiber ($5.22 \pm 0.44\%$), while the blueberry jam contained the highest carbohydrate content ($81.97 \pm 0.004\%$). Mineral content also varied notably, with fresh blueberries showing the highest calcium (0.017 ± 0.0003 mg/g), and fresh strawberries containing the highest phosphorus (12.76 ± 0.847 mg/g) and potassium (0.256 ± 0.022 mg/g). Processed samples, particularly blackberry jam, generally exhibited elevated iron, magnesium, and phosphorus levels. These findings provide valuable insights into how processing influences the nutritional composition and health-promoting qualities of berry-based products.

Keywords: Berries; Jam processing; Mineral profile; Nutritional composition; Physicochemical; Proximate

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Innovations in Food Production and Plant Breeding for Climate Change Adaptation

Oral Presentations



Keynote Speech

The Impact of transit: Addressing mechanical damage in fresh produce postharvest transportation

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Postharvest losses present a global challenge to food security and sustainability, occurring at various stages including harvest, storage, handling, packaging, transportation, and marketing. Among these, vibration-induced mechanical damage during transit stands out as a particularly frequent and impactful problem for fresh produce. Transportation is a vital link in the postharvest chain, where vibration can severely degrade produce quality. This type of damage often leads to significant economic losses, diminished product quality, and heightened food safety concerns. It further highlights how factors such as the packaging unit's type and surface properties, its position within the vehicle, and its placement in a stack collectively influence vibration levels and the resulting damage. Understanding these contributing factors is crucial for developing effective measures to minimize postharvest losses during transit. In summary, adopting appropriate packaging solutions and handling practices is essential for enhancing fresh produce's resilience against vibration damage during road transport, thereby contributing to a reduction in overall postharvest losses.

Keywords: Fresh produce; Postharvest; Supply chain; Transportation; Vibration

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ID 31

Extraction optimisation of bioactive compounds from Hemp upper part material (*Cannabis sativa* L.)

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Abstract:

Cannabis (*Cannabis sativa* L.) has been a well-known plant since early times, rich in active compounds such as phenols, flavonoids and cannabinoids. The concentration of these active compounds varies widely depending on extraction method, plant material, and solvents used. This study aims to optimise the extraction of bioactive compounds from the top 30 cm section of *Cannabis sativa* L, grown at the Agricultural Experimental Station in Swojec, Poland (coordinates 51°07'05.4"N 17°08'37.9"E). One gram of dry plant material was extracted using three types of solvents (ethanol, methanol and propanol), three solvent volumes (5, 10 and 15 ml) and three shaking times (20, 40 and 60 min) according to a central composite design using response surface methodology. Extractants were analysed for yield, 2,2-Diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity, total phenolic content and ferric reducing antioxidant power (FRAP). Process optimisation and interaction effects were analysed using Statistica software 14.1.0.4 ($p < 0.05$). The type of solvent and its volume significantly affected the extraction yield and bioactivity of the compounds. The maximum extraction yield ($4.17 \pm 0.95\%$) and DPPH activity (23.48 ± 1.60 Trolox Eq mg/g dry plant) were obtained with 15 ml of propanol and 60 min of shaking. Meanwhile, the highest FRAP (161.10 ± 11.40 Trolox Eq mg/g dry plant) and total phenolic content (1128 Galic acid Eq $\mu\text{g/g}$ plant) were achieved with 15 ml methanol and 60 min shaking. The optimisation results also showed that 15 ml of ethanol with 20 min, 15 ml methanol with 58.38 min and 15 ml of propanol with 60 min are the optimal conditions for each solvent respectively. The study highlights the importance of selecting appropriate extraction methods to fully exploit *Cannabis sativa* as a source of functional food ingredients.

Keywords: Antioxidant properties; *Cannabis sativa* L; Extraction time; Extraction volume

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ID 37

Enhancing the shelf life of guava (*Psidium guajava* L.) using edible coating derived from yellow passion fruit (*Passiflora edulis* forma *flavicarpa*) peel pectin

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Abstract:

Guava (*Psidium guajava* L.) is a major commercial fruit with great export potential in Sri Lanka but has a shorter shelf life due to its climacteric nature. Therefore, this study aimed to investigate the potential of yellow passion fruit (*Passiflora edulis* forma *flavicarpa*) peel pectin as a base material for an edible coating in extending the shelf life of guava. Pectin was extracted using an acidified aqueous method (citric acid, pH 2; solvent: solute ratio 40:1; 75 min at 85°C), identified using Fourier Transform Infrared Spectroscopy (FTIR) and characterized for yield, equivalent weight and degree of esterification. Matured apple guavas were coated with pectin solutions (1%, 2%, 3%) and stored at 25 ± 3°C, 75% RH for 16 days. The quality parameters of guava including appearance, weight loss, firmness, pH, titratable acidity, total soluble solids, total chlorophyll content were monitored at regular intervals of 4 days. The pectin yield from passion peel was 25.25% (dry basis), indicating the potential value-addition of this agro-industrial by product. The moisture content (8.00%), ash content (7.20%), equivalent weight (806.04 mg), and the degree of esterification (64.25%), exhibited the suitability of pectin for gel formation. The FTIR data confirmed characteristic peaks at 3359 cm⁻¹ (O-H stretching), 2924 cm⁻¹ (C-H stretching), 1718 cm⁻¹ (C=O stretching), and 1629 cm⁻¹ (C=C stretching), corresponding to the functional groups. The 3% coating solution was effective until the day 16, and significantly ($P \leq 0.05$) reduced weight loss (13.42%), maintained firmness (43.00 kPa), and preserved quality parameters (pH 4.30, soluble solids 12.40°Brix, chlorophyll 81.30 µg/g, titratable acidity 7.20%) of coated guava compared to control (treated with distilled water). The 2% solution was effective until day 8, while 1% showed no significant difference from the control ($P \geq 0.05$). Therefore, this study concluded that the passion peel-derived pectin has a significant potential in preserving the postharvest quality of guava by regulating various physiological processes.

Keywords: Edible coating; Guava; Passion fruit; Pectin; Shelf life

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ID 44

Biocontrol potential of *Trichoderma* spp. isolated from tea (*Camellia sinensis*) plantations against key postharvest fungal pathogens of banana

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Abstract:

Sri Lanka is a top exporter of the global favorite fruit; banana and is home to many varieties. However, bananas are highly susceptible to many postharvest fungal diseases such as anthracnose, cigar end rot and crown rot. *Colletotrichum musae*, *Lasiodiploidea theobromae* and *Colletotrichum gloeosporioides* are major causal agents of these diseases. Meanwhile, tea (*Camellia sinensis*), another major export crop for Sri Lanka, harbors a unique microbial niche, that includes *Trichoderma* sp., fungus with well documented biocontrol properties through the mechanisms such as mycoparasitism, competition and antibiosis. Twelve *Trichoderma* spp. isolates were obtained from the microflora of tea plantations and characterized based on colony morphology and growth rate. Their inhibitory activity against the selected banana pathogens were determined, focusing on the biocontrol agent-pathogen interactions through mycelia, volatile compounds and non-volatile compounds. The seven most promising isolates from dual culture assays were further tested for pathogenicity on banana fruits. The most effective, non-pathogenic, isolate was selected for detailed assessment of its effect on spore germination of the pathogens. Modes of interaction were further analyzed using light microscopy and scanning electronic microscopy, revealing features such as hyphal coiling and squeezing, typical of mycoparasites' behavior. FTIR spectroscopy was used to detect the presence or absence of organic compounds such as peptaibols, associated with antibiosis mechanism. Out of the 12 primary isolates, one *Trichoderma* isolate, TYST6, showed significant inhibition ($P < 0.05$) with 71%, 60% and 72% reduction against *Colletotrichum musae*, *Lasiodiploidea theobromae* and *Colletotrichum gloeosporioides* respectively, compared to undisturbed growth. It was non-pathogenic. A bioagent that can control these diseases would reduce postharvest losses and food wastage.

Keywords: Anthracnose; Mycoparasitism; Postharvest; *Trichoderma*

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ID 88

Assessment of temperature responses of *in vitro* pollen germination, cell membrane thermostability, and chlorophyll stability among six guava (*Psidium guajava* L.) varieties cultivated in Sri Lanka

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Abstract:

Understanding trait variation in response to temperature is important to predict how plants respond to rising temperature. This study aimed to identify heat-tolerant Guava (*Psidium guajava*) varieties through assessment of physiological and reproductive performance assessment. The experiment was conducted at the Fruit Research and Development Institute, Horana, Sri Lanka. Six widely growing Guava varieties viz. *Horana White*, *Horana Red*, *Horana Rosi*, *Apple guava*, *Kanthi* and *Lanka Giant* that grown at a common temperature (28°C) were evaluated for reproductive and physiological heat tolerance. *In vitro* pollen germination percentage (PG) and pollen tube growth (PTL) were quantified by incubating pollen samples in a liquid germination solution across temperatures ranging from 18 and 40°C. Physiological traits, including cell membrane thermostability (CMT) and chlorophyll stability index (CSI) of fully expanded leaves, were measured following standard protocols. Data for each variety were collected from three randomly selected mature plants (3-replicates) arranged in a completely randomized design. Cardinal temperatures (minimum, optimum and maximum) for pollen germination and pollen tube growth, along with maximum pollen germination percentage and maximum pollen tube length, were estimated by fitting nonlinear regression models using R software. Both pollen germination percentage and pollen tube length increased with temperature up to 28°C, then declined at higher temperatures. Optimum temperatures for pollen germination and pollen tube growth did not differ significantly among varieties (28°C for both). In contrast, the physiological traits CMT and CSI differed significantly between varieties. The variety “*Pubudu*” exhibited significantly higher chlorophyll stability index than other varieties, while “*Horana-white*”, “*Kanthi*”, and “*Pubudu*” showed significantly higher CMT values compared to the other three varieties. These results suggest that “*Pubudu*” possesses superior cell membrane thermostability and chlorophyll stability under elevated temperatures and can be considered a potential heat-tolerant variety.

Keywords: Cell membrane thermostability; Chlorophyll stability; Heat stress; Pollen germination; Pollen tube growth

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ID 112

A novel method for laboratory-scale estimation of methane flux from paddy soils using silicone tubes

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Abstract:

Methane (CH₄) is the second most impactful anthropogenic greenhouse gas (GHG) and is significantly emitted from rice paddies, contributing 6–11% of global CH₄ emissions. Accurate quantification of these emissions is critical for developing effective mitigation strategies. However, field-level measurements of GHGs are often challenging and costly. In paddy soils, approximately 90% of methane is emitted through rice plants, requiring large chambers to enclose the entire plant for accurate CH₄ emission measurements in the field. To address this, a laboratory experiment was conducted to develop a method for measuring CH₄ emissions from inundated paddy soil using gas-permeable silicone tubes (inner diameter: 1 mm; outer diameter: 1.5 mm) to simulate plant-mediated CH₄ transport. A closed chamber system with four chambers (each with a 500 ml headspace) was used to evaluate the feasibility of using silicone tubes and to assess the effects of tube density and insertion depth on CH₄ flux. In the first experiment, five silicone tubes inserted to a depth of 5 cm were tested against a control condition without silicone tubes. The second experiment assessed two insertion depths (5 and 10 cm) and tube densities (5 and 10 tubes), equally distributed over 68 cm². CH₄ emissions were measured every 2 minutes for 30 minutes, followed by a 10-minute ventilation period for gas collection and measuring system including the gas cell of the FTRI spectrometer. Results from the first experiment showed that CH₄ emissions increase significantly under the silicone tube treatment compared to the control. In the second experiment, CH₄ emissions were greater at the 10 cm insertion depth compared to at 5 cm, though the increase was not proportional to the depth, likely due to enhanced oxidation of CH₄ in the surface oxidized layer near the soil-water interface. These findings demonstrate that gas-permeable silicone tubes are a promising tool for simulating plant-mediated CH₄ emissions in laboratory experiments, offering a cost-effective alternative to complex field measurements.

Keywords: Closed chamber; FTIR spectroscopy; Greenhouse gases; Methane emissions; Rice paddies; Silicone tube; Simulation

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ID 133

**Evaluating greenery in urban detached houses using eye-level 3d and aerial-based views:
A case study in Ageo city, Saitama Prefecture**

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Abstract:

Greenery visibility in urban environments provides numerous psychological and ecological benefits. However, existing indices, such as the Green View Index and NDVI, fail to adequately capture greenery as perceived from a pedestrian's eye level. This study introduces a novel three-dimensional (3D) method for evaluating greenery visibility using stereo imagery and depth data derived from eye-level photographs. The study was conducted in Ageo City, Saitama Prefecture, Japan. Plant placement in frontage greening was evaluated using actual photographs. Frontage greening in detached urban houses was captured from a stereo camera and 713 photographs were analysed. A custom-developed program was used to extract depth values of green pixels (Green Depth, GD). The GD value indicates the distance from the viewpoint to the green element along the Z-axis direction. Parallel lines (one through the person, one through the tree) lie along the X-axis, with the Z-axis perpendicular to the parallel reference lines aligned with the X-axis. Using depth value, depth-based indicators were calculated and multiple regression analysis was performed with façade image-based indicators that measure the degree of mixture of greenery and artificial objects, such as greenery-to-greenery proximity, greenery-to-artificial-object proximity and agglomeration. The multiple correlation coefficients were found for standard deviation (0.30), kurtosis (0.35), Simpson diversity index (0.32), proportionality (0.38) and for GD value average (0.48, skewness (0.51) and degree of openness (0.59). Finally, this novel method was proposed to quantify greenery in three dimensions. As future work, using aerial images, 2D greenery visibility indexes will be calculated using satellite images for the same detached houses and will be compared with these 3D indicators. Integrating 2D and 3D indexes will result in a methodology to evaluate and understand urban greenery visibility as people really experience it. Furthermore, aerial photographs will be used to evaluate land plot sizes of the detached houses and the positioning of the building, car parks, plants and entrances. This approach provides urban planners and landscape designers with a more human-centered tool for assessing and improving the visibility and distribution of greenery in urban neighborhoods.

Keywords: 3D greenery visibility; Greenery depth value; Landscape planning; Urban Greenery

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Poster Presentations



Keynote Speech

Understanding the chili leaf curl disease complex in Pakistan and its control through genomics and RNA interference

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Chili (*Capsicum annuum* L.) is a major horticultural crop in Pakistan, but its production is severely hindered by Chili Leaf Curl Disease (ChiLCD), a complex viral disorder primarily caused by begomoviruses and their associated DNA satellites, transmitted by the whitefly vector *Bemisia tabaci*. This study integrates high-throughput sequencing, phylogenomic analyses, and RNA interference (RNAi)-based gene silencing to understand and manage ChiLCD in Pakistani agro-ecologies. Molecular analysis revealed the co-infection of Chili leaf curl virus (ChiLCV), Tomato leaf curl New Delhi virus (ToLCNDV), and *betasatellites* in symptomatic plants from major chili-producing regions. RNAi constructs targeting viral replication-associated protein (Rep) and movement protein (MP) genes were engineered and tested under greenhouse conditions. Transgenic and transiently transformed chili plants exhibited significant viral load reduction and symptom suppression. The study highlights the potential of genome-based diagnostics and RNAi technology in integrated ChiLCD management and developing virus-resistant chili cultivars in Pakistan. In addition, genome mining of chili identifies many begomovirus responsive or resistant genes (ie. *CaNPR1*, *CaEDS*, *CaICS* gene families) that are expressed during Chili Leaf Curl Disease complex infection. These *in silico*-based approaches help identify the regulatory mechanism in chilli plants during begomovirus infection.

Keywords: Begomoviruses; *Capsicum annuum*; Chili Leaf Curl Disease; Genomics; Pakistan; RNA interference; Virus resistance; Whitefly

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ID 01

Non-destructive assessment of carbon sequestration in *Aquilaria malaccensis* plantation in Sri Lanka

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Abstract:

Carbon sequestration by plants has the potential to significantly address global environmental challenges, including accumulation of greenhouse gases in the atmosphere, which leads to climate change. This study is one of the first in-situ, non-destructive investigations of carbon sequestration in *A. malaccensis* plantations in Sri Lanka, addressing a critical gap in local and regional data. A total of 125 trees aged between 4 and 8 years were sampled from Sadaharitha Plantations Limited, Ayagama, Rathnapura. Tree height and diameter at breast height (DBH) were measured using a laser distance meter and measuring tape, respectively, while timber volume was estimated using geometric methods (Cylindrical Volume Method). Biomass was calculated using species-specific wood density (320 kg/m³), and carbon content was estimated based on an established carbon fraction (40.35%). This study focused on developing and validating allometric models for estimating aboveground biomass and carbon storage in agarwood trees categorized by age. Essential variables such as tree height (H), diameter at breast height (D) and timber volume were measured to develop regression models, which were then assessed for accuracy using metrics including R-squared (R²), RMSE, and percentage error. Among the models tested the Logarithmic function: $\text{Log [Above ground Carbon content (kg)]} = -0.819 + 1.5513\text{Log [Tree Diameter at 1.5m height (cm)]} + 1.056\text{Log [Total Tree Height (m)]}$ was identified as the best-fitting model for estimating aboveground carbon content. This model achieved a high accuracy with R² = 96.68%, RMSE = -18.71, and percentage error = 2.79%, indicating strong predictive capability and minimal deviation from observed values. The study showed a significant positive correlation between tree growth parameters and carbon content, highlighting the potential of agarwood as an effective species for carbon sequestration. The carbon sequestration potential of agarwood (50.80 tons CO₂/ha over an 8-year lifespan) was compared with that of rubber (286.26 tons CO₂/ha over 30 years) and teak (664.27 tons CO₂/ha over 50 years) to determine the most effective plantation for carbon fixation. Despite its lower overall carbon sequestration, agarwood is considered the best crop for short-rotation systems due to its higher annual carbon fixation efficiency, although teak remains more effective for long-rotation plantations aimed at maximum long-term carbon storage. These models provide valuable insights for climate change mitigation strategies. Planters may also increase their income through carbon crediting of cultivating agarwood trees. By measuring tree height and DBH, the model allows for accurate estimation of aboveground carbon content in *Aquilaria malaccensis* plantations without destructive sampling. It is a practical and cost-effective tool for plantation managers and policymakers to track carbon stocks, verify carbon credits, and guide sustainable plantation development.

Keywords: Agarwood; Aboveground Biomass; Allometric Models; Carbon Sequestration; Climate Change Mitigation

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ID 04

Diversity and dominance of order: Diptera and Hemiptera fruit pests on papaya in two commercial farms in Weligama, Sri Lanka

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Abstract:

Papaya (*Carica papaya*) is one of the major commercial fruit crops cultivated in Sri Lanka, catering to both local and export markets. However, studies on insect pests affecting papaya and their dominance status remain limited. This study was conducted to identify insect fruit pests (IFPs) and assess their dominance level in two selected papaya farms (commercial varieties) in Weligama, Matara, Sri Lanka. The Midigama Fruit Farm (MFF) and the Weligama Urban Council's Model Fruit Farm (WFF) were selected as the study sites. The survey was conducted from August to October in 2024, using two randomly selected sub-sampling sites (~10 m² per site) per fruit farm. In each sampling round, five papaya trees were randomly selected. For each tree, five mature leaves and five fruits were observed for pest occurrence. Recorded insect pests were collected and identified using pictorial guides. A total of 15 IFP species were recorded, belonging to two orders: Diptera (9 species), Hemiptera (6 species). Of these, 11 insects were identified to the species level, while four were identified only to genus level (Aphid sp.2 & 3, and *Bactrocera* sp.3 & 4). MFF recorded 12 species (80% of total): 4 Hemipteran [33.33%] and 8 Dipteran [66.67%], while WFF recorded 14 species (93.33% of total): 6 Hemipteran [42.86%] and 8 Dipteran [57.14%]. WFF showed higher Margalef species richness ($d_m=1.695$) and Shannon-Weiner diversity ($H=0.538$) than MFF ($d_m=1.410$; $H=0.451$). Eleven IFP species, including *Paracoccus marginatus*, *Pseudococcus longispinus*, *Aleurodicus dugesii*, Aphid sp.3, *Bactrocera dorsalis*, *Bactrocera kandiensis*, *Bactrocera correcta*, *Bactrocera latifrons*, *Zeugodacus cucurbitae*, *Zeugodacus tau*, and *Zeugodacus caudatus* were common to both farms. *Icerya seychellarum*, Aphid sp.2, and *Bactrocera* sp.4 were recorded only in WFF, while *Bactrocera* sp.3 was exclusive to MFF. *P. marginatus* was the most dominant IFP species in both farms (in MFF, $D=0.518$ & in WFF, $D=0.432$), whereas *B. dorsalis* showed the lowest dominance (MFF, $D=0.011$; WFF, $D=0.010$). The results indicated that WFF had a higher diversity ($H=0.538$) and species richness of IFPs than MFF ($H=0.451$), with *P. marginatus* (Papaya Mealybug) emerging as the most dominant pest in both farms

Keywords: Insects; Papaya Mealybug; Papaya pests; Species richness

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ID 05

Effect of edible coating based on Kehipitthan (*Cyclea peltata*) mucilage and Cinnamon (*Cinnamomum zeylanicum*) leaf oleoresin to extend the storage-life of tomato (*Solanum lycopersicum*) at room temperature

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Abstract:

Tomato (*Solanum lycopersicum*), a climacteric vegetable, is highly susceptible to postharvest losses. This study investigated the effectiveness of edible coating formulations derived from Kehipitthan (*Cyclea peltata*) mucilage and cinnamon (*Cinnamomum zeylanicum*) leaf oleoresin to extend the shelf life of "Padma" variety tomatoes at the mature green stage under ambient conditions (28±2°C, 95% RH). Coating treatments included different mucilage concentrations: 90% (T1), 80% (T2), 70% (T3), 60% (T4), and 50% (T5) combined with fixed oleoresin concentration (0.05%). Treated tomato were compared against control samples treated with distilled water. Parameters such as weight loss, firmness, pH, total soluble solids (TSS), lycopene content, visual appearance and color changes were monitored at three-day intervals for 18 storage days. Each treatment was replicated twice. One-Way ANOVA was used to assess the statistical significance of treatment effects ($p \leq 0.05$). Color changes were measured in terms of L*, a*, and b* values. Tomatoes coated with lower mucilage concentrations exhibited greater weight loss, reduced firmness and visible deterioration. The T1 formulation preserved quality upto day 15, with minimal weight loss ($9.60 \pm 0.00\%$), highest firmness (0.40 ± 0.36 kPa), pH (4.70), TSS (5.20 °Brix), lycopene (6.16 mg/100 g), and favorable color values of L* (21.64 ± 2.45), a* (5.04 ± 0.28), and b* (6.39 ± 0.45). In contrast the control tomatoes maintain acceptable quality only until day 9. These findings support the potential of Kehipitthan mucilage-based edible coatings as an eco-friendly approach to postharvest management of tomatoes.

Keywords: Cinnamon oleoresin; Edible coating; Kehipitthan mucilage; Postharvest management; Tomato

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ID 06

Zooplankton diversity and seasonal variability in Kalmadu reservoir, northern Sri Lanka

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Abstract:

Zooplankton plays a vital role in freshwater ecosystems by contributing to energy transfer and nutrient cycling. This study examined how does seasonal variation influences zooplankton diversity and abundance in the Kalmadu Reservoir, Northern Sri Lanka, over a six-month period (August 2024–January 2025). Water samples were collected from ten locations using a 5L bucket and filtered through a 64-µm mesh plankton net. At each location, five replicate samples were taken using horizontal bucket tows, to ensure representative sampling of both surface and subsurface layers. Species identification was conducted out using standard taxonomic keys, and population diversity was estimated using Lackey's drop count method. A total of ten zooplankton species were recorded, including *Paramecium aurelia*, *Vorticella citrina*, *Moina brachiata*, and *Mesocyclops leukarti*. Species abundance varied seasonally, with higher densities observed during periods of elevated water levels. The Simpson Diversity Index ranged from 0.9664 to 0.9993, indicating high species dominance, while the Shannon index (0.0031–0.1108) suggested low species evenness. The dominance of protozoan species, particularly *Vorticella citrina*, indicates eutrophic conditions in the reservoir. These findings underscore the ecological importance of zooplankton diversity in maintaining ecosystem function and supporting fisheries productivity. The observed dominance of protozoan species, low evenness, and seasonal shifts suggest early signs of ecological stress. These conditions imply reduced energy transfer efficiency to fish populations and a risk of algal blooms due to nutrient buildup. Regular monitoring and controlled nutrient input are essential for sustaining the reservoir's biodiversity and fisheries. Such studies provide valuable insights for conservation and effective water resource management.

Keywords: Conditions; Freshwater; Kalmadu reservoir; Seasonal variation; Zooplankton species diversity

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ID 07

Impact of feed resources and feeding practices on milk production in dairy farms of the Northwestern province, Sri Lanka

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Abstract:

Dairy farming plays a crucial role in the economy of the Northwestern Province; however, milk production has declined in recent years due to various challenges. This study examined the impact of feed resources and feeding practices on milk yield in dairy farms across the region. A total of 72 farms were selected from 12 purposively chosen Veterinary Surgeon Divisions, based on dairy farm density and performance, to ensure regional diversity and capture variability in feeding practices. Farms were stratified by herd size into small (<5 animals), medium (5–20 animals), and large (>20 animals), followed by simple random sampling within each category. Data on socio-economic factors, feed resources, feeding practices and milk production were collected using structured questionnaires and analyzed using descriptive statistics, chi-square tests, non-parametric tests, and multiple linear regression. Results indicated that semi-intensive farming was the most common system (69.4%), followed by extensive (20.8%) and intensive (9.7%). The use of silage and total mixed ration (TMR) was significantly higher in medium and large farms ($p < 0.05$). Milk yield per cow per day varied significantly across feeding systems (Kruskal-Wallis, $p < 0.05$), with the highest yield recorded under zero grazing (7.46 ± 2.11 L, mean $\pm$ SD), followed by partial (7.38 ± 2.36 L) and full grazing (5.17 ± 1.90 L). A significant difference was found between full and zero grazing systems ($p < 0.05$). Fodder quality also significantly affected milk yield ($p < 0.05$), but only 54% of farmers cultivated improved fodder, primarily due to land scarcity and limited support. Concentrate intake explained 56.7% of the variation in milk yield. The best-fit regression model explained 60.9% of the variation in milk yield, identifying concentrate amount (kg/day), feeding frequency, feeding system, fodder type, and education level as significant factors ($p < 0.05$). Findings suggest the need for farmer-led training, improved fodder access to fodder, and development of localized feed models to enhance milk production in the region.

Keywords: Dairy Farming; Feeding Practices; Milk Yield; Northwestern Province

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ID 10

Economic valuation of avifaunal diversity using the modified market price approach with proxy valuation in analog forest: A case study of seral succession in the Belipola Arboretum, Sri Lanka

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Abstract:

Biodiversity is essential for ecosystem health, yet its economic value remains largely unquantified. This study explores the economic valuation of bird diversity across different stages of forest recovery, known as seral succession, within an analog forest a designed ecosystem that mimics natural forest structure and function while providing ecological and socio-economic benefits using the Modified Market Price Approach with Proxy Valuation. Conducted in the Belipola Arboretum, the study examined four distinct seral stages across 17 acres, with one ecologically representative sampling plot per stage. Bird species were systematically recorded using the point count method during peak bird activity hours from April to June 2024. Observers recorded all bird species seen within designated 25m x 25m sample plots for a 10-minute duration, resulting in a total of 526 individuals from 51 species. The Shannon-Wiener Index was employed to quantify species diversity, revealing a significant increase from the first seral stage (mean index = 0.38) to the fourth (mean index = 2.66), indicating that ecological succession is associated with a more complex and stable bird community as forest structure matures. Species richness rose from 4 to 37 across stages, reflecting increased habitat complexity. Statistical analyses using one-way ANOVA revealed significant differences in Shannon-Wiener diversity index among seral stages ($p < 0.05$), highlighting the ecological progression of bird communities along the successional gradient. Economic values for bird species were sourced from public literature and market records, with cumulative stage values ranging from \$41.43 (stage one) to \$1,566.88 (stage four), totalling \$4,788 for the entire arboretum. The findings show that higher seral stages support greater biodiversity and economic value, highlighting the importance of mature forests in sustaining ecosystem services. This study proposes integrating ecological and economic metrics into forest management, supporting conservation prioritization and investment in forest maturation.

Keywords: Analog Forestry; Avifaunal Diversity; Economic Valuation; Seral Succession

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ID 13

Relationship between wood density and alkaline copper quaternary (ACQ) preservative uptake in twenty lesser-known Sri Lankan timber species

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Abstract:

Wood is considered excellent, environmentally friendly green building material for furniture, interior decorations, and construction purposes. Storing atmospheric CO₂ in wood can be an effective strategy for mitigating climate change. However, due to the limited availability of high-grade timber resources, the market price of dominant species continues to rise, promoting the use of lesser-known timber species as alternatives. These species, like most timbers, are vulnerable to insect damage. Generally, wood deterioration in lesser-known species is caused by several factors, such as environmental and climatic conditions, as well as degradation agents like pests and insects. To prevent such damage, preservatives are applied to timber. However, some wood preservatives harm the environment and human health. As a solution, Alkaline Copper Quaternary (ACQ) has been introduced as an environmentally friendly wood preservative. Density is a key indicator of wood strength and is predictive of properties such as hardness, ease of machining, and nailing resistance. This study aimed to investigate the relationship between wood density and the chemical uptake of ACQ in twenty lesser-known Sri Lankan wood species treated using the dipping method for a 6-hour period. A negative relationship between chemical uptake and the density was observed ($R^2 = 0.6463$). *Arawkeriya* (38.82 kg/m³), *Rukkattana* (40.84 kg/m³), *Katuboda* (42.99 kg/m³), and *Wanasapu* (47.26 kg/m³) showed higher chemical penetration, while *Pelan* (26.95 kg/m³) and *Mahanuga* (29.92 kg/m³) showed moderate penetration. *Diya Na* (2.50 kg/m³), *Dunumadala* (3.14 kg/m³), *Aladu* (3.73 kg/m³), *Path Kella* (3.77 kg/m³) and *Acasia* (3.99 kg/m³) showed the lowest chemical penetration of the ACQ preservative.

Keywords: ACQ; Chemical Uptake; Density; Dipping Method; Wood

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ID 16

Bioactive compounds and total antioxidant capacity of nuts of selected cashew (*Anacardium occidentale* L.) varieties in Sri Lanka

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Abstract:

Cashew (*Anacardium occidentale* L.), a tropical nut tree, produces nuts rich in bioactive compounds and antioxidants. The prospective health benefits of cashew nuts and their by-products, particularly those associated with antioxidants and bioactive compounds, have garnered increasing attention. The research aimed to evaluate the total phenolic content (TPC), total flavonoid content (TFC), and total antioxidant capacity (TAC) of whole nuts, kernels, and testa of thirteen high-yielding cashew varieties (i.e., WUCC 1, WUCC 2, WUCC 5, WUCC 7, WUCC 8, WUCC 9, WUCC 13, WUCC 16, WUCC 19, WUCC 21, WUCC 23, *Shakthi* and *Wijanitha*) in Sri Lanka. TPC, TFC, and TAC were determined using the modified Folin-Ciocalteu method, AlCl₃ method, and ferric reducing antioxidant power (FRAP) assay, respectively. The study revealed that the testa of all thirteen high-yielding cashew varieties had significantly higher TPC, TFC, and TAC compared to whole nuts and kernels, with ranges of 55.83 ± 0.95 to 62.24 ± 0.99 mg GAE/g DW, 452.35 ± 19.29 to 642.10 ± 14.63 mg RE/g DW and 407.48 ± 7.02 to 620.13 ± 46.39 mg TE/g DW, respectively. The lowest values were recorded in the kernels of all the thirteen varieties. Strong positive correlations were found between TAC and TPC ($R^2 = 0.9773$, $p < 0.0001$) and between TAC and TFC ($R^2 = 0.974$, $p < 0.0001$) indicating that flavonoid and phenolic compounds are the primary contributors to antioxidant capacity. These findings highlight the potential for selecting cashew varieties with elevated phenolic and flavonoid content to improve overall antioxidant capacity. Moreover, the study suggests that the cashew testa, often discarded as a by-product, is rich in bioactive compounds and antioxidants and can be utilized in developing value-added products that promote health and longevity.

Keywords: Antioxidant Capacity; Bioactive Compounds; Cashew Kernel; Cashew Testa

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ID 18

Development of encapsulated probiotic bacteria isolated from vegetables

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Abstract:

Consumers' demand for non-dairy probiotic-containing foods is increasing due to their health benefits beyond nutrition. Milk-based products contain lactic acid bacteria as probiotic bacteria; however, non-dairy food sources also contain probiotic bacteria that may perform better than those identified from dairy foods. This study aimed to identify and characterize probiotic bacteria from non-dairy sources and encapsulate them to develop a starter culture. Different bacteria were isolated from Carrot, Beet, Gotukola and Lettuce using MRSA media. Morphological and biochemical characterisation were performed to screen potential probiotic strains. The screened probiotic isolates were examined for antimicrobial activity, acidity and bile tolerance. The best isolate was then selected for encapsulation. The extrusion technique was used to encapsulate the identified strain using sodium alginate. Finally, encapsulation efficiency was determined. Morphological and biochemical characteristics revealed that six out of ten isolates showed Gram-positive, oxidase and catalase-negative properties. Isolate 101, 107 and 110 showed significantly higher survival percentages at pH 3 compared to the other strains. Isolate 101 showed a significantly ($p < 0.05$) higher average diameter of inhibition zone, 11.5 mm and 10.73 mm against *Salmonella typhimurium* and *Staphylococcus aureus*, respectively. Isolated 101 did not show any significant ($p > 0.05$) loss of viability at 0.3% and 0.7% bile salt compared to the control. However, strain 110 showed significant viability loss at 0.7% bile salt. The selected encapsulated 101 showed a 92% recovery efficiency. Molecular identification is needed to confirm the identity of the probiotic bacteria. This study demonstrates that LAB isolated from vegetables exhibited functional properties that can be used as potential encapsulated probiotics.

Keywords: Carrot; Encapsulation; Extrusion; Probiotics

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ID 19

Formulation of a nutrient-enriched sponge cake using drum-dried pumpkin powder

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Abstract:

Pumpkin (*Cucurbita maxima*), belonging to the family Cucurbitaceae, is a widely grown seasonal vegetable in Sri Lanka which often suffers postharvest losses. This study aimed to increase its utilization by formulating a sponge cake using drum-dried pumpkin powder as a partial substitute for wheat flour at 20%, 40% and 50% replacement levels. A preliminary sensory evaluation was conducted with 30 untrained panelists using a five-point Hedonic scale. Total phenolic content (TPC), total flavonoid content (TFC), total antioxidant capacity (TAC) and proximate composition of both pumpkin powder and sponge cakes were analyzed using the Folin-Ciocalteu method, Aluminum chloride (AlCl₃) method, ferric reducing antioxidant power (FRAP) assay, and Association of Official Analytical Chemists (AOAC) standard procedures, respectively. Physicochemical properties and microbial counts of the sponge cakes were also determined. Pumpkin powder showed TPC, TFC and TAC values of 713.73 ± 48.29mg GAE/100 g, 655.67 ± 75.22 mg RE/100 g, 652.26 ± 26.89 mg TE/100 g, respectively, with moisture content (8.59 ± 0.25 %), ash (13.08 ± 0.72 %), fat (2.89 ± 0.82 %) and protein (7.42 ± 0.1 %). Among the formulations, the 40% pumpkin powder sponge cake, which showed the highest acceptability, was selected for detailed comparison with 100% wheat flour control sponge cake control. The 40% pumpkin powder sponge cake recorded significantly higher TPC (82.98 ± 2.35 mg GAE/100 g), TAC (116.73 ± 1.38 mg TE/100 g), and ash content (2.30 ± 0.14%), while showing the lowest fat content (17.75 ± 0.49%). TFC, protein content and textural hardness did not vary significantly among sponge cake samples. Microbial counts remained within acceptable limits during storage, two months for pumpkin powder and three weeks for sponge cakes. The 40% pumpkin powder-incorporated sponge cake shows potential as a nutritious bakery product, and the development of an instant mix may further enhance its commercial value.

Keywords: Drum drying; Functional properties; Proximate composition; Pumpkin powder; Sponge cake

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ID 21

Identification of the effect of Benzylaminopurine on shoot regeneration of cavendish banana

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Abstract:

The Cavendish banana (*Musa acuminata*) is a commercially significant cultivar in the global horticultural market and is extensively propagated using plant tissue culture techniques. In this technique, Plant Growth Regulators (PGRs) are used to enhance rapid propagation for large-scale production. One such PGR, N6-benzylaminopurine (BAP), a synthetic cytokinin, has gained attention for its effects on plant growth and development in tissue culture. The objective of the present study was to evaluate the effects of different BAP concentrations on *in vitro* shoot multiplication of Cavendish banana. One-month-old *in-vitro* banana plantlets were used as explants and cultured on Murashige and Skoog (MS) media series, supplemented with a constant 2.0 ppm of Indole-3-acetic acid (IAA) and varying concentrations of BAP (0, 2, 4, 6, 8, and 10 ppm). Cultures were maintained at $26 \pm 1^\circ\text{C}$ under a 16-hour photoperiod. After 30 days of culture, shoot number, leaf number, and highest shoot height (cm) were measured. The experiment followed a Completely Randomized Design (CRD) with three replicates per treatment, and each replicate consisted of four explants. Statistical analysis was performed using SPSS software. The results revealed that shoot proliferation and elongation were significantly greater with rising BAP concentrations. BAP concentrations below 2 ppm did not significantly differ from the control in shoot proliferation. The optimum concentration of BAP was found to be 6 ppm for Cavendish plantlets, which produced an average of 1.60 new shoots per explant, 4.50 leaves and a shoot height of 4.40 cm, with a 100% survival rate. Shoot emergence typically began after 12–15 days in 6 ppm BAP medium, while delays were noted in both lower and higher concentrations. Additionally, BAP concentrations above 6 ppm resulted in reduced shoot proliferation and lower plantlet survival rates. It is recommended that future research explore the synergistic effects of BAP with auxins such as IAA or NAA and genotype-specific responses to improve multiplication efficiency and support varietal micropropagation protocols.

Keywords: Cavendish Banana; Indole-3-acetic acid (IAA); *In-vitro* propagation; N6-benzylaminopurine (BAP); Plant Growth Regulators (PGRs)

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ID 22

Cost-effective culture media for biomass production of spirulina using betel fertilizer

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Abstract:

Spirulina (*Arthrospira platensis*) is a nutrient-rich blue-green cyanobacterium extensively cultivated for sustainable food production, pharmaceuticals, and industrial applications. However, the high cost of conventional growth media poses a challenge to largescale production. Traditionally, *Spirulina* is cultured in Zarrouk's medium (ZM), which provides optimal nutrients but is expensive for large-scale cultivation. The study aimed to identify a cost-effective alternative to ZM by incorporating betel fertilizer (BF), a readily available and inexpensive nutrient source. Five culture media formulations were tested: 100% ZM, 75% ZM ± 25% BF, 50% ZM ± 50% BF, 25% ZM ± 75% BF and 100% BF, each with three replicates. Growth performance, biomass yield, pigment content, cell productivity, maximum specific growth rate, cell doubling time and economic viability were assessed over a 16-day cultivation period. Cultures were maintained under a continuous illumination (35W fluorescent tubes, 300–500lux) and continuous aeration. Results revealed that up to 50% of ZM can be replaced with BF without significantly affecting growth rate, biomass yield, cell concentration, maximum specific growth rate or cell productivity. Statistical analysis using one-way ANOVA ($p > 0.05$) showed that the 50% mixture performed similarly to the 100% ZM treatment in these parameters, while reducing production cost. Furthermore, Duncan's multiple range test confirmed that the mean values across these treatments were not significantly different. Pigment content analysis also showed no statistically significant decline ($p > 0.05$) up to the 50% mixture compared to 100% ZM, indicating that BF substitution did not compromise biochemical composition. These findings demonstrate that replacing 50% of ZM with BF preserves *Spirulina* growth efficiency while significantly lowering production costs, presenting a promising alternative for commercial cultivation.

Keywords: Alternative culture media; Betel fertilizer; Biomass yield; Cost reduction; *Spirulina*; Zarrouk's medium

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ID 23

Evaluation of aloe vera gel as a commercial auxin replacement for *in-vitro* rooting of sour banana (*Musa acuminata*)

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Abstract:

In vitro propagation is a controlled, sterile method for growing and multiplying plant cells, tissues or organs using Murashige and Skoog (MS) medium, supplemented with growth regulators such as auxins. Indole-3-acetic acid (IAA), a synthetic auxin is widely used to promote *in-vitro* rooting in various plant species, including sour banana (*Musa acuminata*). However, concerns regarding the potential phytotoxicity and environmental impact of synthetic growth regulators have increased interest in natural, plant-based alternatives. This study investigates the potential of aloe vera (*Aloe barbadensis* Miller) gel as a natural substitute for commercial auxin in the *in vitro* rooting of sour banana. Aloe vera gel (AvG), known for its richness in bioactive compounds, including vitamins, enzymes, and phytohormones was incorporated into MS rooting medium at varying concentrations (120, 160, 200, 240, 280, 360, 440 and 520 g/L AvG). The experiment evaluated several parameters, including days to root initiation, number of roots, root length, plant growth rate, plant height, root dry weight and plant dry weight, compared to standard treatments with IAA. The study was conducted using a Completely Randomized Design (CRD) with 9 treatments, each replicated 15 times. Results revealed that supplementing the medium with AvG had a significant effect on growth parameters. The highest number of roots (7) and the shortest time to root formation (4 days) were recorded with 440 g/L AvG in full-strength MS medium. Increased AvG concentrations generally improved rooting ability. Notably, the 160 g/L AvG treatment was most effective in promoting root length (56.9 mm) and plant growth rate (6.8). The highest plant height (52.3) was observed with 280 g/L AvG in full-strength MS medium. Root dry weight (0.05g) was recorded with 0.1 mg/L IAA in full-strength MS medium, while plant dry weight (0.1g) was noted with 120 g/L AvG in full-strength MS medium. These findings suggest that aloe vera gel can be used as a viable natural alternative to synthetic auxin for *in vitro* rooting media used in growing sour bananas, improving multiple growth parameters.

Keywords: Auxin; Aloe vera Gel; *In-vitro* rooting; MS medium; Sour banana

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ID 25

Preliminary growth assessment of vegetative traits in selected Cinnamon (*Cinnamomum verum*) accessions

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Abstract:

Cinnamon (*Cinnamomum verum*) is a high-value perennial crop that contributes significantly to Sri Lanka's export economy. Despite its economic importance, expansion of cinnamon cultivation is hindered by the limited availability of improved and widely adopted cultivars. Evaluation of vegetative growth performance of cinnamon across diverse agroecological zones is crucial to identify superior accessions suitable for cultivation and breeding purposes. Therefore, this study evaluated the vegetative growth performance of twenty selected vegetatively propagated cinnamon accessions transplanted at eight months of age. The assessment was conducted over three months (December 2024 to March 2025), under field conditions in Thalgampala, Galle (WL2a), using a Randomized Complete Block Design with three replicates. The evaluation mainly focused on agronomic parameters including plant height (from soil surface to the apex of the main shoot), stem girth (10 cm above ground), and average leaf chlorophyll content (SPAD readings) on mature, healthy leaves located in the middle canopy. Analysis of variance revealed statistically significant differences among the accessions for all parameters ($p < 0.05$). Accessions 7 and 18 performed well in terms of stem girth (2.21 ± 0.84 cm) and plant height (64.33 ± 14.36 cm), while accession 56 showed the highest average SPAD readings (39.9 ± 9.04 cm), indicating a higher chlorophyll content. These findings emphasize accessions 7, 18, and 56 are the best among the selected twenty, with potential for further agronomic trials to support breeding programs and germplasm conservation. In contrast, accession 12 consistently scored poorly across all parameters, indicating limited adaptability and reduced potential for further cultivation.

Keywords: Accession evaluation; Agroecological adaptation; *Cinnamomum verum*; Vegetative growth

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ID 26

Optimizing guppy (*Poecilia reticulata*) larvae nutrition: The role of *Chlorella vulgaris* and commercial dry feed as artemia replacements

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Abstract:

Recognizing the importance of sustainable practices in the ornamental fish industry, this study aims to enhance the survival and growth of guppy larvae (*Poecilia reticulata*) by investigating cost-effective alternatives to decapsulated Artemia. Specifically, the research evaluates various ratios of *Chlorella vulgaris* and commercial dry feed in the larvae's diet. A 14-day feeding trial was conducted on 5-day post-hatch guppy larvae in 15 indoor aquaria with 15 fish per tank. Five dietary treatments were tested, each with three replicates; CD (100% decapsulated Artemia) as the control diet; FD (100% commercial dry feed); CL (100% *Chlorella*), CC (50% decapsulated Artemia in CD mixed with 50% *Chlorella* in CL); and FC (50% commercial dry feed in FD mixed with 50% *Chlorella* in CL). Growth performance metrics, including final mean body weight (FW), final total length (FTL), specific growth rate (SGR), average daily gain (ADG), along with the survival rate (SR) and stress tolerance were analyzed. The CD and CC dietary treatments provided significantly better growth performance compared to other treatments, as determined by one-way ANOVA followed by Tukey's multiple range test ($p < 0.05$). No statistically significant differences were observed between CC and CD with respect to the growth performance of Guppy larvae ($p > 0.05$). Survival rates showed no significant differences except for CL, which had a significantly lower SR compared to other treatments. Fifteen fish per treatment were subjected to a 25 ppt salinity stress test, which showed no significant treatment effect. Given that CC reveals an ADG of $5.21 \pm 0.07\%$, and SGR of $9.34 \pm 0.26\%$ without negative effects and offers significant cost reduction compared to CD, incorporating *Chlorella vulgaris* into the decapsulated Artemia diet at 50% can be recommended as the most cost-effective and efficient option for the larval feeding of guppy.

Keywords: *Chlorella vulgaris*; Decapsulated artemia; Growth performance; Guppy larvae; Survival rate

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ID 27

Evaluation of ammonium chloride as an alternative to ammonium nitrate in Murashige and Skoog medium for *in vitro* propagation of *Musa acuminata* (Sour banana)

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Abstract:

Sour banana (*Musa acuminata*) is one of the most important fruit crops worldwide. It is grown in the tropics and though most widely consumed there, is valued globally for its flavour, nutritional value, and year-round availability. Among various cultivation methods, plant tissue culture technology holds a significant place for sour banana propagation. Murashige & Skoog (MS) medium is the most popular standard basal salt medium used for *in vitro* propagation of sour banana. One of the main problems currently faced by the tissue culture sector is the increased price of Ammonium nitrate (NH_4NO_3), which provides the nitrogen source in MS medium. This study aimed to evaluate the proliferation performance of banana using Ammonium chloride (NH_4Cl) as an alternative nitrogen source, considering the rising cost of plant production. The experiment was laid out a Completely Randomized Design (CRD) with nine NH_4Cl treatments (0.25–12.0 g/L) and a standard MS medium containing NH_4NO_3 as the control. Data were analysed using ANOVA (Minitab 17) and treatment means were compared using Tukey's test at the 0.05 significance level. When compared after eight weeks, the highest mean callus proliferation was reported in the treatment containing 0.5g/L NH_4Cl . Plant growth rate and callus diameter were significantly higher in the control treatment, with means values of 6.1mm and 31.3mm respectively. A 200.5g higher mean callus wet weight and a 0.43g higher callus dry weight were also recorded in the control treatment. However, at concentrations above 6.0 g/L, NH_4Cl became toxic to callus and had adverse effects. Moreover, considering cost NH_4Cl (Rs 7.00/L) is more cost-effective compared to NH_4NO_3 (Rs 36.30/L). The use of NH_4Cl in tissue culture media highlights the importance of embracing sustainability in callus proliferation and advancing scientific knowledge and discoveries.

Keywords: Ammonium chloride; Ammonium nitrate; Callus proliferations; *In vitro*; Tissue culture

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ID 28

Bioactive compounds, antioxidant capacity and nutritional composition of fruit flesh and seed oil content of selected *Momordica* varieties

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Abstract:

Momordica fruits and seeds are widely used in traditional Sri Lankan medicine and local diets due to their antiviral, anti-inflammatory, anticancer and anti-diabetic properties, which help manage chronic diseases and promote health. However, limited scientific data exist on the functional properties, nutritional composition, and seed oil content of different *Momordica* cultivars. This study aimed to evaluate the bioactive compounds, antioxidant capacity, proximate composition, and seed oil content of nine *Momordica* cultivars grown in Sri Lanka. The varieties included four improved types (Thinnaweli White, MC 43, Matale Green and a hybrid), two traditional types (Kalu Karawila and Batu Karawila) and three wild types (Uru Karawila, Geta Karawila, and Thumba Karawila). Eight belong to *Momordica charantia*, while Thumba Karawila represents *Momordica dioica*. All analyses were conducted using three replicates per variety. Fruit samples for nutritional analysis were collected at the harvesting stage, while seeds from fully ripened pods were used for oil extraction. Laboratory analyses included the Ferric Ion Reducing Antioxidant Power (FRAP) assay for total antioxidant capacity (TAC), the aluminum chloride (AlCl₃) colorimetric method for total flavonoid content (TFC), and the Folin-Ciocalteu reagent method for total phenolic content (TPC). Proximate composition was determined using AOAC methods, and seed oil content by Soxhlet extraction. Data were statistically analyzed using ANOVA and Tukey's test in SAS. Significant differences ($p < 0.05$) were observed among varieties. MC43 showed the highest TPC (4.28 ± 0.11 mg GAE/g DW) and TAC (3.81 ± 0.26 mg TE/g DW). Wild types like Uru Karawila and Thumba Karawila had high bioactive and protein content. Thinnaweli White showed the highest seed count (28 ± 2) and oil content ($12.03 \pm 0.85\%$). These findings highlight the potential of *Momordica* varieties for agricultural and pharmaceutical use. Promoting their cultivation could enhance health and support Sri Lanka's economy.

Keywords: Antioxidant capacity; Bioactive compounds; *Momordica* varieties; Proximate composition; Seed oil

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ID 32

Production of black lime (*Citrus auratifolia*) and its applications in Sri Lankan culinary and commercial industry

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Abstract:

Lime (*Citrus auratifolia*) plays a significant role in Sri Lankan culinary culture; however, its seasonal availability often leads to overproduction and waste during peak harvest periods. This study explores the production of black lime, a preserved form of lime as a sustainable alternative aiming to reduce post-harvest losses while introducing a novel culinary ingredient. Black lime was prepared by blanching fresh limes in salted water for 4 minutes, followed by immediate cooling in an ice bath. The limes were then oven-dried at 125 °C for 4 hours and subsequently sun-dried for 4 days. Three types of food items (lime juice, coconut sambol, and vegetable salad) were prepared using black lime and fresh lime for comparative analysis. Sensory evaluations were conducted separately for each food item using 30 semi-trained panelists with 7-point hedonic scale and data were analyzed using Kruskal-Wallis non-parametric method. The results showed significant differences in sweetness ($p = 0.000$), aroma ($p = 0.000$), color ($p = 0.000$), and overall liking ($p = 0.000$). Foods item prepared with black lime, especially coconut sambol and salad, scored higher in these areas, suggesting that black lime improves both taste and visual appeal. A separate survey of 80 people showed that 100% use lime in their cooking, but 88.8% reported difficulty accessing it, and all respondents (100%) said it's too expensive. Even though none had used black lime before, every person was willing to try it. All 80 people noticed a clear difference between fresh and black lime, and everyone supported the idea of bringing black lime to the market. These findings show strong support for black lime as a tasty, affordable and easy-to-store alternative to fresh lime, with excellent potential for use in Sri Lankan households and the food industry.

Keywords: Black lime; Culinary applications; Food preservation; Post-harvest loss; Sensory evaluation

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ID 33

Assessing the influence of weather variability and natural disasters on Sri Lankan spice export: A gravity model approach

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Abstract:

Variations in weather and natural disasters pose significant challenge in agricultural production. While there is extensive research on the general impact of climate change on agriculture, limited attention has been given to the export performance of key agricultural commodities. Therefore, this study attempts to fill this gap by using an empirically analysing the impact of weather conditions and natural disasters on spice export from Sri Lanka, a major global spice exporter. Using the Gravity Model approach, the analysis incorporated panel data from 12 primary spice export destinations covering the period from 1999 to 2022. The findings revealed that weather factors, such as deviations in annual precipitation and temperature, significantly reduced spice exports. Additionally, increasing frequency of extreme weather events, such as droughts, tsunamis, aggravated these challenges. The analysis indicates that a 1°C increase in yearly maximum temperature is associated with a 5.7% reduction in export value ($p = 0.026$), while a 1°C rise in yearly minimum temperature leads to a 1.2% decline ($p < 0.001$). Precipitation anomalies similarly disrupt trade flows: a 100 mm increase in annual precipitation corresponds to a 5% decrease in export value ($p < 0.001$). Furthermore, droughts and tsunamis, identified through the international disaster database and modelled as binary events, significantly amplified these weather impacts. Drought reduces export value by 29.4% ($p = 0.002$), while tsunamis cause an even greater 36.2% decline in exports ($p = 0.002$). These results highlighted the importance of climate-resilient agricultural practices, enhancements to irrigation and post-harvest infrastructure, implementation of early warning systems and establishment of financial safety nets and crop insurance schemes to mitigate future impacts. Moreover, the study underscores the need for policymakers to integrate climate adaptation strategies into trade policies to ensure that Sri Lanka's spice sector remains competitive in global markets.

Keywords: Climate resilience; Gravity Model; Natural Disasters; Spice Exports; Weather Patterns

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ID 34

Enhancing shelf-life in tomato (*Solanum lycopersicum*) using sustainable seaweed-based coatings

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Abstract:

Preservation is essential for perishables, but the harmful effects of chemical preservatives on health and the environment highlight the need for sustainable alternatives. Seaweed-based coating offers an effective, safe and cost-efficient solution to these challenges. This study aimed to enhance the shelf life of tomatoes using red seaweed-based coatings. Red seaweeds (*Gracilaria verrucosa* and *Chondrus crispus*) were collected and hot water extracts were prepared by extracting 1 g of dried seaweed in 100 mL of water at 80 °C for 3 hours. The antioxidant activity and viscosity of the seaweed extracts were measured, and two total sugar-concentrated solutions (0.05% and 0.1%) were prepared to dip tomatoes for 15 min. Both coated and uncoated tomatoes were stored at room temperature and at 15°C for 32 days. Weight loss, color, firmness, juice percentage, total soluble solids (TSS), total acidity and TSS to acidity ratio were determined at 6-day intervals. Data were analysed using a 3-factor factorial completely randomized design with two temperatures, two concentrations, and two seaweed varieties, each with three replicates. Results show that the antioxidant activities of *C. crispus* and *G. verrucosa* extract were 44.87% and 20.83% respectively. Tomatoes coated with 0.1% *C. crispus* and stored at 15°C for 32 days showed significantly reduced weight loss (3.01 g), along with increased firmness (10.7 N), juice percentage (57.94%) and titratable acidity (0.352 %), while showing reduced TSS (9 ° Brix) and TSS/acid ratio (24.6) compared to uncoated tomatoes stored under the same conditions. Higher concentration seaweed-based coatings extend tomato shelf life by preventing deterioration and preserving quality, especially when stored at 15°C compared to room temperature. These findings reveal the potential of seaweed-based edible coatings as an eco-friendly postharvest technology for enhancing shelf-life and maintaining the quality of tomatoes under different storage conditions.

Keywords: Edible coatings, Seaweed extracts, Shelf-life extension, Tomato

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ID 36

Assessment of heavy metal residues in common vegetables from Colombo, Sri Lanka

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Abstract:

Vegetables are essential components of daily diets and contribute significantly to the nutritional needs of the Sri Lankan population. With increasing concern over environmental pollution and its potential impact on food safety, it is important to investigate even at a preliminary level the presence of heavy metal residues in commonly consumed produce. This investigation aimed to provide an initial insight into the levels of selected heavy metals; arsenic, cadmium, chromium, copper, lead, and nickel in carrots, leeks, and cabbage obtained from the Colombo district. The study was designed to serve as an early indicator of possible contamination trends and to emphasize the importance of routine surveillance. Fresh samples were collected from wholesale vendors in the Colombo Manning Market. In the first assay, 1 kg samples were analyzed to reflect common household consumption quantities, allowing practical assessment of potential daily intake levels. Heavy metal concentrations were analyzed using microwave digestion and inductively coupled plasma mass spectrometry (ICP-MS). The heavy metal analysis of Sample 1 showed cadmium at 0.15 mg/kg detected only in carrots. Copper was detected in all three vegetables: 0.64 mg/kg in carrots, 0.3 mg/kg in leeks, and 0.14 mg/kg in cabbage. Nickel was found at 0.3 mg/kg in leeks, remaining below the FDA/WHO maximum permissible limits. Arsenic, chromium, and lead were not detected in any samples. Among all metals screened, in Sample 2, only copper was present across all three vegetables, but its levels were well below the WHO/FDA safe limit of 73.3 mg/kg. The highest copper concentration was observed in carrots (0.36 mg/kg), followed by leeks (0.31 mg/kg) and cabbage (0.23 mg/kg). Although this investigation provides only a preliminary overview, the results indicate low levels of heavy metal contamination in the analyzed vegetables. These findings highlight the importance of ongoing monitoring efforts to safeguard food safety and promote sustainable agricultural practices, particularly within urban settings.

Keywords: Heavy Metals; Monitoring; Safe Food Systems; Soil Health

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ID 38

Effects of anther culture for selected varieties of *Solanum melongena* L.

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Abstract:

Anther culture is a plant breeding technique that induces haploid embryogenesis from microspores to rapidly produce homozygous lines. This study aimed to determine the effect of anther culture for five selected brinjal varieties (EGH 6, EGH 9, EGH 13, EGH 16, and EG 11) by culturing sterilized anthers on MS medium supplemented with varying kinetin concentrations [1, 2, 3 and 0 mg/L (control group)] for callus induction. The experiment was carried out in a Completely Randomized Design (CRD) with three replicates. The variety EGH 16 and the kinetin concentration of 3mg/L gave significantly lowest number of days of 16.5 ± 0.62^c and 20.66 ± 1.35^a for callus initiation respectively. The significantly highest number of callus was obtained by the variety EGH 16 (7.16 ± 0.62^a) and by the kinetin concentration of 3mg/L (6.33 ± 0.63^a) as well. The significantly highest number of greenish callus which indicates chlorophyll development and high regeneration potential was obtained by the variety EGH 16 (5.75 ± 0.52^a) and by the kinetin concentration of 3mg/L (4.66 ± 0.58^a). The largest diameter of one-month-old calli was recorded in variety EGH 16 (8.12 ± 0.51^a) and with 1mg/L kinetin (6.49 ± 0.56^a). Considering the combinations, EGH 16 x 3 mg/L kinetin gave the fastest callus initiation and the highest number of calli and greenish calli (14.33 ± 0.33^e), (10.33 ± 0.33^a) and (8.33 ± 0.33^a) respectively. However, the combination EGH 16 x 1mg/L kinetin produced the largest callus diameter (10.11 ± 1.20^a). All differences were significant at $p < 0.05$ unless otherwise stated. The findings show that brinjal variety EGH 16 and 3 mg/L kinetin effectively promote callus initiation in anther culture, likely due to their strong genetic and hormonal influence.

Keywords: Anther culture; Brinjal; Callus induction; EGH 16; Kinetin

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ID 39

The effect of different culture media on the growth of *Tubifex tubifex*

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Abstract:

Tubifex tubifex worms are highly valued as live feed in aquaculture due to their nutritional benefits and simple cultivation techniques. This study evaluated the impact of cow dung, banana peels, and water hyacinth as culture media on the growth performance of *T. tubifex*. *Tubifex* worms were cultured for 30 days in plastic trays ($37 \times 26 \times 6.5 \text{ cm}^3$) using three media; T1: 50% cow dung with 50% paddy clay soil, T2: 50% banana peel with 50% paddy clay soil, and T3: 50% water hyacinth with 50% paddy clay soil. Each treatment had three replicates. Worms were inoculated at 1.25 mg cm^{-2} and each treatment was replenished at 250 mg cm^{-2} of the respective medium every 10 days. A continuous water flow at a rate of $2.04 \pm 0.14 \text{ mL/s}$ was maintained. Growth (density and biomass of worms) and water quality parameters (temperature, pH, TDS, ammonia, nitrite, nitrate, DO, water flow rate, alkalinity, and hardness) were analyzed using One-way ANOVA. After 30 days, T1 recorded the significantly highest worm density ($59.63 \pm 1.98 \text{ individuals/cm}^2$) and biomass ($16.64 \pm 0.51 \text{ mg cm}^2$), while T3 exhibited the significantly lowest density and biomass and T2 showed moderate values. Water temperature, pH, ammonia and DO range from 27.43 ± 0.15 to $28.83 \pm 0.06 \text{ }^\circ\text{C}$, 7.56 ± 0.05 to 8.7 ± 0.05 , 1.03 ± 0.06 to $4.87 \pm 0.06 \text{ mg/L}$ and 7.42 ± 0.01 to $7.77 \pm 0.02 \text{ mg/L}$, respectively. The study concluded that cow dung was the most effective medium for cultivating *Tubifex tubifex* compared to banana peels and water hyacinth.

Keywords: Banana peels; Biomass; Cow dung; *Tubifex tubifex*; Water hyacinth

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ID 40

Food supply chain optimization and waste reduction through AI: An approach towards sustainable food systems

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Abstract:

Industry 4.0 technologies should be adopted in the current era of the digital economy to meet the growing demand for food supply due to population growth, climate change, geopolitical instability and resource scarcity. Artificial Intelligence (AI) has emerged as a promising avenue in ensuring food security and sustainability in food systems through optimization of the food supply chain (FSC) from farm-to-fork and waste reduction along the FSC. More than 40-50% of global food production is wasted throughout the FSC. This review examines the potential of AI in addressing these challenges by optimizing food supply chain efficiency, reducing waste and ensuring food safety as a sustainable approach in food systems. This comprehensive study was conducted based on indexed journal articles published in the last 20 years, collected from ScienceDirect and Google Scholar. AI-driven technologies such as machine learning, deep learning, natural language processing, robotic process automation, advanced algorithms, computer vision, image processing, Internet of Things (IoT) and data analytics capabilities were explored in this review for optimizing the FSC. AI will play a crucial role in revolutionizing traditional FSCs by enhancing resilience and mitigating risk through real-time, automated and optimal data-driven decision making. AI enables the simplification and reconfiguration of supply chain designs through learning, reasoning and self-correction. AI is important in ensuring transparency, traceability, food safety and quality. AI ensure FSC optimization and waste minimization by enabling precise demand forecasting through predictive analytics in market trends, customer demands, climate change and seasonality. AI can be successfully applied in inventory management, intelligent decision-making, freshness and spoilage monitoring of foods and streamlining logistic operations. The review emphasizes the importance of adopting AI technologies in FSC optimization to ensure sustainability in food systems while addressing the barriers and challenges faced by developing countries.

Keywords: AI; Artificial Intelligence; Food supply chain; Food systems; Sustainability

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ID 41

Present status of water quality management practices of ornamental fish farms in Galle district, Sri Lanka

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Abstract:

This study assessed the current water quality management practices of medium-scale ornamental fish farms in the Galle district, Sri Lanka, investigated the major barriers to effective management and explored potential improvement strategies. Data were collected through a structured questionnaire from 33 randomly selected farms registered under the National Aquaculture Development Authority (NAQDA). Data were analyzed using Microsoft Excel (2021) and the chi-square test. Results showed that 60.61% of the farms did not monitor water quality on-site. Common water quality issues, including pH imbalances (54.90%) and low dissolved oxygen levels (19.61%), directly impact fish health and mortality. For immediate water quality improvement, partial water exchanges and enhanced aeration were employed. Long-term strategies included regular monitoring, substrate siphoning, and bioremediation using aquatic plants (*Pandanus amaryllifolius*, *Eichhornia crassipes*, *Vallisneria*, *Pistia* etc.) and natural water conditioning using leaves (*Terminalia catappa*, *T. arjuna*, *Musa paradisiaca*). Most farmers depended on traditional treatment methods, such as salt dips (43.08%) for managing fish diseases. Notably, 93.94% of farms directly disposed wastewater into the environment without treatment, raising concerns about environmental sustainability. A significant correlation was observed between monthly income and on-site water quality measurement practices ($p < 0.05$). The main barriers to effective water quality management were identified as a lack of resources and high equipment costs. Ornamental fish farmers suggested that water quality management practices could be improved through the adoption of advanced treatment technologies, access to loans and enhanced support from government agencies and relevant institutions.

Keywords: Freshwater; Galle district; Ornamental fish farms; Sri Lanka; Water quality

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ID 42

Effect of dietary supplementation of garlic powder and shrimp shell powder on growth performance, feed utilization, survival and coloration of platy fish (*Xiphophorus sp.*)

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Abstract:

A six-week feeding trial was conducted to investigate the effects of three experimental feeds on growth performance and feed utilization, survival and coloration of platy fish, *Xiphophorus sp.* The Prima diet was used as the control diet (CD) with no additives and two experimental diets were prepared by supplementing 5% shrimp shell powder (SD) and 5% garlic powder into a base prima diet (GD). Triplicate groups of platy fingerlings (0.34 ± 0.01 g, 2.25 ± 0.12 cm) were stocked in nine glass aquaria ($60 \times 30 \times 40$ cm³), at a density of ten fish per tank. Fish were fed ad libitum twice daily and growth performance (total length, total weight, weight gain%, length gain%, average daily gain%, specific growth rate%), feed utilization ratio (FCR) and coloration level (total carotenoid content) were evaluated. Fish fed the diet supplemented with shrimp shell powder (SD) exhibited significantly higher ($p < 0.05$) growth performance, including final body weight (0.84 ± 0.10 g), total length (3.28 ± 0.06 cm), specific growth rate ($2.39 \pm 0.04\%$) and average daily gain ($3.49 \pm 0.7\%$) compared to those fed the CD or GD. Survival rate did not differ significantly ($p > 0.05$) among treatments. Hepatosomatic Index (HSI) and Gonadosomatic Index (GSI) were significantly higher ($p < 0.05$) in SD treatment. Skin and caudal fin carotenoid content was highest in the SD group (4.01 ± 0.12 mg/kg), followed by the GD (3.58 ± 0.13 mg/kg) and CD (3.14 ± 0.06 mg/kg) groups. The results indicate that dietary supplementation with 5% shrimp shell powder significantly enhances growth and coloration in platy fish. Therefore, shrimp shell powder has potential as a valuable additive in fish diets for both growth promotion and color enhancement, benefiting the ornamental and food fish industries.

Keywords: Coloration; Garlic powder; Growth performance; Shrimp shell powder; *Xiphophorus sp.*

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ID 47

Short-term seed storage strategies for underutilized crops and fruit species in Sri Lanka

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Abstract:

Understanding the germination and storage requirements of underutilized crop and fruit species is essential for developing protocols to promote their wider use. This study aimed to assess how short-term storage under different conditions affects seed viability and germination performance in *Averrhoa bilimbi*, *Antidesma bunius*, *Canavalia ensiformis*, *Coccinia grandis*, *Cordia dichotoma*, *Ipomoea alba*, *Momordica denudata*, *Sauropus androgynus* and *Solanum violaceum*. For each species, 100 seeds [20 seeds per replicate (n = 5)] were stored in unsealed polyethylene bags under three storage conditions: exposure to wood smoke, cold temperature (refrigeration at 4 °C) and room temperature. Seed viability and germination were evaluated at 0, 3, and 6 months under species-specific light conditions. For dormant seeds, established dormancy-breaking treatments were applied manual scarification for *A. bunius*, *C. dichotoma*, and *M. denudata* and GA₃ treatment for *C. grandis* and *S. violaceum*. Results indicated that all species maintained high viability and germination rates (>80%) after six months of storage under all conditions, comparable to freshly collected seeds (p>0.05). However, the time to reach 50% and maximum germination was significantly reduced in *A. bilimbi*, *C. ensiformis*, *I. alba* and *S. androgynus* when stored under smoking conditions. In contrast, seeds of *C. grandis* and *M. denudata* exhibited significantly reduced mean germination time when stored at room temperature (p<0.001). This study confirms that all species can be stored for up to six months under all storage conditions without compromising seed viability or germination percentage. However, specific storage conditions may offer added benefits in reducing germination time for certain species namely, room temperature storage for *C. grandis* and *M. denudata* and smoke exposure for *A. bilimbi*, *C. ensiformis*, *I. alba* and *S. androgynus*. Long-term seed storage preserves genetic diversity and ensures reliable propagation of these underutilized fruit species for sustainable agriculture.

Keywords: Cold storage; Seed viability; Short-term storage; Smoke; Time taken for germination

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ID 49

Effects of *Solanum torvum* fruit saponin content and processing conditions on stability of *Bacopa monnieri* and virgin coconut oil -in-water emulsion

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Abstract:

The study aimed evaluate the application of saponins from *Solanum torvum* fruits (STS), as a natural emulsifier for an oil-in-water emulsion containing *Bacopa monnieri* extract (BME) and virgin coconut oil (VCO). STS (0.1% to 1.0 % w/w) was homogenized at 15,000 rpm for one minute along with previously optimized BME and VCO contents. Emulsions were pasteurized at 85 °C. Emulsification index (EI), turbidity (T), centrifuged emulsion stability (ES), droplet diameter and distribution (DD) and oil content in the emulsified region (OC) were analyzed. Selected STS contents were further processed with BME and VCO under varying conditions including homogenization speed, pH, heating temperature and salt concentration. Emulsions containing STS showed better emulsification compared to controls. EI, T, ES, DD and OC were significantly higher ($p<0.05$) in emulsions containing 0.5 % to 1.0 % STS compared to those with 0.1 % to 0.25 % STS. Similar increasing emulsification trends were observed in both raw and pasteurized emulsions. Pasteurization caused an immediate reduction in EI, T, ES and an increase in droplet diameter; however, these changes were minimal in emulsions with 0.5 % to 1.0 % STS. Increasing homogenization speed from 5000 rpm to 20 000 rpm and heat treatment at 90 °C increased EI, T, ES and OC. These parameters also increased above the emulsion's natural pH but decreased at pH levels below 4.0. Addition of 0.05 % NaCl and above significantly reduced ($p<0.05$) stability parameters. In conclusion, STS is a potential emulsifier in BME-added VCO-in-water emulsions, providing significant emulsification effects at 0.5 % to 1.0 % concentrations. Its stability decreases below pH 4.0 and with NaCl addition, while increased homogenization speed improves stability.

Keywords: *Bacopa monnieri*; Emulsion stability; Processing conditions; *Solanum torvum* fruit saponins

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ID 50

Home gardening in Trincomalee district: A sustainable food security strategy

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Abstract:

Ensuring food security in crisis-prone regions requires sustainable and resilient livelihood strategies. Home gardening plays a crucial role in household food security, particularly among vulnerable communities. This study examines the food security status of home gardeners in Trincomalee, Sri Lanka, using the Coping Strategies Index (CSI) and explores the coping mechanisms they employ. The research assesses the socio-economic status of home gardeners, garden characteristics, the frequency and severity of coping strategies used and the contribution of home gardens to food security. A structured questionnaire survey was conducted among 100 home gardeners across four Divisional Secretariat (DS) divisions. Food security levels were assessed using the CSI, calculated by assigning severity weights to coping behaviors and multiplying them by their frequency of use. The findings highlight the significant role of home gardening in Trincomalee, with 69% of respondents engaged full-time, primarily on owned land (86%) and the majority (82%) practicing it for over a decade. Gardens are diverse, featuring vegetables, fruits and livestock integration. The CSI analysis revealed that 67% of households were moderately food secure while 17% experienced food insecurity, relying on high severe coping strategies such as reducing meal portions and skipping entire meals. Common coping mechanisms included income diversification, borrowing food and increased reliance on homegrown produce. Regression analysis reveals key factors influencing monthly income from home gardening. Among the independent variables, garden extent has a significant positive impact on income ($P < 0.001$), indicating that larger gardens generate higher earnings. Gender is also a significant, with female respondents earning less than their male counterparts ($P = 0.019$). Interestingly, part-time involvement in gardening does not significantly affect income ($P = 0.118$), suggesting full-time commitment may not be essential for substantial earnings. Moreover, membership in organizations negatively influences income, with non-membership associated with a significant decrease in earnings ($P = 0.002$). Regarding gardening experience, respondents with five to ten years of experience ($P = 0.228$) and those with over ten years of experience ($P = 0.449$) do not show significant income differences, suggesting experience alone does not necessarily translate into higher earnings. These findings highlight the role of home gardens in mitigating food insecurity by reducing dependence on external food sources and providing economic stability. Strengthening institutional support, enhancing access to resources and promoting sustainable home gardening practices are essential to further improving household food security in the region.

Keywords: Coping mechanisms; Coping Strategies Index (CSI); Food security; Home gardening

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ID 53

Extending the productive lifespan of oyster mushroom substrates using external nutrient supplementation

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Abstract:

In conventional mushroom cultivation, the productive lifespan of mushroom bags typically ends after approximately 3.5 months due to nutrient depletion within the substrate. At this stage, farmers discard spent mushroom substrate (SMS) and begin the labor-intensive process of preparing new cultivation bags. This study investigates whether external nutrient supplementation can rejuvenate SMS and extend harvesting in American oyster mushroom cultivation. The effects of two external nutrient media, pasteurized yogurt drink (PYD) and glucose solutions (GS) were assessed at three concentration levels each (2%, 3%, and 4%), alongside a control group (water only). A total of 133 SMS bags were used across all treatments, with 19 bags allocated per treatment, following a completely randomized design. Nutrient solutions were prepared by dilution in water and applied by spraying 10 ml per bed every three days over a four-week period. Environmental conditions such as temperature, humidity and light were maintained consistently. Daily observations recorded yield, contamination and mushroom quality. External supplementation successfully reactivated SMS, extending the productive period by approximately two weeks. The two-weeks average harvest per kilogram of growing media was 17.69 g (Control), 50.56 g (GS 2%), 55.09 g (GS 3%), 67.36 g (GS 4%), 60.30 g (PYD 2%), 71.37 g (PYD 3%) and 58.95 g (PYD 4%). By comparison, the conventional method yielded an average of 61.87 g over three months. The highest regrowth was observed with 3% PYD, followed by 4% GS. PYD outperformed GS, likely due to its higher nutrient and nitrogen content, although excessive concentrations promoted contamination. Economically, PYD was also cost-effective than GS. These findings demonstrate a simple, low-cost strategy for small-scale mushroom farmers to enhance substrate efficiency, increase yields, reduce input costs, minimize waste and promote environmentally and economically sustainable cultivation practices.

Keywords: American oyster mushroom; External nutrient supplementation; Fungal growth; Spent mushroom substrates; Yield longevity

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ID 55

Evidence of microplastics in commercially harvested anchovies (*Stolephorus commersonnii*) collected from Matara and Galle districts

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Abstract:

Microplastics are tiny plastic particles less than 5 mm in size. They pose a major environmental problem when contaminating ecosystems. This study was conducted to determine the presence of microplastics in commercially harvested anchovies (Haalmassa) (*Stolephorus commersonnii*) collected from Galle and Matara districts. Whole fish were digested using 68% nitric acid digestion protocols and filtered through 20µm filter papers to isolate microplastics. Filter papers with isolated microplastics were observed under a photomicroscope to identify the colour, shape, and size. Identified microplastics were confirmed using Nile red staining techniques and polymer types were identified using FTIR-ATR. All 40 samples tested positive for microplastics. Microplastic abundance was significantly higher in the Galle sample (36.55±6.9 MPs/individual) than in the Matara sample (26.80±10.6 MPs/individual). No relationship between morphometric characters (weight and length) of fish and microplastic count inside the fish. Fragment was the most dominant microplastic type (79.2%). Black was the most prominent colour in micro fragments (64% and 53% in Galle and Matara, respectively) and blue was the most prominent colour in microfibers (40% and 61% in Galle and Matara, respectively). All the microplastic films were transparent. Red, orange, yellow, green and purple microplastics were also observed in small quantities. Microplastics were categorized into three size classes based on length: small (<0.5mm), medium (0.5–1.0 mm), and large (>1.0mm) with small being the most dominant size class. According to FTIR-ART, microplastics found in anchovies included ethylene vinyl acetate, ethylene butyl acrylate, high-density polyethylene, low-density polyethylene, medium-density polyethylene and linear-density polyethylene. This study provides solid evidence that commercially important anchovies are highly exposed to microplastic-contaminated environment and further research is suggested to understand the health risk posed by consuming whole anchovies.

Keywords: FTIR-ART; Microplastics; Sri Lanka; *Stolephorus commersonnii*

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ID 56

Phenotypic variation in *Oryza rufipogon* highlights differential adaptation to dry and intermediate climatic zones of Sri Lanka

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Abstract:

Oryza rufipogon, a wild rice species with the AA genome, is closely related to Asian cultivated rice and exhibits high genetic compatibility with it. It is a perennial, primarily cross-pollinated species with photoperiod sensitivity, typically found in persistently wet habitats. Phenotypic plasticity in *O. rufipogon* enables the species to adapt to diverse and changing environmental conditions, such as variations in water availability, temperature, and soil type. This flexibility supports its survival across a wide geographic range and makes it a valuable genetic resource for improving stress tolerance, yield stability, and climate resilience in cultivated rice (*Oryza sativa*). Although *O. rufipogon* has predominantly been reported in wet and intermediate zones of Sri Lanka, this study confirms its presence in the dry zone, particularly in the Trincomalee district. This study aims to evaluate the morphological diversity of two *O. rufipogon* populations collected from Matara (Intermediate Zone) and Trincomalee (Dry Zone) districts in Sri Lanka, to identify specific traits contributing to phenotypic plasticity, potential speciation by distance and ecological adaptation. Each population was randomly sampled with 20 individuals, ensuring a minimum spacing of 5 meters between individuals to maintain the genotypic diversity. A pot experiment (42cm x 42cm x 42cm) was conducted under common garden conditions in a completely randomized design over 6 months at the Faculty of Agriculture, University of Ruhuna (Latitude 06.060337°N and Longitude 80.5681455°E) for phenotypic evaluation. The Trincomalee populations was labeled R5, and the Thihagoda population as R4. Twelve key quantitative traits and eight qualitative traits were measured. The Trincomalee population (R5) exhibited significantly greater plant height by 23.72% ($217.47 \pm 5.08a$ cm), leaf length by 41.65% ($43.2289 \pm 1.0813a$ cm), seeds per panicle by 20.29% ($60.2222 \pm 2.3647a$), panicle length by 27.59% ($30.9600 \pm 0.4713a$), culm length by 35.78% ($169.0911 \pm 4.4966a$), panicle excretion by 85.25% ($32.1961 \pm 0.7038a$) and seed length by 9.60% ($0.80 \pm 0.006a$ cm) compared to the Matara population (R4), indicating enhanced growth potential in R5 ($P < 0.05$). In contrast, no significant differences were observed in qualitative traits, suggesting a conserved morphological pattern in these descriptors. This study demonstrates significant morphological divergence in quantitative traits of the dry zone (Trincomalee) population, particularly in plant height, panicle length and seed yield, reflecting adaptive plasticity to arid environments. These findings suggest the potential utility of dry zone *O. rufipogon* germplasm in breeding climate-resilient cultivated rice. Breeding programs aimed at developing climate-resilient cultivated rice varieties can benefit from these insights.

Keywords: Isolation by distance; Morphological traits; Phenotypic plasticity; Quantitative traits; Wild rice

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ID 60

Analysis of marketing consequences of export value-added cinnamon products: A case study in small and medium scale exporters in Sri Lanka

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Abstract:

Ceylon cinnamon (*Cinnamomum zeylanicum*) is recognized as the world's largest pure cinnamon exporter, holding 90% of the global market share. Sri Lankan small and medium-scale cinnamon exporters are struggling to enhance their market position amidst increasing global competition and changing customer demands. The industry must sustain itself by developing value-added products and implementing innovative marketing strategies. This study examined the current status of exporting value-added products and conducted a SWOT analysis of existing marketing strategies to propose improvement for cinnamon value addition. Primary data were collected through a field survey using a pretested semi-structured questionnaire with purposively selected 20 sample units (small- and medium-scale cinnamon exporters) from Galle and Matara districts in Sri Lanka. Data were analysed using descriptive and inferential statistics. Results revealed that exporters are producing medicinal products (80%), bark oil (75%) and leaf oil (75%) as their key value additions. They use competitor-based pricing (90%) with distribution channels such as direct exporting (78%), distributors (35%), online marketplaces (17%), and government trade missions (21%). Promotional efforts focus on advertising (31%), digital marketing (84%), and social media marketing (64%). The one-sample Wilcoxon signed-rank test showed that perceptions of product quality ($W = 180, p < 0.001$), pricing strategies ($W = 175, p < 0.01$) and promotional effectiveness ($W = 170, p < 0.01$) were significantly affect profitability. Key significant strengths identified were product quality (mean = 3.9), efficient international distribution (mean = 4.1) and competitive pricing (mean = 4.05). Distribution challenges (mean = 3.62) and branding limitations (mean = 3.76) were noted as weaknesses. Further, rising global demand (mean = 3.81) and growth of online sales (mean = 4.38) are key opportunities. Regulatory changes (mean = 3.71) and competition from other countries (mean = 3.67) pose significant risks. The study concludes that to grow sustainably amid rising global demand and competition, the Ceylon cinnamon industry needs to enhance branding, distribution, and marketing strategies. It is suggested that awareness and knowledge dissemination programs, combined with adequate motivation, be promoted to encourage effective marketing trends and tactics.

Keywords: Cinnamon; Export; Marketing consequences; SWOT analysis; Value addition

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ID 61

Pineapple cultivation in Gampaha district: Current status, opportunities and challenges

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Abstract:

Pineapple cultivation plays a significant role in enhancing the livelihoods of farmers in the Gampaha District, contributing to their income, employment, and overall economic stability. The objectives of this study were to examine the socio-economic characteristics of pineapple growers, assess their production and marketing practices, evaluate financial aspects, identify the key challenges and explore potential opportunities associated with pineapple cultivation in this area. Data were collected using a structured pre-tested questionnaire. One hundred pineapple growers across four DS divisions were selected using stratified random sampling. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. The results revealed that most farmers (90%) grow pineapples on their own land, with an average yield of 5,063.81 kg per acre. Despite the profitability of pineapple farming, most farmers engage in it as a part-time job due to the long crop cycle of 18–24 months and economic uncertainties. This study highlights that 92% of farmers earn over Rs. 500,000 per harvest in Gampaha district, but face high production costs, limited access to quality planting materials, and fluctuating market prices. Farmers predominantly rely on wholesalers (90%) to sell their produce, with an average selling price of Rs 340 per kilogram. Labor costs are substantial, with 92% farmers hiring external labor for farming activities. A lack of insurance coverage and minimal access to extension services (92%) of farmers receive no formal agricultural guidance further constrain productivity and financial stability. Regression analysis revealed that education level ($p=0.000$), land size ($p=0.026$) and type of labor ($p=0.058$) significantly affect income from pineapple farming. The study also identifies key challenges, including high input costs and lack of government support. Opportunities exist to implement subsidized input programs, improve market price regulations and enhanced training programs to improve productivity and sustainability. Overall, pineapple cultivation contributes significantly to the livelihoods of farmers in Gampaha District. This research is timely due to the growing demand for pineapple, rising input costs and the need to improve farmer income and sustainability aimed market challenges.

Keywords: Challenges; Gampaha district; Marketing practices; Pineapple cultivation; Production cost

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ID 62

Impact of entrepreneurial competencies on the performance of agribusiness SMEs: A case study in Ja-Ela divisional secretariat division, Sri Lanka

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Abstract:

Small and medium-sized enterprises (SMEs) play a crucial role in the economic and social development in Sri Lanka and a lack of entrepreneurial competencies among SME entrepreneurs is one of the factors hindering SME performance in the Sri Lankan context. Hence, this research aimed to identify the entrepreneurial competencies that impact agribusiness SMEs' performance in the Ja-Ela Divisional Secretariat Division and to provide suggestions to develop these competencies to upgrade agribusiness SMEs in Sri Lanka. A field survey with a pre-tested structured questionnaire was conducted on a randomly selected sample of forty agribusiness SMEs from eight GN divisions in the *Ja-Ela* DS Division to collect primary data. In this research, strategic competency, organizing competency, opportunity competency, commitment competency, learning competency and relationship competency were measured as entrepreneurial competencies. SME performance was measured using percentage growth in revenue, market share, and adaptation to innovation. Data were analysed using descriptive and inferential statistical methods. The Wilcoxon signed-rank test (one sample) was used to identify significant challenges faced by SMEs, and the Spearman correlation coefficient was used to analyse the relationship between entrepreneurial competencies and demographic characteristics. Results revealed that agribusiness SMEs have a normal level of opportunity competency ($\mu=3.3$), strategic competency ($\mu=3.2$), conceptual competency ($\mu=3.4$), commitment competency ($\mu=3.3$) and organizing competency ($\mu=3.3$) while only their relationship competency ($\mu=4.0$) was high. Correlation analysis revealed that the education level of entrepreneurs impacts on opportunity ($\rho=0.382$, $p<0.05$), strategic ($\rho=0.338$, $p<0.05$) and organizing ($\rho=0.405$, $p<0.05$) competencies. Furthermore, entrepreneurs' strategic ($\rho=0.806$, $p<0.05$), opportunity ($\rho=0.733$, $p<0.05$), relationship ($\rho=0.863$, $p<0.05$), conceptual ($\rho=0.537$, $p<0.05$) organizing ($\rho=.850$, $p<0.05$) and commitment ($\rho=.635$, $p<0.05$) competencies have a direct positive relationship with performance of agribusiness SMEs. This study concludes that entrepreneurial competencies affect SME performance. However, SME owners' entrepreneurial competencies are at a low level, and it is necessary to enhance these competencies through programs such as trainings, workshops, exhibitions and associations.

Keywords: Agribusiness SMEs; Entrepreneurial competencies; SME performance; Sri Lanka

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ID 63

Development and characterization of mango seed starch-based film incorporated with pomelo peel extract as an active food package

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Abstract:

The need for sustainable alternatives to food packaging is driven by the negative environmental impacts of traditional plastic packaging. This study aimed to develop and characterize a biodegradable film based on mango seed starch incorporated with pomelo peel extract as an active ingredient for food packaging. Mango seed starch-based films were formulated with different concentrations of pomelo peel extract (0%, 1%, 2%, and 3%) and their mechanical, physicochemical, and biodegradable properties were analyzed. The solution casting technique was used to manufacture the films, employing glycerin and polyvinyl alcohol (PVA) as plasticizers. PVA acted as a cross-linking agent, to enhance film structure, and the citric acid in pomelo peel extract further reinforced cross-linking, increasing mechanical strength and stability. Results showed no statistically significant difference in film thickness between treatments, according to the results ($p > 0.05$). However, as pomelo peel extract incorporation increased from 0% to 3%, density increased from 0.1153 g/cm^3 to 0.1653 g/cm^3 , tensile strength increased from 5.36 to 9.07 MPa, water absorption significantly decreased from 882.2 ± 1.436 to 37.6 ± 1.63 . Biodegradability studies showed some films completely disintegrated after eight weeks, leaving minimal residue. These results indicate that mango seed starch films incorporated with pomelo peel extract can serve as a sustainable and biodegradable alternative to plastic packaging.

Keywords: Active food package; Biodegradable film; Mango seed starch, Pomelo peel extract

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ID 66

Optimization of the pigment production conditions and investigation of bio-active properties of newly isolated *Talaromyces albobiverticillius* genbank®pq616019.1 as a potential food colorant/food additive

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Abstract:

Talaromyces albobiverticillius, a group of fungi that synthesize pigment metabolite “Azaphilone” Generally Recognize as Safe, is an emerging organism due to its potential industrial applications. This study aimed to optimize pigment production conditions and investigate the bio-active properties of a soil-derived novel strain of *T. albobiverticillius* GenBank®PQ616019.1 isolated from *Makandawa* forest reserve, Sri Lanka as a potential food colorant. Prior to growth optimization, its mycotoxin synthesis ability was investigated using Liquid Chromatography-Tandem Mass Spectrometry (LOD 0.8 µgkg⁻¹). To optimize fermentation conditions, liquid culture flasks were tested with different concentrations of carbon sources (glucose, maltose, sucrose, lactose, dextrose, galactose and soluble starch), nitrogen sources (peptone water, yeast extract, ammonium nitrate and sodium nitrate), pH values (4, 5, 6), temperatures (22, 25, 27 °C), stirring/non- stirring conditions and fermentation times (0-240 hours). Antioxidant properties were evaluated using DPPH free radical scavenging and ferric-reducing antioxidant power assay. Antibacterial properties were evaluated using agar well diffusion method. Results revealed that *T. albobiverticillius* PQ616019.1 is non-aflatoxin synthesizing strain having optimum growth and pigment production in the presence of peptone water (Nitrogen source), at pH 5, at 25 °C with a fermentation time of 168 hours under non-stirrer conditions (significant at $P < 0.05$). Although non-significant ($P > 0.05$), growth and pigment production were optimal with lactose as the carbon source. The red-colored extracellular pigment exhibited strong ferric reducing activity (30.255 ± 0.105 mg Trolox Eq/g of dye) and moderate DPPH free radical scavenging activity (8.371 ± 0.365 mg Trolox Eq/g of dye). Antibacterial activity was observed against *Escherichia coli* ATCC8739 (9.96 ± 0.50 mm) and *Bacillus subtilis* ATCC6633 (10.84 ± 0.71 mm) at the concentration of 0.05 mg/µL. Further chemical characterization and structure elucidation of the metabolite are currently under investigation.

Keywords: Bio-active properties; Fermentation; Optimum growth conditions; *Talaromyces albobiverticillius*

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ID 68

Impact of planting material types on success of infilling in Cinnamon (*Cinnamomum zeylanicum* Blume) cultivation

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Abstract:

Infilling is a crucial agronomic practice in cinnamon cultivation as it enhances yield. However, the success of infilling depends on choosing correct planting materials and proper after care practices. Therefore, a field experiment and a survey were conducted from May to August 2024 in Beliatta and Kamburupitiya, Matara, Sri Lanka, to select suitable planting materials for infilling and identify key management changes associated with the age of cinnamon cultivation. The field experiment was conducted using Randomized Complete Block Design (RCBD) with six treatments: normal polybagged plants, normal polybagged plants with tip pruning, normal poly bagged plants treated with gibberellic acid hormone (100 ppm), super grade polybagged plants (30 cm x 25 cm), super grade polybagged plants with tip pruning and super grade polybagged plants treated with gibberellic acid hormone (100 ppm), applied across six blocks representing different ages of cultivation (0-1, 1-2, 2-3, 3-4, 4-5 and more than 5 years old) cultivations. All treatments were randomly applied in vacant patches within each block with three replicates. Plant height was recorded weekly. A survey was conducted with 40 farmers. Survey results were presented using pie charts and bar graphs, while field experiment data were analysed using the non-parametric Friedman test. Results revealed that the success of infilling in cinnamon was significantly ($p \leq 0.05$) dependent on both types of planting material and the age of cultivation. Tip pruning had a significantly positive effect ($p \leq 0.05$) increasing plant height by 41% compared to other treatments. Although success rate was 100% in all treatments, both super grade and normal polybagged plants with pruning showed significantly higher growth after infilling in the fields. Furthermore, significantly ($p \leq 0.05$) highest plant height increments were observed in 1-2 years (19%) and 4-5 years (21.5%) after field establishment. Survey results indicated that infilling declined with the age of cultivation. All farmers practiced weed control and fertilization, but lack of pest control, pruning and training and peacock damage tended to reduce infilling success. Therefore, it can be concluded that both normal and super grade polybagged plants, when tip-pruned showed significantly higher post- infill growth compared to other treatments. The optimal periods for successful infilling in cinnamon cultivation appear to be between 1–2 and 4–5 years after field establishment.

Keywords: Cinnamon plantation; Different age category; Infilling; Planting materials; Super grade polybag plants

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ID 69

Optimizing stocking density of *Catla (Catla catla)* fingerlings for sustainable yield in Bandagiriya reservoir

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Abstract:

Inland fisheries play a significant role in the food security and livelihoods of Sri Lanka, especially the culture-based fisheries (CBF) systems in Sri Lankan reservoirs that rely on regular stocking. Stocked exotic fish species such as Catla (*Catla catla*) have become one of the most popular low-cost protein sources in rural areas of Sri Lanka. Therefore, enhanced management practices are needed to maximize yields by fully harnessing the natural productivity of seasonal reservoirs. This study aimed to estimate the optimal stocking density of Catla in Bandagiriya reservoir to achieve maximum sustainable yield while ensuring the long-term sustainability of CBF. The potential yield of the reservoir was estimated using the widely established yield predictive model, the morpho-edaphic index (MEI), which predicts the fish yield based on water conductivity (μScm^{-1}) and depth (m). A strong positive correlation ($r = 0.93$, $p < 0.001$) between MEI and fish yield was observed. Based on this relationship, the optimum potential yield of Bandagiriya reservoir was predicted to be $439.94 \text{ kg ha}^{-1}$. The optimum number of fingerlings to be stocked was calculated using Cowx equation to determine the optimum stocking density in seasonal reservoirs. The estimated optimum stocking density of Catla fingerlings in Bandagiriya reservoir was $1795 \text{ fingerlings ha}^{-1}$, which is above the previously reported highest stocking density of $700 \text{ fingerlings ha}^{-1}$, suggesting that stocking density can be increased to enhance the CBF production in Bandagiriya reservoir. Based on these findings, we propose a foundational approach to optimize stocking densities for maximizing production in culture-based fisheries in Sri Lankan reservoirs, using Bandagiriya as a model system.

Keywords: *Catla catla*; Culture-based fisheries; Morpho-edaphic index; Reservoir; Stocking density

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Effect of *Acorus calamus* and *Curcuma zedoaria* as a phytoremediation plant in *Cyprinus carpio* rearing tanks in a laboratory study

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Abstract:

Maintaining water quality in small-scale ornamental fish systems is challenging, making phytoremediation a sustainable, low-cost solution. This experiment evaluated the effect of *Acorus calamus* (Sweet Flag) and *Curcuma zedoaria* (White Turmeric) as phytoremediation plants in Koi carp rearing tanks over a six-week period. Three treatments were tested: C (control without plants), AC (tanks with *A. calamus*) and CZ (tanks with *C. zedoaria*), each with three replicates. Koi carp juveniles (30 days old; 2.35 ± 0.01 cm, 0.17 ± 0.00 g) were stocked at 10 fish/ tank ($30 \times 21 \times 21$ cm), and two plants were introduced into each respective tank. Fish growth performance was assessed using length, weight, growth parameters and survival, while plant performance was assessed based on height, wet and dry weight and leaf number. Water quality parameters were monitored throughout the experiment. After six weeks, the final length of koi carp in the CZ treatment (3.31 ± 0.29 cm) was significantly greater than in the AC (3.16 ± 0.19 cm) and control (3.03 ± 0.21 cm) groups. Fish in CZ ($305.88 \pm 5.88\%$) and AC ($287.99 \pm 17.65\%$) treatments exhibited significantly higher weight gain percentages compared to the control group. Plant performance was also superior in the CZ treatment, where the final height reached 50.18 ± 6.29 cm, significantly exceeding that observed in AC (33.45 ± 1.06 cm). The final root-to-shoot ratio was markedly lower in CZ (0.26 ± 0.09) than in AC (0.52 ± 0.12), indicating a differential biomass allocation. CZ tanks exhibited significantly improved water quality on day 42 with reduced ammonia (0.67 ± 0.05 mg/L), total hardness (26.69 ± 2.31 mg/L) and conductivity (99.50 ± 2.65 ms/cm). The study concludes that *C. zedoaria* performed better than *A. calamus* in maintaining water quality in Koi carp rearing tanks.

Keywords: *Acorus calamus*; *Curcuma zedoaria*; Growth performance; Koi carp; Phytoremediation; Water quality

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ID 75

Development and quality evaluation of a peanut based pumpkin seed spread with natural flavors

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Abstract:

Pumpkin (*Cucurbita maxima*) seeds are an underutilized, nutrient-rich agricultural by-product that is often discarded as waste despite their exceptional nutritional profile. This study aimed to develop a high-quality spread utilizing pumpkin seed powder and to evaluate its physicochemical, sensory, and microbial characteristics. The experimental spreads were formulated with peanuts (*Arachis hypogea*) (68.9 g) and pumpkin seed powder (31 g) as base ingredients, with three treatments incorporating distinct natural flavouring agents: scotch bonnet pepper (2.5 g), black pepper (3 g) and garlic (2.5 g). An unflavoured formulation served as the control. Sensory evaluation was conducted with 30 untrained panellists using a 9-point hedonic scale to assess appearance, odor, texture, flavor, mouthfeel and overall acceptability. The scotch bonnet-flavoured spread was identified as the most preferred flavoured spread. Proximate analysis of the optimized spread revealed: $3.31 \pm 0.01\%$ moisture, $3.9 \pm 0.1\%$ crude ash, $31.8 \pm 0.1\%$ crude protein, $36.2 \pm 0.1\%$ crude fat, $11.4 \pm 0.1\%$ crude fiber and $16.7 \pm 0.1\%$ carbohydrates, yielding 519.8 kcal per 100 g. Compared to conventional peanut butter the product had lower fat but higher protein, ash, fiber, and carbohydrate contents. During one-month storage at ambient temperature, moisture content and water activity significantly increased ($p < 0.05$), while pH significantly decreased ($p < 0.05$). Total plate count and yeast and mold count indicated that refrigeration maintained microbial counts below Sri Lanka Standards Institution (SLSI) specifications, although preservatives would be required for extended shelf-life at room temperature. This research demonstrates a viable method for valorizing agricultural waste into a nutritionally superior food product, contributing to food security and sustainable resource utilization while offering a healthier alternative to conventional spreads.

Keywords: Flavour enhancement; Food product development; Peanut spread; Pumpkin seed; Nutritional analysis

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ID 79

Development and quality evaluation of multi grain bread using rice, mung bean and soybean

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Abstract:

Sri Lanka's bread production heavily depends on imported wheat flour, creating significant economic challenges. This study aim to explore the potential of multigrain composite flours, combining wheat, rice, mung bean and soybean flours to reduce this dependency. Four bread formulations were prepared by blending wheat flour with rice, mung bean and soybean flour in ratios of 100:0:0:0 (W_{100}), 70:10:10:10(W_{70}), 60:20:10:10 (W_{60}) and 50:30:10:10 (W_{50}) respectively. The physicochemical properties were evaluated and compared. The proximate composition (crude protein, fat, fiber, moisture and ash) was analyzed following standard AOAC methods. W_{100} bread recorded the highest specific loaf volume (4.357 ± 0.123 ml/g) and loaf volume (1841.7 ± 22.05 ml), while W_{50} showed the highest loaf weight (460.67 ± 10.35 g). Composite flour bread showed significantly ($p < 0.05$) higher crude fat, crude protein, crude fiber content of compared W_{100} , with W_{70} showing the highest values among the composite samples. Higher substitution levels increased hardness (178.3 g to 473.3 g) and adhesiveness (-1.223 mJ to -3.9 mJ), while reducing cohesiveness (0.643 to 0.49) and springiness (0.967 mm to 0.667 mm). Conversely, gumminess increased from 114.93 g to 232.1 g and chewiness from 111.50 mJ to 154.27 mJ. The pH of composite breads was significantly lower than of W_{100} ($p < 0.05$). Sensory evaluation, conducted with 30 untrained panelists using 7-point hedonic scale, identified W_{70} as the most preferred formulation. The results indicate that using a composite flour blend with 70% wheat flour and 30% rice, mung bean and soybean flours presents a promising alternative to reduce reliance on imported wheat. Further optimization for cost-effectiveness and scalability could enhance the sustainability of bread production in Sri Lanka.

Keywords: Bread; Composite flour; Consumer acceptability; Import substitution; Multi grain; Physicochemical properties; Texture analysis

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Development and shelf-life evaluation of drinking yogurt enriched with encapsulated probiotics

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Abstract:

Encapsulation is an effective approach to deliver probiotics to consumers without compromising their viability. Probiotics are sensitive to processing, storage and gastrointestinal tract conditions, often leading to cell death during production and ingestion. The study aimed to develop drinking yogurt enriched with encapsulated probiotics. Probiotics were obtained from a commercial starter culture and identified through Gram staining and catalase test. The isolated probiotics were encapsulated using the spray-drying method. Viable cells within the encapsulated beads were determined by breaking the beads with a sodium citrate solution (2% w/v, pH 7), and encapsulated probiotics were incorporated into drinking yogurt. Yoghurts were stored at 4°C for 13 days and analysed for total plate count, yeast and mold count and pH. The isolated bacteria produced cream color colonies with entire margins, were Gram-positive and catalase-negative. Encapsulated probiotics showed significantly higher survival at acidic pH (pH 3) compared to free cells with counts of $6.44 \pm 0.09 \log_{10}$ CFU/mL at pH3 and $7.39 \pm 0.12 \log$ CFU/mL at pH7, compared to the control (6.28 ± 0.03 , $7.36 \pm 0.01 \log$ CFU/mL). Both yoghurt samples showed a significant pH decrease over the 13-day storage period. Probiotic viable cell count increased significantly from day 1 to 13 for both control and encapsulated yoghurt samples. On day 13 encapsulated probiotic yogurt recorded a higher count ($6.21 \pm 0.14 \log$ CFU/mL) than the control ($6.01 \pm 0.10 \log$ CFU/mL), though, the difference was not $> 2 \log$ CFU/mL. Lactic acid bacteria counts did not change drastically, suggesting the encapsulated probiotics remain intact without being released into the yoghurt matrix, potentially enabling delivery to the large intestine. The encapsulation efficiency was 86.78%. No yeast or mold growth was detected up to day 13 confirming the products shelf life. In conclusion, drinking yogurt enriched with encapsulated probiotics to consumers.

Keywords: Drinking yogurt; Encapsulation; Probiotic

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ID 84

Impact of the Good Agricultural Practices (GAP) certification on consumer buying behaviour of fruits and vegetables: A study in Gannoruwa, Sri Lanka

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Abstract:

Good agricultural practices (GAP) certification has become a benchmark for ensuring food quality and promoting sustainable agriculture. This study aims to examine how consumer perceptions of GAP-certified produce, as along with related marketing elements, influence consumer buying behaviour. Primary data were collected from the 100 consumers of the Gannoruwa GAP-certified produce sales center using a pretested structured questionnaire and simple random sampling. Data were analyzed using partial least square structural equation modeling to assess the relationship between consumer perceptions, market elements and purchase intention. The results revealed that overall awareness, knowledge and attitude levels towards GAP-certified produce were close to a high, with mean values of 3.66, 3.34 and 3.64 respectively on a five-point Likert scale. Regarding marketing elements, the results of the Wilcoxon sign-rank test indicated that consumers prioritized environmentally friendly features and benefits over price (Mean = 3.71, $p = 0.000$) and agreed that the premium price is worth the benefits (Mean = 3.58, $p = 0.000$). Availability in preferred locations and recommendations significantly influenced purchasing decisions. Consumer perception (path coefficient = 0.020, $p = 0.958$) was not statistically significant for purchase intention. Only product market elements (path coefficient = 0.55, $p = 0.001$) and effective market communication (path coefficient = 0.213, $p = 0.015$) were significant factors influencing purchase intention. Purchase intention was positively correlated with gender (0.407, $p = 0.047$) and annual income (0.204, $p = 0.047$). However, willingness to pay extra and purchase frequency showed no significant relationship with consumer perception or marketing elements. The findings suggested that enhancing the product quality of GAP-certified produce and ensuring effective market communication can improve purchase intention, with higher sales achievable by targeting higher-income consumers.

Keywords: Consumer perception; GAP certification; Marketing elements; Purchase intention

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Effect of decolorization treatment on the gel strength of seaweed (*Eucheuma cottonii*) for food product development

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Abstract:

Seaweeds, *Eucheuma cottonii*, is widely recognized for its nutritional and industrial value due to its high content of bioactive compounds, including carrageenan. In this study, *E. cottonii* was sourced from the coastal area of Mannar, Sri Lanka, where it is cultivated by local seaweed farmers. Carrageenan, a water-soluble polysaccharide, is extensively utilized in the food industry as a gelling, thickening, and stabilizing agent. However, *E. cottonii*'s dark brown color and odor limits its food applications despite its valuable carrageenan and mineral content. This study optimized decolorization methods to preserve gel strength while effectively removing color and odor, thereby maintaining functionality. Three 3% solutions, hydrogen peroxide, sodium metabisulfite and ascorbic acid were tested in 24h ambient dips, followed by hot water extraction at 70-75°C. Hydrogen peroxide exhibited the highest gel strength among the treatments, along with effective decolorization. According to hedonic scale evaluation, it also achieved the highest deodorization scores, indicating the greatest reduction in undesirable odor as perceived by panelists. Further optimization trials tested H₂O₂ concentrations of 0.5%, 1%, and 3% over 24, 48, and 72 hours to determine the ideal balance between decolorization and gel strength. At 0.5% H₂O₂, the 48-hour dipping method was identified as optimal, achieving effective decolorization with an L value of 18.58 while maintaining a high gel strength of 0.18N. In contrast, extending the treatment to 72 hours improved decolorization slightly (L value of 20.21) but significantly reduced gel strength to 0.11N. This demonstrates that prolonged exposure beyond 48 hours compromises gel strength despite increased color removal. Treatment duration was strongly correlated with gel strength at 0.5% H₂O₂ ($r = 0.912$, $p < 0.001$), highlighting the critical role of optimizing dipping time. Therefore, 48 hours was selected as the best treatment duration to maximize decolorization while preserving the gel strength of *E. cottonii*, supporting its application in developing high-quality food products.

Keywords: Decolorization; Deodorization; *Eucheuma cottonii*; Gel Strength

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ID 86

Comparative analysis of physicochemical and functional characteristics of rice flour produced in the Ampara district and commercial brands

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Abstract:

Rice flour is an integral part of Sri Lanka's culinary tradition, yet small-scale production in the Ampara District faces challenges in standardization and competitiveness. This study compared the physicochemical, functional and sensory properties of locally produced (LPRF) and commercial rice flour (CRF). Thirty local samples were collected from major paddy-cultivation areas in the Ampara – Akkaraipattu (n=10), Nintavur (n=10) and Sammanthurai (n=10), alongside 10 commercial samples. String hoppers were prepared to assess physical properties. Sensory evaluation was performed by 30 semi-trained panelists (aged 20-50 years; 17 female and 13 male) using a 9-point hedonic scale. Data were analyzed by one-way ANOVA (SPSS Ver.25, p=0.05). LPRF, processed by semi-milling and traditional roasting, had larger particle size (>180 µm) and higher acid insoluble ash content (0.35–0.47%), exceeding SLS 913:2020 limits due to contamination. CRF had finer particles (70.58% <180 µm), higher moisture content (8.71% vs 6.15–7.05%) and superior hydration properties: water absorption index (WAI) (3.02 vs 1.81–2.02), swelling power (SP) (8.60 g/g vs 7.29–7.57 g/g) and solubility (2.94% vs 1.04–1.19%). CRF exhibited lower gelatinization temperatures (70.66°C vs 73.64–74.08°C). All samples complied with pH (5.44–5.66) and total ash (<1%) standards. String hoppers made from CRF showed higher moisture content (66.88%) and lower evaporation (17.33%). Moisture content positively correlated with finer particles (r=0.341) and hydration properties: WAI (r=0.385), SP (r=0.376) and solubility (r=0.381). Moisture evaporation negatively correlated with particle size (r= -0.486), solubility (r= -0.435), WAI (r = -0.576), and SP (r= -0.235). Sensory evaluation favored CRF for softness and smoothness, with no significant differences in color, odor, taste or overall acceptability. Improving the marketability and quality of locally produced rice flour requires improved processing, including particle size, controlled roasting and optimized drying.

Keywords: Ampara District; Contamination; Functional properties; Physiochemical properties; Quality standardization; Rice flour

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Cinnamon cultivation in Hakmana: A study of smallholder practices and economic implications

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Abstract:

Cinnamomum zeylanicum is a high-value spice with deep historical and economic significance, particularly as a major export crop in Sri Lanka. This study aimed to examine the economic aspects of cinnamon farming, focusing on input use, transportation, profitability and factors affecting income from cinnamon cultivation in Hakmana Divisional Secretariat Division in Matara. Primary data collected from 100 farmers using stratified random sampling across 12 Grama Niladhari divisions were analysed using descriptive statistics, Cost-benefit analysis and regression models. The average yield was 795.85 kg/acre/year, with the majority of farmers producing H1/H2 grade cinnamon (92%), indicating a preference for grades that meet market demands. The average cost of cultivation was Rs 1,428,372.83 per acre and income per acre ranged from Rs. 1,056,000 and Rs 4,500,000, with a mean income of Rs 2,645,486.42 per acre. Average profit was Rs 1,217,113.59 per acre with the benefit-cost ratio of 1.88. While results highlight the profitability potential of cinnamon farming, better cost control could further increase profit margins. Regression analysis revealed that land size ($p < 0.01$) and education level ($p < 0.01$) significantly influenced the income from cinnamon cultivation. Further, planting at spacings of 3 x 2 feet, 3.5 x 3.5 feet and 4 x 3 feet significantly and positively influenced the income. Moreover, cinnamon planted without any intercropping also had a significant positive effect on income ($p < 0.05$). Major challenges identified included high input costs, labor shortages and limited availability of skilled peelers. Nevertheless, cinnamon cultivation remains profitable, with most farmers relying on hired transportation, primarily lorries, to deliver products to the market. This research emphasizes the need for policies promoting mechanization, farmer education and cooperative resource access to enhance the sustainability of cinnamon cultivation.

Keywords: Cinnamon; Labor; Production cost; Profitability; Smallholders

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ID 90

Development of jam from sea lettuce (*Ulva lactuca*) and yellow passion fruit peel (*Passiflora edulis f. flavicarpa*)

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Abstract:

Seaweeds are macroalgae that grow in coastal regions and are a good source of nutrients. However, they are rarely used in functional foods. Therefore, this study aimed to enhance seaweed consumption as a functional food among Sri Lankans by developing a seaweed-incorporated jam. The marine seaweed, *Ulva lactuca*, collected from Thalalla rocky shore area of the Southern coast of Sri Lanka, was thoroughly washed, cleaned with water several times and pre-treated with hot-water blanching. Jam was prepared by mixing *Ulva* with different fruit pulps, namely mango, pineapple and passion fruit peel. Preliminary sensory evaluations identified yellow passion fruit peel as the most suitable fruit pulp for incorporation with *Ulva*. A series of jam samples were developed using different ratios of air-dried (ADT₁₋₄) and oven-dried (ODT₁₋₄) *Ulva* powder with fruit pulp and sugar. The ratios for ADT₁₋₄ were 1:1:2, 1:2:3, 1:3:4 and 1:4:5, while those for ODT₁₋₄ were 1:8:10, 1:9:11, 1:10:12 and 1:11:13. The best ratio was selected through sensory evaluations conducted by 37 untrained members, assessing appearance, texture, taste, sweetness, aroma, spreadability, and overall acceptability using a five-point Hedonic scale. Sensory data revealed that jam prepared with oven-dried *Ulva* powder, yellow passion fruit peel pulp and sugar in a 1:9:11 ratio (ODT₄) was significantly preferred. This jam contained 33.51% moisture, 3.89% total minerals, 0.17% crude fat, 8.61% crude fiber, 4.56% crude protein and 49.03% carbohydrate, with an energy content of 215.85 kcal/g. It also showed that a total antioxidant capacity of 61.68 mg AAE/g, 65.30 ± 1.07 °Brix and pH 6.15. Shelf-life studies indicated that the product remain consumable for over three weeks under refrigerated conditions (4 °C). In conclusion the developed seaweed-based fruit jam offers an affordable, nutrient-rich and novel confectionary product for consumers.

Keywords: Dried seaweed; Functional food; Jam; Sensory evaluation; *Ulva lactuca*

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ID 94

Geospatial approaches for enhancing crop productivity and soil health: A GIS-GPA based framework for climate adaptation in agricultural systems

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Abstract:

Agricultural systems worldwide are increasingly vulnerable to climate-induced stresses, yet there remains a lack of integrated GIS-GPS frameworks tailored for site-specific climate adaptation. This study aims to develop a GIS-GPS-based framework for site-specific crop and soil management under climate stress, applying geospatial intelligence to enhance resilience and sustainability in agricultural practices. Geographic Information Systems (GIS) were used to assess spatial variability in land use, soil characteristics, topography, and climate patterns, while Global Positioning System (GPS) tools enabled precision field mapping and real-time tracking of crop and soil conditions. The methodology included NDVI analysis, spatial interpolation and thematic mapping to identify zones of soil degradation, nutrient deficiency and climate vulnerability. Results revealed significant spatial heterogeneity in soil pH, organic matter content, and moisture retention capacity. Crop yield improved by 20%, and input costs were reduced by 15%, demonstrating the framework's potential in real-world settings. These improvements correlated strongly with geospatially mapped zones of soil health and management intervention. The findings suggest that integrating GIS-GPS technologies enables more informed, site-specific decisions in land and resource management, allowing farmers to adapt on both spatial and temporal variability. The study concludes that embedding geospatial approaches in agricultural planning significantly enhances soil stewardship and crop resilience under changing climatic conditions. It further recommends institutional support for GIS-GPS-based decision-support systems, capacity building for extension services and the development of open-access geospatial databases to promote data-driven adaptation strategies. Overall, the proposed geospatial framework provides a scalable, practical, and evidence-based solution to support sustainable food production systems in climate-stressed agricultural environments.

Key words: Agricultural systems; Crop growth; Geospatial; GIS; GPS; Soil

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ID 95

Grain quality attributes of different rice varieties affected by different rates of nitrogen

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Abstract:

The study was conducted at the Rice Research and Development Centre, Bombuwala, to evaluate the effects of varying nitrogen fertilizer rates on the grain quality of rice. Three nitrogen levels (0, 50 and 100 kg N/ha) were applied to seven rice varieties (Bw 372, Bw 367, Bw 363, Bg 359, Bw 312, Bg 300 and Bw 272-6b) using a split plot design with three replicates. Physical, biochemical, nutritional and functional quality attributes of rice grains were assessed in response to nitrogen application. Results showed that the interaction between rice variety and nitrogen level significantly influenced grain quality traits. Increased nitrogen rates improved several grain quality attributes, including brown rice percentage, thousand seed weight, hardness, protein content, phenol content, flavonoid content and gelatinization temperature. However, iron (Fe) content decreased with higher nitrogen application while ash content remained unchanged. Among the rice varieties, Bg 300 exhibited the highest brown rice percentage (81.80 ± 0.37 %) and thousand seed weight (26.923 ± 1.43 g) at all nitrogen levels tested. Variety Bw 272-6b" was identified as the most protein-rich variety across all the treatments, with 9.613 ± 0.02 %. Bw 312 demonstrated the highest hardness (64.433 ± 1.78 N), while Bw 372 and Bw 363 consistently showed high gelatinization temperatures (fscore value = 1). BW 312 also recorded the highest phenol content (160.266 ± 13.71 mg Gallic Acid Equivalent/100g). Notably, Bg 300 had the highest total flavonoid content (132.566 mg Quercetin Equivalent/100 g extract) at 100 kg N/ha, while Bg 367 showed the highest antioxidant content (69.166 Trolox mM/g) under no nitrogen application. In conclusion, applying nitrogen fertilizer, particularly at 100 kg N/ha, significantly enhances several physical and biochemical traits, although it may reduce iron content. The findings support the use of appropriate nitrogen levels to optimize rice grain quality depending on the variety and desired quality attributes.

Keywords: Eating qualities; Functional properties; Nutritional properties; Physical properties

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ID 106

Formulation of a fiber-enriched instant soup mixed with pumpkin peel and evaluation of physicochemical, nutritional characteristics and storage stability

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Abstract:

Recently, there has been growing interest in utilizing fruit and vegetable by-products for food product development. This study investigates the potential of pumpkin peel (PP), a fiber-rich by-product abundant in minerals, polyphenols and antioxidants, as a functional ingredient in the formulation of an instant soup mix. Five vegetable soup mix samples were formulated using potato flour as the base material, substituted with PP at five levels: 0%, 25%, 50%, 75%, and 100%. The best formula was selected based on sensory evaluation with 30 semi-trained panelists, and its physicochemical properties and storage stability were subsequently analyzed. The results revealed that 50% substitution of potato flour with PP was the most preferred sample in terms of taste and other sensory attributes, comparable to the control. Furthermore, the addition of PP significantly increased ($p < 0.05$) the crude fiber (7.50%), total dietary fiber (9.9%) ash content (22.72%) phenolic content and antioxidant capacity, while reducing the carbohydrate content (51.30%) compared to a control. No significant differences ($p > 0.05$) were observed in moisture content, pH, viscosity, or L^* value between the control and PP-enriched samples. However, PP incorporation significantly decreased the a^* value (from 2.29 ± 0.13 to 1.58 ± 0.09) and increased the b^* value (from 21.47 ± 0.89 to 23.37 ± 0.27), indicating a shift towards a more yellowish color. Storage studies conducted over three months at 25 °C revealed reductions in moisture content, pH, viscosity and color parameters (L^* , a^* , b^*) in the PP-added sample, while microbial counts remained within safe limits. In conclusion, pumpkin peel flour demonstrates potential as a functional ingredient in instant soup formulations by enhancing fiber content, nutritional quality, and storage stability. The valorization of such agro-industrial by-products supports sustainable food production and promotes environmental sustainability.

Keywords: Antioxidant; Dietary Fiber; Fruit and vegetable by-products; Functional food

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ID 111

Enhancing crop safety and nutritional quality through precision fertilization: Mitigating anti-nutrients and toxic metal uptake in food crops; a systematic review analysis

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Abstract:

Precision fertilization constitutes an innovative paradigm in crop nutrient management, emphasizing site-specific and plant-specific optimization of nutrient inputs. Despite its growing application, a comprehensive understanding of its potential to mitigate anti-nutritional factors and toxic metal uptake remains underexplored. This review addresses this gap by evaluating the impact of precision fertilization on reducing these harmful substances, with a focus on food safety and sustainable agriculture. A systematic review was conducted following PRISMA guidelines, analyzing peer-reviewed studies published between 2016 and 2024. Anti-nutrients and toxic metals are prevalent contaminants that adversely affect human health and nutritional quality. Conventional fertilization practices and the impurity profiles of fertilizers often exacerbate these issues through imbalanced nutrient supply and environmental interactions. In contrast, precision fertilization aims to enhance nutrient use efficiency by tailoring nutrient applications based on real-time assessments of soil and crop conditions, thereby reducing the uptake of undesirable substances. Recent advancements in precision agriculture technologies-comprising soil nutrient sensors, variable rate application machinery and advanced data analytics facilitate the implementation of these targeted nutrient management strategies. Integration of soil health diagnostics with crop monitoring enables precise modulation of fertilization practices according to geospatial and temporal variability within fields. Empirical evidence from case studies demonstrates that precision fertilization can reduce the accumulation of harmful compounds in edible plant tissues by improving nutrient uptake efficiency. This not only enhances crop yield and quality but also contributes to lowering the concentration of undesirable substances. Additionally, precision fertilization supports sustainable agriculture by minimizing nutrient runoffs, reducing environmental pollution and preserving soil health. The review highlights the need for further interdisciplinary research to optimize precision fertilization protocols across diverse agro-ecosystems and promote safer, more sustainable food systems.

Keywords: Anti-nutrient; Nutrient management; Precision fertilization; Sustainable agriculture; Toxic metals

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ID 115

Effects of fertilizer type and fruit diameter on firmness of pickled gherkin (*Cucumis sativus* L.) during vinegar fermentation

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Abstract:

Cell wall-modifying enzymes, activate during fruit development or triggered by environmental conditions such as heat and apoplastic pH changes, degrade structural polysaccharides like pectin leading to reduced fruit firmness, a key quality trait in pickled products. This study aimed to evaluate the combined effects of fertilizer type and fruit diameter on the firmness of pickled gherkin. The experiment was conducted at the University of Ruhuna using two-factor factorial arrangement in a completely randomized design (CRD) with five replicates. The first factor was fertilizer type (urea and calcium nitrate-CN), and the second was fruit diameter (11 mm, 12 mm, 13 mm and 14 mm), forming eight treatment combinations: T₁-Urea,11 mm; T₂-Urea,12 mm; T₃-Urea,13 mm; T₄-Urea,14 mm; T₅-CN,11 mm; T₆-CN,12 mm; T₇-CN,13 mm; and T₈-CN,14 mm. After fruit setting, grade 1 gherkin fruits (standard fruit diameter 11- 14 mm) were harvested and fermented in vinegar. Firmness was measured using a digital force gauge after 45 days of fermentation. Data were analyzed using two-way ANOVA, and means were compared using Duncan's Multiple Range Test at a 5% significance level. The interaction between fertilizer type and fruit diameter had a highly significant effect on firmness ($p = 0.0006$), indicating a diameter-specific fertilizer response. However, neither fertilizer type nor fruit diameter alone had a significant effect ($p > 0.05$). The significantly highest firmness (22.07 N) was observed in urea-treated fruits at 14 mm (T₄). CN maintained consistent firmness (18.00–18.75 N) across 11–14 mm with low variability, while urea showed lower firmness at 11–13 mm (16.3- 17.0 N) but increased sharply at 14 mm, with higher variability. Therefore, when harvesting grade 1 gherkin fruits, it is recommended to harvest fruits with diameters of 11 to 14 mm when using CN, while only fruits with a diameter of 14 mm should be harvested when using urea to ensure optimal firmness during vinegar fermentation.

Keywords: Calcium; Cell wall; Firmness; Grading; Vinegar

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ID 119

Carbon sequestration through vegetative infrastructure (BVIs): A climate-smart approach towards sustainable environment

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Abstract:

Although cities significantly contribute to global carbon emissions, they also have significant potential to function as carbon sinks through building-integrated vegetative infrastructures (BVIs), such as green roofs, green walls and vertical terraces. These represent climate-smart engineering solutions that can enhance carbon sequestration (CS), though research on their effectiveness remains limited. The study aimed to (1) evaluate the CS potential of various BVI types, including green roofs, green walls and vertical terrace and (2) understand stakeholder perceptions and the factors influencing BVIs. Three buildings integrated with BVIs and located in urban environments were purposively selected for field data collection, including plant height, canopy area, base height and diameter, that were required for quantifying CS. Calculations were conducted individually for different selected types of structures per area and per time. The i-Tree Eco tool was used to quantify CS, carbon storage, and pollution removal. Semi-structured interviews were conducted with 40 professionals, including architects, civil engineers, quantity surveyors and sustainability officers those most responsible building construction to assess their awareness, experience and perceptions regarding BVI implementation using five-point Likert scale. Results indicated that vertical terraces exhibited the highest CS rates (1.326–3.81 kg/m²/year), followed by green walls (0.749–4.62 kg/m²/year) and green roofs (1.889 kg/m²/year). While awareness of BVI for CS was relatively high, practical experience remained limited (Wilcoxon signed-rank test, Friedman test). The hotels and office sectors emerged as the most suitable for BVI adoption, whereas the educational and manufacturing sectors faced structural and financial constraints (Wilcoxon signed-rank test). Experts expressed the importance of long-term evaluation methods, such as benefit-cost ratio and net present value, to justify sustainable investments over short-term gains (frequency-analysis). This study highlights the urgent need for scale up nature-based solutions that strengthen urban sustainability and support climate-smart design and policy against climate change.

Keywords: Carbon sequestration; Environmental sustainability; Green infrastructure; Sustainable designs; Urban climate adoption; Vertical greenery

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ID 122

Optimized *in vitro* seed culture for disease free propagation of curry leaf

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Abstract:

Curry leaf (*Murraya koenigii*) is a valuable plant for both culinary and medicinal purposes, preliminary due to its unique aroma, flavour and bioactive compounds. This semi-hardwood species in tropical and subtropical regions, however faces challenges in conventional propagation due to bacterial, fungal and viral infections. These pathogens reduce yield and disrupt genetic fidelity, affecting desirable traits such as aroma, disease resistance and overall vigor. Although, seed propagation is preferable to vegetative methods, it remains susceptible to contamination. *In vitro* seed culture presents a viable solution by enabling seed sterilization and cultivation in a controlled, aseptic environment, thereby eliminating external and some internal contaminants. This approach supports the propagation of disease-free, true-to-type seedlings and helps conserve elite genotypes. To develop a standardized *in vitro* seed culture protocol, seeds were collected from fully ripened berries of premium, export-grade curry leaf plants in Jaffna. A total of 108 replicates were used in the experiment applying 10% and 15% Clorox concentrations with three exposure times: 10, 15 and 20 minutes. The most effective treatment was 15% Clorox for 20 minutes, yielding the highest survival and contamination-free rate of 78% ($P < 0.05$). Germinated seedlings were then cultured for shoot proliferation under various hormonal treatments, including 2.0 mg/L, 2.5 mg/L, and 3.0 mg/L 6-Benzylaminopurine (BAP) combined with 0.5 mg/L Naphthaleneacetic acid (NAA). Among them, 2.5 mg/L BAP with 0.5 mg/L NAA produced the maximum number of shoots per explant (6) after eight weeks, significantly outperforming other treatments ($P < 0.05$). These findings, validated through SAS software using ANOVA and Duncan Multiple Range Test (DMRT) analysis, demonstrate that *in vitro* seed culture with optimized protocols enables large-scale propagation of genetically stable, disease-free curry leaf plants, boosting both commercial viability and export potential.

Keywords: Curry leaf; *In vitro* propagation; *Murraya koenigii*; Seeds sterilization; Shoot proliferation

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ID 125

Farmers' awareness and adaptive crop-soil management to rainfall variability in Kurunegala paddy cultivation

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Abstract:

Paddy cultivation in Sri Lanka is highly dependent on rainfall patterns, economic resources and temperature changes. Changes of these factors influence the adaptability of agriculture. This research evaluated farmers' awareness of changing rainfall patterns, their impacts on cultivation and the adaptation strategies employed. The study was conducted in two Divisional Secretariat (DS) Divisions, Kuliyaipitiya West and Kurunegala, in the Kurunegala District, using a multistage sampling method to select 100 paddy farmers. Data were collected through a structured questionnaire covering demographic factors, cultivation practices, observations of rainfall pattern, impacts on yield, adaptation strategies and challenges faced. Statistical analysis was performed using SPSS software. Results showed that years of farming experience did not significantly influence farmers' awareness of rainfall variability, adoption of adaptation strategies, or the type of government support (fertilizer, seeds, plant protect chemical) requested. Independent t-tests comparing adopters and non-adopters of strategies such as adjusting planting time, using resistant varieties and water management yielded p-values greater than 0.43, indicating no significant differences. A one-way ANOVA examining farming experience among farmers requesting fertilizer subsidies, high-quality seeds, cash assistance, or other aid showed no significant variation ($F(3,41) = 2.747$, $p = 0.055$), with post hoc tests confirming similarity ($p = 0.069$). Most farmers reported irregular rainfall and yield reductions. The main barriers to effective adaptation were limited financial resources and technical knowledge, restricting farmers' ability to invest in necessary inputs for paddy cultivation. Overall awareness of rainfall variability and the responses to it were consistent among farmers, regardless of their level of experience. The study highlights the urgent need for government involvement, improved access to climate information and farmer training programs to mitigate the adverse effects of rainfall variability on paddy cultivation.

Keywords: Adaptation strategies; Farmers' awareness; Government intervention; Paddy cultivation; Rainfall variability

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ID 127

Exploring the entrepreneurial potential of *Adenium obesum* cultivation in the southern dry zone of Sri Lanka

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Abstract:

Adenium obesum (Desert Rose), known for its striking form and adaptability to arid conditions, is gaining popularity in the global ornamental horticulture industry. Despite this rising demand, its commercial potential in Sri Lanka remains underexplored, particularly in the Southern Dry Zone (annual rainfall 1,200–1,900 mm; pronounced dry season from March to August), which offers ideal climatic conditions for cultivation. This study explores the entrepreneurial opportunities and cultivation potential of *A. obesum* in the Southern Dry Zone of Sri Lanka. A survey was conducted among floriculture farmers (n = 96) from May to August 2024, targeting those currently engaged in flower and ornamental plant cultivation. Participants were selected using a purposive sampling, and data were collected through a pre-structured questionnaire. Analysis was performed using SPSS software as for a one-sample proportion test at $P < 0.05$. Among respondents, 9.3% reported floriculture as their primary source of income and more than half (56.5%) ($P < 0.05$) had been engaged in the industry for over five years. However, the majority operated solely in the local market (90.9%) ($P < 0.05$) and 54.2% recognized *A. obesum* as a commercially promising species. All participants expressed interest in technical training on propagation and maintenance for its cultivation. Key barriers identified were limited market access (58.3%), inadequate financial support (29.2%) and land constraints (12.5%). Globally, the export market for *A. obesum* recorded 46% growth in value 2024 compared to 2023. Given the regions dry climate and available labour force, the Southern Dry Zone hold strong potential for developing this species as an export crop. However, limited market access and low financial capacity remain major constraints. Farmers indicated that improving market linkages and financial support could address over 87% of the challenges to commercializing and exporting *A. obesum* in the region.

Keywords: *Adenium obesum*; Commercial propagation; Dry zone agriculture; Entrepreneurship; Floriculture

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ID 128

Feature sensitivity and interpretability in AI-driven rice yield prediction: A systematic review

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Abstract:

Paddy yield prediction has become increasingly critical in the context of global food security and climate variability. Artificial-Intelligence (AI) and machine learning (ML) provide powerful tools for improving prediction accuracy, but selecting and interpreting input features remain challenging due to complex agro-environmental interactions. This review aimed to (1) categorize critical features used in AI-based models, (2) assess the influence of various parameters on paddy yield predictions and (3) evaluate methodologies applied in feature selection and sensitivity analysis. A structured review of 89 peer-reviewed studies from Google Scholar was conducted using PRISMA guidelines, with data extracted to address four research questions. The review found that the most commonly used features fell into eight categories: climatic, soil, crop phenotypic, remote sensing, management, geospatial, temporal and stress/environmental factors. Rainfall and temperature were the most frequently used meteorological inputs, appearing in over 90% of studies. Evapotranspiration and cumulative rainfall were especially impactful in water-stress contexts. The importance of meteorological features varied by crop season, region, and irrigation practices, rainfall dominated in rain-fed systems, while temperature or vegetation indices were more influential in irrigated settings or during later crop stages. A wide range of feature selection and sensitivity analysis techniques was applied, including correlation-based methods (Pearson, Spearman), statistical techniques (stepwise regression, t-tests, RFE, GAM), and model-intrinsic scoring tools (Gini index, SHAP, attention weights). Performance impact methods such as LOOCV, feature shuffling and ablation studies were also used, along with dimensionality reduction (PCA) and optimization algorithms (GA, PSO, SCA). Key challenges included high dimensionality, feature redundancy, temporal-spatial variability, poor data quality, lack of model interpretability and inconsistent reporting. Best practices identified included feature pre-screening (PCA), adopting temporally aware models like LSTM, applying explainable AI tools (SHAP, LIME, PDP), combining expert judgment with algorithmic selection, and ensuring standardized, interpretable reporting for better reproducibility and decision-making in sustainable agriculture. These insights underscore the need for integrative, explainable and context-specific AI approaches to enhance the reliability of rice yield forecasting and support evidence-based decision for climate-resilient, sustainable agriculture.

Keywords: Artificial Intelligence; Feature Selection; Machine Learning; Parameter Importance; PRISMA guidelines

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ID 129

Optimizing the surface sterilization protocol for *in vitro* culture of ginger (*Zingiber officinale* Rosc.)

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Abstract:

Ginger is a widely cultivated tropical plant renowned for its culinary, medicinal, and economic significance. Rhizome buds of ginger are commonly used as explants in micropropagation, a technique employed to rapidly produce disease-free planting material. However, these buds are often heavily contaminated with soil-borne microbes, making surface sterilization a critical step in the successful establishment of *in vitro* culture establishment. This study aimed to develop an effective surface sterilization protocol that minimizes contamination while maintaining high explant viability. The rhizome buds measuring 0.5–1.0 cm in length were subjected to a multi-step surface sterilization process. Initial washing was carried out using a detergent (Teepol) and a surfactant (Tween 20), followed by treatment with 30% Thiram fungicide for 30 minutes. Subsequently, the buds were immersed in 70% ethanol for 2-3 minutes and exposed to 30% sodium hypochlorite (Clorox) under two-time regimes. In the first treatment, Clorox was applied for 10 minutes, replaced with a fresh solution and applied for another 10 minutes using 102 buds. In the second treatment, the same procedure was followed with 15-minute exposures each time using 92 buds. Each Clorox treatment was followed by 2–3 rinses with sterile distilled water. After final trimming, the buds were re-dipped in 70% ethanol for 5–10 seconds and immediately washed with sterile distilled water. The experiment was conducted using a Completely Randomized Design. Results indicated that the 30% Clorox treatment for 15 minutes, applied twice, was the most effective surface sterilization protocol achieving the highest survival rate (67.39%) and the lowest contamination rate (30.43%) while minimizing plant mortality. These findings highlight the importance of extended, repeated, time-regulated sterilization steps over a single prolonged exposure for effective surface sterilization without compromising explant viability.

Keywords: Clorox, *In vitro* propagation; Rhizome buds; Soil-borne pathogen; Spices

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ID 130

Evaluation of coconut flour incorporated muffin mix: Shelf-life evaluation with respect to chemical, sensory and microbial changes

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Abstract:

Defatted Desiccated Coconut Flour (DDCF) is a gluten-free, high-fiber, low-carbohydrate ingredient derived from virgin coconut oil production. This study evaluated the quality and shelf life of an instant muffin mix (IMM) containing 40% (w/w) DDCF and 60% (w/w) wheat flour (previously optimized formulation), stored in Kraft paper and aluminum pouches, compared to a control mix made with 100% wheat flour. Key components like moisture, ash, protein, fat and crude fiber were analyzed using AOAC methods. Over 42 days, changes in free fatty acids (FFA), peroxide values, microbial counts and moisture content were monitored. Sensory evaluation involved 30 semi-trained panelists using a 5-point hedonic scale, with data analyzed by one-way ANOVA in Minitab 22. The DDCF muffin mix contained higher moisture ($6.87 \pm 0.22\%$), protein ($8.72 \pm 0.00\%$), fiber ($1.03 \pm 0.18\%$), fat ($1.31 \pm 0.20\%$) and ash ($2.49 \pm 0.06\%$) than the control mix. After storage DDCF muffin mix, the FFA value was lower in the Kraft paper pouch ($0.05 \text{ mg NaOH/g oil}$) than in the aluminum pouch ($0.06 \text{ mg NaOH/g oil}$), both below the acceptable limit of $<0.2 \text{ mg NaOH/g oil}$. At 42 days, moisture was higher in the aluminum pouch ($5.95 \pm 0.33\%$) compared to the Kraft paper pouch ($5.80 \pm 0.60\%$). Total plate counts were also higher in the aluminum pouch ($6.01 \times 10^2 \text{ CFU/g}$) than in the Kraft paper pouch ($4.70 \times 10^2 \text{ CFU/g}$), but both were below the standard limit of $<10^4 \text{ CFU/g}$. Yeast and mold growth at 42 days was greater in the aluminum pouch ($5.88 \times 10^2 \text{ CFU/g}$) versus the Kraft paper pouch ($5.40 \times 10^2 \text{ CFU/g}$), remaining below the standard limit of $1 \times 10^3 \text{ CFU/g}$. Peroxide values remained undetectable throughout the storage period. The DDCF muffin mix showed significantly better nutritional composition than the control mix, and a Kraft paper pouch is recommended for storage.

Keywords: Coconut flour; Instant muffin mix; Packing materials; Shelf-life evaluation

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ID 131

Development and quality evaluation of functional bread fortified with dietary fiber extracts from coconut kernel

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Abstract:

This study explored the development of functional bread fortified with dietary fiber from Defatted Desiccated Coconut Residue (DDCR), a fiber-rich by-product of virgin coconut oil production. Given the growing interest in sustainable foods, DDCR is a valuable source of soluble and insoluble dietary fiber. The research aimed to isolate dietary fiber from DDCR and evaluate the quality, nutritional value, and sensory acceptability of bread formulations fortified with it. Dietary fiber extracted from DDCR was analyzed for quality parameters, including free fatty acid content, peroxide value and water absorption capacity. Bread samples were made by partially replacing wheat flour with DDCR dietary fiber at levels of 2.5%, 5% and 10%, and were evaluated against a control (100% wheat flour) for proximate composition, physical properties and sensory attributes. DDCR dietary fiber showed low free fatty acid (0.43 ± 0.02) and peroxide value (1.92 ± 0.09), high total dietary fiber (80.11 ± 1.36) and significantly higher water absorption capacity (693.26 ± 16.66) compared to wheat flour (94.60 ± 29.30). Bread with 2.5% dietary fiber had significantly higher moisture (39.8 ± 2.66), fat (2.05 ± 0.46) and crude fiber (0.82 ± 0.15) than the control. Sensory scores for taste (3.75 ± 1.01), texture (3.68 ± 0.78) and overall acceptability (3.84 ± 0.62) were significantly higher in the 2.5 % dietary fiber-fortified bread compared to the control and other dietary fiber-incorporated breads. The textural properties and baking characteristics of this bread were not significantly different from the control. In conclusion, 2.5% DDCR dietary fiber is a promising ingredient for enhancing bread nutrition while maintaining consumer acceptability.

Keywords: Bread; Coconut; Defatted Desiccated Coconut Residue; Dietary fibre fortification; Functional food

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ID 140

Effects of various drying methods on the physical and nutritional characteristics of carrot powder

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Abstract:

Drying vegetables enhances their value by reducing moisture content and inhibiting microbial growth, thereby extending shelf-life. It minimizes post-harvest losses and enables off-season availability. However, drying methods can significantly affect the properties of dried vegetables. Among root crops, carrot holds high nutritional and economic importance. This study evaluates the impact of four drying methods on the physical and nutritional characteristics of carrots. Cleaned samples were dried using four different drying methods: freeze drying (FD), cabinet drying (CD), microwave drying (MD), and oven drying (OD), followed by characterization of the ground powder, with statistical analysis performed using R (version 4.2.1) software was used for statistical analysis. Based on the analysis, the moisture content of the fresh sample ($85.78 \pm 0.49\%$) decreased through drying, with powders ranging from 8 to 9.6%, where CD samples had the lowest. Ash content of raw carrots was $2.20 \pm 0.07\%$ (wet basis) and ranged from 2.56% (FD) to 3.66% (OD) in dried powders. Protein content increased after dehydration, ranging from 7.15% to 8.9% (wet basis), with no significant differences ($p > 0.05$) across different drying methods. Fat content of fresh carrots ($1.22 \pm 0.14\%$ dry basis) increased to 4.7%–9.8% after drying, with the highest value in FD samples. Crude fiber in fresh carrot was $43.17 \pm 0.43\%$ (dry basis), which decreased to 6.44%–8.51% after drying. Carbohydrate content increased from $22.43 \pm 0.43\%$ (raw dry basis) to 64%–68% in dried samples. Total phenolic content (TPC) of raw carrot was 46.55 ± 1.5 mg Gallic acid equivalent/100 g (wet basis), with no significant differences in TPC ($p > 0.05$) across dried samples. Total flavonoid content (TFC) was 3.01 ± 0.21 mg Quercetin equivalent/100 g (raw, wet basis) and ranged from 3.98 to 10.69 in dried samples. Color analysis using L^* , a^* , and b^* values showed that OD had the highest lightness (62.61 ± 0.39), while CD was best preserved redness (28.76 ± 0.1). Among the methods evaluated, CD was found to be the most found to be most suitable for producing carrot powder, offering an optimal balance of nutritional quality, making it ideal for extended storage and health-focused applications.

Keywords: Bioactive compounds; Carrot powder; Color parameters; Drying methods; Proximate composition

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ID 141

Substrate composition influences growth performance of Dwarf Rotala (*Rotala rotundifolia*)

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Abstract:

The aquatic plant *Rotala rotundifolia*, commonly known as dwarf rotala, is valued for its ornamental and medicinal properties. Substrate composition influences plant growth in height and colonization, which is important for commercial propagation. This study investigated the impact of substrate composition on growth performance by evaluating four substrate mixtures: paddy soil: top soil (1:1) as the control, and paddy soil: top soil combined with either gliricidia, cow dung or coconut coir in a 5:4:1 ratio. One healthy apical stem of *R. rotundifolia* (6.3cm) was planted in each plastic pot containing 1.5 inches of respective mixture, with water levels maintained below the substrate interface. Each treatment had four replicates. Plants were grown under natural light for three weeks. Plant growth performance was assessed based on total height, wet and dry weights and leaf characteristics. Plants cultured in the control and cow dung treatments showed the significantly ($p < 0.05$; One way ANOVA) higher total plant height (18.34 ± 1.41 cm and 18.08 ± 0.50 cm, respectively) and shoot height (14.00 ± 1.29 cm and 13.16 ± 1.28 cm, respectively) compared to the other two treatments. However, the number of leaves, wet weights of the plants, wet weights of the shoots and roots were not significantly different among treatments. The highest percentage of shoot dry weight ($86.43 \pm 3.38\%$) and lowest percentage of root dry weight ($13.56 \pm 3.38\%$) were observed in the control treatment. Therefore, a substrate composition of paddy soil: top soil (1:1) is recommended for optimal growth performance of *R. rotundifolia*.

Keywords: Dwarf Rotala; Medicinal; Ornamental; *Rotala rotundifolia*; Substrate

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ID 143

Study about the natural oral rehydration solution from watermelon

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Abstract:

This study developed a natural fruit-based Oral Rehydration Solution (ORS) using watermelon powder, which is hydrating and nutritious due to its natural sugars, potassium and bioactive compounds. Watermelon is often produced in excess, leading to waste. Using it to make ORS helps reduce losses, adds value and promoting sustainability. The research aimed at formulate a viable ORS using watermelon powder, sodium chloride (NaCl) and sodium bicarbonate (NaHCO₃) to meet the World Health Organization (WHO) recommended electrolyte equilibrium, osmolarity and pH standards. Three formulations were prepared by varying the proportions of the ingredients in 1 L distilled water. The amounts used were 15g, 20g and 25g of watermelon powder; 2.5g to 3g of sodium chloride; and 2g to 2.5g of sodium bicarbonate. Watermelon powder was prepared by freeze-drying fresh watermelon pieces. The measured values for each formulation were: 15g watermelon powder-Osmolarity 232 ± 2.1 mOsm/L, pH 6.6 ± 0.1 , Glucose 13.2 ± 0.3 g/L, Potassium 18 ± 1.1 mmol/L. 20g watermelon powder: Osmolarity 243 ± 1.8 mOsm/L, pH 6.9 ± 0.2 , Glucose 15.4 ± 0.4 g/L, Potassium 19 ± 1.3 mmol/L. (25g watermelon powder: Osmolarity 249 ± 2.5 mOsm/L, pH 7.3 ± 0.1 , Glucose 17.8 ± 0.2 g/L, Potassium 20 ± 1.0 mmol/L. Among them, Formulation 20g of water melon powder formulation was the most suitable. Formulations with 15g and 20g were within the normal range, whereas the 25g formulation slightly exceeded the osmolarity limit, affecting absorption efficiency, because it was within WHO limits (≤ 245 mOsm/L, Glucose 13–20 g/L, Potassium 15–25 mmol/L, pH 6.5–7.5), with best taste, stability and electrolyte balance. The study concludes that watermelon powder is a viable, natural and health-promoting alternative for ORS production and recommends further clinical trials be carried to establish its large-scale feasibility.

Keywords: Dehydration; Electrolytes; Natural formulation; Oral rehydration solution; Watermelon powder

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ID 150

Price behaviour of selected marine fish species in Colombo market Sri Lanka

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Abstract:

In Sri Lanka, fish provide about 50% of the animal protein consumed, which is nearly three times the global average. The country's fisheries, including marine, inland and aquaculture sectors, play an important role in food security and livelihoods. However, significant price fluctuations have impacted stakeholders such as fishers, traders and consumers. This study analyses price trends and seasonal patterns of selected six fish species (large pelagic and small pelagic) consumed by Sri Lankans and available in Colombo market. Monthly retail prices from January 2014 to December 2024, obtained from the Hector Kobbekaduwa Agrarian Research and Training Institute, were used to develop a forecasting model for better market insights. The Augmented Dickey-Fuller (ADF) test confirmed that the first order differenced real price series were stationary. Accordingly, the Autoregressive Integrated Moving Average (ARIMA) and Seasonal ARIMA (SARIMA) models were used for analysis with R software. Results show an upward trend in nominal prices, mainly due to inflation while real prices remain stable over time. Seasonal price index values indicate variations in the monthly average real prices of different fish species linked to monsoon seasons. SARIMA models consistently provided the best fit for forecasting the prices across all species. For Salaya, Hurulla, Balaya, Kelawalla, Thora and Talapath, the best-fitting SARIMA models were $(2,1,2)(0,1,12)^{[12]}$, $(1,1,2)(1,0,12)^{[12]}$, $(0,1,2)(2,0,12)^{[12]}$, $(0,1,3)(0,0,12)^{[12]}$, $(0,1,5)(0,0,12)^{[12]}$ and $(0,1,2)(0,0,12)^{[12]}$ respectively, with AICc values ranging from 1295.76 to 1674.75, MAPEs between 0.0506 and 0.0885 and R-squared values from 0.7536 to 0.9149, indicating strong predictive accuracy across all species. The findings suggest that the apparent increasing trend in nominal fish prices is influenced mainly by external factors such as inflation, supply chain disruptions and weather patterns. These results highlight the need for price stabilization and continuous market monitoring mechanism to enhance affordability and improve the value chain in the sector.

Keywords: Marine fish; Price forecasting models; Real market price; Seasonality

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ID 155

A survey of post-harvest losses of fruits and vegetables in major economic centers of Sri Lanka

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Abstract:

Post-harvest losses in Sri Lanka constitute a critical challenge to national food security and the sustainability of agricultural livelihoods. Current estimates indicate that 20% to 40% of vegetables and 30% to 40% of fruits are lost annually due to inadequate handling, storage and transportation practices throughout the supply chain. To evaluate the extent of post-harvest losses of fruits and vegetables, a comprehensive survey was conducted at the Meegoda, Dambulla, and Tambuththegama economic centers, representing the Low Country, Up Country and Mid Country agricultural zones of Sri Lanka, respectively. The study encompassed key stakeholders in the supply chain, including farmers, wholesalers, retailers and middlemen, selected through random sampling. The total sample size comprised 180 participants, with data collected achieved via field surveys (83.33%) and online responses (16.64%) using a structured questionnaire. The principal objective was to identify the most wasted fruits and vegetables at major economic centers, based on empirical data regarding produce wastage. Statistical analysis using ANOVA revealed significant variation in post-harvest losses among the three economic centers. At the Thambuththegama economic center, post-harvest losses were reported as follows: tomato ($37.27\% \pm 3$), banana ($22.71\% \pm 2$), and pumpkin ($27.5\% \pm 4$). In the Dambulla economic center, losses were tomato ($37.33\% \pm 4$), banana ($22.50\% \pm 0$) and pumpkin ($27.38\% \pm 4$). At the Meegoda economic center, the corresponding figures were tomato ($36.60\% \pm 4$), banana ($24.64\% \pm 2$) and pumpkin ($30.83\% \pm 2$). Aggregated across all centers, tomatoes exhibited the highest post-harvest loss at $36.87\% (\pm 3)$, followed by pumpkin at $27.75\% (\pm 4)$ and banana at $23.08\% (\pm 2)$, all of which represent substantial losses. These findings underscore the considerable magnitude of post-harvest losses in fruits and vegetables in Sri Lanka. To date, no effective system has been implemented to mitigate wastage resulting from improper post-harvest handling. The introduction of value-added products is proposed as a viable solution to reduce post-harvest losses in the Sri Lankan market.

Keywords: Banana; Economic Centers; Postharvest-Losses; Pumpkin; Survey; Tomato

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ID 166

Effects of glyphosate on seed germination and early growth of weeds (*Sorghum bicolor* and *Sorghum sudanense*)

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Glyphosate is recognized as an effective herbicide because of its ability to suppress various weeds. However, its potential effects on seed germination and early growth of weeds are not fully understood. The novelty of this research lies in examining seed germination and early growth responses of weeds exposed to glyphosate, aiming to optimize glyphosate application rates in agricultural fields while minimizing environmental impacts. This study investigated the effects of glyphosate on the germination and early growth of two major weeds commonly found in paddy fields, *Sorghum bicolor* and *Sorghum sudanense*. Seeds were exposed to a range of glyphosate concentrations; 0.0 ppm (control), 0.1 ppm, 0.3 ppm, 0.5 ppm, 0.7 ppm, 0.9 ppm, 1 ppm and 2 ppm, including environmentally realistic concentrations, for eight days. Seed germination, morphometric and morphological changes were recorded daily. In the control treatments, seed weight increased by approximately 50 mg and 30 mg for *S. bicolor* and *S. sudanense*, respectively. In contrast, *S. sudanense* exhibited a reduction in seed weight, ranging from -1.66 mg to -0.65 mg across treatments, while *S. bicolor* showed a consistent increase (~10 mg) under all treatments. The length of emerging leaves in the control set up reached up to 2.0 cm and 3.5 cm, respectively, in *S. bicolor* and *S. sudanense*, but was restricted to 0.6 cm under glyphosate treatments for both species. Similarly, root length reached 2 cm and 3 cm in *S. bicolor* and *S. sudanense*, respectively, in controls, whereas the maximum recorded root length under treatments was only 0.2 cm for both species. Statistical analyses (ANOVA) revealed significant differences ($p < 0.05$) between control and treatment groups for all assessed parameters. A glyphosate concentration of 25 ppm completely inhibited seed germination in both species. These findings improve our understanding of glyphosate's role in weed management and highlight its potential environmental implications.

Keywords: Glyphosate; Herbicides; Seed germination; Weeds

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ID 171

Exploring the potential for community-based tourism in Panduwasnuwara, Sri Lanka: A preliminary assessment

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Abstract:

Community-Based Tourism (CBT) offers a sustainable development pathway by empowering local communities to manage tourism activities that generate income, create employment, conserve the environment, and promote cultural exchange. This study investigates the potential for CBT to enhance sustainable livelihoods in the Panduwasnuwara divisional secretariat division, a valuable heritage site in Sri Lanka that hasn't been fully explored for CBT. The research employed remote sensing and GPS-based field analysis to identify distribution pattern of main resources, including land cover and tank system. Traditional livelihoods and cultural practices were documented through field observations and informal interviews with 75 households selected using random sampling. A SWOT analysis further evaluated the viability of CBT initiatives in the region. Results show that panduwasnuwara's natural beauty, heritage, and hospitality offer strong CBT potential, despite gaps in transport and facilities. Unexplored history and eco-tourism present development opportunities, though climate variability and local resistance pose challenges. Coconut plantations (55%) and paddy cultivation (18%) dominate the land use, with 9% comprising irrigation tanks and surface water bodies critical to agriculture based on GPS survey. The region features dispersed cultural, religious, industrial, and natural tourism attractions. Despite the uneven distribution of tourism infrastructure, the study identifies strong potential for CBT development, supported by the presence of a wide range of traditional industries as a percentage wise pottery (36%), handicraft (21%), handloom weaving (14%), traditional cuisine (13%), wood carving and temple artistry (12.5%) and others (3.5%). The study concludes that community engagement, supported by targeted development strategies such as the formation of community-based cooperatives, microfinance support for local entrepreneurs, and low-cost technology training is essential for realizing a sustainable CBT model, especially considering the limitations in funding and technological access.

Keywords: Community-based tourism, Destination analysis, Panduwasnuwara, SWOT analysis

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ID 172

Antibiotic resistance of bacteria associated with larval stages of giant freshwater prawn (*Macrobrachium rosenbergii*)

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Abstract:

The evolved antibiotic resistance of pathogenic bacteria associated with various life stages of *Macrobrachium rosenbergii* may lead to disease outbreaks, resulting in reduced yield. The present study determines the antibiotic sensitivity of all larvae (11 larval stages) and post-larvae of *M. rosenbergii* qualitatively against commonly used antibiotics. All samples were collected from the Freshwater Prawn Breeding Centre, Kahandamodara, Sri Lanka. Individuals of each sample (n=150) were homogenised and inoculated onto nutrient agar plates using the spread plate technique. After overnight incubation at ambient temperature, individual colonies were selected and transferred into nutrient broth cultures. Kirby-Bauer antibiotic sensitivity test (ABST) was then carried out to investigate the antibiotic resistance of bacteria against ten antibiotics; Amikacin-30µg (AK30), Cefixime-5µg (CFM5), Cephalothin-30µg (KF30), Chloramphenicol-30µg (C30), Erythromycin-15µg (E15), Kanamycin-30µg (K30), Metronidazole-25µg (MTZ5), Streptomycin-10µg (S10), Sulfamethoxazole-25µg (RL25), and Tetracycline-30µg (TE30). Bacteria from all samples were 100% resistant to MTZ5. Except for three larval stages, the other eight larval and post-larval (75%) stages were sensitive to TE30, making it the most efficient antibiotic. Other tested antibiotics exhibited varying degrees of efficacy, with TE30 leading the group, followed by C30, AK30, and S10. Of the bacteria from all larvae and post-larvae samples, 83.3%, 75%, 66.7%, 50%, and 33.3% were resistant to CFM5, KF30, RL25, E15, and K30 respectively, whilst bacteria from the rest of the samples showed intermediate resistance. The present study concludes that administering MTZ5, CFM5, KF30, RL25, E15, and K30 as treatments for diseases is ineffective, as none of the bacteria in any larval stage or post-larvae were sensitive. Four of the ten tested antibiotics, (TE30, C30, AK30, and S10) were efficient against the bacteria associated with different larval stages and post-larvae.

Keywords: Antibiotics; Bacteria; Culture-based fisheries; Freshwater prawns; Post-larvae; Resistance

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ID 175

An assessment of the solar power plants and their impact on the vegetation in the Poonakary region of Sri Lanka

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Abstract:

This study aims to assess the impact of a solar power plant on the vegetation in the Poonakary region of Sri Lanka. Data collection primarily relied on a field survey and field observations. A total of 22 transects were used for the study, each measuring 100 m in length and 5 m in width. The extent of the study area is approximately 606.21 ha. Vegetation types, species names, genera, and family details were recorded using a structured data table. Field observations were carried out to assess the potential impact on vegetation in the area. The study was conducted from February 2024 to February 2025. A total of 239 flora species, including 5 endemic species, 24 nationally threatened and 23 near threatened (NT) species, were observed during the field ecological study within the study area. Among the five endemic flora species, one species (*Dendrophthoe ligulatus*) was listed as nationally Vulnerable (VU) and another (*Ampelocissus pheoenicantha*) was listed as nationally Near Threatened (NT) according to the national red list 2020 of Sri Lanka. Of the 24 nationally threatened flora species, 7 are listed as nationally Endangered (EN) and 17 species (including 1 endemic) are listed as nationally Vulnerable (VU) species. A few invasive alien flora species were also observed, including *Salvinia adnata*, *Typha angustifolia*, *Opuntia dillenii*, and *Lantana camara*. The construction of the proposed solar park is expected to cause significant ecological damage by directly impacting diverse and sensitive ecosystems. This includes the destruction of critical vegetation types such as mangroves, salt marshes and seasonally flooded grasslands, which serve as essential habitats for a variety of endemic and migratory species. One of the most immediate threats arises from the clearing of land and vegetation during the construction phase, which will lead to the loss of large habitat areas that support vital ecological functions. These plant communities play a crucial role in carbon sequestration, water purification, and natural flood control. In addition to habitat loss, there is a risk of invasive plant species spreading during construction activities, which can outcompete native vegetation, degrade habitat quality and further threaten biodiversity. The project is proposed in an area recognized for its unique ecological characteristics. While similar species may exist in nearby locations, the remaining natural habitat is extremely limited. Therefore, it cannot be assured that the damage caused can be fully reversed or offset by the surrounding areas. This uncertainty is heightened by the lack of a proper environmental assessment, making it impossible to fully understand or mitigate the long-term impacts of the development. Given these factors, the potential ecological consequences of the solar park cannot be overlooked.

Keywords: Ecological damages; Habitat degradation; Solar power projects; Vegetation

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ID 178

Baseline assessment of fuel consumption and thermal efficiency of conventional biomass cookstoves: A case study

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Abstract:

Conventional biomass cookstoves are the predominantly utilised household cooking method in rural Sri Lanka. Nevertheless, the in-use performance is under-quantified. This study adopted a baseline experimental approach combined with field surveys to produce the first initial integrated efficiency and fuel demand baseline for *Maskeliya, Nuwara Eliya* District. Fifty households were enrolled in 5-day Kitchen Performance Tests (KPT) to measure the amount of wood utilized during cooking, while 25 households were in Water Boiling Tests (WBT) under controlled cold-and hot-start conditions. A systematic survey was conducted to analyse socio-economic determinants of stove choice. The average wood demand was 2.56 kg cap⁻¹ day⁻¹, which was equivalent to 0.93 T cap⁻¹ yr⁻¹, with an inter-household coefficient of variation of 0.35. Cold-start thermal efficiency varied from 6.69 % to 10.79 %, while hot-start efficiency varied from 9.33% to 13.71%. The baseline overall efficiency of conventional stoves was 10.62 %. In cold- and hot-start conditions, the average boiling times were 20.3 min and 17.4 min, respectively. Households served a mean of 5.1 persons per meal across 772 recorded cooking events, indicating substantial aggregated fuel pressure on local wood supply. Affordability, cultural orientation and limited resources were identified as the main barriers to improve stove adaption. Replacing conventional stoves with high-efficiency alternatives can mitigate CO₂ emissions. These findings provide a platform for targeted clean-cooking approaches, tracking future impacts, and for informing evidence-based policy design and programming at the regional scale throughout rural Sri Lanka.

Keywords: Biomass fuel; Cookstove efficiency; Kitchen performance test; Water boiling test

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Oral Presentations



Prevalence and molecular detection of extended spectrum beta lactamase producing *Escherichia coli* in chicken meat and edible poultry organs collected from north-western province of Sri Lanka

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Abstract:

Escherichia coli, a gram-negative bacterium classified within the family *Enterobacteriaceae*, serve as a commensal bacterium that lives in both poultry and humans. The emergence of extended-spectrum beta-lactamase (ESBL) producing *Escherichia coli* poses a significant public health risk and reduces the effectiveness of veterinary care due to its antibiotic resistance. The CTX-M group of ESBLs is frequently found in poultry, with CTX-M-15 being the predominant gene detected in both poultry and human populations. The North-Western province of Sri Lanka is a leading region in poultry production, where chicken meat and edible poultry organs are widely consumed. This study aimed to assess the prevalence and molecular detection of ESBL producing *E. coli* in chicken meat and edible organs collected from the North-Western province of Sri Lanka. A total of 85 extracted DNA samples that were phenotypically negative for ESBL were analyzed. These isolates had previously been assessed for phenotypic ESBL detection using the double disk diffusion method. The presence of ESBL genes was confirmed using polymerase chain reaction (PCR) techniques, which revealed that 12.94% of the samples tested positive for the CTX-M-15 gene. The prevalence of the CTX-M-15 gene was slightly higher in retail shops (13.85%) compared to supermarkets (10%), although this difference was not statistically significant. Furthermore, the prevalence rates in chicken meat and edible organs were found to be 18.60% and 7.14%, respectively. This study emphasizes the necessity for enhanced monitoring and control strategies within the poultry sector and highlights the critical need for effective food safety practices to mitigate the risk of antibiotic-resistant bacteria entering the food chain.

Keywords: Antibiotic resistance; Chicken meat; CTX-M-15; ESBL; *Escherichia coli*; PCR

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Development of a myco – composite using locally available mushroom strains and agricultural waste materials in Sri Lanka

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Abstract:

Myco-composites composed of fungal mycelium bonded with organic substrates have emerged as a promising sustainable alternative to synthetic packaging materials. This study aimed to develop a myco-composite using locally available mushroom strains in Sri Lanka by utilizing agricultural waste materials. It addressed key aspects including the feasibility of developing myco-composites using locally available fungal strains, the selection of optimal substrates, and the development of effective inoculation technique. Five mushroom strains collected from Mapalana, Matara District were selected for the study. Six different substrate combinations composed of rice bran, sawdust, coir dust, finger millet and spent mushroom substrate (SMS) were tested to determine the most effective substrate for the mycelial growth. Among five strains, strain 2 demonstrated the fastest growth *in vitro* growth, achieving 4.5 ± 0.8 cm/per day radial mycelial growth. A 1:1 ratio of rice bran and sawdust (M3 media) and SMS supported the most rapid and dense mycelial colonization, reaching a 9 cm colony diameter within 10 and 14 days after inoculation respectively. Further optimization of the inoculation technique revealed that making a small incision on the sealed polypropylene bag, followed by resealing without ethanol surface sterilization, facilitated uniform mycelial colonization, achieving a mean surface coverage of 98.67 ± 0.88 %. Growth performance analysis demonstrated that strain 2 cultivated on M3 substrate exhibited the highest mycelial growth rate, making it the most suitable candidate for myco-composite production. After 25 days of incubation, the fully colonized mixture was oven-dried to successfully produce myco-composites. These findings highlight the potential of developing myco-composites from locally available mushroom species and agricultural waste with enhanced composite-forming properties. A thorough evaluation of the mechanical properties of myco-composites to is essential to enhance their strength, durability, and flexibility. Such improvements are crucial for establishing myco-composites as viable, eco-friendly alternatives to conventional synthetic packaging materials.

Keywords: Agricultural waste; Mushroom strains; Myco-composites; Sri Lanka, Sustainable packaging

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Effect of fertilizer schedules and media composition on growth and yield of *Capsicum chinense* Jacq. under protected house conditions

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Abstract:

Capsicum chinense Jacq. is one of the most popular vegetables cultivated around the world. This study evaluated the effects of different fertilizer schedules and media compositions on its growth and yield under protected house conditions. A two-factor factorial Completely Randomized Design experiment with four replicates was conducted at the Faculty of Agriculture, University of Ruhuna. The factors were fertilizer schedule (F1- fertilizer schedule 1/existing schedule, F2- fertilizer schedule 2 and F3- fertilizer schedule 3) and media composition (M1- 50% coir dust + 30% partially burnt paddy husk + 20% coco chips/ existing media, M2- 70% coir dust + 30% partially burnt paddy husk and M3- 70% coir dust + 30% coco chips), resulting in nine treatment combinations. Mainly Albert's solution was used as the liquid fertilizer for the existing fertilizer schedule (F1), while F2 and F3 were prepared using alternative inorganic liquid fertilizers. Growth parameters (number of branches, stem girth, time to flowering) and yield parameters (pod circumference, fresh weight per pod, pod yield per plant, marketable grade) were recorded along with the costs of production. Data were analyzed using two-way ANOVA and means separated by Dunnett's Test at 5% significance. The interaction of the two factors did not significantly influence the measured parameters. Fertilizer schedule significantly influenced all parameters except stem girth, which was affected only by media composition. The highest pod yield per plant (745g) and marketable yield (99.5% by weight, 99% by color) were recorded under F1. Although F1 had the highest production cost, it produced superior yield and quality. Therefore, the existing fertilizer schedule is recommended, while any of the tested media compositions may be used under controlled environment conditions.

Keywords: *Capsicum chinense*; Fertilizer schedules; Growth media composition; Protected house condition; Yield

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The impact of economic crisis on food security among urban poor households in Colombo district: A multi-indicator assessment

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Abstract:

The Sri Lankan economy faced its most severe crisis since independence in 2022, marked by a significant contraction in economic activity. The COVID-19 pandemic, coupled with global and domestic challenges, adversely affected food security by limiting access to affordable food and driving up food prices. Consequently, malnutrition worsened, where 54% of households facing acute food insecurity, 46% moderately and 8% severely. Despite the urban poor being one of the most vulnerable groups, their dietary diversity and food security remain underexplored in literature. This study assesses the impact of economic downturn on dietary diversity and food security of urban poor households and examines the coping strategies adopted. A questionnaire survey (n=80) was conducted in Colombo and Maharagama divisional secretariat divisions in July 2024. Sampling units were selected through simple random sampling. Five dietary diversity indices: the Household Dietary Diversity Score (HDDS), Entropy Index (EI), Shannon Equitability Index (SEI), Herfindahl-Hirschman Index (HI), and Simpson's Index (SI) were used to evaluate the food security. A multiple regression model was employed to analyze socio-demographic determinants. Findings indicate that dietary diversity among urban poor households is low according to EI and SEI but moderate when measured using HDDS, HI, and SI. Additionally, dietary diversity shows statistically significant variation ($p < 0.01$ and $p < 0.05$) across socio-demographic factors. The economic crisis worsened food insecurity among urban poor households, prompting dietary shifts towards greater reliance on cereals and vegetables and reduced protein consumption. This study highlights the urgent need for integrated policy interventions to enhance dietary diversity and food security. It further recommends a systematic analysis of post-crisis food consumption patterns among the urban poor populations and at the national level to inform equitable and sustainable solutions.

Keywords: Dietary diversity; Coping strategies; Economic crisis; Food security; Urban poor

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Assessing the effectiveness of international trade fairs in enhancing export performance of Sri Lanka

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Abstract:

This study evaluates the effectiveness of international trade fairs in enhancing the export performance of Sri Lankan exporters, addressing the lack of systematic third-party assessments that hinder strategic planning and resource allocation. Focusing on pre-fair, during-fair, and post-fair phases, the study examines the impact of trade fair participation on export performance, brand recognition, networking opportunities and identifying best practices to enhance export performance. Data were collected from 30 exporters participating in international trade fairs organized by the Export Development Board (EDB) using a semi-structured questionnaire and secondary data from the EDB database. Results indicate a positive correlation between trade fair participation and export turnover, export volume, brand recognition and networking opportunities. As measured by Spearman's correlation coefficient, pre-fair activities show the strongest correlation with export turnover ($r = 0.791$, $p < 0.001$) and export volume ($r = 0.648$, $p < 0.001$), particularly brand recognition ($r = 0.558$, $p < 0.001$) and networking opportunities. Compared to pre-fair activities, both during-fair and post-fair activities have less impact. Goal setting and online pre-marketing have the greatest impact among pre-fair activities. The findings offer actionable recommendations for exporters and EDB to maximize trade fair benefits. This study concludes that focusing on pre-fair efforts provides greater effectiveness from trade fair participation.

Keywords: Brand recognition; Effectiveness of trade fair; Export performance; International trade fairs; Networking opportunities

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Evaluating the role of theory of planned behaviour in climate-smart alternate wetting and drying (AWD) adoption among paddy farmers

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Abstract:

Alternate Wetting and Drying (AWD) is a water management technique introduced by the International Rice Research Institute (IRRI) to address water scarcity and reduce methane emissions in irrigated rice cultivations. This controlled, intermittent irrigation approach enables farmers to use up to 30% less water without compromising crop yields. Despite its clear environmental and economic benefits, the adoption rate of AWD among farmers remains low. This study aims to assess the socio-psychological factors influencing paddy farmers' intentions to adopt AWD using the Theory of Planned Behaviour (TPB) as the theoretical framework. Data were collected from a randomly selected sample of 70 paddy farmers in Agunakolapalassa through a pre-tested questionnaire. Structural equation modelling (SEM) was employed to analyse the data. The findings indicate that perceived behavioural control is the most significant predictor of adoption intentions ($\beta = 0.393$, $P=0.003$) suggesting that farmers with greater confidence and access to enabling resources such as crop insurance or economic incentives are likelier to adopt AWD. Positive attitudes towards AWD also significantly influence adoption intentions ($\beta = 0.277$, $P=0.014$), indicating that communicating the benefits of AWD (E.g.: water conservation and productivity gains) can enhance the adoption. However, the findings suggest that personal beliefs and control perceptions have a greater impact on adoption decisions than social pressure. Overall, the study confirms the applicability of TPB in explaining farmers' behavioural intentions to adopt AWD and highlights the need for further research incorporating external factors, including economic and policy support to gain a more comprehensive understanding of AWD adoption.

Keywords: Adoption intention; Alternate wetting and drying; Climate smart agriculture; Theory of planned behavior

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An advanced machine learning approach for early detection of sugarcane white leaf disease using UAV-based multispectral imagery

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Abstract:

White Leaf Disease (WLD) of sugarcane, caused by phytoplasma and transmitted through infected seed-cane and secondarily by sap-sucking leafhoppers, poses a significant threat to crop yield and quality, with potential economic losses reaching 100% in susceptible varieties. Early detection is critical for mitigating its impact on sugarcane cultivation. Traditional identification methods, including visual inspection and laboratory tests, are labor-intensive, time-consuming, and prone to errors, underscoring the need for automated, rapid diagnostic tools. This study explores the application of Machine Learning (ML) models for early-stage WLD detection using UAV (Unmanned Aerial Vehicle)-acquired multispectral imagery. Data were collected from three locations in Sri Lanka, comprising 13 fields and 1800 augmented images across six spectral bands (Green, Blue, Red, Red Edge, NIR and Visible). The dataset was processed through image preprocessing and labeling and trained using supervised ML classifiers, including YOLOv8s, YOLOv5s, and a custom CNN model built with TensorFlow and Keras. Results demonstrated that the CNN model achieved superior performance, with precision of 98%, recall of 95%, and mean Average Precision (mAP) metrics exceeding 97% at both 50% and 50–95% thresholds, indicating high robustness for early-stage WLD detection. In YOLO models, the green spectral band proved most effective for distinguishing between healthy and diseased sugarcane crops, while the CNN model, all spectral bands performed well for this purpose, except the blue band. These findings highlight the potential of integrating UAV multispectral imagery with ML for precise and timely disease detection, offering transformative implications for precision agriculture. The CNN model's ability to deliver superior results in identifying diseased sugarcane with high precision is critical for timely intervention in crop management. Future research directions include expanding datasets, testing additional ML architectures, and developing field-deployable tools to validate and generalize these results for real-world precision agriculture applications.

Keywords: Machine learning; Multispectral imagery; Precision agriculture; Sugarcane white leaf disease

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Abundance and characteristics of microplastics in selected fish species from the southern coastal area of Sri Lanka: A preliminary study

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Abstract:

Microplastics (MPs) have emerged as pervasive contaminants across diverse ecosystems worldwide. In recent years, microplastic contamination in aquatic environments and its potential implications for human health have received increasing attention. The study investigated the presence of MPs contamination in eight fish species with varying feeding habits and feeding zones including *Stolephorus commersonnii*, *Amblygaster sirm*, *Stolephorus indicus*, *Decapterus russelli*, *Thunnus albacares*, *Nemapteryx caelata*, *Etroplus suratensis* and *Leiognathus equula*; from the Southern coastal area, Sri Lanka. A total of 30 specimens were collected from local fishers at Palena, Dondra boat landings, and Rekawa lagoon area. Following the alkaline digestion and density separation, the gut and muscle tissues of the samples were analyzed for the abundance, type, color and shape of the MPs. Findings showed that all fish examined (100%) contained MPs in their guts, and 88.23% had MPs in their muscle tissue. Fibers were the dominant morphotype with blue and black being the most common colors. Most MPs ranged from 0.5-1 mm in size. The highest MPs abundance in terms of MPs/g was found in *S. commersonnii* (24.11 ± 9.11 MPs/g) and the MPs abundance in terms of MPs per individual was highest in *T. albacares* (367.65 ± 412.58 MPs/ Individual). The average abundance of MPs in the gut varied significantly among species ($P < 0.05$) whereas no significant difference was found in muscle tissue among species ($P > 0.05$). Additionally, MPs abundance differed significantly among the species belonging to different habitats. The calculated biomagnification factor was < 1 , indicating no biomagnification among the selected fish species. Detection of MPs in edible tissues revealed a potential risk for human intake through seafood consumption, underscoring the need for further investigation and public health awareness.

Keywords: Biomagnification; Fish; Gut; Human health; MPs contamination; Muscles

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Artificially intelligent digital twin for predictive control of greenhouse temperature in tropical environments

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Abstract:

This study introduces Sri Lanka's first artificially intelligent digital twin (DT) system for agriculture, developed to enable real-time monitoring and predictive control of greenhouse ambient temperature. The system was developed using historical and real-time weather data from Horana, and was integrated with a virtual greenhouse model, Model Predictive Control (MPC), advanced thermal modeling, IoT-enabled sensors, and a cloud-based framework utilizing Google Cloud Platform and InfluxDB, supported by a Python-based graphical user interface (GUI). The DT-MPC framework was tested under three major Sri Lankan seasonal patterns: Northeast Monsoon, Inter-Monsoon, and Southwest Monsoon, inside a hypothetical simulated 25 m² photovoltaic greenhouse. The system maintained indoor temperature within a narrow optimal range of 24.99°C to 25.52°C, despite wide environmental temperature variations from 21.2°C to 31.4°C. The temperature difference between the optimum setpoint and real values was limited to $\pm 1.2^\circ\text{C}$ during the study. Automated control features, such as dynamic shading percentages and dual-sided ventilation by fans, reduced internal temperature peaks by over 3.5°C and stabilized humidity fluctuations within a limited range of $\pm 5\%$. A 15% reduction in cooling energy demand and an 18% reduction in heating energy demand were achieved through the implementation of dynamic response. The latest system protocols, further offer scalable deployment for precision agricultural applications in the future. Several limitations were identified, including low sensor precision, high computational demands, and abrupt temperature fluctuations. However, system performance could be improved through the use of reliable sensors and actuators, the introduction of edge computing, the selection of appropriate communication protocols, and the integration of AI for anomaly detection. This study demonstrates the potential of digital twin systems to enhance sustainability and resource efficiency in tropical greenhouse agriculture, offering a scalable model for future climate-adaptive farming technologies.

Keywords: Agriculture; Artificial intelligence; Digital twin; Greenhouse; Model predictive control

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Production of xanthan gum from *Xanthomonas campestris* using locally available substrates

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Abstract:

In the Sri Lankan context, almost all the xanthan gum requirement is imported, resulting in a significant foreign exchange outflow and increasing the cost of production. The objective of the present study was to produce xanthan gum using locally available substrates with an isolate of *Xanthomonas campestris* collected from infected cabbage samples. The experiment was carried out with three locally available substrates, namely glucose syrup, sugarcane molasses and cabbage extract. The three substrates were maintained at same total soluble solids, supplemented with 0.75 g L⁻¹ of yeast extract, 0.525 g L⁻¹ of peptone as nitrogen sources and 5 g L⁻¹ of KH₂PO₄. These mixtures were fermented with *Xanthomonas campestris* under aseptic conditions at 180 rpm in an orbital shaker, maintaining the temperature at 27 °C, pH at 7 for 72 hours. The best substrate was selected based on the amount of xanthan gum produced and recovered from each substrate. The xanthan gum yields recorded were 1.055 g L⁻¹ for cabbage extract 0.524 g L⁻¹ for glucose syrup and 8.212 g L⁻¹ for sugarcane molasses. Therefore, among the tested local substrates, sugarcane molasses performs best in producing xanthan gum with the local isolate. The efficiency of using sugarcane molasses for xanthan gum production needs to be further investigated with more stringent recovery techniques

Keywords: Cabbage extract; Glucose syrup; Sugarcane molasses; Xanthan gum; *Xanthomonas campestris*

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Impacts of heat induced alterations on water repellency of particle size fractions in coastal dune sand

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Abstract:

Soil water repellency (SWR) is the resistance of soil for spontaneous wetting when water is applied on the surface. Vegetation types such as casuarina, eucalyptus, cypress, pines, and eucalyptus produce litter with hydrophobic waxes and resins that create severe SWR in underlying soils. Due to natural or anthropogenic causes, forest fires can occur in these forests, subjecting soils to different levels of heating. Heating impacts can influence the water-repellent nature of different particle size fractions of the soils. The objective of this study was to examine the impacts of heat-induced alterations on water repellency of particle size fractions in coastal dune sand under a *Casuarina equisetifolia* forest in the low-country dry zone, Sri Lanka. Water-repellent dune sand was separated into six particle size fractions through sieving (2000 - 500, 500 - 212, 212 - 180, 180 - 100, 100 - 53, and < 53 μm) and exposed to heat at six temperatures (50, 100, 150, 200, 250, and 300°C). The SWR (as soil-water contact angle) and organic matter contents (%) of particle size fractions were measured after heating. SWR was highest in the smallest particle size fraction and gradually decreased with increasing particle size. SWR of all particle sizes increased at low levels of heating ($\leq 150^\circ\text{C}$) and then decreased with further heating until it disappeared at 250°C. Samples became completely wettable at 300°C. The organic matter content of all particle size fractions decreased continuously with increasing heating temperature. At low temperatures, volatile organic materials are removed from soil, reducing the organic matter. However, compositional and structural changes, such as conversion of hydrophilic cellulose and hemicellulose into hydrophobic long-chain aldehydes and ketones, can occur in organic matter at these temperatures, causing an increase in SWR. Heating to higher levels removes more organic materials, leading to reduction in SWR. The absence of SWR at 300°C can be due to the high level of burning of organic matter. Further experiments are required to understand the structural changes that occurring in organic substances when exposed to heat in different types of water repellent soils.

Keywords: *Casuarina equisetifolia*; Dune sand; Heat impacts; Particle size fractions; Soil water repellency

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Poster Presentations



Molecular characterization of MC1R gene in Thamankaduwa white cattle

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Abstract:

Coat color is a major factor in the animal selection process, including in cattle. The Melanocortin 1 receptor (MC1R) gene plays a major role in the signalling pathway of melanin production and determining coat color variation in cattle. Although the variation of the MC1R gene has been sufficiently characterized in common cattle breeds, studies on local breeds such as Thamankaduwa white are limited. The present study focused on the genetic characterization of the MC1R gene in Thamankaduwa white cattle, a local breed native to Sri Lanka, predominantly found in the Eastern, Southeastern, and North Central provinces. The main objective was to identify single nucleotide polymorphism (SNP) variations in the MC1R gene of Thamankaduwa white cattle and compare them with MC1R gene sequences of three bovine species: *Bos indicus*, *Bos taurus*, and *Bos grunniens*. Genomic DNA was extracted from whole blood samples (n=6), and the gene was amplified via PCR followed by sequencing of a single exon. Sequence alignment and phylogenetic analysis were performed using BioEdit and MEGA software. Six SNP variations (c.218T>A, c.296T>C, c.374T>A, c.415C>T, c.581C>T, c.661C>T) were identified in Thamankaduwa white cattle, aligning with other bovine species. Additionally, two unique SNPs (c.310G>-, c.871G>A) were identified compared to brown-coated cattle, while seven SNPs (c.583T>C, c.663C>T, c.830T>C, c.853G>A, c.880G>A, c.906C>G, c.927C>T) were identified compared to Tharparkar cattle. Further studies are needed to validate these identified SNPs using larger sample sizes and to establish their association with white coat color and other economically important traits beneficial for breeding programs.

Keywords: Coat color; MC1R gene; Molecular characterization; Single nucleotide polymorphism; Thamankaduwa white cattle

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A histopathological study of digenean metacercariae infection in goldfish varieties

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Abstract:

The research investigated the infestation of digenean metacercariae in commercially important goldfish varieties, aiming to identify histopathological alterations associated with infestation and to assess the correlation between the degree of metacercariae infestation and lymphocyte cell populations at affected sites. A total of 30 diseased goldfish were collected from an ornamental fish farm: 5 each from Black Moor, Red Cap Oranda, Goldfish Oranda, common Goldfish and Red Comet; 3 from Calico; and 1 each from Comet and Calico Comet varieties. Live fish were euthanized using clove oil at a concentration of 0.4ml per liter of aquarium water. Gill samples were collected and fixed in 10% neutral-buffered formalin for histopathology. Stained tissue slides were observed under 40× magnification and the metacercariae count was recorded for three random gill lamellae of each fish. Total parasitic counts were calculated for each fish of each variety. Lymphocytes were counted in three random microscopic fields (100×) and average counts were determined for each fish. The average total parasitic counts were: Black Moor: 13, Red Cap Oranda: 66, Goldfish Oranda: 51, common Gold fish: 17, Red Comet: 27, Comet: 4, Calico: 1, Calico Comet: 0. The average lymphocyte counts for each variety were: Red Cap Oranda, 49.7 ± 10.9 ; Goldfish Oranda, 43.8 ± 6.1 ; common Goldfish, 34.1 ± 8.6 ; Red Comet, 47.1 ± 7.7 ; Comet, 77.7 ± 11.7 ; Calico, 34.4 ± 5.7 ; Calico Comet, 86 ± 10.5 . Encysted digenean metacercariae were detected in seven out of eight goldfish varieties examined. Histopathological alterations in the gills included curling of gill lamellae, gill epithelial hyperplasia, accumulation of inflammatory cells, epithelial lifting and clubbing of gill filaments. There was a positive correlation between parasites counts and lymphocyte cell counts at affected sites ($r = 0.40$; $P < 0.05$). While encysted metacercariae are dormant larval stages, their infestation resulted in considerable histopathological changes in the gills and an immune response proportional to the degree of parasitic infestation.

Keywords: Digenean metacercariae; Gills, Goldfish; Goldfish varieties; Histopathology

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Effect of burial depth and burning on *Mimosa pigra* L. seedling emergence at invaded areas in southern province, Sri Lanka

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Abstract:

Mimosa pigra L., a member of the Fabaceae family, thrives and often dominates ecosystems in both wet and dry tropical climates. This troublesome weed was first recorded in Sri Lanka in 1997, initially colonizing the Central and North-western provinces before spreading to other regions. In the study area, it has invaded paddy cultivable lands, with previous studies reporting an infestation covering approximately 27 hectares. Field burning has been reported to trigger the germination of *M. pigra* and subsequent seedling emergence. This study aimed to assess the germination of *M. pigra* seedlings at different soil depths in the seed bank and to evaluate the response of the soil seed bank to burning. Soil samples were collected from Akuressa Divisional Secretariat Divisions and Paraduwa Grama Niladari Divisions in the Southern Province of Sri Lanka. In total, 120 samples were collected from 20 sampling points with four control points, using a 20 × 20 cm frame to cover a surface area for each quadrat. Soil samples were taken at a depth of 30 cm in 5 cm intervals: A (0–5 cm), B (5–10 cm), C (10–15 cm), D (15–20 cm), E (20–25 cm), and F (25–30 cm). Each sample was split into two portions. One portion was subjected to burning using a 3 cm layer of rice straw and a 5 cm layer of rice husk on top. Both burned and unburned samples were then allowed to germinate under controlled conditions. The emergence of *M. pigra* and other vegetation types at various depths was recorded weekly over a period of eight weeks. Burning did not trigger *M. pigra* germination, but seedling emergence significantly decreased with increasing soil depth, with the highest emergence observed at shallower depths (0–5 cm and 5–10 cm). These findings suggest that land preparation practices beyond 10 cm in depth may reduce seed exposure and limit germination. Additionally, field burning practices can be utilized alongside the other chemical and mechanical control measures.

Keywords: Burning; Emergence; Fabaceae; Germination; Trigger

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Antagonistic mechanism of *Trichoderma* spp. against *Sclerotinia sclerotiorum*, the causal agent of white mold disease in soybean

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Abstract:

White mold, caused by the necrotrophic fungus *Sclerotinia sclerotiorum*, is a devastating disease in soybean, resulting in significant yield losses globally. *Trichoderma* spp. are well known biocontrol agents that exhibit a range of mechanisms to suppress plant pathogens, offering a potential environmentally safe alternative for crop disease management. This research investigated the antagonistic potential of selected *Trichoderma* strains against *S. sclerotiorum* infecting soybean plants. The objectives of this study were to isolate and screen *Trichoderma* strains from environmental samples against *S. sclerotiorum* mycelial growth *in vitro*, to evaluate their effectiveness in suppressing *S. sclerotiorum* sclerotia germination *in vitro*, and to evaluate the efficacy of the selected *Trichoderma* strains in managing *S. sclerotiorum* development in soybean seedlings under *in vivo* conditions. Of the eight *Trichoderma* strains tested, seven significantly suppressed the radial mycelial growth of the *Sclerotinia* isolate, with inhibition rates ranging from 25.6% to 57.8% three days after culturing (DAC). In volatile inhibition tests, *Trichoderma* strains CST1, MCT and CST2 exhibited the highest inhibition of *S. sclerotiorum* mycelial growth: 23%, 35% and 40% respectively, at 3 DAC. Sclerotia formation was inhibited by CST1, CST2, MCT, and the consortium by 84%, 88%, 93%, and 87%, respectively, compared to 55% in the control. These promising strains and consortium treatment were further evaluated *in vivo* through a greenhouse trial using PB1 soybean variety with three replicates in the Completely Randomized Design (CRD). Topsin (thiophanate-methyl) fungicide was used as the positive control and plants inoculated with the pathogen were used as negative controls. Mean stem lesion length on soybean seedlings were measured and data were analyzed using SAS 9.1 software. Mean lesion lengths of CST1, CST2, MCT, consortium, negative control and positive control were 0.98, 1.55, 1.29, 1.54, 1.69 and 3.68cm respectively (significant at 0.05 P value). These results demonstrated that the *Trichoderma* strains CST1, CST2, MCT and their combined application significantly suppressed white mold disease development on two-week-old PB1 soybean seedlings under the tested conditions. The findings highlight the potential of four *Trichoderma* treatments as effective bio control options against white mold in soybean, offering a sustainable and environmentally friendly alternative to chemical fungicides for disease management.

Keywords: Antagonism; Biocontrol; *Sclerotinia*; Soybean; *Trichoderma*; White mold

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Trait-based evaluation of *Dracaena sanderiana* varieties for enhanced value-added production

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Abstract:

Dracaena sanderiana, commonly known as lucky bamboo, is a widely cultivated ornamental plant valued for indoor and outdoor use. This study aimed to evaluate and compare the growth, morphological, and anatomical characteristics of four *D. sanderiana* varieties; 'Gold', 'White', 'Victory', and 'Celes' to assess their suitability for value-added production. The experiment followed a Completely Randomized Design (CRD) with four treatments and ten replicates each. Cuttings were planted in coir dust and sand (1:1) and grown under shade house conditions. Data were collected on growth parameters (plant height, number of leaves, stem radial growth, and dry matter content), morphological traits (leaf color, number of internodes, internodal distance, and stem breaking angle), and anatomical features (collenchyma tissues). Statistical analysis was performed using one-way ANOVA in Minitab 17, with mean comparisons via Tukey's test at a 0.05 significance level. Results showed that the 'Gold' variety had the highest plant height, stem radial growth, absolute growth rate, and stem breaking angle. 'Celes' produced the most leaves and internodes, while 'Victory' demonstrated the greatest internodal distance. Relative growth rate did not differ significantly among varieties. Based on morphological compatibility, the study concludes that 'Gold', 'White', and 'Victory' can be effectively blended for value-added lucky bamboo products, whereas 'Celes' is not recommended for such arrangements.

Keywords: Blending; *Dracaena sanderiana*; Lucky bamboo; Value addition

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Development of a novel wood quality index for timber classification

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Abstract:

Wood is a renewable and versatile natural resource that has been utilized by humans for a wide range of purposes throughout history. This study aimed to develop a comprehensive wood quality index to classify 91 timber species based on their suitability for various applications. Factor analysis was applied to ten key wood properties: average vessel diameter, ray height and width, compressive strength parallel to grain, density, modulus of elasticity, modulus of rupture, seasoning ability, overall strength and wood durability. The analysis identified four major sub-factors with eigenvalue greater than one each representing a cluster of related traits. These sub-factors were used to construct a novel wood index for sustainable timber assessment. Cluster analysis based on the index values grouped the species into five distinct clusters, each reflecting specific suitability profiles: Cluster one (3000-3400), Cluster two (3401-4200), Cluster three (4201-6440), Cluster four (6441-9300), and Cluster five (above 9301). Wood grouped within the same cluster is suitable for similar applications. This wood quality index serves as a practical decision-making tool for the timber industry, enabling the selection management of timber species based on inherent wood characteristics. The developed wood quality index significantly advances beyond existing indices, that typically focus on limited number of macroscopic features. This new index provides a more stable and suitable assessment by integrating a broader range of wood properties crucial for predicting long-term performance and application suitability, thereby enhancing accuracy compared to traditional methods.

Keywords: Classification; Cluster analysis; Factor analysis; Timber species; Wood quality index

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Consumer preference and willingness to pay for value added products based on Catla fish

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Abstract:

This study aims to estimate consumer preference and willingness to pay for value-added Catla (*Labeo catla*) fish products, as well as to identifying the factors influencing consumption and purchasing behavior of inland fish. Three value added products: fish cracker, fish pickle, and fish soup powder were formulated using minced Catla fish. A sensory evaluation involving 30 participants assessed organoleptic properties, including appearance, taste, smell, color, and texture. The results showed that overall acceptability exceeded 75% for all three products. Additionally, respondents expressed willingness to pay 150, 300, 590 rupees for 100g of fish crackers, fish pickles, and fish soup powder respectively. Most participants indicated willingness to pay if the initial prices were reduced by 20%. Factors affecting consumers' purchasing behavior were collected using the Theory of Planned Behavior. Data were collected from 120 respondents in fishing (Embilipitiya) and non-fishing (Matara) areas, selected through stratified random sampling and analyzed using descriptive and inferential statistical methods. Structural equation modelling was applied to analyze consumers' purchasing behavior. The results revealed that consumer attitudes did not significantly impact (ρ -c [Composite reliability] <0.7) the purchase of inland fish. However, preferences for Catla fish were limited due to the fish's odor and inter-bones. Awareness on Catla fish is notable low in Matara. The study found that subjective norms, perceived behavioral control, and intention to purchase significantly influenced buying behavior. The findings suggest potential for the developing new Catla products, as all respondents expressed willingness to buy at the proposed prices. The study recommends implementing awareness programs or campaigns to promote inland fish consumption.

Keywords: Fish cracker; Fish pickle; Fish soup powder; Structural equation modeling; Theory of planned behavior

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Large pelagic fish handling practices: A case study in Negombo

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Abstract:

The advantageous location in the Indian Ocean endows Sri Lanka with rich marine resources, which are crucial for economic advancement, employment generation, foreign income generation and food security. Despite fish and fish products being the main source of animal protein for Sri Lankans, 40% to 60% of fresh fish is lost during post-harvest handling practices. Proper fish handling practices are essential for achieving food security, ensuring efficient food utilization and healthy life. Being highly perishable, fishery products are subjected to rapid spoilage and quality loss throughout the fish supply chain. Therefore, this study was designed to identify diverse handling practices of selected large pelagic fish especially yellowfin tuna, skipjack tuna, sail fish and trevallies. A questionnaire survey was conducted with 100 participants: 25 fishers, 25 wholesalers and 50 retailers, using a time randomization method. A freshness index was developed to identify better handling practices. The study revealed handling practices affect the freshness of fish at various stages of the supply chain, with icing and sorting being universally adopted at a 100% compliance rate while practices such as waste management are rarely implemented. Sensory evaluation scores revealed a decline in freshness from fishermen (17.84) to wholesale (17.56) and retail stages (13.38). The Fish Freshness Index identified personnel hygiene, onboard handling practices, cooling practices, sanitation practices, and waste management practices as statistically significant predictors ($p < 0.05$) for freshness preservation across all stages, while maintenance practices had minimal impact. Despite initiatives to upgrade the industry, infrastructure limitations, capital constraints, unfavourable weather conditions, and lack of awareness about proper handling practices persist. An approach integrating proper training programs, legislative enforcement, community engagement, and financial incentives is recommended to address current deviations in the industry.

Keywords: Fish recourses; Food Security; Freshness; Freshness index; Handling Practices; Large pelagic fish

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Factors affecting the adoption of micro-irrigation technology for vegetable cultivation in Kinniya in Trincomalee district, Sri Lanka: An application of UTAUT model

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Abstract:

Despite many benefits provided by the use of micro irrigation systems, the implementation of these systems among vegetable growing farmers in Kinniya DS Division is quite low since the time it was introduced by the Department of Agriculture in 2018. Therefore, the objective of this study is to assess factors influencing the adoption of micro-irrigation systems among vegetable farmers in Kinniya DS Division, Trincomalee District, Sri Lanka. The Unified Theory of Acceptance and Use of Technology (UTAUT) was used as the conceptual framework, which is a widely accepted model for studying technology adoption. Four major vegetables cultivating *Grama Niladari* divisions, namely *Naduoothu*, *Neduntheevu*, *Kakamunai* and *Majeethunahar* were selected for the study based on their prominence in vegetable cultivation. A field survey was done by using a structured questionnaire with randomly selected 50 farmers who are using the micro irrigation system and 50 farmers who are not using the system. Partial Least Squares regression was applied for the model and hypothesis testing. The results of the Partial Least Squares structural equation model showed that the performance expectancy positively and significantly impacts the intention to adopt micro-irrigation ($\beta = 0.571$, $p < 0.001$). However, effort expectancy negative but non-significant influence on the intention to adopt ($\beta = -0.106$, $p = 0.301$). Similarly, facilitating conditions have a positive impact on technology adoption ($\beta = 0.083$, $p = 0.330$) while behavioral intention has a positive and significant impact ($\beta = 0.736$, $p < 0.001$). Male farmers perceive micro-irrigation as less beneficial ($\beta = -0.587$, $p = 0.007$) than their female counterparts. However, male farmers feel greater ease in using the technology ($\beta = 0.807$, $p = 0.001$), and show stronger intentions to adopt it ($\beta = 0.479$, $p = 0.028$) compared to female farmers. Age shows a negative impact on behavioral intention to adopt a micro irrigation technology ($\beta = -0.222$, $p = 0.011$). Younger farmers demonstrate a higher intention and more like to put effort to adopt a micro-irrigation technology. Conversely, education level showed no statistically significant effort on performance expectancy, effort expectancy and behavioral intention. Overall, the findings highlight the importance of addressing gender disparities and providing targeted support to encourage the adoption of micro-irrigation systems among farmers, particularly in socio-economically diverse contexts. Adoption of micro irrigation is significantly influenced by gender, perceived ease of use, and age. These findings suggest the need for targeted interventions focusing on younger and male farmers to increase uptake. This could be providing references for policy making to improve the adoption of micro irrigation technology in Sri Lanka.

Keywords: Behavioral intention; Micro-irrigation systems; Structural equation modeling; Technology adoption; UTAUT model

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Revitalizing organic regulations in Sri Lanka: Stakeholder perspectives

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Abstract:

National Organic Control Unit (NOCU) is the regulatory body that implements Sri Lankan organic regulations and it was gazetted (No 1870/71) in 2014. Real organic products are not easily identifiable in the local market due to incomplete implementation of organic regulations. Therefore, trust towards organic products is less in the market. This study aimed to assess stakeholder perceptions towards effectiveness of organic regulation, certification and issues regarding organic regulation, and compare Sri Lankan organic regulations with international regulations (Great Britain, European Union, United State Department of Agriculture) to provide recommendations for revitalize Sri Lankan organic regulation. Data were collected through questionnaire survey. Purposive sampling was employed to select 86 consumers and study area was Colombo district. Twenty exporters and seven organic farmers were selected from simple random sampling. Any sample techniques were not employed to select four certification bodies and eight technical committee members and study area was Sri Lanka. Descriptive analysis, Wilcoxon sign rank test, overall mean values and mean scores were employed for data analysis. Findings indicate that consumers have neutral perspective towards effectiveness of organic regulations, certification and do not have perceive towards issues of organic regulation with mean score of 3.23, 3.06, and 2.68 respectively. According to the mean score value of scales, Certification bodies, technical committee members, exporters, and farmers have neutral to positive perspectives towards effectiveness of organic regulations and certification. However, certification bodies, technical committee members and farmers have perceived towards issues of existing organic regulations and exporters have neutral perspective. When compared with international organic regulations, Sri Lankan organic regulation lacks comprehensive documentation procedures. Recommendations include increasing awareness and training programs for stakeholders. Sri Lanka Standard Institute (SLSI) standard can be incorporated into organic regulation to upgrade that. Additionally, a uniform certification scheme for all certification bodies under NOCU is suggested to enhance consistency and transparency in organic certification.

Keywords: Certification; Effectiveness; Limitations; Organic regulations; Stakeholder perspective

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Revitalizing the cinnamon oil distillation industry in Matara district, Sri Lanka: Strategies for sustainable recovery

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Abstract:

The cinnamon oil distillation industry in the Matara District, has faced a significant decline due to a combination of economic, technological, environmental, and policy-related challenges. This study aims to identify the key barriers hindering the industry's progress and propose targeted strategies for revitalization. Given the district's historical prominence in global cinnamon oil production, overcoming these constraints is crucial for sustainable recovery. A complete census approach was adopted, collecting data from all 60 distillation unit owners in the district through pre-tested, structured questionnaires. Both operational and abandoned units were included to ensure comprehensive representation. Of the surveyed units, 38.3% remained active while 61.7% had been abandoned. Descriptive statistics and qualitative analysis revealed four major categories of constraints. Economic factors such as fluctuating market prices, high production costs, monopolistic market structures, and limited access to financing emerged as the most critical constraints ($\bar{X} = 3.48$). Environmental factors ($\bar{X} = 3.33$), including climate variability, erratic weather, and poor waste management, significantly affected industry sustainability. Technological limitations: the widespread use of outdated manual distillation systems and limited technical expertise hindered productivity and efficiency. Political related barriers; High taxation and complex sanitary and phytosanitary (SPS) regulations, further impeded industry growth. Economic and environmental challenges were found to have a greater influence on the abandonment of distillation units than technological and policy-related issues. To address these challenges, this study proposes a suite of revitalization strategies. Key policy reforms ($\bar{X} = 4.13$) involve simplifying certification processes, reducing export-related costs, and introducing supportive frameworks for small-scale producers. Market development initiatives ($\bar{X} = 4.78$) emphasize strengthening value chains, establishing direct international market linkages, promoting the Ceylon cinnamon oil brand, and expanding digital marketing efforts. Capacity-building programs were also recommended enhancing technical knowledge and promoting best practices among producers. Implementing these targeted interventions is vital for overcoming industry stagnation, improving market competitiveness, and supporting the long-term sustainability of the cinnamon oil distillation sector in the Matara District.

Keywords: Cinnamon oil; Economic barriers; Policy reforms; Revitalization; Sustainability; Technological challenges

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Design and development of a portable infrared-based CO₂ monitoring device for environmental applications

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Abstract:

Industrial and agricultural activities, along with natural biogeochemical processes, significantly alter atmospheric composition, contributing to air pollution and accelerating climate change. Carbon dioxide (CO₂), a major greenhouse gas, plays a central role in global warming. Despite its importance, the adoption of CO₂ monitoring in localized environmental and agricultural research remains limited due to the high cost and complexity of commercial gas analyzers. This study was conducted to introduce a portable, low-cost, and high-precision CO₂ measurement system to address this gap in field-based environmental monitoring. The device utilizes non-dispersive infrared (NDIR) spectroscopy, integrating a custom-fabricated 25 cm gas chamber, an infrared emitter (MICRO-HYBRID – JSIR 350-4), a thermoelectric CO₂ detector (MICRO-HYBRID – MPS2SENS), a control circuit board (MICRO-HYBRID NDIR evaluation kit), and two CaF₂ convex lenses (Thorlabs: Ø 25.4 mm, F = 40 mm, E-coated) to optimize optical performance. Calibration established a CO₂ detection range of 1–2000 ppm. Laboratory validation was performed by simulating temporal soil CO₂ fluxes in response to ammonium sulfate fertilizer application under controlled soil moisture variations over seven days. Results demonstrated the device's sensitivity to moisture-induced CO₂ fluctuations, highlighting its capability to capture real-time changes in soil respiration dynamics. The system consistently delivered accurate and reproducible measurements and is estimated to cost approximately 200,000 LKR, substantially lower than comparable commercial alternatives. This innovation presents a scalable and calibratable solution for decentralized environmental and agricultural monitoring, enabling wider adoption of CO₂ sensing technologies in precision agriculture, soil carbon research, and climate change mitigation initiatives.

Keywords: Climate change mitigation; CO₂ monitoring; Environmental instrumentation; Low-cost analyzer; Non-Dispersive Infrared (NDIR); Portable gas sensor

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Water quality monitoring using multispectral images of UAV in small and medium-scale water bodies

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Abstract:

Water quality monitoring is crucial for sustainable management of aquatic ecosystems and resources. Unmanned Aerial Vehicles (UAVs) equipped with multispectral imaging offer an effective, high-resolution substitute for traditional techniques, which are often time-consuming and geographically constrained. This study assessed the feasibility of UAV based multispectral imagery to monitor key water quality parameters including nitrate, phosphate, and Total Suspended Solids (TSS) in two freshwater bodies (small and medium-size) - Mapalana and Wilpita lakes in Sri Lanka. Nitrate, phosphate, and TSS concentrations were analyzed in the laboratory using *in situ* water samples. Simultaneously, multispectral UAV data were processed using Pix4D software to extract various waterbody indices, including NDWI, NLWI, EWI, RDWI, RENDWI, and LWI. Findings showed that RENDWI was particularly successful in tracking phosphate levels according to the validation process. RENDWI displayed strong accuracy for phosphate estimate ($R^2 = 0.93$, $r = 0.96$) while nitrate and TSS showed weak relationship for all indices. NWI and RENDWI had low validation R^2 values (0.27 and 0.30 respectively), therefore, predictive reliability was limited. In conclusion, UAV multispectral imaging is a promising tool for efficient and accurate water quality monitoring, particularly for nitrate and phosphate. Further studies should focus on improving indices for wider application.

Keywords: Nitrate; Phosphate; Total suspended solids (TSS); UAV multispectral imaging; Water quality monitoring

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Optimizing Bael (*Aegle marmelo* L.) powder drink with comparison of two dehydration technique: Spray drying and convection drying

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Abstract:

Bael (*Aegle marmelos* L.) is a seasonal and underutilized fruit with great medicinal and nutritional benefits, yet its consumption is largely limited to the fresh form. Higher post-harvest losses due to inefficient post-harvest systems hinder its commercial utilization. This study investigated the feasibility of converting Bael fruit into powder using spray drying and convection drying techniques enhancing its commercial potential. Bael powder was produced using both drying methods and assessed for physicochemical properties such as its moisture content, water activity, solubility, pH, titratable acidity, ascorbic acid content, and antioxidant activity. Further product development incorporated tamarind as a flavoring agent and optimized a sugar ratio 1:2.5 based on sensory evaluation outcomes. These formulations underwent physicochemical, biochemical, and microbiological analysis to evaluate their shelf life and quality stability during a 45-day storage period. Results showed that spray-dried Bael powder (for both raw juice and final commercial product) exhibited higher titratable acidity, ascorbic acid content, solubility, and antioxidant activity, along with lower moisture content, water activity, and pH compared to convection-dried powder. Both methods yielded powders with favorable physicochemical characteristics for both raw and final commercial products. The final spray-dried powder demonstrated excellent texture and flavor in sensory evaluation. Microbiological quality testing revealed no microbial growth in any of the final powders. Findings underscore the commercial viability of Bael juice powder, indicating spray drying as the more effective method for preserving quality and extending shelf life. The initial physicochemical parameters of both powders were ideal, confirming their potential for scalable commercial development.

Keywords: *Aegle marmelos* L.; Bael juice powder; Convection drying; Physicochemical properties; Spray drying

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Exploring the dynamic impacts of electric car adoption in Sri Lanka on national energy demand and sustainability

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Abstract:

Sri Lanka faces increasing energy demands and environmental challenges from its transportation sector, motivating interest in electric car (EC) adoption. Despite global momentum in electric mobility, the dynamic impacts of EC adoption on national energy demand and sustainability in Sri Lanka remain poorly understood. This study aims (1) to develop a system dynamics model to quantify the impact of EC adoption on Sri Lanka's electricity demand, (2) to analyze sustainability implications, and (3) to assess major barriers, including infrastructure limitations, cost challenges, and policy constraints, using qualitative and quantitative data. A mixed-method approach was employed, combining system dynamics modeling with descriptive analysis. Primary data were collected from 100 EC owners and 60 charging stations, while secondary data were obtained from the Sri Lanka Customs Department and Department of Motor Traffic (2010–2023). Expert opinions and policy reviews informed variable selection, ensuring realistic scenario simulations. Using Powersim and Vensim PLE 10.1.3, a causal loop diagram (CLD) and stock–flow diagram (SFD) were developed to represent interactions among EC adoption, charging demand, and the electricity grid. Relationships were formalized into ordinary differential equations, and model validation employed extreme condition testing. The system dynamics model provides a Sri Lanka-specific analysis with greater detail than previous studies. Simulation results indicate that a 10% EC penetration could raise national electricity demand by ~15%, requiring an additional 480–520 MW of grid capacity, potentially leading to energy supply shortfalls. EC adoption enhances sustainability by integrating with renewable energy, particularly solar PV (65.1% of home-charging EC owners), while 83.7% charge during off-peak hours, supporting grid stability. Public perceptions also influence adoption, with 44.2% of owners citing environmental friendliness and 79.1% citing fuel efficiency, contributing to a reduced carbon footprint. The study identifies key barriers, including limited charging infrastructure 40% of stations concentrated in the Western Province and high upfront costs, which disproportionately affect middle- and low-income consumers. To overcome these barriers, targeted policy initiatives are recommended: expanding nationwide charging infrastructure, integrating smart charging strategies, enhancing financial incentives, and developing robust battery recycling policies, noting that expert interviews revealed no existing policies for EC battery recycling in Sri Lanka.

Keywords: Electric mobility in Sri Lanka, Energy consumption Model, EV policy Sri Lanka, Sustainable transportation systems, System dynamics modeling (Powersim)

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Comprehensive utilization of cashew nut shells for circular economy and sustainable innovation

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Abstract:

This study transforms cashew nut shells (CNS), an abundant yet underutilized byproduct of Sri Lanka's cashew industry, into sustainable biocomposite insulation panels, aligned with circular economy principles. Using a cascading approach, the process maximizes resource efficiency by first extracting cashew nut shell liquid (CNSL), a valuable feedstock for producing resins, coatings, and adhesives. The remaining deoiled shell cake is ground into fine particles and combined with peanut shells, coir fiber, and nontoxic adhesives to formulate eco-friendly insulation panels. These panels outperform traditional Styrofoam, exhibiting a punch strength of 51.9 N approximately 12 times higher and low moisture absorption of 0.643 g at 24°C, ensuring excellent dimensional stability over time. Microstructural analysis reveals robust particle matrix bonding, which enhances durability, microbial resistance, and structural integrity, making the panels suitable for long-term construction applications. By fully utilizing CNS through liquid extraction and solid filler applications, this research establishes a replicable model for valorizing agricultural waste, minimizing environmental impact while replacing petrochemical-based materials. The CNS-based panels offer a scalable, green solution for the construction industry, reducing waste and promoting resource efficiency. This study highlights the technical feasibility and environmental benefits of CNS-based biocomposites, demonstrating their potential to drive material innovation and support global sustainability agendas. By addressing both ecological and economic challenges, these panels pave the way for sustainable building practices, contributing to a circular economy transition and fostering a greener future for construction worldwide.

Keywords: Agro-Waste Valorization; Biocomposites; Cashew Nut Shells; Circular Economy; Resource Efficiency; Sustainable Materials

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Development of a fermented rice beverage incorporating spices and the evaluation of its physicochemical and sensory properties

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Abstract:

Rice (*Oryza sativa*) is a staple food widely consumed throughout Asia, valued for its digestibility, nutritional content, and low allergenicity. It has been proven that overnight-soaked cooked rice serves as a nutritious breakfast and is crucial to the well-being of people. This study focused on developing a functional beverage using fermented Red Kekulu rice, incorporating spices, and evaluating its physicochemical, nutritional, and sensory properties. Raw rice was soaked for three hours, cooked for 20–25 min, and subjected to fermentation for 8, 12, and 16 hrs to prepare three different samples. The resulting fermented beverages enriched with spices: cardamom, cinnamon, and black pepper were pasteurized and evaluated for sensory attributes using a 7-point hedonic scale with 30 semi-trained panelists. The best-performing samples in terms of taste, aroma, and overall acceptability were selected for further processing. Beverages made with 12-hour fermented rice were freeze-dried to produce powdered forms with extended shelf life. The freeze-dried samples were then evaluated for physicochemical and nutritional parameters. The 12-hour fermented rice showed improved flavonoid content (180.25 ± 0.01 mg of quercetin equivalent/100 g), total phenolics (112.96 ± 0.332 mg of GAE/100 g), and antioxidant activity (591.62 ± 0.002 µg/ml) compared to those values of rice in the raw state, after soaking and cooking. Samples incorporated with cardamom-pepper and cinnamon-pepper exhibited $0.49 \pm 0.13\%$ and $0.47 \pm 0.12\%$ moisture, $6.01 \pm 0.84\%$ and $5.94 \pm 0.87\%$ crude protein, $1.11 \pm 0.18\%$ and $1.07 \pm 0.08\%$ crude fibre, $1.21 \pm 0.30\%$ and $1.44 \pm 0.48\%$ crude fat, $0.43 \pm 0.14\%$ and $0.55 \pm 0.14\%$ ash, $90.76 \pm 1.23\%$ and $90.54 \pm 1.53\%$ carbohydrate, and the products' pH and brix values were 5.87 ± 0.00 and 5.88 ± 0.03 and 3.2 ± 0.14 and 4.55 ± 0.21 , respectively. Microbiological analysis confirmed that the freeze-dried fermented rice powders, with a total plate count, yeast, and mould absence, could be stored in triple-laminated aluminium packaging for more than three weeks at ambient temperature conditions. Solubility percentages were 77.58% and 78.9% for cardamom-pepper and cinnamon-pepper powders, respectively. The findings indicate that the fermented rice beverage enriched with spices not only improves nutritional and antioxidant properties but also yields a shelf-stable, palatable functional drink in powder form. This product shows potential to be developed as a natural energy beverage with added health benefits and market sustainability.

Keywords: Antioxidant properties; Fermented rice beverage; Freeze-dried powder; *Red Kekulu* rice; Sensory evaluation

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Study on value addition to banana (*Musa paradisiaca*) pseudo stem flour by developing composite flour-based cracker

P.S.R. Elvitigala, A.A.M. Subodinee* and A.P.H.I. Abeysuriya

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Abstract:

Banana pseudo-stem, a readily available and underutilized by-product of banana farming in Sri Lanka, is rich in dietary fibre and other beneficial nutrients. Despite its nutritional potential, it is mostly discarded or used for low-value purposes. This study aimed to add value to banana pseudo-stem by developing two types of fibre-rich crackers incorporating either fresh pseudo-stem pulp or banana pseudo-stem flour, and to assess their nutritional composition and shelf life. Two different crackers were developed, using two processing methods: fresh pseudo-stem was chopped, boiled, and turned into a pulp, while pseudo-stem was chopped, dried (at 50 °C for 8 hours), and ground into flour. For each product, wheat flour was partially substituted with rice flour and either banana pseudo-stem flour or pulp in different ratios. Sensory evaluation revealed that the most accepted pulp-based cracker formulation consisted of 49% wheat flour, 16% rice flour, and 35% banana pseudo-stem pulp. However, flour-based crackers were successful only with 5% banana pseudo-stem flour, which showed a significantly higher crude protein ($9.40 \pm 0.03\%$) and crude fibre ($7.37 \pm 0.1\%$) compared to pulp-based crackers ($6.79 \pm 0.03\%$ and $6.65 \pm 0.1\%$, respectively; $p < 0.05$). Other parameters, including moisture, crude fat, ash, and carbohydrate content, showed no significant differences between the two types. Shelf-life assessment was carried out over six weeks, with crackers stored at room temperature (25°C) in triple-laminated aluminium packaging. Regular monitoring of moisture content, microbial load (total plate count, yeast and mold count), and visual appearance revealed no signs of bacterial or fungal contamination or quality degradation during the storage. The study demonstrates that banana pseudo-stem can be successfully utilized to produce nutritious, fibre-enriched crackers with acceptable taste, texture, and shelf stability. This innovative approach not only adds value to agricultural waste but also contributes to the development of healthy snack alternatives. Further research is recommended to evaluate the product's micronutrient content, extended shelf life, and consumer acceptability on a larger scale.

Keywords: Agricultural waste utilization; Banana pseudo-stem flour; Fibre-enriched cracker; Nutritional analysis; Shelf-life stability

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Development of a low-cost soil test kit for potassium analysis under field conditions

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Abstract:

Soil testing provides some important information on the nutrient content, including essential elements like potassium (K). Commonly used standard laboratory methods (SLM) like flame photometry are expensive, time consuming, and need trained personnel. Therefore, development of a rapid, cost-effective, and portable soil test kit for determination of soil K is important. This research aims to determine the accuracy between developed test kit method (DTKM) and SLM, and to validate the DTKM via a pot experiment. Soil samples were collected, and K content was analysed by a flame photometer. A test kit method was developed, and used to determine the K content of the same soil samples by comparing color and turbidity of soil extracts with the color and turbidity of K standard series. Correlation analysis was then conducted between SLM and DTKM. The DTKM was validated using bulk soil samples from vegetable fields through a pot experiment. Soils were categorized as low (<160 ppm), medium (160–400 ppm), and high (>400 ppm) K. Seven treatments were designed by varying only the K fertilizer rates. The full Department of Agriculture (DOA) recommended muriate of potash (MOP) was applied to low, medium, and high K soil levels. These soil levels were also tested without MOP and medium K soil received an additional treatment with half the full DOA-recommended MOP rate. The correlation analysis between SLM and DTKM showed R^2 values of 0.98, 0.98 and 0.96 for low, medium, high K vegetable-cultivated soils, respectively and R^2 values of 0.93, 0.98, 0.98 and 0.96 for very low, low, medium and high K rice- cultivated soil, respectively. Colour charts were developed for vegetable and rice soils according to K concentration levels. Considering the growth parameters, fruit yield, number of flowers, root fresh and dry weight, root length and brix value were not significantly different ($p > 0.05$), while plant height, plant dry and fresh weight showed significant differences ($p < 0.05$). Although most parameters were not significantly different, the results indicated an increasing trend in plant growth with higher soil K levels. Therefore, the pot experiment validated the use of DTKM for field soil testing.

Keywords: Correlation; Potassium; Soil testing; Soil test kit; Validation

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Optimizing betel (*Piper betle* L.) growth: Evaluating the impact of a controlled-release fertilizer and a compound fertilizer

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Abstract:

Betel (*Piper betle*) is a commercially important crop, cultivated for both local use and export mainly in Gampaha and Kurunegala districts of Sri Lanka. Frequent harvesting depletes soil nutrients, requiring effective fertilization in betel cultivation. Many farmers believe that the Department of Export Agriculture (DEA) fertilizer recommendation is inadequate for optimal growth, often leading to over-application. This study aimed to evaluate the effectiveness of a controlled-release fertilizer (CRF) and a compound fertilizer (CF) compared to the DEA recommendation in betel growth. The experiment was conducted at the Intercropping and Betel Research Station, Narammala. Seven treatments with eight replicates were arranged in a Completely Randomized Design to supply NPK levels equivalent to the DEA recommendation over three months. The treatments were; T1 (control): DEA recommendation (Urea: 195 g, TSP: 65 g, MOP: 100 g, Kieserite: 60 g - for 100 plants), T2: CRF once for 3 months, T3: CRF every 3 weeks, T4: DEA + CRF - I (initial DEA fertilizer application + one CRF application after 3 weeks), T5: DEA + CRF - II (initial DEA fertilizer application + CRF every 3 weeks), T6: CF every 3 weeks, T7: DEA + CF (initial DEA fertilizer application + CF every 3 weeks). Standard agronomic practices were followed. Stem elongation, number of leaves, nodes, uprights, side branches, and 'Pidunu Kola' (matured leaves) were recorded every 10 days. Soil parameters [pH, electrical conductivity, available N, P, and K, organic matter, and texture] were measured at the beginning and the end of the experiment. Results showed no significant differences in plant growth parameters among treatments. CRF treatments applied once or infrequently showed low soil EC, K, N, and P levels, indicating slow nutrient release, yet with similar plant performance. CF and DEA treatments showed comparable soil nutrient levels effectiveness in supporting plant growth. Given the similar effectiveness of all treatments, CRF could be an environmentally and economically sound fertilizer for betel, particularly when considering nutrient losses and labor costs. Long-term field studies are required to validate the performance of both CRF and CF for practical application recommendations.

Keywords: Bulath; DEA recommendation; Fertilizer efficiency; Nutrient release; Piperaceae

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International Symposium on Agriculture and Environment (ISAE) 2025

Three-Minute Industrial Training Session (3MIT)



Keynote Speech

Innovation and Research for Transforming Agriculture in Sri Lanka

Waruna Madawana Arachchi

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Agriculture has always been the foundation of human civilization, and in Asia it represents more than an economic activity—it is a way of life deeply embedded in culture and society. In Sri Lanka, however, the sector continues to face persistent challenges. Crop productivity in almost all major crops remains below global averages, reducing farm profitability. Post-harvest losses of fruits and vegetables are estimated at 30–40%, resulting in economic waste as well as ethical concerns when a significant proportion of the population faces food insecurity. Seasonal fluctuations in production create price volatility, while the increasing impacts of climate change cyclones, floods, prolonged droughts, and salinity—further threaten livelihoods. At the same time, youth remain largely disengaged from agriculture, raising concerns about the sector's future sustainability.

Addressing these challenges requires a shift from traditional approaches toward a system driven by research, development, and innovation. Feeding a global population of nearly 10 billion by 2050 will demand producing more with fewer resources while protecting the environment, and incremental improvements will not be sufficient. Lessons from countries such as the United States, Israel, Korea, Japan, Sweden, and Germany demonstrate how significant investments in agricultural research and development have driven transformation. In contrast, Sri Lanka invests only about 0.1 percent of GDP in research, limiting its capacity for innovation. Successful experiences from China and India further illustrate that decades of sustained investments in high-yielding varieties, irrigation technologies, and post-harvest management can achieve food self-sufficiency and even enable exports. Sri Lanka's rice self-sufficiency, achieved through locally developed improved varieties, is another example of the critical role of agricultural research.

The way forward lies in embracing innovation across multiple domains. Digital technologies and mobile applications can connect farmers with markets and advisory services, while precision agriculture tools such as drones and remote sensing can improve crop monitoring and resource use efficiency. Biotechnology can generate climate-resilient, high-yielding, and pest-resistant crop varieties, while robotics and automation can address labor shortages and increase efficiency. Artificial intelligence and data analytics can strengthen decision-making by forecasting yields, pest outbreaks, and market trends. Meanwhile, advancements in post-harvest technologies, value addition, and food technology are essential to reduce losses, diversify food products, and enhance nutrition.

Young researchers and innovators will be central to this transformation. They must foster curiosity, work collaboratively across disciplines, ensure practicality in applying research outcomes, remain resilient in the face of failures, and uphold ethics and sustainability in their work. The future of Sri Lankan agriculture depends on empowering a new generation to reimagine farming as a pathway to prosperity rather than a struggle for survival. The next major breakthrough for Sri Lanka, or even for Asia, may well arise from the creativity and vision of today's students and early-career scientists.

Keywords: Agriculture; Innovation; Productivity; Research; Sri Lanka; Sustainability

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Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) - Ministry of Agriculture

M.D.H. Karunarathne

HARTI is the premier national institute for socio-economic research in agrarian sector in Sri Lanka. I had the opportunity to train under the Food Systems Division and the Administrative Division, contributing to local and international research projects and organizational tasks. I gained experience in conducting literature reviews, designing surveys, collecting field data, cleaning and analyzing data, writing scientific reports, and performing administrative functions. I assisted in preparing the Food Commodities Bulletin by collecting daily market prices and participated in workshops and demonstrations. This internship gave me valuable experience and skills, contributing to my professional growth and interest in sustainable development.

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People's Bank – Monaragala

A.M.C.M.R. Aththanayaka

People's bank is a leading government commercial bank in Sri Lanka. I completed my research and the internship program at Monaragala main branch, gaining experience in digital banking, loans, savings and current accounts. I also contributed to two major projects; the Youth Savings Accounts Promotion Project and the Small Medium Entrepreneur loan Project. I developed my skills in customer relationship management, problem-solving, teamwork, adaptability, and leadership by working with customers and staff. Finally, I demonstrated important retention strategies from my research findings to improve employee job satisfaction, and three these strategies were selected for implementation by the company.

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Rice Research Station – Labuduwa

R.I. Ekanayaka

RRS, Labuduwa is the main rice breeding station in the Low Country Wet Zone of the Southern Province, Sri Lanka. I had the opportunity to train under the Rice Breeding Division, Soil and Agronomy Division, and Plant Protection Division. I assisted with ongoing research projects including the development of a control package for weedy rice, the alternate parachute technique, evaluation of different seed priming and coating methods for submergence tolerance and the evaluation of the performance of rice varieties under different fertility conditions. I also gained experience in hybridization, seed certification and agro meteorological data collection. Working with professionals, technicians and labourers enhanced my teamwork skills. Beyond subject knowledge, exposure to team work and new working dynamics helped shape me as a professional.

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Sanskriti University, Mathura, India

B.A.H. Nimaya

I completed my internship at Sanskriti University, Mathura, India, a pioneering institution ranked among the top 10 universities. As a Research Assistant in Department of Biotechnology, I conducted entomological research on mosquito diversity and review paper on Japanese Encephalitis. Simultaneously, I served as an Assistant Lecturer, teaching undergraduate courses in Biotechnology and Forensic Science. I developed course materials, conducted exams, and mentored students. This experience enhanced my teaching, research, and professional skills, fostering adaptability, leadership, and cultural awareness. It also aligned with my dream of becoming a lecturer, while enabling me to contribute to undergraduates, the scientific community and broader community improvement.

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'Mono Tea & Beverages Pvt Ltd' Company

P.P.N. Nanayakkara

This internship captures an immersive experience at Mono Tea and Beverages (Pvt) Ltd., a company dedicated to bringing nature's finest organic powders, teas, and coconut-based products to local and global markets. It was a valuable opportunity to train under the Department of Production, Marketing and Finance. From crafting innovative marketing campaigns to engaging with international clients in hands-on workshops, the journey blended learning, creativity, and real-world challenges. The experience offered a deep dive into brand-building, financial management, and strategic thinking, while navigating the fast-paced beverage industry. This transformative journey enhanced technical skills and brewed a fresh perspective on the art of marketing and consumer engagement.

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Sri Lanka Export Development Board

S.A.K.S. Perera

The Export Development Board (EDB) is the premier state organization responsible for the promotion and development of exports in Sri Lanka. I had the opportunity to train under the National Organic Control Unit, an independent sub-division of Department of Export agriculture. May training allowed me to gain knowledge and practical exposure to organic standards and regulations, organizing trade fairs, fair trade practices, interviews, awareness programs and proper documentation handling. this experience improved my communication, leadership, teamwork, problem-solving, event-planning skills. Furthermore, I contributed suggestions to improve Sri Lanka's organic regulations through research work, which were highly appreciated the institution.

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Department of Agriculture

A.M.I.S. Attanayaka

The Department of Agriculture is a leading government institution with an extensive network of agricultural scientists. My training in the Engineering Division provided the opportunity to apply academic knowledge to practical projects. I contributed to the Agriculture Modernization Project, which transforms G1 potato seed-producing polytunnels into an aerophonic pre-basic G0 seed potato production system. I also conducted research on irrigation and hybrid seed production, collaborated with engineering assistants, handled price quotations and use AutoCAD to design structures. In addition, I visited Agro Parks and seed production farms gaining valuable field experience. This training enhanced my technical expertise, broadened my understanding of agricultural engineering, and provided a strong foundation for my future career.

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National Institute of Fundamental Studies (NIFS)

T. D. G.T. D. Wijepala

The National Institute of Fundamental Studies is Sri Lanka's premier research institute dedicated to natural and social sciences. I trained under the Biological Sciences Microbiology and Soil Ecosystems Research Unit, focusing on soil ecosystems related to Tank Cascade Systems. My work involved soil sampling, biodiversity identification, and laboratory analysis. This experience sharpens my analytical and technical skills while enhancing teamwork and professional interactions. It also broadens my knowledge on advanced research methodologies. Exposure to multidisciplinary research environment strengthened my problem-solving abilities and practical understanding, preparing me to contribute meaningfully to future research and environmental sustainability initiatives.

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Oleena Natural Foods (Pvt) Ltd

B.P.M.K. Bulugahamulla

I completed my industrial training at Oleena Natural Foods Pvt Ltd, a leading Sri Lankan manufacturer of organic and conventional coconut-based products. As a trainee in the Quality Assurance Department, I gained hands-on experience in the production process of virgin coconut oil, quality control measures, and laboratory testing. I also learnt about hygiene management, contamination prevention, and sustainability practices. Working closely with staff members enhanced my problem-solving, teamwork, and communication skills. This experience not only deepened my knowledge of sustainable food production and resource optimization but also prepared me for a professional career in the coconut industry.

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The China-Sri Lanka Joint Research and Demonstration Centre (JRDC)

S.I. Yapa

The training at the China–Sri Lanka Joint Research and Demonstration Centre (JRDC) focused on environmental research, sustainability, and bridging the gap between academia and industry. I gained expertise in advanced laboratory analyses for water, and molecular biology, while also serving as a JRDC representative in pioneering initiative such as Sri Lanka's first Eco-Industrial Park (EIP) project, and ISO 14001 certification for Kandy Industrial Park, the largest environmental Management System component in South Asia. I also contributed to research publications on GHG verification, life cycle assessment (LCA), and sustainable FDI, in collaboration with the Chinese academy of sciences. This experience was transformative enabling me to translate advance research into practical applications for sustainability.

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Kandy Industrial Park (KIP), Board of Investment (BOI), Pallekele, Kandy

J.F. Safeeya

The Board of Investment (BOI) is the key government agency guiding industrial development and investment promotion. I trained under the Environmental Department at Kandy Industrial Park (KIP), engaging with 248 export-oriented entities across seven districts. I gained experience in compliance monitoring, carbon footprint assessment, water quality monitoring, waste management, and sustainability metrics for Eco-Industrial Parks in collaboration with the Chinese Academy of Sciences. I also contributed to industrial ecology applications, proposed a reed-based wetland system, and published two international research papers. This journey enhanced my analytical and teamwork skills, fostering active involvement in sustainability programs and paved the way for my master's studies in China.

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CIC Agribusinesses (Private) Limited

R.M.B.M. Rathnayaka

During my industrial training at CIC Agribusinesses, I contributed to the "Dallakin Wenasak" project, which aimed to uplifting the production of small-scale tea growers in Sri Lanka. I visited 20 clusters of smallholder farmers, providing advisory services on sustainable farming practices, such as crop management, fertilizer use, and soil fertility improvement. I also guided farmers in adopting new agronomic practices and recording their activities. This training enhanced my skills in crop management, communication, and problem-solving, and technology integration. Moreover, it gives me valuable experience in working with divers smallholders and strengthen my understanding of sustainable agricultural development.

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Renuka Foods PLC - Shaw Wallace Ceylon Limited

Mahsoom Ahamed

Renuka Foods PLC - Shaw Wallace Ceylon Limited is a leading FMCG company in Sri Lanka. I trained as a Quality Assurance Intern, gaining hands-on experience in food quality control, supplier ingredient verification, and packaging material analysis. My responsibilities included conducting free fatty acid tests, monitoring storage and transportation conditions, and ensuring compliance with food safety standards. Additionally, I prepared training presentations for workers and suppliers. Collaborating with industry professionals enhanced my teamwork and communication skills. I also proposed improvements in storage protocols, which were well received by the QA team. This internship provided valuable exposure to food quality assurance and safety standards.

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'Naresuan University' Thailand

D.S. Wickramasinghe

Naresuan University, a distinguished institution in Phitsanulok, Thailand, provided me with an invaluable training opportunity under the Faculty of Engineering. I participated in state-of-the-art projects, including "Predictive Analysis of Crack Formation in Rice Grains Using Machine Learning." Field visits to large scale strawberry and lettuce farms enriched my understanding of climate-smart agriculture. I also developed a predictive analytics model for rice quality assurance, which was highly recommended by the university. This training sharpened my problem-solving, teamwork, and technical skills, expanded my professional network and strengthen my interest in applying machine learning to agriculture. I intend to use these insights in Sri Lanka to improve rice quality control.

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XPERTS Facility

Thilaxsana Amirthalingam

XPERTS Facility is a leading YouTube automation service provider, specializing in channel branding, scriptwriting, AI voiceovers, and SEO optimization. During my internship, I trained under the Channel Management & Marketing team, gaining hands-on experience in SEO analytics, AI voiceover creation, project management (Trello), and corporate communication. I also developed skills in automation tools such as RPA and Eleven Labs, while contributing to performance auditing and data driven content strategies. Collaborating with cross-functional teams enhanced my adaptability and problem-solving abilities in a fast-paced digital environment. My contributions included optimizing growth strategies for YouTube channels and improving client engagement. This experience deepened my expertise in digital marketing and automation technologies, paving the way for future innovation in the field.

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Nations Trust Bank PLC

Thanukshan Thuraiyappa

I completed my industrial training at Nations Trust Bank PLC in the Lean Transformation Department, where I gained hands-on experience in business process reengineering and digital transformation. I worked on process mapping, automation using Power Apps, EDM flyer creation, and digital course development. Additionally, I contributed to sustainability projects such as the Ecomate app and conducted research for my Lean Six Sigma Yellow Belt project. This training enhanced my analytical, technical, and problem-solving skills, while providing valuable insights into corporate operations. It also strengthened my ability to drive efficiency and innovation, preparing me for future roles in business transformation and process improvement.

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HJS Condiments Ltd

V. S. Kahandagamage

HJS Condiments Ltd, a leading Sri Lankan manufacturer of processed fruits and vegetables exporting to over 52 countries, is a joint venture of Hayleys conglomerate. During my internship, I had the opportunity to work across all sectors of production as well as the Quality Assurance Department. I developed skills in documentation for major audits such as ISO 9001, ISO 14001 and HALAL and gained hands-on-experience in Good Manufacturing Practices (GMPs), processing, pretreatment and storing techniques. Participation in the HALAL audit was one of the pivotal moments of my training. Overall, this experience provided valuable insights and prepared me for my future career.

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Dole Lanka (PVT) Ltd

D.M.C.I. Dissanayake

Dole Lanka (Pvt) Ltd, a subsidiary of Dole Food Company, is a prominent player in the global fresh produce industry. I was assigned to the Research and Development division, where I gained practical experience in microbiology laboratory work and research activities. This training enhanced my understanding of laboratory procedures, health and safety protocols, and scientific methods. Through group work, field activities, and workforce collaborations, I strengthen my communication, interpersonal, and teamwork skills. I also developed time management, documentation, presentation abilities, as well as the capacity to applying theory in real-world situations. This experience equipped me with confidence and essential skills for professional growth.

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Sri Lanka Export Development Board

P. S.T. Weerasinghe

The Sri Lanka Export Development Board (EDB) is the national body for export promotion and development. During my training at the Regional Development Division, I gained exposure to export procedures, international trade, policy frameworks, project management, and data analysis. My competencies in strategic planning, leadership, teamwork, and critical thinking were strengthened through training programs and workshops. I also conducted research on the effectiveness of international trade fairs in Sri Lanka, providing strategic recommendations for EDB. My contributions were highly recognized, leading to the opportunity to join an international project with EDB after my internship.

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Ceylon Grain Elevators PLC

K.N.G. Senaratne

Ceylon Grain Elevators PLC is a pioneer in feed milling in Sri Lanka. I trained under both the Department of Production & Engineering and Department of Quality Assurance & Quality Control. My responsibilities included laboratory testing, record keeping, culture media preparation, and maintaining professional communication and ethics. and Time management. I also developed time management and teamwork skills through close collaboration with staff members, while improving interpersonal skills by engaging with individuals across all organizational levels, from top management to labourers. Challenges such as technical complexities in lab work and the limited training duration further strengthened my adaptability and problem-solving abilities.

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