



International Symposium on Agriculture & Environment

Building Resilient Agri-Food Systems for
Nutrition Security and Food Sovereignty

Proceedings

Faculty of Agriculture, University of Ruhuna, Sri Lanka

**Proceedings of the International Symposium on
Agriculture and Environment (ISAE)
2024**

**"Building Resilient Agri-Food Systems
for
Nutrition Security and Food Sovereignty"**

**10th May 2024
Faculty of Agriculture
University of Ruhuna
Sri Lanka**

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Preface

With immense pleasure and excitement, the Editorial Board is delighted to unveil the Proceedings of the **International Symposium on Agriculture and Environment (ISAE-2024)**, centered on the theme of **"Building Resilient Agri-food Systems for Nutrient Security and Food Sovereignty."** This theme perfectly resonates with the contemporary global focus on advancing agriculture. As the editor-in-chief of ISAE for the 7th consecutive time, it is a privilege for me to present this compilation of scholarly works, which embody the innovative research, diverse perspectives, and collaborative endeavors highlighted at ISAE 2024 on 10th May 2024.

In a world marked by rapid population growth, shifting climatic patterns, and evolving dietary preferences, the resilience of our agri-food systems has never been more critical. The theme of ISAE 2024 highlights the urgent need to build agricultural systems that are not only capable of sustaining food production but also resilient to shocks and stresses, ensuring nutrient security and upholding food sovereignty for all.

Nutrient security lies at the heart of sustainable development, encompassing access to safe, nutritious, and culturally appropriate food for all individuals. However, achieving nutrient security goes beyond mere calorie intake; it necessitates a holistic approach that considers the availability, accessibility, and affordability of essential nutrients, micronutrients, and bioavailable foods. Similarly, food sovereignty represents the right of communities to define their own agricultural and food policies, ensuring that food is produced, distributed, and consumed in a manner that prioritizes local needs, cultural values, and environmental sustainability. By empowering farmers, indigenous peoples, and marginalized communities to assert control over their food systems, food sovereignty becomes a powerful tool for promoting social justice, economic empowerment, and environmental stewardship.

The ISAE 2024 conference explores a wide array of themes and topics that resonate with the overarching theme of building resilient agri-food systems for nutrient security and food sovereignty. From soil health and agricultural biodiversity to food waste management and sustainable diets, the conference covers a spectrum of issues relevant to the sustainable transformation of our food systems. This symposium will feature a diverse range of papers, with nearly 125 presentations scheduled across four thematic areas. The parallel technical sessions will focus on the following thematic areas: **1) Crop production, Soil management, and Environmental stewardship, 2) Agricultural Economics, Entrepreneurship and Agribusiness, 3) Precision Agriculture: Navigating the Digital Landscape, and 4) Food Technology, Nutritional Sciences, Livestock Production and Aquaculture.**

Moreover, ISAE 2024 includes a specially curated segment: the **Young Graduate Forum (YGF-2024)**. Within this forum, 10 oral presentations and 19 poster presentations will be delivered by recent graduates from seven departments of the Faculty of Agriculture at the University of Ruhuna. These graduates, hailing from three-degree programs - BSc in Agricultural Resource Management, BSc in Green Technology, and BSc in Agri-business Management, will have a significant platform to refine their future professional pathways.

The Proceedings of ISAE 2024 feature contributions from researchers, practitioners, policymakers, and stakeholders from diverse backgrounds and disciplines, offering valuable insights, innovative solutions, and best practices for building resilient agri-food systems. From empirical research studies and case analyses to policy recommendations and community-led initiatives, each paper in this volume contributes to our collective understanding of the challenges and opportunities facing our food systems.

By fostering interdisciplinary dialogue, promoting knowledge exchange, and encouraging collaboration, the ISAE 2024 conference serves as a catalyst for transformative change in the way we produce, distribute, and consume food. Through shared learning and collective action, we can work towards a future where nutrient security and food sovereignty are not only aspirations but also tangible realities for communities around the world.

Moreover, the Proceedings of ISAE 2024 exemplify the spirit of innovation, collaboration, and commitment to sustainability that defines our collective efforts to build resilient agri-food systems. As we navigate the complexities of the 21st century, let us draw inspiration from the insights and findings presented in this volume to forge a path towards a more equitable, resilient, and sustainable future for all.

The Editorial Board and Publication Committee extend their heartfelt appreciation to the esteemed chief guest, guest of honor, keynote speakers, and all authors for their invaluable scholarly contributions and exceptional collaboration in assembling the Proceedings of ISAE 2024. The success of this significant endeavor is a testament to the concerted efforts of numerous individuals, including the coordinator, Dr. (Mrs). A.A.M. Subodinee along with members of the publication committee and the Editorial Board. Their unwavering dedication and steadfast commitment are deeply acknowledged and commended. As the Editor-in-Chief of ISAE-2024, I am delighted to convey my warmest regards to all participants for what promises to be a rewarding and enriching experience during the conference of ISAE 2024. Together, we are shaping a brighter future for agriculture, the environment, and humanity as a whole.

Best wishes and have a great time!

Snr. Prof. Guttila Yugantha Jayasinghe
Editor-in-Chief
Proceedings of ISAE 2024

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**Message from the Vice Chancellor
University of Ruhuna, Sri Lanka**

I am pleased to send this message to the International Symposium on Agriculture and Environment (ISAE) 2024, organized by the Faculty of Agriculture, University of Ruhuna. “Building Resilient Agri-Food Systems for Nutrition Security and Food Sovereignty” is a timely theme, especially at a time when Sri Lanka finds itself amidst a food crisis followed by its worst economic crisis in the last 70 years, exacerbated by the Covid-19 pandemic, the climate change scenario and undoubtedly with a huge contribution from erroneous policies by the agricultural professional and the Sri Lankan government.

According to the FAO, food security means having both physical and economic access to safe, nutritious food in quantities that meet dietary requirements and food preferences, enabling an active and healthy lifestyle. On the other hand, food sovereignty refers to people's entitlement to wholesome, culturally appropriate food, emphasizing environmentally friendly and sustainable production methods, and crucially, the autonomy to shape their own food and agricultural frameworks. Even though Sri Lanka is an agriculture-based nation, contributions both from the agricultural sector to national GDP and its employment percentage have declined over the last 3-4 decades despite the increment in agricultural land extent. Climatic changes over the said time have proven to play a major role in this, but the absence of a strong strategic plan to revive the agricultural sector with short-term and long-term measures and the short-sighted policies enforced by the local administrators/legislators cannot be exempted. According to the UNICEF Sri Lanka Humanitarian Situation Report covering January to December 2023, 3.9 million individuals (17.8% of the population) experienced moderately acutely food insecurity, with child wasting among those aged 6 to 59 months reaching 19.8%, marking a 6.6% increase from the previous year. Many families have adopted negative coping mechanisms, prioritizing food consumption over education, health, and protection which poses long-term risks to the nation's well-being.

As a frontier academic institution, University of Ruhuna and particularly the Faculty of Agriculture greatly contributes to building resilient agri-food systems through research, development, and innovation addressing the gaps in many aspects such as agroecology, agroforestry, biotechnology, climate change adaptation, etc.

It is time that we promote young graduates to engage more in farming with novel insights and strategies not only in the field but also in decision-making where the outdated nature and unawareness of the local authorities and policymakers in the country show reluctance to shift from the conventional agriculture to sustainable initiatives which are crucial in safeguarding food security and food sovereignty. Finally, I highly appreciate the Dean/FOA and the organizing committee for hosting such an inspiring event amid the numerous disruptions we are currently confronting. I truly wish the event to be a great success!

Snr. Prof. Sujeewa Amarasena

Vice Chancellor, University of Ruhuna

Message from the Dean
Faculty of Agriculture, University of Ruhuna, Sri Lanka

It is indeed a great pleasure to send this message as the Dean on behalf of all my colleagues who worked tirelessly to organize this symposium amidst many obstacles and challenges. The Faculty of Agriculture, University of Ruhuna has very successfully organized many national and international symposia in the past and the first edition of the ISAE was held in 2011. We are committed to raise the quality of this event and live up to the expectations of researchers who selected our symposium to present their research findings.

Our vision is to make the ISAE an annual meeting place for scientists and professionals in agricultural, environmental and allied sciences to share their research findings, innovative ideas and forge new collaborations. Agriculture is considered as one of the main polluters of environment and our biggest challenge is to raise the agricultural production to feed the ever-increasing human population while protecting the environment for the benefit of future generations.

The overarching theme of this year's symposium is ***"Building Resilient Agri-Food Systems for Nutrition Security and Food Sovereignty"*** highlighting the need of new strategies to ensure that individuals have access to an adequate and secure food supply to meet their nutritional needs. The key concepts in the theme emphasizes creating robust agricultural and food systems that not only ensure food security but also prioritize nutrition and sovereignty over food resources. This approach recognizes the interconnectedness of agriculture, nutrition, and food sovereignty, acknowledging that a resilient food system is one that can withstand shocks and stresses while providing sufficient, nutritious, and culturally appropriate food for all. The global demand for food is projected to increase several folds in the coming decades and there will be greater consumption of processed foods, animal proteins, fruits and vegetables with higher demand for food quality and safety. Our country is in need of solid approaches in food security and natural resource management to position Sri Lanka's agriculture sector towards effective and efficient fulfillment of its multi-functional roles. By prioritizing resilience, nutrition, and sovereignty within agricultural and food systems, communities can better withstand challenges and uncertainties while ensuring that all individuals have access to safe, nutritious, and culturally appropriate food.

Collaborations among scientists and institutions and networking in research is pivotal for the advancement of science and technology and hopefully, the presentations done and discussions followed at this symposium would lead to further research and development of technologies and collaborations towards national development. I take this opportunity to express my sincere gratitude to all my colleagues of the organizing committee who devoted their time and energy to make this event a success. Finally, I sincerely wish invited guests and speakers, all authors and participants a productive and pleasant stay at the ISAE 2024.

Snr. Prof. Sudas D. Wanniarachchi

Dean/Faculty of Agriculture,
University of Ruhuna

Message from the Coordinator
International Symposium on Agriculture and Environment (ISAE) 2024

It is indeed an honour to convey this congratulatory message on the occasion of the 14th International Symposium on Agriculture and Environment - ISAE 2024, organized by the Faculty of Agriculture, University of Ruhuna, Sri Lanka. This annual event aims to foster collaboration among global academics, researchers, and professionals across the agriculture, food, and environmental sectors. Being of the theme for ISAE 2024, "*Building Resilient Agri-Food Systems for Nutrition Security and Food Sovereignty*," focuses on addressing the challenges and opportunities in global agriculture and sustainable food access to establish practical, systematic approaches for community-based sustainability, ensuring nutrition-rich food availability through innovative research, technology transfer, and strengthening multidisciplinary collaborations.

A conference of this scale and scope is only possible with your generous contributions. As the coordinator of this event, I would like to take this opportunity to personally express my sincere gratitude to Chief Guest, His Excellency Badli Hisham Bin Adam, the Honorable High Commissioner of Malaysia to Sri Lanka and Ambassador of Malaysia to the Republic of Maldives, and the Guest of Honour, Shri Harvinder Singh, Honorable Consul General of India, Hambantota, Sri Lanka representing the His Excellency honourable Indian High Commissioner, High Commission of India for gracing this occasion. Your presence and contributions would honour us and significantly enhance the event's impact, fostering meaningful reconciliation and expanding opportunities for higher education and collaborative research between each other. This Symposium aligns with our long-standing relationship and shared goals in food & agriculture, science & technology, and skill development, further strengthening bilateral cooperation and collaborative studies on innovative research and investigations. The Symposium will be a physical, interactive conference that will allow direct engagement and the exchange of ideas. On behalf of the Faculty of Agriculture, University of Ruhuna, I welcome keynote speakers, special invitees, Sponsors, Chairpersons, evaluators, conveners, all authors, participants and all well-wishers to this prestigious occasion. Your invaluable experience and expertise in developing the agriculture and food sector, particularly in the context of our theme, are appreciated and crucial. They would provide significant learning opportunities to all the participants of ISAE 2024, and we look forward to your active participation.

The event will feature plenary sessions with industry experts and professionals from leading food industries and the Oil palm sector in Sri Lanka alongside technical sessions aligned with the conference theme. We would be incredibly honoured and deeply grateful for your insights and guidance during the plenary. Your contributions are not just valuable, but they have the potential to significantly impact our multi-stakeholder audience and contribute to exploring new avenues in food & agriculture. We are excited about the potential outcomes of your participation. Special thanks go to my two secretaries for their untiring efforts and dedication to organizing the event. I express my profound appreciation for the support extended by all our active memberships representing the ISAE organizing committees. I also want to express my special gratitude to my dear students and the non-academic staff at the Faculty of Agriculture, University of Ruhuna, who played an essential role behind the scenes in making this event a success and a reality. Finally, my dear participants, I wish you all an informative and productive time at ISAE 2024. I am sure the event will unforgettably inspire you.

Dr. (Mrs) AAM Subodinee
Conference Coordinator - ISAE 2024

Message from the Chief Guest

Keynote Speech

His Excellency Mr. Badli Hisham Bin Adam
Honourable High Commissioner of Malaysia to Sri Lanka

Navigating the Future of Food Security: The Malaysia Madani Vision for Sustainable Development"

I am profoundly grateful for the opportunity to speak before you at the 14th International Symposium on Agriculture and Environment (ISAE_2024). Today, I bring forward insights from our beloved nation, Malaysia, embodying a vision deeply rooted in our cultural essence while bravely navigating the pathways of modernity through the Malaysia Madani framework.

1. The Essence of Malaysia Madani

The Malaysia Madani concept is not merely a policy initiative; it is a profound civilizational ethos that embodies the spirit of our nation's aspirations towards a more balanced, inclusive, and sustainable future. Introduced by Prime Minister Datuk Seri Anwar Ibrahim, Malaysia Madani calls upon us to rethink our approach to development, blending modern innovations with the wisdom of our cultural heritage.

At its core, "Malaysia Madani" is about creating a society where development is not just measured by economic output, but by the quality of life and the well-being of every citizen. It rests on six fundamental pillars:

- 1.1. **Sustainability (Green Economy and Good Governance):** Sustainability is the backbone of the Madani philosophy, focusing on fostering a green economy and implementing good governance practices. This pillar promotes environmental protection, sustainable resource management, and policies that are transparent and accountable, ensuring that growth does not compromise future generations.
- 1.2. **Prosperity (Investment and Future Industry):** Under the Madani vision, economic policies are designed to drive prosperity through strategic investments and nurturing future industries. This involves enhancing Malaysia's economic competitiveness by leveraging new technologies and innovations that open up opportunities for all, reducing economic disparities.
- 1.3. **Innovation (Quality Education and Skilled Workforce):** Innovation in the Madani framework is propelled by a commitment to quality education and the development of a skilled workforce. By focusing on educational empowerment, the vision aims to equip individuals with critical skills and knowledge that enable them to innovate and adapt in a fast-evolving global landscape.
- 1.4. **Respect (Unity through Diversity and Heritage):** Respect for diversity is crucial in the Madani vision, which celebrates Malaysia's cultural tapestry. It fosters unity and mutual respect among different ethnicities and religions, promoting a society where diversity is seen as a strength and cultural heritage is preserved.
- 1.5. **Trust (Ethical Governance):** Trust is cultivated through ethical governance, which is central to the Madani approach. This involves upholding integrity and

- accountability in leadership, ensuring that governance mechanisms are fair, serve the public interest, and maintain high standards of public welfare.
- 1.6. **Care and Compassion (Happiness and Well-being through Sports, Arts, and Culture):** The final pillar emphasizes the importance of care and compassion, enhancing happiness and well-being through active engagement in sports, arts, and cultural activities. This approach not only enriches the societal fabric but also supports mental and physical health, fostering a more holistic sense of community well-being.

These principles guide every facet of our national agenda, influencing how we tackle the challenges of modern governance, such as food security. By adhering to these values, we aim to build not just a more prosperous nation, but a more harmonious and resilient one.

In the heart of the Malaysia Madani framework lies a commitment to sustainability, inclusivity, and ethical governance, which are crucial elements in addressing the multifaceted challenge of food security. The Madani vision seeks to translate these lofty principles into concrete actions through various programmes and initiatives that not only aim to ensure food availability and affordability but also strive to achieve environmental sustainability and social equity. Here, we explore how the Madani principles are intricately linked to food security through specific programmes and initiatives that embody this vision.

2. Ethical Governance and Food Security

At the foundation of the Madani philosophy is ethical governance, which prioritizes transparency, accountability, and integrity in all governmental actions. In the context of food security, this principle has led to the implementation of stringent monitoring and regulation policies to ensure the safety and quality of food products. For example, the Malaysian government has ramped up its efforts to crack down on food fraud and contamination, which not only protects consumers but also enhances the international reputation of Malaysia's food products, thus supporting local producers and the economy.

3. Economic Equity in Agricultural Development

Economic equity is another pillar of the Madani vision, ensuring that the benefits of development are shared across all segments of society. This is particularly visible in initiatives aimed at supporting smallholder farmers, who are integral to the agricultural landscape in Malaysia. Programmes such as the Integrated Agricultural Development Area (IADA) projects focus on improving the infrastructure and resources available to farmers in designated areas. These projects help increase yield and productivity through better irrigation systems, seed quality improvement, and access to farming technology, thus supporting Malaysia's food self-sufficiency goals.

Additionally, the AgroBazaar programme under the Madani framework serves as a platform for small-scale farmers to sell their produce directly to consumers, cutting out the middlemen and ensuring fairer prices for both producers and consumers. This initiative not only boosts the income of local farmers but also makes fresh, local produce more accessible and affordable to Malaysian households.

4. Sustainable Living Through Smart Agriculture

Sustainable living, a core component of the Madani principles, is directly linked to the development of sustainable and smart agricultural practices. The Smart Farming initiative, which incorporates the use of technology and sustainable farming methods, is a prime example of this. By utilizing precision farming techniques, IoT (Internet of Things) technology, and eco-friendly pest management systems, this initiative aims to increase the efficiency of resource use, including water and energy, reduce the environmental impact of farming, and boost crop yields.

Furthermore, the Malaysian Organic Scheme (SOM) certifies farms that adhere to strict organic farming standards, promoting practices that are free from synthetic pesticides and fertilizers. This not only supports the sustainability of agriculture but also caters to the growing market demand for organic products, enhancing the livelihoods of organic farmers.

5. Educational Empowerment through Agricultural Training

The Madani vision places a strong emphasis on educational empowerment, recognizing that knowledge and skills are fundamental to empowering individuals and communities. This is evident in various training and development programmes aimed at farmers and agricultural entrepreneurs. The Young Agropreneur Programme is a government initiative offering grants, training, and support to young farmers and entrepreneurs looking to innovate in the agriculture sector. This programme aims to attract younger generations to agriculture, ensuring the sector's future while equipping them with the skills needed to operate sustainably and efficiently.

6. Community Involvement and Cooperative Movements

Respecting and promoting diversity, the Madani vision encourages community involvement and cooperative movements in managing food security. Cooperative farming initiatives have been encouraged, allowing communities to collectively own, manage, and benefit from agricultural resources. These cooperatives often provide members with access to shared resources, training, and markets, which can significantly improve food production capabilities and economic returns.

Through these cooperatives, communities are also able to implement integrated farming systems that combine crop cultivation with livestock raising, which can lead to more sustainable agricultural practices and diversified income sources.

The Malaysia Madani framework is a comprehensive approach to governance that intertwines ethical values with practical initiatives to address the country's challenges. In the realm of food security, the application of Madani principles through various government-led programmes and initiatives demonstrates a commitment to not just addressing the immediate needs of food availability and safety but doing so in a way that is sustainable, equitable, and empowering for all Malaysians. As Malaysia continues to develop and implement these initiatives, it sets a notable example of how integrating traditional values with modern governance can lead to profound and lasting benefits across society.

7. Various Projects:

Malaysia is actively implementing various projects to bolster its food security, leveraging modern technologies and strategic policies to ensure the availability and affordability of food for its population.

- a. **Integrated Dairy Farm Development Project in Chuping, Perlis**
This project aims to revitalize the dairy industry, reducing reliance on imported milk by developing state-of-the-art dairy facilities that incorporate modern farming technologies and sustainable practices (Malay Mail).
- b. **Agrovest Investment Program**
Managed by Agrobank, this program provides RM250 million in funds to support agricultural start-ups that utilize modern technology, helping to modernize Malaysia's agricultural sector and enhance its productivity (BusinessToday).
- c. **Food Security Strengthening Program**
With an allocation of RM400 million, this initiative aims to protect consumers from price shocks by enhancing the resilience of the local food supply chain amid global disruptions (BusinessToday).
- d. **National Food Security Policy Action Plan 2021-2025**
This comprehensive plan covers various strategic initiatives aimed at improving food availability, accessibility, safety, and sustainability across Malaysia (KP Knowledge Management).
- e. **Pilot Project for Padi Planting**
Aiming to increase local rice production, this project involves a pilot scheme across multiple padi planting seasons in regions like Bota Kiri, Perak; Kangar, Perlis; and Kota Sarang Semut in Kedah. Additionally, subsidies for cultivating hill padi have been increased to encourage expansion and improve self-sufficiency (The Star).
- f. **COSAFS2024 Conference in Sarawak**
This event focuses on sustainable agriculture and food security, providing a platform for learning and sharing innovative agricultural practices and technologies. It includes conferences on indigenous crops, fisheries, animal sciences, and food and industrial crops, aiming to strengthen both local and global food security networks (UPM Conference).

These initiatives illustrate Malaysia's holistic approach to food security, integrating financial support, modern technology, and international collaboration to foster a sustainable and resilient food system.

8. Conclusion: A Call to Action

As we look ahead, the Malaysia Madani vision provides a compass for our journey towards a sustainable future. It reminds us that in the pursuit of technological and economic advancement, we must not lose sight of our ethical values and the need for a compassionate and equitable society.

In conclusion, let us carry forward the spirit of Malaysia Madani, embracing challenges as opportunities to innovate and transform our food systems for the betterment of all. Together, we can build a resilient agri-food system that not only feeds our nation but also nurtures the planet. Thank you for your attention. I look forward to the ideas and collaborations that will emerge from this symposium, as we collectively advance towards a more sustainable and secure global food future.

His Excellency Mr. Badli Hisham Bin Adam

Honourable High Commissioner of Malaysia to Sri Lanka

Message from the Guest of Honour

Mr. Shri Harvinder Singh
Honourable Consul General of India – Hambanthota, Sri Lanka

In 2024, we are blessed to have facilities like internet, advanced medical treatments and air connectivity etc. As humans, today we live a comfortable life in comparison to those who lived 100 years before us. We have quick access to information through mobile in our hands and we are able to communicate and reach out to people sitting in other parts of the world within seconds. While we have a very good quality of life, thanks to scientific advancements, the fact remains that in spite of all this, the three basic needs of every human being remain: Food, Shelter and Clothing.

If any of these three basic needs are not fulfilled the entire paraphernalia of scientific progress that we see around us seems to be meaningless. Even out of these three basic needs also, the first and foremost need for any individual is Food. Food security, health and nutrition are paramount not only for overall human wellbeing, but also for securing livelihoods and economic development.

Unfortunately, while we as humans have embarked on a journey of scientific advancement, we have somehow diverted our attention from this very basic need. Food for all and its continued supply should be the most basic objective for each one of us.

According to the 2023 edition of the State of Food Security and Nutrition in the World report of the United Nations, between 691 and 783 million people faced hunger in 2022, representing an increase of 122 million people compared to 2019. If recent trends continue, the number of under-nourished people will surpass 840 million by 2030. The report also highlights that while 2.4 billion people experienced moderate food insecurity and 900 million people faced severe food insecurity. Over 3.1 billion people could not afford a healthy diet. Many children under five suffer from malnutrition. Further, human health is threatened by poor food safety and diseases transmitted within food systems. Diet-related non-communicable diseases are also increasing across the globe.

The major factors which adversely affect agriculture yield are global greenhouse gas emissions, land degradation and the depletion of water resources. Further, due to increased population, the area under irrigation is also getting reduced.

India being a large country with the highest population in the world has first-hand experience of dealing with the problem of food scarcity. Over the years, she has done exceptionally well in ensuring food security for its population. During covid times government of India was able to provide free ration comprising of wheat, rice and other cereals to over 800 million citizens of India.

Govt. of India has embarked upon multiple strategies including reducing the significant productivity gaps of smallholder farmers, Nature-Positive solutions, restoration of degraded land, selecting tree species to be used in restoration etc. to address the issues of food security. These measures have been carefully designed and have multiple uses and benefits in terms of food and nutrition security.

Ending hunger and enabling safe, affordable and healthy diet not only for her own people but also for the world's most vulnerable people is a priority of India. India believes in the concept of

“*Vasudhaiva Kutumbakam*” (Sanskrit: वसुधैव कुटुम्बकम्) which means “*The World Is One Family*”. The idea of the phrase remains relevant today as it emphasizes a global perspective, prioritizing the collective well-being over individual or family interests. It encourages to think about the welfare of others, fostering global solidarity and responsibility, especially in addressing crucial issues like food security. With these ethos and cultural values in mind, India supplied vaccines and essential medicines to more than 160 countries around the world during covid times. Even recently, India came forward and relaxed its rules to supply onions to Sri Lanka when there was a shortage of onions in the country.

In our journey ahead, let us work together to ensure food, health and progress for all as we are part of one world, one family and have one future. I hope this symposium will bring out ideas and enable policy-makers and stakeholders to look into the issues with open mind and proceed further with this objective of shared future and strengthen multidisciplinary collaboration.

Thank you.

Mr. Shri Harvinder Singh

Honourable Consul General of India

Hambanthota, Sri Lanka

Keynote Speech of the Inaugural Session

International Symposium on Agriculture and Environment (ISAE) - 2024

Encapsulation of polyphenols and dietary fiber-based colon-targeted delivery

Zhongxiang Fang

Professor, School of Agriculture, Food and Ecosystem Sciences, Faculty of Science, The University of Melbourne, Parkville, Vic 3010, Australia

Natural polyphenols, abundant in plants, are vital components of both human and animal diets, boasting a diverse range of biological activities like antioxidant, anti-inflammatory, antibacterial, and antiviral functions. Evidence from preclinical studies and epidemiological data indicates that these compounds may slow down cancer progression, reduce the risk of cardiovascular and neurodegenerative diseases, diabetes, osteoporosis, and potentially offer therapeutic effects for colon-related diseases and gut microbial imbalances. Over recent decades, there has been significant interest in researching and applying polyphenols in functional foods, nutraceuticals, and pharmaceuticals.

However, while polyphenols show promise *in vitro*, their effective concentrations often surpass what is achievable *in vivo*. Maintaining the bioavailability of these active compounds poses a considerable challenge. Factors such as limited gastric residence time, low gut permeability and solubility, and susceptibility to degradation during food processing, storage, and digestion hinder their efficacy and health benefits. Thus, effectively delivering these compounds requires protective mechanisms to preserve their activity until consumption and target their delivery within the body.

Microencapsulation technology offers a solution by encapsulating polyphenols in miniature, sealed capsules. This approach addresses the challenges of instability, unpleasant taste, and poor bioavailability associated with free polyphenols. Encapsulation of polyphenols enhances both *in vitro* and *in vivo* bioavailability, prolongs the compounds' half-life, and facilitates targeted delivery to specific organs, thereby improving their functionality.

Based on the keynote speakers two publications (Fang & Bhandari, 2010; Tang, Fang, Ng, 2020), the technologies of encapsulation of polyphenols including spray drying, coacervation, liposome entrapment, inclusion complexation, cocrystallization, nanoencapsulation, freeze drying, yeast encapsulation and emulsion will be discussed. Recent development of colon-targeted polyphenol delivery systems using dietary fibre-based encapsulation technologies will also be elaborated. This keynote speech will expand our knowledge on effectively using encapsulation technologies to improve the stability and bioactivity of polyphenols for human health.

References:

- Fang, Z., Bhandari, B. (2010). Encapsulation of polyphenols: a review. *Trends in Food Science and Technology*, 21(10), 510-523.
- Tang, H-Y., Fang, Z., Ng, K. (2020). Dietary fiber-based colon-targeted delivery systems for polyphenols. *Trends in Food Science and Technology*. 100, 333-348.

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LIVESTOCK PRODUCTION AND AQUACULTURE

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International Symposium on Agriculture and Environment (ISAE) 2024

Industrial Interactive Plenary Session



Rights based approach on food security, peasant farmers and agroecology

Fazly Mohamed

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Food security and nutritional security are among many buzz words being discussed within the agriculture and food related policy circles. Ensuring the food security is essentially ensuring the right to life and takes utmost priority in achieving sustainable development goals. Understanding the concept of 'food security' and the concept of 'right to food' is important in policy making and policy implementation on the arena of food and agriculture. It allows the stakeholders of the agri food sector to understand the current and future trends and respond positively towards the changes. Present day world, where the global community is trying to achieve the 'Sustainable Development Goals' by 2030 while ensuring equity among all levels of people, upholding the food security has become an utmost priority. Understanding the development of the right based approach on food security allows different stakeholders in Agri food system to understand their responsibility as a responsible corporate citizen and to contribute to realize the sustainable world we all work to achieve.

Keywords: Agri-food systems, Food security, Nutrient security, Sustainable development goals

From orchard to table: Nurturing fruit diversity for sustainable nutrition and empowering communities through resilient agri-food system

Punya Nanayakkara

Managing Director, Nelna Agri Development (Pvt) Ltd, Sri Lanka

Nelna Agri Development (Pvt) Ltd is one of the leading agriculture-based companies in Sri Lanka who has truly transformed agriculture in the country, particularly in the mango industry.

Sri Lanka has always been known for tea, rubber, and coconut but since the last 15 years, Nelna has been able to bring attention to Sri Lankan mango from all parts of the world. Today, Sri Lanka is not only known for tea, rubber, and coconut but also for Sri Lankan Nelna Mango. As a means of fruit diversity, Nelna has intentions to expand into other fruit crops such as durian which is also considered king of fruits which will certainly enhance the livelihood of the plantation areas and the country.

Fruits from Sri Lanka are truly a Taste of Paradise, so is TomEJC Nelna Mango. To create a resilient Agri food system, we truly believe the importance of focusing on activities such as supporting small scale farmers, while investing in research and development, particularly on developing new fruit crop varieties to enhance fruit diversity towards sustainable nutrition. We must also look at conserving wild fruit species which are of high nutritional value.

Agriculture, particularly in Sri Lanka is truly a challenge. But it is possible as Nelna has proved it. There is so much potential to innovate and world will not survive without food. But the key here is the dedication, passion, commitment, and the belief.

Keywords: Agri-Food systems, Durian, Fruit diversity, TomEJC Nelna Mango

Black Soldier Fly farming is a sustainable solution for an affordable protein source in Sri Lanka

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Introduction

The cost of animal protein, particularly eggs, has risen dramatically in Sri Lanka in recent years by a staggering 3-4 times. This increase creates a burden on household budgets and limits access to essential nutrients. However, there is a potential solution to find a sustainable solution through Black Soldier Fly (BSF) farming in Sri Lanka which is the way to provide a cheap, alternative source of protein. BSF larvae are insects with immense potential as a substitute for expensive animal proteins. They are packed with nutrients, containing healthy fats, protein, fiber and minerals.

BSF Larvae as a Powerhouse of Protein

BSF larvae are insects with remarkable potential as a substitute for expensive animal proteins. It contains an impressive nutrient profile, around 40-50% crude protein, along with healthy fats, essential minerals, and a complete amino acid profile. This means BSF protein provides all the essential building blocks needed by animals for growth and development. While the concept of directly consuming insects might not be widely accepted in Sri Lankan culture, BSF farming offers an alternative approach.

The Power of Indirect Application

The true value of BSF farming lies in its indirect application within the poultry industry. BSF larvae can be efficiently cultivated using biodegradable waste, diverting organic matter from landfills and transforming it into the main ingredient for their growth. As they break down the waste, they become a protein-rich feed source for chickens.

Reduced Costs and Improved Affordability

By incorporating BSF meal into chicken feed, poultry production costs can be significantly reduced. This translates to lower prices for consumers – for both chicken meat and eggs. This approach benefits not only poultry farmers but also improves affordability for Sri Lankan families, ensuring greater access to nutritious protein sources.

A Win-Win for All

BSF farming presents a sustainable and economical solution for achieving a future where nutritious eggs and chicken are accessible to everyone. It offers a win-win scenario for the environment because; BSF larvae divert organic waste from landfills, reducing greenhouse gas emissions and promoting waste management.

Further Exploration

A detailed comparison of the nutritional value of BSF protein (40-50% crude protein, complete amino acid profile) compared to traditional chicken feed sources (e.g., corn, soybean meal).

The environmental benefits of BSF farming, including waste reduction (diversion from landfills) and greenhouse gas mitigation (reduced methane emissions from landfills).

Success stories from other countries that have adopted BSF farming for poultry feed.

Challenges and opportunities associated with implementing BSF farming in Sri Lanka, such as establishing efficient BSF production facilities and educating farmers on integrating BSF meal into chicken feed. As Power Hands Holdings we are playing a significant role while investing to convert all bio-degradable materials to high valued source in our diets.

By fostering open discussions and addressing potential challenges, Sri Lanka can unlock the potential of BSF farming and ensure a more sustainable and affordable future for its protein needs.

Keywords: Amino acid profile, Black Soldier Fly, Crude protein, Poultry feed

Building and strengthening climate-resilient agri-food systems

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A comprehensive transformation of agri-food systems is critical for achieving food and nutritional security. Building and reinforcing climate-resilient systems necessitates moving beyond a sole focus on production to incorporate inclusive, participatory structures that are both sustainable and ethical, while capable of withstanding the pressures of a changing climate.

A central element of this transformation is accessibility, which implies providing equitable access to the resources required for food production and considering the ethical and environmental impacts of investments within the system. Practices that prioritize short-term gains over long-term ecological health are incompatible with a resilient future.

Climate change poses a significant threat to food security. Extreme weather events, prolonged droughts, and gradual processes such as sea-level rise directly impact food production. To create climate-resilient agri-food systems, a comprehensive approach to risk management is essential, integrating adaptation, mitigation, and preparedness strategies.

Strengthening climate-resilient agri-food systems necessitates the involvement of stakeholders at all levels, from farmers and academia to the private sector and policymakers, to collect on-the-ground evidence and develop suitable solutions. SLYCAN Trust plays a pivotal role in this context.

Our work in food systems focuses on identifying and promoting alternative plant-based protein sources that are accessible and contribute to livelihood development in Sri Lanka. This aligns with the move towards more sustainable and climate-friendly food production methods. Moreover, SLYCAN Trust highlights the importance of a conducive environment for small and medium-sized enterprises (SMEs) to engage in agriculture, acknowledging their potential as agents of change and solution providers in building resilient food systems.

The pursuit of climate-resilient agri-food systems offers a promising route towards achieving lasting food and nutritional security prioritizing sustainability, inclusivity, and resilience, the goal is to establish a future where food production can thrive despite the challenges of a changing climate.

Keywords: Agri Food-Systems, Climate resilient farming, Food security, National Security, SLYCAN Trust

Transforming a farmer into an entrepreneur

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Basically, farmer should not be just a producer but also a potential business owner. It is essential for farmers to adopt an entrepreneurial mindset which involves taking risks, seeking opportunities, being proactive in decision making, embracing creativity, demonstrating resilient, managing risk effectively and adopting to changing circumstances etc.

To begins with farmers, need to identify opportunities through thorough market research. This research should focus on discovering potential niches or gaps in the market where their skills and resources can be utilized effectively.

Next farmers require assistance in developing comprehensive business plans. These plans should outline their goals, target market, products or services, marketing strategy, financial projections etc.

To acquire the necessary entrepreneurial skills farmers should receive training and support in areas such as marketing, financial management, negotiation, and networking. This can be achieved through workshops, online courses or mentoring programmes.

Access to resources and support services is also crucial. Farmers should be connected with government grants, loans, incubators, business development centers, and relevant industry associations or networks to help them thrive.

Build networks is another key aspect. Farmers should encourage to establish relationships with other entrepreneurs, suppliers, distributors, and potential customers. Networking can provide valuable insights, opportunities for collaboration, and access to new markets.

Adaptation and innovation are vital for staying competitive. Farmers should embrace new technologies, production methods, and business models to meet evolving consumer demands.

Finally, persistence and resilience are essential for any entrepreneur it's essential to remind farmer to stay persistent and resilient in the face of obstacles or setbacks. Encourage them to learn from failures, pivot when necessary, and stay focused on their long-term goals.

Keywords: Business models and plans, Entrepreneur, Farmer, Financial management, Business incubation, Market analysis

Mariculture - the future expansions of agriculture into new horizons

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Traditional land-based agriculture consumes more than half of all developed land and more than 70% of the world's freshwater resources. Despite this, more than 800 million people are chronically undernourished. In addition, Ocean covers more than 70% of the Earth's surface. Marine aquaculture offers many environmental benefits, relative to other forms of animal farming. Mariculture, the farming of marine organisms, has received higher attention in recent times due to the limiting factors gradually immersing in conventional agriculture, such as climate change and non-availability of suitable lands, urban sprawling and infrastructure development. As a result, mariculture has seen several recent developments aimed at sustainability, efficiency, environmental concerns and expanding the range of species cultivated. It is estimated that edible food from the sea could increase by 21–44 million tonnes by 2050, a 36–74% increase compared to current yields. This represents 12–25% of the estimated increase in all meat needed to feed 9.8 billion people by 2050.

To reach this level, the latest innovations and improvements are vital such as are Integrated Multi-Trophic Aquaculture (IMTA), Land-Based Recirculating Aquaculture Systems (RAS), Biotechnology and Genomics, Selective Breeding and Genetic Improvement, Alternative Feeds, Diversification of Species and Technological Innovations. IMTA approach involves cultivating several species together in the same space, utilizing the waste from one species as nutrients for another. IMTA systems can improve environmental sustainability by reducing waste and increasing overall productivity. RAS technology enables the farming of various species, including fish, shrimp, and even seaweed, in inland areas, where as selective breeding programs are being implemented to enhance desirable traits in farmed species such as growth rate, disease resistance, and feed conversion efficiency. This can lead to more sustainable and productive mariculture operations. Alternative sources of feed for farmed fish and shellfish, such as plant-based proteins, insect meal, and single-cell proteins derived from microbes are becoming popular as it reduces the reliance on wild-caught fish for feed and helps to mitigate pressure on marine ecosystems. Technological Innovation such as advancements in sensors, automation, and data analytics are being integrated into mariculture operations to monitor water quality, optimize feeding regimes, and enhance overall efficiency. Diversification of species and regulatory frameworks also facilitate this process, collectively contribute to the sustainable development of mariculture, helping to meet growing global demand for seafood and expanding more into novel concepts while minimizing environmental impacts and enhancing resource efficiency.

Keywords: Integrated Multi-Trophic Aquaculture (IMTA), Land-Based Recirculating Aquaculture Systems (RAS), Mariculture, Marine organisms

Systematic approach of insect farming for assuring protein security in Sri Lanka

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Introduction

Health, Nutrition, and Education are vital components of human capital formation, which is essential for achieving sustainable economic growth and development. Investing in these three components can lead to significant returns in terms of increased productivity, higher earnings, and better quality of life.

Importance of Proteins in our diet

Protein is an important part of a healthy diet. Proteins are made up of amino acids used to build and repair muscles and bones and make hormones and enzymes, and they are involved in immunological reactions in the body. They can also be used as an energy source. According to the Dietary Reference Intake report for macronutrients, a sedentary adult should consume 0.8 grams of protein per kilogram of body weight. That means that the average sedentary man should eat about 56 grams of protein per day, and the average woman should eat about 46 grams. Almost all the metabolic reactions in a body are operated/coordinated by numerous enzymes and protein-based biomolecules.

Effects of Protein Energy Malnutrition

A situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Human body development prevails for up to 22 years in human life. A well-structured human being is produced during this age limit. Nutritionists urge governments to facilitate the general public to have a balanced diet despite their purchasing power for food commodities. Any nutritional disturbance during the growth period of a human being cannot be reversed without compromising proper growth as there are genetically programmed age limits in human body development. Protein-energy malnutrition (PEM) is a common childhood disorder and is primarily caused by a deficiency of energy, protein, and micronutrients. PEM manifests as underweight (low body weight compared with healthy peers), stunting (poor linear growth), wasting (acute weight loss), or edematous malnutrition (kwashiorkor). Data for GHI scores are from 1998–2002 (2000), 2006–2010 (2008), 2013–2017 (2015), and 2018–2022 (2023). In the 2023 Global Hunger Index, Sri Lanka ranks 60th out of the 125 countries with sufficient data to calculate 2023 GHI scores.

Establishment of Protein security via Insect Farming

Protein security is an essential part of food security which is hardly discussed in nutrition forums. As termed food security by FAO, protein security also be defined as “a situation that exists when all people, at all times, have physical, social and economic access to a sufficient, safe and balanced protein that meets their dietary needs and food preferences for an active and healthy life”. Among the most efficient protein-producing living systems, insect farming (mini livestock or microstock) is pivotal.

Among all insect farming methods, Black Soldier Fly Farming (BSFF) and meal-worm farming (MWF) are two identified solutions for protein production in Sri Lanka.

Food waste recycling for protein production through BSF farming

We started introducing BSF farming to Sri Lanka in 2017 and it is at the level of making it a national project with the collaboration of Power Hands Private Limited, Sri Lanka as a private venture.

Food waste management is the biggest nuisance for any Government. Thousands of tons of food waste are generated and discarded from hotels, reception halls, vegetable markets, fish markets, slaughtering houses, food manufacturing industries, and household kitchens daily. These wastes are finally dumped in an open environment creating numerous health and environmental issues including diseases and heavy greenhouse gas emissions.

A well-organized channel from the waste collection to the production of larvae has been designed and established for each unit operation of this overall process as a zero-waste project. Garbage suppliers are also benefitted differently and the end products are further applied in the direct and indirect animal feed industry as the main protein source.

Farmers of rearing Chicken, Ducks, Turkey, Swine, Fish, and Shrimp are registered as cluster farmers to the company, and the BSF/MW protein-rich well-formulated feeds are supplied. The final farm products of meat, eggs, fish, and shrimp are transported to a company-owned food processing factory, and value-added protein products are produced. A set standard is made compulsory for each product and the company is highly responsible for what they are issuing to the consumers. The cluster farmers are encouraged to widen their production range and are regularly inspected and monitored by company supervisors island-wide. Quality control of this overall process is managed by a company-owned participatory guarantee system (PGS). The products will be available for purchasing at the company-operated specific sales outlets island-wide and, the prices are expected to be competitive so that every social category can be benefitted and nourished.

Keywords: Black Soldier Fly Farming (BSFF), Global Hunger Index, Insect Farming, Meal-Warm Farming (MWF), Mini livestock or micro-stock, Protein security, Protein-Energy Malnutrition (PEM)

Poultry for SHARP diets

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Sustainable-healthy diets that can nurture human health and the environment are paramount important to achieving SDGs and the targets of the Paris Agreement. However, the diets of many individuals and nations are neither healthy nor sustainable. Healthy diets prevent nutrient deficiencies and reduce non-communicable disease risks. Animal source foods (ASF) are considered a critically important component of a healthy diet. However, consumption of ASF, particularly excess amounts of red meat and processed ASF items is reported to be associated with a range of non-communicable diseases. Since the environmental impacts of ASFs are higher than plant-sourced foods, the type and the amount of ASF consumed have a significant impact on the sustainability and the healthiness of the diets. To make a practical impact on people and the planet, apart from being sustainable and healthy, food items that are to be included in diets should be affordable, reliable and preferred. This paper highlights the importance of chicken meat and eggs as a sustainable, healthy, affordable, reliable and preferred (SHARP) source of ASF for Sri Lankans.

Environmental impact indicators of chicken meat and egg are lower than other livestock products and sometimes even comparable with popular ASF alternatives. Availability and the utilization efficiencies of nutrients present in chicken meat and eggs are high due to their better digestibility and balance of nutrients, particularly that of amino acids. Chicken meat contains a low amount of fat and cholesterol. The conception that the consumption of chicken eggs is associated with health risks has proven to be wrong. The steady increase in per capita consumption of chicken meat and eggs that was experienced until the recent economic crisis and subsequent sharp drop in prices of them with economic stability indicate better affordability. Environmental friendliness, nutritional-merits and affordability of chicken meat and egg become even better compared to other livestock products and popular ASF alternatives when the performances of relevant indicators are expressed on unit of nutrient basis. Due to several reasons, the poultry industry offers a reliable option to meet the increasing demand for animal proteins. Sri Lanka has reached self-sufficiency in chicken meat and has great potential to expand, adapt and innovate. Showing resilience and tenacity, the poultry sector showed a quick recovery along with economic stability. In contrast to other livestock sectors, the production performance parameters of the Sri Lankan poultry industry are comparable with those of international competitors. Importantly, ethno-religious taboos related to the production of poultry and consumption of poultry products are less severe compared to other livestock products. The EAT-Lancet report for sustainable healthy diet recommends up to 58 and 30 g of chicken meat and egg per day, respectively thus allowing great opportunities for Sri Lanka to increase its present per capita consumption of chicken meat (29g) and egg (18g) within the framework of SHARP diets.

Keywords: Animal Source Foods (ASF), Paris agreement, SHARP source, Sustainable Development Goals

Industrial Interactive Plenary Session



**Appreciation of Invited Speakers –
Ms. Dulanga Witharanage, SLYCAN Trust**



**Appreciation of Invited Speakers –
Prof. P.L.N. Lakshman, University of
Ruhuna**



**Appreciation of Invited Speakers –
Prof. P.B. Terney Pradeep Kumara,
University of Ruhuna**



**Appreciation of Invited Speakers –
Senior Prof. N.S.B.M. Attapattu
University of Ruhuna**



Invited industrial partners sharing their insights in the plenary session



Ms. Shyama Rajapaksha from CBL Group, Sri Lanka delivering her speech and appreciation of Ms. Rajapaksha and CBL Group, Sri Lanka for their contribution to the ISAE - 2024



Mr. Fazly Mohamed from FIAN, Sri Lanka delivering his speech and appreciation of FIAN, Sri Lanka for their contribution to the ISAE - 2024



Appreciation of Ms. Punya Nanayakkara and Nelna Agri Development (Pvt) Ltd for their contribution to the ISAE - 2024

Appreciation of Power Hands Plantation (Pvt) Ltd for their contribution to the ISAE - 2024

International Symposium on Agriculture and Environment (ISAE) 2024

Oil Palm Plenary Session



Message from the Chairman
Oil Palm Plenary Session – ISAE 2024

This is a very special occasion for me as the Chairman of Special Oil Palm Session held as a part of ISAE 2024. Oil palm has the potential of playing a very significant role in Sri Lankan economy by generating employment opportunities, sustaining food security and nutrition and saving foreign exchange and so on. The aim of this session is to emphasize this and paving the way to make oil palm industry revamped and sustainable. I sincerely believe that all the contributions made here will add value to this purpose and my duty is to appreciate this and thank all the participants for their invaluable contributions.

First of all, I wish to thank H E High Commissioner of Malaysia for Sri Lanka for accepting our invitation and attending the session, undoubtedly, amidst a very busy schedule. I again wish to thank Honourable High Commissioner for the keynote address on Palm oil industry. The speech carries many important and practical insights Sri Lanka as a whole and our palm oil industry can learn and implement for the betterment of our future. This is a very important value addition to this special session and we really appreciate your great effort and look forwards to have your valuable contributions in the future too.

ISAE 2024 is continued for 14th year and organizing a forum of this diversity and magnitude is not, by any means, an easy task. Being the coordinator for ISAE 2023, I personally have the experience of the gravity and complexity of the process. In appreciation of this great effort, I wish to convey my heartfelt gratitude towards the coordinator and the organizing committee and wish to make a special note on accommodating this special session.

As I mentioned earlier, Oil Palm has a significant potential for positively impacting Sri Lankan economy. However, Sri Lanka is, not presently, reaping the benefits of Oil Palm as the industry is at cross roads at the moment. As professionals, I believe, it is our duty to make policy makers aware of practices best for our country and its people. Hence, we expect to compile all the findings of this session in to a booklet and forward the same to policy makers in view of effecting more informed process of decision making.

Many academic and research professionals participated in this session and contributed for the success of the session by sharing and discussing their research findings, experiences and ideas. I, sincerely, thank you all for making worthwhile contributions and making the session a noteworthy success.

Last but not least I thank our external participants, observers and financial supporters for this event provided by Solidaridad as well as Elpitiya plantation PLC.

Thank you and best of luck.

Dr. Indika Palihakkara

Senior Lecturer
Faculty of Agriculture
University of Ruhuna

Oil Palm Plenary Session



Distinguished Guests graced the Oil Palm Plenary Session of ISAE 2024



Industrial partners, academic and research community sharing their insights at the oil palm plenary session



Oil palm-based value-added products demonstrated parallel to the oil palm plenary session

International Symposium on Agriculture and Environment (ISAE) 2024

Scientific Sessions



Crop production, Soil management, and Environmental Stewardship

Sub theme – Crop Production

Oral Presentations



Keynote Speech

Studies on the bioactive components and medical function of commercial Daodi-Ugon, the roots of *Helminthostachys zeylanica*

Chih-Chuang Liaw

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Abstract

The rhizome of *Helminthostachys zeylanica*, referred to as 'Daodi-Ugon' or 'Ding-Di-U-Gon,' possesses a rich historical background in traditional Chinese medicine, demonstrating efficacy in the treatment of diverse conditions such as malaria, dysentery, fever, burns, hepatic disorders, and pneumonia (including catarrh and early stages of phthisis). This indigenous fern, a member of the Ophioglossaceae family, is endemic to southeastern Asia. Our investigation led to the identification of more than 20 novel bioactive compounds from this traditional Chinese medicine (TCM) herb. In the commercial sphere, two distinct products derived from *H. zeylanica*, namely Hei Daodi-Ugon (HZB) and Hong Daodi-Ugon (HZR), are available. Empirical evidence from seasoned TCM practitioners suggests that HZR surpasses HZB in terms of both quality and efficacy. Intriguingly, preliminary anti-inflammatory screenings revealed that the aqueous layer of HZR exhibited superior activity in reducing the levels of IL-1 β , iNOS, and COX-2 compared to the corresponding layer in HZB. Conversely, the ethyl-acetate layer of HZB demonstrated stronger activity than its HZR counterpart, despite a prior report indicating no significant difference in the composition of HZR and HZB based on the total content of the three standard organic compounds (ugonins J and M and quercetin) using conventional UV-Vis HPLC analysis. Our findings align with the observations of TCM practitioners, particularly given the prevalent practice of preparing TCM formulations with boiling water. In this context, we present an evidence-based analysis elucidating the chemical distinctions between Hei Daodi-Ugon (HZB) and Hong Daodi-Ugon (HZR) utilizing GNPS molecular network analysis and subsequent LC quantification of flavonoid glycosides in both water-soluble HZR and HZB extracts. Furthermore, our exploration of additional medical applications of HZ components and extracts revealed promising outcomes. Based on *in vivo* data demonstrating an increase in serum amino-terminal propeptide of type 1 procollagen (PINP) levels and a reduction in radiographic healing time (RHT) through oral administration of HZ for 42 days, we propose the potential use of HZ in treating patients with ankle fractures requiring surgical intervention. Additionally, our findings suggest that ugonin L holds promise as a candidate for the development of novel anti-resorption therapies. Moreover, ugonin P emerged as a potential candidate for the development of therapeutic agents targeting lung cancer.

Keywords: Bioactive compounds, *Helminthostachys zeylanica*, Hei Daodi-Ugon (HZB) and Hong Daodi-Ugon (HZR), Traditional Chinese medicine

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ID 09

Analysis of the association between the stem bark characteristics and Peelability of Cinnamon

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Abstract

Ceylon cinnamon (*Cinnamomum zeylanicum* Blume) is globally recognized for its unique properties and health benefits. Despite its high demand, the process of peeling cinnamon bark is known to be time and labor-intensive. Peelability is influenced by various factors, including climatic conditions, stem maturity, and anatomy. This study aimed to explore the relationship between peelability and stem anatomy in the Siri Gemunu variety of Ceylon cinnamon. Two treatments are employed: T1 involves peelable cinnamon stems harvested during wet weather with light green leaves, while T2 comprises non-peelable cinnamon stems bearing flowers or fruits. Each treatment is replicated 50 times for comprehensive analysis. Cross-sectional slides of the stems were prepared, and anatomical measurements were conducted using Image J software. Key measurements included cambium layer thickness, outer bark thickness, inner bark thickness, stone cell layer thickness, and mucilage cell count per unit area. The mucilage content of the bark was also determined. Calculate means and standard deviations for each anatomical measurement and mucilage content within each treatment group. Perform ANOVA to compare means across the two treatments for each anatomical parameter and mucilage content separately. Conduct Tukey's HSD to identify specific differences between treatments. Regression analysis was used to model the relationship between environmental conditions (seasons) and anatomical features or mucilage content. Contrary to expectations, there was no consistent relationship found between peelability and anatomical measurements. However, a noteworthy observation emerged concerning bark mucilage content. Cinnamon sticks sampled during wet weather and from plants bearing light green leaves exhibited higher mucilage content compared to non-peelable sticks (bearing flowers or fruits) ($P < 0.05$). This suggests a positive association between bark mucilage and peelability of Ceylon cinnamon. In conclusion, the study indicates that bark mucilage content may play a significant role in the peelability of cinnamon. While the anatomical measurements did not show a consistent correlation, further exploration of the relationship between mucilage content and peelability is warranted. Understanding these factors could contribute to improving the efficiency of cinnamon processing methods.

Keywords: Bark anatomy, Ceylon cinnamon, Mucilage content, Peelability

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ID 11

Guild diversity of insects associated with paddy fields under two different cultural practices in Thenmaradchi division, Jaffna, Sri Lanka

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Abstract

This study on insect communities in rice agro-ecosystems was conducted in Thenmaradchi Division, Jaffna, Sri Lanka, with the objective of comparing the diversity of insects and their ecological guilds associated with paddy in different cultural practices P1 (traditional agro practices with no agrochemical usage) and P2 (conventional agro practices with agrochemical usage). Periodical insects were collected by sweep net from demarcated sub divided units ($4 \times 1 = 4\text{m}^2$) in P1 and P2 from November 2017 to March 2018. Collected insects were taxonomically identified and categorized into different guilds. The abundance of each group was also recorded. A total of 1647 (971 from P1 and 676 from P2) insects were collected during the period and categorized into 09 orders and 33 families. 51 species were recorded from P1 and 43 from P2. The Simpson's and Shannon wiener indexes for P1 were 2.957 and 0.920 respectively and for P2 were 1.214 and 0.912 respectively. They were then categorized into various guilds such as phytophagous pest species [P1 - 60.26%; P2 - 56.80%], Predator [P1 - 18.48 % (n=180); P2 - 18.49 % (n=125)], Parasitoid [P1 - 0.92%; P2 - 2.66%] and Scavenger [P1 - 18.06%; P2 - 18.93%]. The number of phytophagous species from traditional and conventional practices were respectively 21 and 19. Whereas the predator species collected from traditional and conventional practices were 19 and 13, respectively. And Order Hemiptera contributed to the highest number of individuals in pest and predatory guilds both types of paddy fields. Even though the numbers are comparatively higher in traditional practices, but it is not significant. From the findings there were no significant guild diversity of insects found in traditional and conventional practices, so stable relationship could be maintained between rice insect pests and their predators through minimal biocide applications. This information can be incorporated into integrated pest management.

Keywords: Conventional, Integrated Pest Management, Paddy, Phytophagus, Traditional,

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ID 31

Impact of different levels of biochar and carbonyl diamide (urea) on physicochemical properties of rice (*Oryza sativa*. L)

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Abstract

The present study explores the impact of varying levels of biochar and carbonyl diamide (urea) on the grain equivalent diameter, sphericity, volume, surface area, amylose, and iron content of rice (*Oryza sativa* L.). This study aimed at exploring the potential benefits of biochar as a soil amendment and its interactions with urea in influencing on physicochemical properties of rice grains. Four distinct biochar (BC) levels (0, 1, 2 and 3 t ha⁻¹) and partially burned paddy husk (PBPH - 0.62 t ha⁻¹) treatments were combined with varying urea levels (0, 30, 70 and 100 %) following the recommended rate for paddy cultivation (225 kg ha⁻¹) to assess the responses of rice plants to different combinations following split plot experimental model at Rice Research Station, Ambalantota. Using a manual husker, paddy samples from each treatment were dehusked and the grain length and width were examined to ascertain the physical properties. Amylose concentration was assessed by measuring the UV absorption value (620 nm) of the starch solution. The UV (480 nm) absorption of the color developed solution (Fe²⁺) was used to measure the iron concentration. Analysis of variance was performed using Statistix 8.1.1.0 software for windows. The results revealed significant changes in grain physicochemical properties of rice in response to different biochar and urea treatments. Conspicuously, the highest physicochemical values were observed in rice plants treated with 70 % urea in aggregation with 2 to 3 t ha⁻¹ biochar. These conditions induce a significant increase in equivalent diameter (2.70 mm), sphericity (40.60 %), volume (10.62 mm³), surface area (3.15 mm²), amylose content (32.60 %), and iron content (21.80 µg g⁻¹) compared to the control treatment. These findings indicate that specific combinations of biochar and urea have a synergistic effect on grain equivalent diameter, sphericity, volume, surface area, amylose content, and iron content which lead to improve the grain yield and nutritional composition. The results of this experiment demonstrated the substantial effects of varying biochar and urea concentrations on the physicochemical characteristics of rice grains. The aforementioned results provide important understanding regarding the application of biochar as a sustainable soil supplement with urea to improve the physicochemical characteristics of rice harvest.

Keywords: Biochar, Chemical properties, Physical properties, Rice, Urea

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ID 42

Assessment of Phytoplasma titer variation across white leaf disease severity levels in sugarcane varieties cultivated in four selected regions of Sri Lanka

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Abstract

Sugarcane White Leaf Disease (WLD) is one of the major threats to the sugarcane industry in Sri Lanka. This study was conducted to investigate the phytoplasma titer variability of WLD in different sugarcane varieties grown in four different sugarcane growing areas, namely, Pelwatta, Ethimale, Siyambalanduwa and Hingurana in Sri Lanka. Healthy (severity level 0), initial (1-2 white color strips emerge in the leaf lamina), middle (50% of the leaf lamina covered by white color streaks) and severe stages (entire leaf lamina is white colour) were considered as the selected WLD severity levels. Genomic DNA was extracted from the leaf samples using CTAB method. The presence of the causal agent phytoplasma was determined by the standard PCR method using two phytoplasma specific primers (SPP1 and SPP2). The quantification of amplified phytoplasma DNA was evaluated using BlasTaq™ 2X qPCR assay. Almost all four of the examined locations exhibited similar levels of disease severity. The disease incidence level in the four tested locations had a range of 23% to 26%. Among the tested sugarcane varieties in four locations, WLD phytoplasma abundance was significantly higher ($P < 0.05$) in Ethimale SL 98 2524 with a phytoplasma abundance level of $888344.957 \times 10^6 \pm 254072.449 \times 10^6 \mu\text{M}$, followed by Hingurana, Co 775 with a phytoplasma abundance level of $20.444 \times 10^6 \pm 6.011 \times 10^6 \mu\text{M}$. In Pelwatta, variety SL 00 652 had the significantly highest phytoplasma abundance level of $182.168 \times 10^6 \pm 49.010 \times 10^6 \mu\text{M}$. In Siyambalanduwa the variety SL 10 950 and SL 10 979 were the most susceptible varieties. The lowest abundance levels with no significant differences were observed in varieties of SL 00 354, SL 96 128, SL 10 904 and SL 10 1123. The healthy stage of all the tested varieties recorded a phytoplasma abundance level within a range of $0.000000416 \mu\text{M}$ to $0.00619 \mu\text{M}$. In Ethimale SL 98 2524, Hingurana SL 00 652 and Co 775, Pelwatta SL 00 652 and in Siyambalanduwa SL 10 950 and SL 10 979 were identified as the most susceptible varieties for WLD in terms of phytoplasma titer levels.

Keywords: Phytoplasma, qPCR, Severity stage, Susceptible, WLD

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ID 49

Detection of SSR and RAPD markers capable of distinguishing the genetic purity of tomato hybrid Hordi- Hybrid- 3

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Abstract

Genetic purity is an important criterion for quality assurance of hybrid seed production. Grow-Out Test (GOT) is the usual practice to confirm hybrid purity based on morphological differences, which is time consuming, laborious, costly, and highly influenced by the environment. The main objective of the present study was to identify SSR and RAPD markers that can be potentially used for distinguishing purity of tomato hybrid HORDI-Hybrid-3. Twelve Simple Sequence Repeat (SSR) and fourteen Random Amplified Polymorphic DNA (RAPD) markers were used to confirm the genetic purity of tomato hybrid, HORDI- Hybrid-3. Hybrid seeds are produced by crossing two genetically distinct parental lines. During hybridization, genetic material from both parents is combined, resulting in offspring (hybrid seeds) that possess a mixture of alleles from each parent. Among the SSR markers tested, TOM 6 exhibited polymorphism, making it useful for distinguishing between the parental lines "V2" and "AVT01130" of the tomato hybrid, HORDI-Hybrid-3. Within the set of RAPD markers evaluated, both OPA 7 and J14 (PG12) displayed polymorphism between the parental lines, suggesting their potential utility in identifying the genetic purity of the hybrid variety HORDI-Hybrid-3. SSR marker TOM 6 can be verified to detect the genetic purity of the hybrid variety HORDI-Hybrid-3, after testing and confirming on a batch of randomly selected seeds of the hybrid variety HORDI-Hybrid-3 along with its parental line. The RAPD markers OPA7 and J14 (PG12), can be recommended to be used to develop Sequence Characterized Amplified Regions (SCAR) markers to detect the hybrid purity of variety HORDI-Hybrid-3. These findings will aid in determining the genetic purity of tomato hybrid HORDI Hybrid 3 with greater precision in a shorter period.

Keywords: Hybrid purity, Polymorphism, RAPD markers, Tomato hybrid, SSR markers

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ID 56

Evaluation of F₃ population of ridge gourd (*Luffa acutangula*) for yield and quality related characters

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Abstract

Ridge Gourd (*Luffa acutangula*), a widely cultivated vegetable crop belongs to Family Cucurbitaceae. There are some local varieties such as “Niyana Watakolu” and “Heana Watakolu” which are low in diversity. Germplasms are hard to find to continue the breeding programs. The recognition of superior genotypes that have improved characteristics is essential for sustainable production and the market demand. Therefore, a comprehensive study is required to evaluate the genetic diversity of ridge gourd. The aim is to investigate genetic variability within *Luffa* populations to identify genetic potential associated with yield, quality traits, and phenotypic characterization. This study was conducted at Plant Breeding Division, Horticultural Crop Research and Development Institute in Yala season 2023. The superior plant varieties RG152, RG007, RG003, KSP9298, Amaya, Roshani, Ajax which selected based on the mean performance of yield and quality related traits from F₂ population and self-pollination was done to obtain F₃ population seeds. The parents and origin of F₁ population is unknown. Vegetative data, pod data, inflorescence data and seed data were collected under the guidance of both *Luffa* descriptor from International Plant Genetic Resource Institute (IPGRI) and the *Luffa* catalogue from Plant Genetic Resource Center (PGRRC). The research revealed the variation in characters like leaf length, width, internode length, peduncle length, fruit length, weight, mature fruit length, width was distinct among the cultivated species. Data were analyzed using Minitab 17 software, and cluster analysis was conducted to identify similar groups of accessions with a 70% similarity. Varieties were grouped into clusters such as cluster one - Ajax, RG152; cluster two - KSP9298, Ajax, Amaya; cluster three - RG003, RG007, Ajax, Roshani; cluster four - RG003, cluster five - Ajax, Roshani; cluster six - Roshani based on qualitative and quantitative data accordingly. In conclusion, this study found that descriptors used for morphological characterization effectively distinguished differences between accessions. Cluster analysis also identified common parents among the accessions were proven by the similarity index between the clusters. Future studies should use Principal Component Analysis to select quality traits in *Luffa*, discern distinct characteristics and develop future populations (e.g., F₄, F₅, F₆) for obtaining inbred lines.

Keywords: F₃ population, *Luffa acutangula*, *Luffa* descriptor, Superior genotypes, Yield and pod quality traits

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ID 72

Evaluation of the segregation patterns of morphological characteristics of Bg 38 x At 311 cross for high yielding traits of rice

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Abstract

In rice (*Oryza sativa* L.) breeding, evaluation of the segregation patterns of high yielding traits in segregating generations are important for future breeding programs. Bg 38 is a 5–6-month-old, high yielding, photoperiod sensitive, white rice variety with a short round shape grain. At 311 is a 3-month-old, photoperiod insensitive, and red rice variety with a long slender grain shape. The objective of the research was to evaluate the segregation patterns of selected morphological characteristics of the cross between Bg 38 and At 311 for high yielding traits. The research was conducted at Rice Research and Development Institute (RRDI), Bathalagoda during *Yala* season, 2023 based on selected morphological characters in F₂ and F₃ populations. Three *Ghd7* linked molecular markers namely RM5346, RM5436, and Seq 7-8 were used for the molecular assessment of the segregation patterns. The chi square test (χ^2) results indicated a significant ($p<0.05$) segregation distortion in plant height (7.938) and grain size (18.896) in F₂ population. However, a significant deviation from the expected ratio was not observed in basal leaf sheath colour (0.053), apiculus end colour (0.077), and awning pattern (0.018). A significant ($p<0.05$) segregation distortion was observed in basal leaf sheath colour (4.810), apiculus end colour (6.453), grain shape (16.693) and grain size (19.080) in F₃ population. However, plant height, number of tillers, awning, leaf angle, colour of pericarp, colour of lemma and palea did not show significant deviation from the expected ratios. The correlation analysis indicated that plant height showed significant ($p<0.01$) positive correlation with panicle length (0.449**) indicating plant height as a good morphological marker to predict the panicle length. The polymorphism was observed in RM5436, RM5346 markers and Seq 7-8 was monomorphic. The Dendrogram was constructed using the received banding patterns of two polymorphic and one monomorphic markers grouped the F₃ population diversity into four main clusters. In breeder's perspective segregation distortion is advantageous in selection since it leads to a higher population variation and new phenotypes. This will provide valuable insights into the inheritance of high-yielding traits and assist in advancing rice breeding strategies.

Keywords: Breeding, Mendelian ratio, Molecular markers, Rice, Segregation patterns

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ID 115

Identification of an unknown pathogen in a commercial strawberry cultivation

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Abstract

Strawberry (*Fragaria × ananassa* Duch.) is an economically important fruit crop around the globe. However, strawberries are susceptible to various diseases caused by bacteria, viruses, and fungi, leading to substantial yield losses. Recently a severe outbreak of a disease was observed in a strawberry field in Nuwara Eliya district. The objective of the present study was to identify the causative agent of the said disease and to characterize the pathogen using morpho-molecular data analysis. Early symptoms of this disease include different size reddish to dark brown lesions irregularly distributed on the abaxial surfaces of the leaves. In some cases, the leaves become reddish in color. As the disease progress, leaves become completely necrotic and reddish color lesions were visible on the crown region, ultimately resulting the plant death. Pathogen was isolated using standard procedure into pure cultures and white, cottony colonies layered with concentric circles were observed on PDA media. The colonies turned dark with time. Ten days after inoculation, black color spores formed and concentrated forming black color acervuli scattered over the PDA. Conidia had two to three apical appendages, and one basal appendage. Conidia harbored versicolor median cells and were 17 – 25 µm × 6.5 – 8.5 µm in dimensions. The pathogenicity test of the fungal isolates conducted on 50 young strawberry cultivars showed that the fungal isolates caused typical symptoms. A fungus with significant similarity to the original strain was re-isolated from the inoculated strawberry crowns. Total genomic DNA was isolated and sequences of the PCR products of the internal transcribed spacer region (ITS1-5.8S-ITS4) were obtained. Sequences were similar to *Neopestalotiopsis* sp. with above 97% query coverage and above 97% percent identity. The best matches with the highest query coverage (99%) were multiple *Neopestalotiopsis clavispora* accessions (OR913022.1, OR913021.1, OQ594895.1 etc), and the reference sequence matched with many *Neopestalotiopsis* sp. with 97% query coverage. Therefore, *Neopestalotiopsis* sp. can be tentatively identified as the causative agent of strawberry plant infection based on morpho- molecular data.

Keywords: *Neopestalotiopsis* sp., Morphology, Pathogenicity test, Molecular identification

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ID 116

Effect of plant growth regulators and stress conditions for accelerated peak harvest of gherkin

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Abstract

Gherkin (*Cucumis anguria* L.) is a determinant crop with a short life cycle (75 days). The lack of enough time to harvest maximum yield due to short duration of yala off (time between yala and maha) season is a major challenge faced by Sri Lankan farmers. This study was conducted to identify the most suitable treatment to accelerate the peak harvest of gherkin under protected house conditions at the Faculty of Agriculture, University of Ruhuna. There were two pot experiments conducted, as the first experiment was in soilless media, and the second experiment was in soil media. The experiment was laid out in Completely Randomized Design (CRD) with six treatments, T1(100 ppm ethrel, 0.1 ml/l at 4th leaf stage), T2(0.001 mol/l salicylic acid after first flowering), T3(2 ml/l cycocel, 1 week before flowering (WBF), T4(0.625 ppm sodium nitrophenolate, 1 WBF), T5(3 temporary wilting- water stress), and T6(2.5 g/l of K-44, 1 WBF-K stress) with four replicates from each. Vegetative and reproductive data were recorded, and they were statistically analysed by ANOVA. Means were separated by Duncan's multiple range test. The results revealed that, significantly lowest internodal length was recorded in T3(6.34 cm, 2.98 cm) while the highest in T2(9.03 cm, 8.25 cm) for both soil and soilless media respectively. Significantly lowest leaf area was recorded in T3(44.75 cm², 27 cm²) while the highest was in T2(136.50 cm²) and T6 (189 cm²) in soilless and soil media respectively. T2(26.80) was taken minimum number of days for first flowering in soilless media while T3(28.00) was recorded significantly lowest number of days in soil media. Significantly highest number of fruits were obtained from T2(25.25) during 7th and 8th weeks in soil media. Significantly highest fruit weight was recorded by T2(82.365 g) in 2nd week in soil media while T3(195.02 g) was recorded highest weight of fruits at 10th week in soilless media. T2 provided peak yield earlier than other treatments in both soilless (6th week) and soil media (7th and 8th). Research findings conclude that, application of T2 (salicylic acid) after first flowering at 0.001 mol/L ensures the minimum time for peak harvest of gherkin (6th -7th WAP).

Keywords: Gherkin, Peak yield, Salicylic acid, Soil, Soilless

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ID 119

Comparative analysis of nine fungicides in inhibiting the growth of *Neopestalotiopsis* sp. under *in-vitro* conditions

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Abstract

Recently a severe disease outbreak caused by *Neopestalotiopsis* sp. on strawberries was reported from commercial cultivations in Sri Lanka. The symptoms began with reddening of the leaves progressing to necrosis. As the disease progressed, wilting and eventual death of the infected plants occurred along with the lesions on the roots and crowns. This research was conducted to evaluate the *in vitro* efficacy of nine commercial fungicides against the pathogen; Commercial fungicides including Topsin M (thiophanate – methyl 70%(w/w) WP), Captan (captan 50%(w/w) WP), Carbendazim (carbendazim 50%(w/w) WP), Carbrio™ top (metiram 55% + pyraclostrobin 5% WG), Mancozeb (mancozeb 80%(w/w)WP), Azoxystrobin (azoxystrobin 250 g/l SC), Homai® (Thiophanate methyl 50% + Thiram 30% + Aditivios 20% (w/w) WP), Daconil (chlorothalonil 82.5%), Ridomil Gold® SL (mancozeb 64% + metalaxyl 8%(w/w)WP) were tested against the pathogen. PDA plates amended with fungicides at concentration ranging from 0ppm to 2500ppm were prepared. Five mm diameter mycelial plugs of *Neopestalotiopsis* sp. pure culture were inoculated to each plate with triplicate for each treatment. Mycelial growth inhibition was determined 72 hours after inoculation. The effective concentration that inhibits mycelial growth by 50% was determined for each fungicide and statistical analysis for EC₅₀ values was conducted. Cabrio™ top, Ridomil Gold® SL, Daconil, Mancozeb, Homai® and Captan showed 100% inhibition against the fungus. EC₅₀ values for Carbendazim, Topsin and Azoxystrobin were determined to be 2241.087±91.419 ppm, 418.663±11.20 ppm, and 471.958 ± 10.891 ppm respectively. Based on *in vitro* assay Cabrio™ top, Redomil Gold® SL, Daconil, Mancozeb, Homai® and Captan fungicides demonstrated higher efficacy in inhibiting the mycelial growth of *Neopestalotiopsis* sp. According to the one-way ANOVA, six out of nine fungicides; Cabrio™ top, Ridomil Gold® SL, Daconil, Mancozeb, Homai® and Captan fungicides exhibited a significant inhibition of the *Neopestaoloteopsis* sp. However, field level experiments should be carried out to further validate results obtained in this *in vitro* study.

Keywords: EC50 value, Fungicide assay, In-vitro, Mycelial inhibition, Strawberry

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ID 122

Invasion of Bondar's Nesting Whitefly (*Paraleyrodes bondari* Peracchi) in coconut: The first record of a new whitefly species from Sri Lanka

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Abstract

Since the first report in 2019, several whitefly species have invaded coconut plantations in Sri Lanka. Until now, the presence of *Aleurodicus rugioperculatus* Martin, *Paraleyrodes minei* Iaccarino, *Aleurotrachelus atratus* Hempel and *Aleurodicus dispersus* Russell have been confirmed through morphological and molecular characterization. Another whitefly species was recently observed in Sri Lankan coconut plantations during the continuous field inspections. Hence, the present study was conducted to characterize this new species. During the random field surveys conducted in Gampaha district, whitefly-infested coconut leaflets (n= 20) were randomly collected. Morphologically similar adults with unique 'X' shaped oblique greyish bands on wings were collected from characteristic wooly wax nests. These adults were then examined under the stereomicroscope and used for total genomic DNA isolation using the Cetyltrimethylammonium Bromide (CTAB) method. Subsequently, the extracted DNA samples were subjected to PCR targeting a specific region of mitochondrial gene cytochrome c oxidase subunit I (mtCOI) using universal primers: LCO 1490 and HCO 2198. The resulting PCR products were subjected to 1% agarose gel electrophoresis under 90 V for 01 hour. PCR products of the expected band size 675 bp were observed. One clear DNA band resulting from PCR amplification was subjected to bidirectional Sanger sequencing at Macrogen, Republic of Korea. Analysis of the resulting sequences using BioEdit software and a BLASTn similarity search confirmed the presence of *Paraleyrodes bondari* with 99-100% sequence similarity to known samples in the National Center for Biotechnology Information (NCBI) database. Therefore, the study confirms the presence of Bondar's Nesting Whitefly (BNW), a neotropical whitefly species; *P. bondari*. Emerging non-native whitefly species like *P. bondari* and its polyphagous nature may pose a threat to the Sri Lankan coconut industry in the future.

Keywords: Bio invasion, First report, New pest, *Paraleyrodes bondari*, Sri Lanka

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ID 139

Adaptability Testing of Promising Jumbo Peanut Breeding Lines in Sri Lanka.

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Abstract

Expanding peanut cultivation in Sri Lanka is becoming a timely need with the current socio-economic situation in the country, as it can sustain the food, nutrition and improve the poor livelihoods. Improvement of new varieties of peanut with market demanded attributes such as seed size can further strengthen the profit of the industry. In the peanut breeding program in Sri Lanka, jumbo peanut variety development is being continued through conventional breeding techniques. Six promising breeding lines (*ANKGL2019-1*, *ANKGL2019-2*, *ANKGL2019-3*, *ANKGL2019-5*, *ANKGL2019-6* and *ANKGL2019-7*) which were identified at previous yield trials were further tested for their yield performances at multi locations. The experiment was conducted according to a RCBD design at three research stations during 2019 *Yala* and at four research stations during 2019/20 *Maha*. The adaptability of the genotypes was assessed using a ranking method. All the tested lines scored significantly higher pod yield than the check variety, Lanka Jumbo. The best two lines, *ANKGL2019-1* and *ANKGL2019-2* were selected for further testing at farmer fields. Based on performance at farmer managed conditions and acceptance of farmers those lines can be considered for general cultivation.

Keywords: Adaptability, Breeding lines, Jumbo peanut, Multilocal, Pod yield

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ID 145

Evaluating new fertilizer schedules for enhanced cultivation of salad cucumber (*Cucumis sativus* L.) under controlled environmental agriculture

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Abstract

Controlled environmental agriculture (CEA) represents a progressive paradigm in agricultural methodologies. Cucumber (*Cucumis sativus* L.), a globally pervasive vegetable, underscores the paramount importance of efficient nutrient management in soilless cultivation systems. Farmers resort to diverse liquid nutrient solutions to optimize crop growth and productivity. While Albert's solution is a prevalent hydroponics fertilizer in Sri Lanka which has comparatively high cost, burgeoning interest stimulates the exploration of alternatives. The present study was conducted in a protected house at the Faculty of Agriculture, University of Ruhuna situated within the low country wet zone of Sri Lanka endeavors to evaluate the efficacy of innovative fertilizers from *Mugasol* and *Densol* ranges with the aim of augmenting *C. sativus* L. (Variety. Hanyan-CU13502) growth, fruit development and overall yield. Existing fertilizer schedule developed for *C. sativus* L. using Albert's solution (control treatment- 1.5g/l/plant) was compared with two new fertilizer scheduled developed from *Mugasol* and *Densol* ranges. The experimental design consists of six replicates per treatment, employing a Completely Randomized Design, with one replicate comprising three plants for heightened precision. A comprehensive array of growth parameters, spanning plant height, leaf increment, internodal length (7th to 8th), and stem girth were measured, alongside yield parameters encompassing total yield and marketable yield. There was no significant difference among treatments for many growth parameters recorded except for stem girth measurements. Similarly, no statistically significant differences resulted in yield parameters, suggesting that the new fertilizer schedules developed utilizing *Mugasol* and *Densol* exhibit a yield profile which is not different from that of the Albert fertilizer, the control. Of particular note, the cost-effectiveness analysis revealed that the *Mugasol* and *Densol* fertilizer regimen outperformed the control. This study thus propounds that the *Mugasol* and *Densol* fertilizer formulations hold promise as viable alternatives for devising fertilizer schedules tailored to *C. sativus* L. cultivation within CEA. However, it's crucial to conduct repeated experiments to ensure robust conclusions.

Keywords: Cucumber, *Cucumis sativus* L., Controlled environmental agriculture, *Densol*, *Mugasol*

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ID 179

Preserving Genetic Diversity in Medicinal Plant Cultivation: Case Studies on *Tripterygium wilfordii*, *T. hypoglaucum* and *Nypa fruticans*

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Abstract

Traditional and potential medicinal plants play a vital role in human health, but over-exploitation has resulted in biodiversity loss that raise global concerns. Moreover, there are no known breeding programs to improve their populations leaving them under threat from any form of disturbances. To secure a future sustainable supply, cultivation and domestication are proposed. Two case studies are presented here. First, the population genetics of *Tripterygium wilfordii* and *T. hypoglaucum*, reveals a distinct genetic divergence through DNA sequences and microsatellites. *Tripterygium wilfordii* exhibits lower diversity and subdivision than *T. hypoglaucum*, possibly due to migration rates and population history. Cultivated populations have reduced genetic diversity due to small sizes and vegetative propagation, underscoring diverse populations as primary important to conservation and breeding. The study highlights the use of various DNA markers to understand medicinal plant genetics. The second case study explores the genetic diversity of *Nypa fruticans*, a potential functional food and medicinal resource with an extensive distribution across the Indo-West Pacific region. Utilizing microsatellite markers, the research reveals significant genetic differentiation influenced by geographical distances. It identifies barriers and migration patterns, shedding light on the species' population structure and potential applications. Domestication involves artificial selection and genetic bottlenecks, leading to the loss of wild genetic diversity. This loss has serious implications, including reduced plasticity in secondary metabolism (a major source of medicinal compounds), diminished genetic diversity for compound yield improvement, reduced adaptability to changing environments, and negative impacts on sustainable use. Furthermore, the genetic diversity of promising medicinal plants, critical for new drug development, is rapidly declining due to over-harvesting. The problem of homonyms exacerbates this issue, damaging wild resources and plant diversity. To protect these resources and meet increasing demands, large-scale cultivation is urgently needed. Future cultivation strategies can be improved by studying genetic diversity in both wild and cultivated populations of these plant species.

Keywords: Biodiversity, Sustainable Management, Traditional Medicinal Herbs, *Nypa fruticans*, *Tripterygium* sp.

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Crop production, Soil management, and Environmental Stewardship

Sub theme – Soil Science

Oral Presentations



Keynote Speech

Soil microbial community shows clear changes in soil recovery process in a tin-mining area on Belitung Island, Indonesia

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Abstract

Mineral mining often alters the soil environment and reduces the sustainability of the surrounding environment. Recovery of soil physical and chemical properties after tin mining on tropical Belitung Island, Indonesia, has been a painstaking process, even after more than 100 years of reclamation. This study aimed to determine which parameters of soil properties are responsible for the slow recovery and whether there are other properties that show more rapid changes. Physical, chemical, and biological properties of the soil were measured at different time periods after tin mining: soil samples were collected from three areas at 0-, 1-, and 6-years post-mining and from an adjacent natural forest as a reference site. Soil moisture, hydraulic conductivity, bulk density, particle distribution, mineral content, and soil microbial composition were measured in the field and analyzed in the laboratory. The soil showed a decrease in particulate matter and, despite the absence of clay, a significant increase in water holding capacity and a 0.2% increase in organic carbon after 6 years. Copper, iron, manganese, and zinc in the soil changed little. Lead and cadmium were present in very small amounts. The soil bacterial community clearly varied with the age of the land, with actinobacteria predominating in the first few years after mining, but after 6 years, proteobacteria had established themselves in the mined area. The degree of land recovery was more clearly described by including the results of the microbial community analysis in the principal component analysis. This study examined more clear changes in soil properties on land after tropical tin mining. Soil and bacterial properties can be used as markers to monitor land restoration progress.

Keywords: Belitung Island, Microbial community, Soil properties, Tin-mining

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A phosphate-solubilizing bacteria based biofertilizer applied with Eppawala rock phosphate as a strategy to supply phosphorous in rice (*Oryza sativa*) cultivation

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Abstract

Concerns regarding environment and economics necessitate sustainable alternatives for synthetic phosphorous (P) fertilizers like triple-superphosphate (TSP). This study aimed to assess the efficacy of a Phosphate-Solubilizing Bacteria (PSB) based biofertilizer in solubilizing Eppawala Rock Phosphate (ERP) to supply P required for paddy cultivation. Experiments were performed in a plant house and farmer's fields. Four treatments, equivalent to field recommendations (T1- zero P, T2- P applied as TSP at 60 kg/ha, T3- P applied as ERP at 90 kg/ha, T4- T3 with PSB) were used to grow Bg360 variety in pot-experiment with six replicates, and growth and yield parameters were determined. Treatments T2, T3 and T4 were repeated in a field study in "Yala" 2022 in four farm fields in Matale district, Sri Lanka (plot size = 100 m² per treatment). Each farm field served as a replicate. Soils collected before crop establishment and after harvest were characterized. Rice yield, yield parameters and P uptake in grains were determined at the time of harvest. Dry weights of shoots and roots, and plant nutrition levels were determined at the end of the vegetative and harvesting stages. Analysis of variance (ANOVA) was performed on data and means were compared using Tukey's HSD test. In the pot-experiment, T2 resulted in the highest grain yield (1.36 ± 0.05 g/plant) and P content in grains ($0.26 \pm 0.01\%$). However, plant growth and grain yield were comparable ($P > 0.05$) among T2 and T4, and significantly higher ($P < 0.05$) than those under T1 and T3. Melich-3 extractable soil P content increased significantly in T2 (9.11 ± 0.36 mg/kg) followed by T4 (7.41 ± 0.13 mg/kg) compared to initial P level (6.12 ± 2.26 mg/kg). In the field experiment, the treatment effect was not significant ($P > 0.05$) on grain yield or yield parameters. The average grain yield under T2, T3 and T4 were 5572.00 ± 1512.71 , 3968.29 ± 1258.56 and 4113.88 ± 1174.66 kg/ha, respectively (expected yield; 4300 kg/ha). Results indicate application of PSB-biofertilizer increased P availability from ERP to the crop. PSB together with ERP can be used to supply P without compromising paddy yield in the studied region. The biofertilizer should investigate further under field conditions to establish as a sustainable approach for P management in paddy cultivation.

Keywords: Phosphate-Solubilizing Bacteria, Eppawala Rock Phosphates, soil phosphorous, field conditions

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The potential of *Nostoc* cultivated in parboiled effluent as a biofertilizer for paddy cultivation

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Abstract

Paddy cultivation predominantly depends on inorganic fertilizers due to the limited availability of high-quality organic alternatives. Cyanobacteria have emerged as a widely accepted tool in the agriculture sector, due to their macro and micronutrient profiles. Among these *Nostoc* stands as a popular nitrogen fixing cyanobacteria, capable of surviving, in both terrestrial and aquatic environments. In this study, a pot experiment was conducted to find the potential of *Nostoc* grown in parboiled water, in combination with either organic or inorganic fertilizers, on the growth, yield and residual nutrient content in soil. The experimental design was CRD with five treatments, namely T1 – control, T2- 100 % IF (inorganic fertilizers), T3- 100 % OF (organic fertilizers = compost), T4- *Nostoc* + 50 % IF except N, + *Nostoc* foliar application (NF), T5- *Nostoc* + 50 % compost + NF and three replicates. Data was analyzed by SAS with LSD mean separation at P=0.05. Various growth parameters, such as plant height, leaf numbers per plant, number of effective tillers and grain yield were measured. Additionally residual nitrogen, phosphorus, potassium and carbon content of the soil was measured after paddy harvesting. The results revealed that *Nostoc* combination treatments (T4 & T5) exhibited significantly higher values in leaf numbers (T4-31.99 and T5-32.11 @ 6th week), effective tillers (T4-5.44 and T5-5.56), and residual nutrient content of available nitrogen (T4-12.96 ppm and T5-16.83 ppm), phosphorous (T4-11.26 µg/g and T5-17.37 µg/g), potassium (T4-509.45 µg/g and T5-501.25 µg/g) and total carbon (T4-3.75 µg/g and T5-3.84 µg/g) compared that of sole inorganic (T2-26.99, 4.56, 5.329ppm, 3.09µg/g, 461.17µg/g, 3.47µg/g respectively) or organic treatments (T3-30.34, 4.44, 7.61ppm, 18.83µg/g, 413.59µg/g, 3.93µg/g respectively). Notably T4 (11.22g/plant) recorded the highest grain yield while T2 (10.36) and T5 (10.02g/plant) yielded comparably. The results therefore highlighting the potential of *Nostoc* to substitute the inorganic nitrogen application and to cut down 50% of P and K inorganic fertilizers in paddy cultivation. In addition, 50% of the compost also could be substituted by *Nostoc* in the organic paddy cultivation. Further, Field level studies are suggested in different agroecological conditions, to find the suitability of *Nostoc* as a biofertilizer.

Keywords: Biofertilizer, Cyanobacteria, *Nostoc*, Paddy cultivation

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Potential of *Chlorella* sp. cultivated in dairy effluent as a complementary liquid organic fertilizer on growth and yield of finger millet (*Eleusine coracana* L.)

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Abstract

The over-use of synthetic chemical fertilizer has an adverse effect on the environment. To overcome this issue, usage of alternate sources of nutrients is essential. *Chlorella* sp.(C) is a green microalga which has been identified as a potential bio-fertilizer. The present study was intended for identifying the potential of *Chlorella* sp. grown in dairy effluent as a complementary liquid organic fertilizer (CLOF) on growth and yield of finger millet (*Elusine coracana* L.). Nutrient content of CLOF namely nitrogen (Kjeldhal method), phosphorous (Spectrophotometer method), and potassium (Flame photometer method) was analyzed. A greenhouse pot experiment was conducted to study about the effect of CLOF as foliar spray in combination with organic or inorganic sources on the growth and yield of finger millet (*Elusine coracana* L.). The treatments were T1 – control, T2- 100% inorganic fertilizer (IF), T3 – 75% IF + 25% CLOF, T4 – 50% IF + 50% CLOF, T5 – 25% IF + 75% CLOF, T6 – 100% Vermicompost (VC), T7 – 75% VC + 50% CLOF, T8 – 50% VC + 50% CLOF, T9 – 25% VC + 75% CLOF, arranged in CRD design with four replicates. The CLOF was diluted (1/5 times) and a total of 150 ml, 100 ml and 50 ml per plant was applied to treatments 75%, 50% and 25% CLOF respectively. For each treatment with CLOF, the required amount of nitrogen was applied by changing the volume of spray in eight split doses. Data analysis was done by using the SAS statistical analytical system with Duncan's multiple range test at p=0.05 significant level. The nutrient content of CLOF was 1% nitrogen, 0.58% phosphorous and 0.67% potassium. In the greenhouse experiment, the results of plant height, leaf number, effective tiller number, ear number, weight of the yield and nutrient content of plant tissue (total nitrogen, total phosphorous and total potassium) revealed that, the T4 (50% IF+ 50% CLOF) treatment gave the equal or higher values as that of T2 (100% IF). In addition, T8 (50% VC + 50% CLOF) and T3 (75% IF+ 25% CLOF) showed comparable values in most growth parameters and yield as that of T2. T1 (control) showed the significantly lowest results in all parameters. This study, therefore, highlights the potential of using *Chlorella* sp. cultivated in dairy wastewater as a nutrient source for crop production as a complementary liquid organic fertilizer.

Keywords: Liquid Organic Fertilizer, *Chlorella* sp., Dairy Industry Wastewater, Finger millet, Complementary Fertilizer

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ID 32

Effect of vermicompost in combination with inorganic fertilizers and vermiwash on growth and yield of *Amaranthus polygamus*

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Abstract

Sole reliance on inorganic farming methods can lead to environmental problems and health issues. An integrated nutrient management system is the alternative approach to address these challenges and enhance agricultural sustainability. This study investigates the potential of vermicompost (VC) in combination with inorganic fertilizers (IF) with or without vermiwash (VW), on the growth and yield of *Amaranthus*. Vermicompost contained 1.12% nitrogen, 0.73% potassium, and 1.24% phosphorus, while vermiwash contained 0.346% nitrogen, 0.41% phosphorus, and 0.24% potassium. A field experiment was conducted using Randomized Complete Block Design (RCBD) with three replicates to assess the effects of different percentages of vermicompost (50%, 75%, 100%, and 125%) and inorganic fertilizer (IF) combinations with or without vermiwash foliar spray on growth and yield of *Amaranthus polygamus*. The treatments used in this study were T1: 50% VC + 50% IF + VW, T2: 50% VC + 50% IF, T3: 75% VC + 25% IF + VW, T4: 75% VC + 25% IF, T5: 100% VC + VW, T6: 100% VC, T7: 125% VC, T8: 100% IF + VW, T9: 100% IF, T10: 75% VC + VW, T11: 75% VC, and T12: Control (No fertilizer). Plant height, leave numbers, average leaf length, width, and crop yield were recorded. The data were statistically analyzed using Analysis of Variance and treatment means were compared using Duncan's multiple range test. The results showed that thirty days after seed sowing, T1 treatment (50% VC + 50% IF + VW) had significantly higher plant height (55.34 cm), number of leaves (22), average leaf length (15.54 cm), and average leaf width (7.8cm) compared to other treatments. However, there were no significant differences among T1, T2 (50% VC + 50% IF), T8 (100% IF + 10% VW), and T9 (100% IF). The highest yield (21.17ton/ha) was obtained from T1 (50% VC + 50% IF + VW); however, it was not significantly different from T2 (50% VC + 50% IF), T8 (100% IF + 10% VW) and T9 (100% IF). The highest net benefit was recorded in T8 (100% IF + VW). T1 and T2 also showed comparable net benefits to T8 and T9. Therefore, this concluded that the combined application of vermicompost, inorganic fertilizers, and vermiwash significantly enhances *Amaranthus* growth and yield, compared to control and chemical fertilizers alone highlighting the potential of integrated nutrient management for sustainable agriculture.

Keywords: *Amaranthus*, Inorganic-Fertilizers, Organic-Fertilizers, Vermicompost, Vermiwash

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ID 65

The effects of phosphate fertilizer on growth, yield and anthracnose resistance in chili (*Capsicum annum*) plant

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Abstract

Chili plants (*Capsicum annum*) are globally cultivated for their culinary, economic, and medicinal value, with their diverse flavors and spiciness enriching cuisines worldwide. In Sri Lanka, chili is a key condiment and an important cash crop. However, production falls short of annual demand due to various factors, notably anthracnose, a group of fungal disease caused by *Colletotrichum* fungi, leading to significant crop yield losses. Therefore, this study examined the effects of different levels and forms of phosphate fertilizer on chili plant growth, yield, and disease resistance, particularly against anthracnose disease. The experiment was conducted in the wet zone, spanning September to December. Data collection occurred from October to December (2023). The MICH HY1 chili variety was selected for this research based on its high potential yield of 32 t/ha, adaptability to major chili-growing regions in Sri Lanka and moderate resistance to Leaf Curl disease of Chili (LCDC). Plants were treated with three different levels of Triple Super Phosphate (TSP); 0.5g, 1.0g, and 1.5g in two forms along with 0.0022g/mL Albert's solution per plant, and control was maintained without phosphate treatment, weekly for six weeks, under greenhouse conditions in grow bags (13×13cm²). The experiment was set up in a Randomized Complete Block Design (RCBD) with four experimental units per treatment. The growth and yield were assessed using five parameters: plant height, leaf count, leaf area, days to 50% flowering, and the number of fruits per plant. *Colletotrichum* was isolated from infected chili samples and morphologically identified. Chili leaves were exposed to isolated *Colletotrichum* under *in-vitro* conditions and lesion areas were measured using ImageJ software V1.8.0. Findings revealed the highest fruit yield with an average of 13 fruits per plant under the treatment of 1.0g of powdered phosphate fertilizer suggesting it as the suitable level to maximize yield. Conversely, the smallest lesion area of 1.258cm², indicating the highest resistance to anthracnose, was recorded with the application of 0.5g phosphate in powdered form, suggesting that level to be used to enhance resistance to anthracnose disease. Additionally, the results revealed that excessive phosphate application led to stunted growth and increased susceptibility to anthracnose disease.

Key word: Anthracnose disease, *Colletotrichum* fungi, MICH HY1, Chili plant, Triple Super Phosphate (TSP)

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ID 69

Identification of cadmium (Cd²⁺) bioremediation potential algal species in Beira Lake, Sri Lanka

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Abstract

Algae have been shown to be capable of removing a wide variety of pollutants from water, including harmful heavy metal ions. The research gap in the identification of cadmium-degrading algal species in wastewater in Sri Lanka is the lack of comprehensive studies or knowledge specifically focused on this topic in Sri Lanka. While research on wastewater treatment and algal bioremediation exists, there is limited research specifically addressing the identification of algal species capable of effectively degrading cadmium in Beira Lake, Sri Lanka. Algal species growing in Beira Lake, Sri Lanka, were identified in this study, and their potential to remove Cd (II) was studied. Based on morphological characteristics, 21 algae species were identified by using Light microscope and scanning electron microscope. Out of the identified 21 algae species, two algae species of them (*Spirulina plantensis* and *Chlorella vulgaris*) were further analyzed for bioremediation against 20-mg/L Cd (II) solutions. For selection of most suitable culture media for algae culturing algal culture media were selected as the most suitable algal culture media for algae culturing and growth than the MS medium and artificial seawater medium. The mean of Cd (II) removal abilities/percentages of algae species varied: Algae mix (*Spirulina plantensis*, *Chlorella vulgaris*, Beira Lake wastewater) > *Spirulina plantensis* sp. > Beira Lake Wastewater > *Chlorella vulgaris* sp. Within 72 hours, *Spirulina plantensis* algae demonstrated higher tolerance for Cd (II) concentrations of 20 mg/L than *Chlorella vulgaris* algae and Beira Lake effluent. Biofilm formation was demonstrated by *Spirulina plantensis* algae species and Beira Lake wastewater algae species. Furthermore, the one-way ANOVA and Tukey tests revealed a positive correlation between algae species' ability to remove Cd (II) and live cell percentage. In conclusion, *Spirulina plantensis* algae species showed high tolerances for Cd (II) and demonstrated strong Cd (II) removal abilities. As a result, *Spirulina plantensis* algae species and a combination of algae species (*Spirulina plantensis*, *Chlorella vulgaris*, Beira Lake wastewater) can be identified as promising sorbents for the development of ecologically acceptable, and appropriate adsorption systems for the removal of Cd (II) from aqueous solutions.

Keywords: Algae, Bio-removal, Biofilm formation, Cd (II) Bioremediation, Beira Lake

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Microbiological analysis of Phenanthrene and Naphthalene degrading soil bacteria isolated from landfills and paddy fields: Bioremediation approach for a green environment

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Abstract

Polycyclic Aromatic Hydrocarbons (PAH) are organic compounds made up of carbon and hydrogen, consisting of two or more connected aromatic rings, produced by the combustion of carbonaceous compounds. They accumulate in the environment and have an enormous impact on pollution. Through wet and dry deposition, they accumulate in the biota and invade human systems via dietary sources, leading to various adverse effects such as carcinogenicity and genotoxicity. The primary objective of this study is to isolate, identify and select the best soil inhabiting bacteria from landfills and paddy fields which can degrade lower molecular weight PAHs, phenanthrene and naphthalene and study their degradation percentages. Bacterial strains with varying morphology were isolated to identify and evaluate their PAH-degrading potential and PAH degradation percentages. Plate assay was used as the primary screening test while spectrophotometric analysis with methylene blue (in 609 nm wavelength) was used as the confirmation test. For naphthalene, the strains ST1-1, ST1-2, ST2-3, ST3-6, ST3-8, ST3-8/a, SV2-02, SV3-03, SV4-04 and SV7-07 were capable of a degradation percentage of over 30% with ST1-1 presenting the highest value at 68.25%. ST1-1 presented a population density of 1×10^6 CFU/ml. For phenanthrene, the strains ST1-1, ST1-2, ST2-4, ST3-5, ST3-8, ST3-8/a, SV4-04 and SV6-06 were capable of a degradation percentage of over 20% with ST3-8/a and ST1-1 presenting the highest value at 46.76% and 41.16%. Both these strains presented a population density of 1×10^6 CFU/ml. These strains were collected from landfills being used for over 15 years. With the continuous addition of persistent organic pollutants to the soil, it can be assumed their ability to degrade prevalent PAHs has been well developed over a long period of time. These selected strains can be categorized as potential biological agents to degrade PAHs such as phenanthrene and naphthalene in polluted agricultural soils.

Keywords: Biological agents, Naphthalene, Phenanthrene, Polycyclic Aromatic Hydrocarbons, Spectrophotometry

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Evaluation of clay soil mixtures as cost-effective grow bag media for curry chili (*Capsicum annuum*) cultivation under protected house conditions

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Abstract

This study was conducted to evaluate the clay soil mixtures as cost-effective grow bag media for curry chili (*Capsicum annuum*) cultivation under protected house conditions. Clay soil is commonly available and inexpensive. Therefore, mixture of clay soil with other commonly available inexpensive soil amendments were used as an alternative for coir dust (100%) medium. Curry chili seedlings of 21 days of age were used. Nine treatments were made mixing soil amendments to clay soil such as T₁ (coir dust 100%), T₂ (clay soil 50%+coir dust 50%), T₃ (clay soil 50%+cow dung 50%), T₄ (clay soil 50%+partially burned paddy husk 50%), T₅ (clay soil 50%+sand 50%), T₆ (clay soil 50%+cow dung 25%+ sand 25%), T₇ (clay soil 50%+ coir dust 25%+sand 25%), T₈ (clay soil 50%+partially burned paddy husk 25%+sand 25%) and T₉ (clay soil 100%) were tested using completely randomized design (CRD) with five replicates. Plant height and number of leaves/plants were measured at 50% flowering stage. Number of pods/plant and weight of pods/plant were recorded at harvesting. ANOVA procedure was adapted to the analysis of data and means were compared by using Duncan's Multiple Range Test at 5% probability level. A cost analysis was performed to compare the cost of making a grow bag with the medium. The results revealed that, the significantly higher values for plant height (71.9cm and 70.7cm), number of leaves/plant at 50% flowering stage (87 and 85), number of pods/plant (30 and 29), weight of pods/plant (982.5g and 1057.0g) were obtained by T₃ and T₆ respectively compared to other treatments. It was concluded that T₃ (clay soil 50%+cow dung 50%) and T₆ (clay soil 50%+cow dung 25%+sand 25%) were the best-growing media to enhance the growth and yield performances of curry chili under protected house conditions. Considering the cost per bag with medium, the highest cost (Rs.200.00) was T₁ (coir dust 100%), the cost for T₃ and T₆ (Rs.55.00 and Rs.61.25) respectively. Therefore, T₃ and T₆ can be recommended as cost-effective grow bag media for curry chili cultivation under protected house conditions. In future studies, proposed to use inexpensive granular fertilizer rather than Albert's fertilizer to reduce the fertilizer cost.

Keywords: Clay soil, Cost-effective, Curry chili, Growing media, Soil amendments

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Evaluation of the performances of crop residue based mulching pellet with different organic mulching materials on growth of weeds, soil properties, and growth and yield of ground nut (*Arachis hypogaea* L.)

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Abstract

In ground nut cultivation, the period of up to one month of plant growth is a critical period of weed growth and competition with weeds. The objective of the study was to develop crop residue based mulching pellets for weed control, improve the soil, the yield and yield parameters of groundnut. An experiment was carried out during yala season in 2023 at the Grain Legume and Oil Crops Research and Development Centre (GLORDC), Angunukolapelessa (Agroclimatic region DL1b) in the Hambantota District of Southern Sri Lanka. The experiment was designed as a Randomized Complete Block Design (RCBD) with five treatments with three replicates. The composition of the mulching pellet was three parts guinea grass, two parts banana leaves, two parts groundnut husk and three parts maize cob biochar. The proportions of the material were selected based on the final physio-chemical characteristics of the pellets. The physical properties of the pellets water absorption ($k=1.82$), density (0.44 gcm^{-1}), average length (22.43mm), average diameter (5.58mm) and average weight (5.09g). Chemical properties were pH (7.75), electric conductivity (1.755 dS/m) and N:P:K ratio ($0.33: 0.23:6.9$). Treatments were T1 (Application of mulching pellet), T2 (Groundnut husk mulch), T3 (Guinea grass leaves mulch), T4 (Banana leaves mulch) and T5 (Without mulch) and all were applied at 10t/ha rate. After 7 weeks, soil moisture retention was improved in T1 treatment (45.3%) than control (30.67%), therefore crop residue based mulching pellet can be used as the ideal mulch to maintain soil moisture. The initial soil pH, EC and Organic matter content were 6.86 , 3.65mS/cm and 1.684 . After two months of treatment application values were 5.5 , 3.9 , 2.01 in T1 and 5.86 , 0.09 , 0.97 in T5. 04 weeks after planting the count of different types of weeds as grasses, sedges broad leaves were observed significantly difference (<0.05). The overall weed count was highest in T5 and lowest in T1. In grasses the highest values were recorded in T5 (83.42^a), lowest in T1, T2, T4 (23.5^c , 37.7^{bc} and 50.7^{bc}) and highest in T5 (139^a). In sedges, the highest were recorded in T4, T5 (107.3^a , 130.3^a) and the lowest in T1 (44.7^b). In broad leaves the highest were in T3, T4, T5 (59^{ab} , 51.3^{ab} , 83.3^a) and the lowest in T1 and T2 (20^b , 30^b). The highest pod weight per plant (42.99^a), number of mature pods per plant (70.67^a) and 100 seed weight (22.93^a) were recorded in T1 and lowest yield values were recorded in T5 (20.21^b , 36.67^b and 16.82^b). Application of all the tested mulches gave best results, instead that the crop residue based mulching pellet was observed most better qualities than tested other mulches, therefore with further improvements the mulching pellet can be recommended to farmers as a sustainable and innovative solution to environmentally friendly agricultural sector in the future.

Keywords: Biochar, Guinea, Groundnut, Mulch, Pellet

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ID 168

Comparison of the Eppawala Rock Phosphate (ERP) solubilizing efficiencies by fungi in selected agricultural soils

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Abstract

Phosphorus (P) is a macro nutrient, which mainly presents as fixed forms in soils. The fixation limits the P availability for plant uptake. Conventionally, P fertilizers are applied excessively for upland vegetables and paddy fields in dry zones in Sri Lanka though these crops do not give expected yields with increased P applications due to high fixation. The excessive usage of P fertilizers not only adversely affects the root rhizosphere but also accelerates the diminishing of the natural rock phosphate deposits used as the major source for P fertilizer production. Microbial application is one of the sustainable and ecofriendly strategies to improve P solubility and, thereby, to facilitate efficient use of the limited P resources. The laboratory experiment was conducted for qualitative comparison of the ERP solubilizing capacity by the randomly isolated microorganisms (PSM) in soils at the horticulture farm, Gannoruwa. Microorganisms extracted from the diluted soil series were introduced to Pikovskaya agar media (PKV) containing ERP less than 125 µm particle size in petridishes. Halo zones were developed by the P solubilizing microorganisms, and these microorganisms were identified as *Aspergillus flavus* (PSF1), *Aspergillus niger* (PSF2), *Penicillium sp.* (PSF3), and *Aspergillus terreus* (PS4) by morphological studies. These PSMs were single spot inoculated for creating pure culture using 20 ml of PKV media with ERP as prepared previously. Measurements of P solubilizing index (PSI) [$\text{PSI} = \frac{\text{Colony diameter} + \text{Halo zone diameter}}{\text{Colony diameter}}$] and P solubilizing efficiency (PSE) [$\text{PSE} = \frac{\text{Colony diameter}}{\text{Halo zone diameter}} \times 100\%$] were taken in three, six, nine, twelve and fifteen days intervals. Four replicates were done for each treatment. The PSI and PSE values were recorded with descending order as PSF1(4.33)>PSF2(2.75)>PSF4(2.56)>PSF3(2.056) and PSF1(335.06%)>PSF4(172%)>PSF2 (157.39%)>PSF3(110%), respectively. According to the scale introduced by Silva Filho and Vidor, the P solubilizing capacity is low, medium, and high when the PSI is lower than two, in-between two and three, and higher than three, respectively. Accordingly, the PSF1 shows high P solubilizing capacity and other fungi show medium P solubilizing capacities. Therefore, the PSF1 with ERP is identified as a potential P-biofertilizer for improving the plant availability P in agricultural soils.

Keywords: Eppawala Rock Phosphate, Fertilizer, Microorganisms, Phosphorus solubilization, Sustainable

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ID 177

Study the effect of Azolla (*Azolla pinnata*) based organic fertilizer enriched with Eppawala Rock Phosphate and Rice Husk Ash on growth and yield of Chilli (*Capsicum annum*)

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Abstract

The excessive utilization of inorganic fertilizers can result in severe human and environmental risk. The study was conducted to evaluate the effect of an organic fertilizer derived from Azolla in its dry form blended with Rice husk ash (RHA) and Eppawala rock phosphate (ERP) on the growth and yield performance of Green Chilli variety MICH HY 01. This study was conducted as a pot experiment at the Faculty of Technology, University of Ruhuna. The basal growing media was prepared by using compost, sand, and coir dust at 2:1:1 ratio. The experiment followed a complete randomized design with four treatments and four replicates. The treatments comprised of Azolla: ERP: RHA ratio as follows, T1 (control - 0g: 3g: 3g), T2 (3g: 3g: 3g), T3 (6g: 3g: 3g), and T4 (9g: 3g: 3g). Growth parameters (plant height, number of leaves, number of branches, leaf length, leaf width, stem diameter) and yield parameters (number of days to first flowering, number of flowers, number of pods, pod length, pod girth, fresh weight of pods) were recorded. Results revealed that the application of the fertilizer at a ratio of 9g: 3g: 3g of Azolla: ERP: RHA (T4) per plant significantly enhanced both growth and yield of Chilli. Applying Azolla as a fine powder with ERP and RHA resulted in significant difference ($P<0.05$) in plant height (88.25 ± 1.65 cm), number of leaves (196 ± 4.35), number of branches (82 ± 4), leaf length (15.075 ± 0.189 cm), leaf width (6.00 cm), stem diameter (7.535 ± 0.149 mm) in T4. The minimum number of days to first flowering were recorded in T4 as 60.00 ± 0.00 days, and highest number of flowers per plant (84.25 ± 6.30), number of pods per plant (45.75 ± 3.52), greatest pod length (12.375 ± 0.11 cm), pod girth (10.360 ± 0.15 mm) the highest total yield per plant were recorded (108.69 ± 5.19 g) in T4. Comparatively, the control treatment (T1) with 0g: 3g: 3g of Azolla: ERP: RHA exhibited significantly lower yields. Therefore, the application of Azolla, Eppawala rock phosphate, and Rice husk ash at a rate of 9g: 3g: 3g per plant proved to be most suitable for achieving high yield in Chilli cultivation.

Keywords: Azolla, Eppawala rock phosphate, Organic fertilizer, Rice husk ash, Sustainability

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ID 180

Examining physicochemical properties of compost derived from water hyacinth (*Eichhornia crassipes* L.) mixing with cattle manure and saw dust

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Abstract

Water hyacinth (WH) (*Eichhornia crassipes* L.) is an aquatic weed that invades freshwater bodies. Utilizing WH for composting presents a sustainable management technique for WH. In this study, WH was employed in various ratios to prepare compost piles with a combination of cattle manure and Albizia sawdust. The cattle manure and Albizia sawdust were mixed in a 1:1 ratio to create a base mixture (M), which was then used to prepare compost with WH. The ratios of WH:M in the compost piles were designated as follows: 1:0 (T0), 1:1 (T1), 2:1 (T2), and 3:1 (T3). The physicochemical properties of the composite samples from each pile were examined after a 120-day period. The resulting compost from all mixtures exhibited a brown or black color, a pleasant odor, a soil-like texture, and a reduction in moisture content, indicating efficient decomposition. The pH remained within the optimal range (6.5 – 8.5) for all samples. T0, T1, T2, and T3 samples recorded EC (dS/m) values of 6.01, 2.35, 3.56, and 4.24, respectively. However, T0 and T3 did not meet the Sri Lanka standards (SLS). Total N of T0 ($1.084\% \pm 0.001\%$) and T2 ($1.395\% \pm 0.021\%$) reached the acceptable level according to SLS, with T2 being significantly higher. There were no significant differences in P and K content among the compost samples. The C:N ratio was within the recommended range (10-25) for T0, T1, and T2, but T3 recorded a higher value ($35.81\% \pm 0.75\%$) than recommended. Further, Na, Ca, and Mg were observed in smaller quantities in all samples, and heavy metals (Mn, Fe, Cr, Ni, Cu, Cd, Pb, As, and Zn) were within acceptable ranges according to SLS. The results indicated that all parameters studied in T2 were within the appropriate ranges according to SLS. Hence, the 2:1 ratio of WH:cattle manure and Albizia sawdust is deemed the optimal mixture for compost production using WH. This study demonstrates that WH can be effectively composted with cattle manure and sawdust. Additionally, the study emphasizes the potential of WH for sustainable utilization in composting owing to its prolific growth.

Keywords: Cattle manure, Composting, Saw dust, Sustainability, Water hyacinth

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ID 181

Effects of application of dolomite with inorganic fertilizers on nutrient availability and yield of rice

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Abstract

Low country wet zone (LCWZ), the buffer zone of rice production in Sri Lanka is having lower productivity about 3.2 t/ha. The paddy soil in LCWZ is typically acidic and may be one of the reasons for poor productivity. Nutrient availability in the soil is limited by the low soil pH. Amelioration of soil pH by dolomite application is common. However, dearth of information is available on reducing fertilizer when applying dolomite in rice cultivation. A field experiment was conducted to study the dolomite application to enhance productivity as well as to reduce fertilizer. Rice variety Bw 367 was tested with five treatments T1= nitrogen, potassium and phosphorus were applied based on the Department of Agriculture fertilizer recommendation (DOA), T2 = DOA+ dolomite (2t/ha), T3 = 75% DOA + dolomite, T4 = dolomite only and T5 = no fertilizer in complete randomized block design with three replicates in *maha* 22/23 and *yala* 2023 seasons. Dolomite was applied in the first season only. One month prior to sowing, dolomite was applied. Soil pH was measured in monthly intervals and available phosphorus (P) exchangeable potassium (K) and magnesium (Mg) were measured after harvesting. The analysis of variance and mean separation were performed for the experimental data using the SAS version 9.4. The soil pH of the dolomite-treated plots was increased up to 6 during the experimental period which is favorable for rice plant growth. In DOA+ dolomite and 75% DOA + dolomite treated plots, the P, K and Mg contents were similar. However, the significantly highest K was recorded in DOA-treated plots. Magnesium content was 159% and 129% respectively higher in DOA+ dolomite and 75% DOA + dolomite treatments than in DOA treatment. In both seasons, significantly higher yield was recorded in DOA+ dolomite treated plots and it was a 20% yield increment. In both seasons, yield of DOA treated plots and 75% DOA treated plots recorded the similar yield. In conclusion, the co-application of dolomite with the recommended dose of inorganic fertilizers increases the productivity in acidic rice fields and 25% of fertilizer can be reduced without compromising the yield.

Keywords: Amelioration, Acid soil, Low country wet zone, Soil pH

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**Food Technology, Nutritional Sciences, Livestock
Production and Aquaculture**

Sub theme

Livestock Production and Aquaculture

Oral Presentations



Keynote Speech

Genomic selection and use of molecular tools in breeding programs for indigenous and crossbred cattle in developing countries

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Abstract

The benefits of applying genetic selection and molecular tools in cattle genetic improvement programmes have been well demonstrated in developed countries. However, genetic improvement in the cattle systems in developing countries is faced with some major bottlenecks resulting from the lack of proper data and pedigree recording schemes. The application of molecular tools and genetic selection provide opportunities to overcome some of these limitations. In addition, understanding the genetic basis of adaptation of indigenous breeds to harsh climatic is fundamental to designing breeding programmes for their sustainable utilization. This paper therefore examines the role of genomic selection and genomic tools in genetic improvement programs for indigenous and crossbred cattle in developing countries in addition to the role genomics for their sustainable utilization. Some potential “quick wins” of genomics in developing countries include the ability to handle the limited data structure resulting from lack of pedigrees and small herd and sire progeny sizes in these countries. These quick wins could be achieved through the development of tools for determining parentage and breed composition and the use of the genomic relationship and single step genomic best linear unbiased prediction methodology for the prediction of genetic merit. The accuracies of genomic predictions reported for systems in these developing countries vary from low (0.21 for back fat thickness) to medium (0.55 for milk yield) and high (0.83 for body weight), thereby providing opportunities to select top ranking animals. Genomics approaches have identified genomic regions associated with heat-tolerance, trypanotolerance and reproduction in some indigenous cattle breeds, which would be useful in designing sustainable breeding programmes for these breeds. Lower methane emission has been reported in some indigenous breed. Therefore, utilizing the underlying genetics for adaptation for local breeds will become even more important in the light of climate change. However, the cost efficiency of genomic technologies remains one of the limiting factors for their widespread usage in developing countries. There is the need to establish a one stop shop to offer bundled services such as genotyping, parentage and breed composition, genomic selection, and mating advice to increase the cost efficiency. The joint application of genomic and reproductive technologies has been found to improve cost efficiency. Finally, use of digital tools to build efficient and routine data collection systems will be critical. To increase efficiency and maximize impact, genomic systems must be linked to existing systems such the national artificial insemination centers, for the delivery of superior genetics to the farmer.

Keywords: Developing countries indigenous cattle, Genomic selection, Molecular tools, Sustainability

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ID 106

Development and evaluation of a high efficiency egg incubator for small-scale poultry farmers

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Abstract

The evolution of the incubation process over the years is characterized by significant scientific and technological development. The research aimed to develop a modern, cost-effective, and energy-efficient incubator with a capacity of 186 eggs, targeting small-scale local poultry farmers. The system incorporated a Liquid Crystal Display (LCD) to control temperature, a Direct Current (DC) motor to rotate eggs for uniform heating, and an AT89C52 Microcontroller to manage the entire incubation process. A Proportional-integral-derivative controller (PID) within the microcontroller maintained the temperature at 37°C-37.7°C using mathematical models developed for the incubator, actuator, and PID controller. MATLAB Simulink was employed for controller design and simulation, with Zeigler-Nichol tuning optimizing temperature control parameters. Humidity, maintained at 60% set at for the initial 18 days and then maintained at 70% till hatching. The turning of eggs was accomplished using tilting trays controlled by a programmed electric motor. The trays were tilted at an angle of 45° on either side of the horizontal axis 4 times per day. To test the incubator, 50 fresh, healthy, well-developed, and matured eggs were incubated. Conventional small-scale incubator was used as a control for compare the properties of the prototype incubator using 50 eggs. Egg and chick quality parameters, hatchability measurements and Pasgar score were measured before and after incubation period to evaluate the performances. Egg Quality parameters revealed few disparities between the two incubators. Chick weight, length, and feather length showcased nuanced differences among both incubators. Although the prototype Incubator exhibited marginally higher mean chick weight, the prototype consistently yielded chicks with longer lengths and feathers. The prototype incubator consistently produced chicks with notably higher Pasgar Scores. While both incubators displayed high hatchability rates, the prototype Incubator's slightly lower rate of hatchability (82.97%) and hatchability efficiency 82.97% indicates a scope for optimization in this aspect for more trials. Comparative Analysis highlighted the prototype Incubator's promising energy efficiency and cost-effectiveness, despite a marginally lower hatchability rate compared to the Conventional Incubator. Both systems, however, recorded a mortality rate of 0%, signifying successful incubation outcomes. Conducting additional trials with diverse batches of eggs would contribute to the optimization of incubation conditions, providing valuable insights and recommendations for small-scale poultry farmers.

Keywords: High Efficiency, Incubator, LCD, Poultry Eggs, Small Scale

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ID 108

Replacement of hydroponic maize fodder for concentrate feed in the diet of lactating dairy cows

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Abstract

Feeding lactating dairy cows with high-quality green fodder is essential for achieving high yields and ensuring the sustainability and viability of dairy farming. The experiment was conducted for the first time in Sri Lanka to assess the impact of hydroponically produced maize green fodder (HMF) on the performance of Jersey Friesian crossbred lactating cows when integrated as a partial replacement for concentrate feeds. The experiment commenced using locally available Bhadra variety Maize (*Zea mays* L) seeds, which were initially pre-soaked in water and incubated for two days. Subsequently, these soaked seeds (6 kg) were carefully positioned across eight trays within a protected environment where misters were automated every 4-5 hours for a one- to three-minute time to water the trays in the growth period until harvest after 7 days. Harvesting took place on the 8th day post-germination, marking the conclusion of each growth cycle. The fodder yield and height of maize fodder were analyzed at the end of each harvesting time. The one-month feeding trial consisted of six crossbred lactating cows, strategically assigned to two distinct groups: the control group (n=3) and the treatment group (n=3). Both groups received a diet comprising Napier CO4 (*Pennisetum purpureum*) grass as roughages. Within the control group, 6.0 kg of concentrated feed was administered to each cow daily. Meanwhile, in the treatment group, a paradigm shift was introduced, with 50% of the weight of concentrated feed being substituted by HMF, equating to a daily intake of 8.0 kg. Solids-not-fat (SNF) content, fat content, and density of milk samples were measured in both groups at the starting date of each successive week of the study period. The results indicated no significant differences ($P>0.05$) between the control and treatment groups in milk yield. However, higher milk yield was reported in the treatment group. There were significant differences ($P<0.05$) among control and treatment groups in SNF, Fat, and Density of milk. The milk yield showed no significant difference between the treatment and control groups; however, a marginal increment was observed in the treatment group compared to the control. It can be concluded that the partial substitution of conventional concentrate feeds with HMF can exert a positive influence on the milk production of lactating cows.

Keywords: Concentrates, Hydroponic Maize Fodder (HMF), Lactating Cow, Milk Yield, Sri Lanka

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ID 118

Potentials and constraints of growing improved grass varieties: A case study of small-scale dairy farmers in Dankotuwa DS division

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Abstract

Small-scale dairy farmers play a crucial role in contributing to the majority of milk production in Sri Lanka and are important in ensuring food security. However, the current milk demand in the country has made it unable to meet and rely on imports. One of the reasons for this is that providing poor nutrition to dairy cattle results in lower productivity. It has been widely adopted to use improved grass varieties as a remedy for this problem. Therefore, this study was conducted to identify the potential and constraints of growing improved grass varieties in the *Dankotuwa* DS division. Fifty small scale farmers were selected using proportionate random sampling from the 5 GN divisions in the *Dankotuwa* DS division. Data were collected using pre-tested questionnaires and analyzed using one sample Wilcoxon signed rank test and descriptive statistics. Results indicate that most of the small-scale dairy farms practice semi-intensive farming systems and use main grasses, Torpedo grasses, Mana grasses, Guinea grasses, and Cogon grass varieties as feeding sources. While most of the farmers are aware of these improved grass varieties, their adoption rate (16%) is very low. In fact, there are enough land resources available to the dairy farmers that they can utilize for the growth of improved grass varieties. Moreover, as per the farmers' perception, findings revealed that ease of getting financial support, having water resources, ease of finding planting materials, having better knowledge about normal grass varieties, and ease of finding and buying fertilizers and pesticides mainly affect the potential of growing improved grass varieties ($p < 0.05$). Constraints such as problems with hiring labor, poor extension services, limited access to information about improved grass varieties, limited access to updates with new technologies, and high production costs significantly affected the growth of improved grass varieties ($p < 0.05$). The majority of the farmers are suggested to be aware of the benefits of improved grass varieties and need subsidies to grow improved grass varieties. This study concludes that there is potential for growing improved grass varieties among small-scale dairy farmers with proper extension service.

Keywords: Constrains, Improved Grass Varieties, Perception, Potentials, Small-scale Dairy Farmers

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ID 110

Impact of Covid-19 and current economic crisis on ornamental fish farms in Colombo district, Sri Lanka

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Abstract

The ornamental fish industry in Sri Lanka is a thriving industry that attracts foreign income to the country. The COVID-19 pandemic significantly impacted global lifestyles, trade, and the economy. Many countries experienced an economic crisis with the end of pandemic. The objective of the present study is to study how COVID-19 and the economic crisis impacted on Sri Lanka's ornamental fish industry and identify the measures that farms have taken to overcome challenges for success. Five Divisional Secretariat Divisions in Colombo District ie: Padukka, Homagama, Seethawaka, Kaduwela and Kesbewa, that conduct most ornamental fish culture activities were selected. A questionnaire was used to collect primary data from 32 randomly selected farmers. Information on present status of fish farms, variation of different categories related to ornamental fish farms: cultured species, quantity and selling prices of fish, labour force, fish feed types, quantity and cost, market demand, packaging and transportation, technologies used, and common problems were collected for the three time periods: Before COVID-19, During COVID-19 and Present period. Data analyzed by calculating percentage as a proportion of total farms using Microsoft Excel. Results show both positive and negative impacts of COVID-19 and the economic crisis on ornamental fish farms. Unexpected growth of local market demand for ornamental fish and reduction of export market orders were the main positive and negative impacts of COVID-19 on ornamental fish farms, respectively. The main benefit of the economic crisis for ornamental fish farms was practicing to operate a farm with limited resources. However, the closure of ornamental fish farms or farms being converted into other businesses were the main drawbacks of the economic crisis on fish farms. Overall, the ornamental fish farming industry in Colombo has faced various challenges at the first quarter of both the COVID -19 pandemic and Sri Lankan economic crisis. However, most farms have adapted and found new opportunities for success.

Keywords: Colombo District, COVID-19, Economic crisis, Ornamental fish farms

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ID 155

Assessing the present status of low-cost small pelagic fish production, supply, and consumption in Matara district, Sri Lanka

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Abstract

Low-cost small-pelagic (LC-SP) fish is rich in essential nutrients and can be a cost-effective solution to ensure food and nutrient security in Sri Lanka. However, researchers indicate that the current performance of Sri Lankan LC-SP fisheries is generally low, highlighting the need for improvement. Hence, this study aims to explore the present status of LC-SP fish production and supply, and consumer behavior towards LC-SP fish in the Matara district. Primary data on the industry's present status were collected from Gandara fisheries harbor. Thirty single-day fishermen were conveniently selected from a population of 130. A consumer survey was conducted to understand the consumer preferences and behavior towards LC-SP fish. It included one hundred participants, chosen through convenience sampling, ensuring representation from both urban (50 from Matara DS division) and rural areas in the Matara district (50 from Pasgoda DS division). Major LC-SP fish species harvested in the Gandara fisheries harbor include Sardinella, Herrings, Indian scad and Thryssa. Issues in LC-SP fish production and supply include overexploitation, weather pattern changes, ocean pollution, increasing fishing costs, low economic gain, and huge post-harvest loss. Consumer survey found that urban consumers eat LC-SP fish three times, averaging 3.4 kg per week while rural consumers limit it to two times, averaging 2.6 kg per week. Under the same market conditions, 51% of consumers prefer to choose large marine fish over LC-SP fish, primarily due to its ease of consumption (95%). Consumers prioritize fish quality and price among various factors influencing demand. Consumers agree that LC-SP fish is a valuable nutrient source (93%), considering it a better option than larger marine fish (51%). Furthermore, they express awareness of different LC-SP species (77%), market prices (71%), and nutritional benefits (83%). Moreover, 45% of consumers indicate the impact from subjective norms on LC-SP fish consumption. Consumers face difficulties in eating (97%) and preparation (90%) due to small-bones in LC-SP fish body. Fishermen highlighted the need of good price mechanism (25%) while consumers suggested value-added, ready-to-eat fish products (85%). Finally, this study provided valuable insights for managing LC-SP fish which can nourish Sri Lankans, especially those in low-economic groups.

Keywords: Consumer preference, Food security, Low cost- small pelagic fish, Marine fisheries

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ID 169

Effects of dietary incorporation of Hathawariya leaves (*Asparagus racemosus*) powder on immune response and resistance to *Aeromonas hydrophilla* in Koi carp (*Cyprinus carpio*)

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Abstract

Few research studies have been conducted with the aim of developing immune-stimulating feeds for the ornamental fish industry in Sri Lanka. Therefore, the present study was conducted to identify the most effective immuno-stimulant concentration of Hathavariya leaf (*Asparagus racemosus*) powder as a diet for Koi fish (*Cyprinus carpio*) against *Aeromonas hydrophilla*. A total of 120 Koi carp (4.0 - 4.5 g) were fed for 60 days with four treatments (in triplicate) to investigate immune response and growth performance. Fish in four nutritional treatments (T1, T2, T3 and T4-control) were fed diets containing 1%, 2.5%, 5% and 0% *A. racemosus* leaf powder, respectively. A challenge study using PCR tested *A. hydrophilla* was done at the end of 60 days and blood sampling was done after a five-day challenge test. Complete randomized design was used as the experimental design and all data were analyzed using one way ANOVA after normality testing. All the tests were carried out using statistical software Mini tab (17). The results revealed no significant ($p > 0.05$) differences in growth parameters. Koi carp fed the control diet had the highest weight gain and SGR while fish fed the T1 diet had the least. WBC value in T2 was significantly ($p < 0.05$) higher than other treatments and significantly ($p < 0.05$) decreased in control diet. In addition, fish fed T2 treatment had the highest percentage values of lymphocytes (72.0 ± 5.6), neutrophils (25.0 ± 11.3) and survival rate (77.8). Therefore, the results of this study revealed that 2.5% *A. racemosus* powder incorporated T2 diet has a possible immune effect against *A. hydrophilla*. Further research is essential in the future to identify an active chemical component in Hathavariya leaf that acts against *A. hydrophilla*.

Keywords: *Aeromonas hydrophilla*, *Asparagus racemosus*, *Cyprinus carpio*, Immuno-stimulant

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ID 59

Assessment of functional diversity of macroinvertebrates in Rekawa lagoon, Sri Lanka

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Abstract

Macroinvertebrates are important as ecosystem engineers that perform diverse ecosystem functions to sustain ecosystem resilience. This study was conducted to assess the taxonomic and functional diversity of macroinvertebrates and to understand the environmental drivers of their community composition in Rekawa Lagoon. Physico-chemical parameters of water (temperature, salinity, conductivity, pH, dissolved oxygen concentration, total dissolved solids, depth, and Secchi depth) and sediment samples were collected from seven sites in the Rekawa lagoon during September 2023. We identified macroinvertebrate species and calculated taxonomic and functional diversity indexes. The correlation analysis, ANOVA, and redundancy analysis (RDA) were performed to understand variations in macroinvertebrate species composition/diversity indexes and their link to the environmental variables. There were nine species of benthic macroinvertebrates named *Grandidierella* sp., *Gammarus* sp., *Alitropus typus*, *Sphaerodema rusticum*, *Chironomus* sp. larvae, *Melanoides tuberculata*, *Nassarius* sp., *Lymnaea stagnalis*, and *Nereis* sp. were in the lagoon. Shannon-Weiner index in sites 1, 2, and 6 was significantly higher than in site 7. The highest functional richness (F_{ric}) was recorded on site 5 as 16.44 ± 0.73 and the lowest on site 7 as 0.92 ± 0.00 . The lowest functional dispersion (F_{dis}) was also recorded at site 7 as 2.05 ± 0.38 and it was significantly lower than sites 1, 2, 5, and 6. Overall, Site 7 showed significantly lower functional diversity indexes compared to other sites that are characterized by high salinity and conductivity in water. *Gammarus* sp. were highly correlated with DO concentration. *Grandidierella* sp. and *Chironomus* sp. larvae were highly associated with soil organic content. Our study gives insights into how site-specific management practices are needed to manage and conserve the biodiversity of Rekawa Lagoon. Furthermore, we recommend studying the functional diversity of the ecosystems which reveal different and more information than traditional taxonomic indexes to understand our ecosystems.

Keywords: Biological traits, Functional diversity, Macroinvertebrates, Redundancy analysis, Rekawa lagoon

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ID 77

Effect of dietary supplementation of papaya peel powder (*Carica papaya*) on coloration, growth performances and feed utilization of Swordtail fish (*Xiphophorus helleri*)

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Abstract

Attractive coloration is a decisive factor determining the market value of ornamental fish. As usage of dietary synthetic carotenoids to enhance coloration in ornamental fish is expensive, many research has focused on the increment of coloration of them by using natural carotenoid sources. The present study was carried out to elucidate the effect of papaya peel (*Carica papaya*) powder on color enhancement, growth performances and feed utilization of Swordtail fish (*Xiphophorus helleri*). Three experimental diets (30.4% crude protein, 4.9% crude lipid) were formulated and labeled as CT (Control diet - 0% papaya peel powder), PP4 (diet with 4% papaya peel powder) and PP8 (diet with 8% papaya peel powder). Juvenile fish (1.35 ± 0.10 cm; 0.21 ± 0.01 g) were stocked in 9 glass tanks (20L; 15 fish/tank) and fed with experimental diets twice a day *ad libitum* for 42 days. At the end of the experimental period, fish fed with PP4 (3.75 ± 0.22 cm, 1.21 ± 0.10 g) diet recorded significantly higher live weight compared to other two treatments and there was no significant difference in Feed conversion Ratio (1.53 - 1.87) and % Specific Growth rate (3.77 - 3.80) among all three treatments. Further, % Average Daily Gain of fish in PP4 (11.43 ± 0.26) and PP8 (11.02 ± 0.26) treatments had no significant difference but showed a significant difference with that of fish in CT (7.29 ± 0.52) treatment. Carotenoid content of fish tissues (6.62 ± 0.23) was significantly higher in fish in PP4 treatment compared to that of other two treatments. The survival rate (91 – 100%) was good in all the treatments. In conclusion, the present findings established that among the diets tested, the diet containing 4% of the papaya peel powder (PP4) showed better growth performance and maximum enhancement of coloration in Swordtail fish (*Xiphophorus helleri*).

Keywords: *Carica papaya*, Carotenoids, Coloration, Papaya peel powder, *Xiphophorus helleri*,

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ID 83

Phytoremediation potential of *Ipomoea aquatica*, *Bacopa monnieri*, and *Alternanthera sessilis* in *Xiphophorus maculatus* (Platy) rearing tanks

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Abstract

Phytoremediation is a frequently employed biological method which entails utilizing aquatic plants to diminish, extract, or eliminate organic and inorganic compounds from both water and soil. The present study was conducted to explore the phytoremediation capabilities of *Ipomoea aquatica* (IA), *Bacopa monnieri* (BM), and *Alternanthera sessilis* (AS) in rearing tanks of *Xiphophorus maculatus* (Platy). In control treatment no plants were used, in other three treatments one of the experimental plants (4 plants/tank) was used. Fish (0.1742 ± 0.042 g and 1.7815 ± 0.21 cm) were stocked at the stocking density of 08 fish/tank. Seedlings of IA (9.33 ± 0.50 cm), BM (7.49 ± 0.50 cm), and AS (8.66 ± 1.09 cm) were transplanted onto a floating Styrofoam raft. Fish were fed 5% of bodyweight twice a day. Final lengths (3.1199 ± 0.23) and weights (0.4003 ± 0.079) of fish were not significantly different among treatments. There were no significant differences observed in dissolved oxygen, salinity, temperature, and pH among the treatments during the study period. However, the ammonia levels in IA (0.15 ± 0.005 mg/L) were significantly lower than those in BM (0.31 ± 0.03 mg/L), AS (0.23 ± 0.025 mg/L), and the control (0.50 ± 0.20 mg/L). Additionally, the nitrite levels in IA (0.66 ± 0.14 mg/L) were significantly lower than in the other treatments (1.08 ± 0.144 mg/L). Moreover, the nitrate levels in IA (0.333 ± 0.57 mg/L) were significantly lower compared to the other treatments (1.66 ± 0.57 mg/L). IA exhibited significantly higher various plant growth parameters, including total plant height, shoot length, root length (cm), % shoot length, % root length, wet weight of plants, and % weight gain. Conversely, the number of leaves was significantly higher in the BM treatment than in the other two. Analysis of both plant growth and water quality parameters, the findings strongly indicate that *Ipomoea aquatica* emerges as a highly promising candidate for effective phytoremediation applications.

Key words: *Ipomoea aquatica*, Phytoremediation, Water quality parameters

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ID 92

Determination of microalgal diversity in three selected coastal locations of Sri Lanka with varying degrees of water pollution

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Abstract

Microalgae is expected to play a vital role in a bio-based economy in Sri Lanka due to its rich biodiversity in marine and coastal environments. However, many human activities causing water pollution are identified as threats for the biodiversity in selected coastal locations. The current study was carried out to determine the microalgal diversity in three selected west-coast locations of Sri Lanka, with varying degrees of water pollution: Ulhitiyawa (UL, 7.34°N, 79.83°E), Mattakkuliya (MK, 6.97°N, 79.87°E), and Uswetakeiyawa (UK, 6.59°N, 79.52°E). The sampling of water was done from January to February 2023 and physico-chemical parameters (pH, EC, TDS, TSS, Na⁺, NO₃⁻, PO₄³⁻, Ca²⁺ etc.) of water samples were measured analyzed. Morphological identification of microalgae species was carried out using a Digital Light Microscope (OPTIKA-B-290 TB). The relative abundance of each species was determined using a Petroff-Hausser bacteria counting chamber and biodiversity indices (Shannon-Wiener Index, Simpson's Index and Margalef's Index) were calculated. While the water from MK was brackish, it was saline (Na⁺ ion concentration) in the other two locations (UH 7950.00 ± 1394.74^b ppm, UW 7623.33 ± 1296.70^b ppm). Total Dissolved Solid (TDS) values decreased when the distance from seashore to the sampling site increased. The phosphate concentration in MK (0.45 ± 0.09 mg/L) was higher compared to UL (0.30 ± 0.01^b mg/L) and UK (0.04 ± 0.02^a mg/L), possibly due to the water pollution in MK (p < 0.05). Forty-two species of phytoplankton present in the water column and scoop samples from the three locations and were phenotypically characterized into four groups (*Chlorophyta*, *Cyanophyta*, *Bacillariophyta* and *Euglenophyta*). The highest mean species diversity and richness were observed in UK followed by UL while the highest mean species dominance was observed in MK. The most abundant microalgae species in UL was *Coelastrella vacuolata* while *Ankistrodesmus* sp. and *Licmophora abbreviata* were the most abundant species in UK. In MK, *Chlorella vulgaris* was the highest abundant species. Correlation analysis revealed a significant relationship between the physico-chemical parameters of seawater and the microalgal diversity. A positive correlation between F⁻ (+0.913), Na⁺ (+0.889) and Ca²⁺ (+0.883) and species diversity was found while a negative correlation was observed with PO₄³⁻ (-0.868) TDS (+0.755) was positively correlated with species richness while EC (-0.959), NO₃⁻ (-0.698), NH₄⁺ (-0.814) and Total Solids (-0.833) were negatively correlated with species dominance.

Keywords: Biodiversity, Correlation, Marine microalgae, Pollution, Variation

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ID 109

Feasibility of improving water quality using *Terminalia arjuna*, *Cinnamomum zeylanicum*, and *Azadirachta indica* Leaf powder packs in *Poecilia reticulata* rearing tanks

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Abstract

The inclusion of herbals into the aquatic media is extensively practiced by farmers, especially in ornamental fish farming, to enhance fish performance. A six-week experiment was designed to test the effect of *Terminalia arjuna* (TA), *Cinnamomum zeylanicum* (CZ), and *Azadirachta indica* (AI) leaf powders on water quality and growth performance of guppy fish (*Poecilia reticulata*). Dry leaf powder (3.0 g) was packed in a cloth bag and kept in the tank during the experimental period except in the control treatment (CT). Each treatment had three replicates and 12 fingerlings of *P. reticulata* (2.26 ± 0.03 cm; 0.12 ± 0.01 g) were introduced into each tank (56 L). In CT, water was daily siphoned, and 1/3 of the water was replaced at three-day intervals, but no water was replaced in other treatments. All the treatments were aerated continuously. Growth, feed utilization, and water quality parameters were monitored during the study. The final body length, weight, average daily growth, % weight gain, and specific growth rate in TA and CZ were significantly higher than those in CT and AI. The water quality parameters (pH, Phosphate, Ca^{2+} Hardness, conductivity, and total dissolved solids) in all treatments remained within acceptable ranges throughout the study. However, in AI treatment, ammonia and nitrite levels of water quality were elevated. After the eighth day, the ammonia levels in CZ and TA treatments decreased and it was lower for about 18 to 20 days and then started to increase until the end of the experiment. The final results showed that the growth, feed utilization, and water quality parameters of fish in CT, TA, and CZ were better than those of fish in AI. The survival rate of fish is good in all treatments. As water was not replaced in TA and CZ tanks, it will be helpful to reduce the cost of water as well as labor cost. Among the tested leaf powders, TA, and CZ leaf powders were better than AI leaf powder.

Keywords: *Azadirachta indica*, *Cinnamomum zeylanicum*, Herbal powder packs, *Terminalia arjuna*, Water quality

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ID 126

Effect of dietary pumpkin flower on coloration and growth performance of swordtail fish (*Xiphophorus helleri*) in aquarium conditions

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Abstract

The skin and fin color of ornamental swordtail fish (*Xiphophorus helleri*) is an important factor affecting their market value. This 84-day feeding trial aimed to evaluate the effects of dietary supplementation with pumpkin (*Cucurbita maxima*) flower powder on the coloration and growth performance of juvenile swordtails. The fish (Number of fish 90) with an initial average length of 2.020 ± 0.04^a cm and weight of 0.097 ± 0.01^a g were stocked into nine glass tanks (1.5 ft x 1.5 ft x 1 ft) at a density of 10 fish per tank. Three diets were formulated with equal amounts of proximate composition: a control diet without pumpkin flower powder (Diet CT), and diets containing either 2.5% (Diet PF2.5) or 5% (Diet PF5) pumpkin flower powder. Each diet was fed to fish in triplicate tanks. At the end of the trial, fish fed Diet PF5 had significantly ($P < 0.05$) greater final length (6.678 ± 0.41^a cm) and weight (5.193 ± 0.31^a g), specific growth rate (5.936 ± 0.23^a %/day), average daily gain (76.4 ± 13.7^a %), and better feed conversion ratio (3.407 ± 0.01^a) compared to the other diets. The final carotenoid content varied significantly among the three treatments: Diet CT (14.881 ± 0.29^c), Diet PF2.5 (70.141 ± 0.85^b), and Diet PF5 (85.47 ± 0.44^a), indicating notable differences in carotenoid levels obtained. Skin and fin coloration demonstrated a positive correlation with the increment in dietary pumpkin flower powder. Higher muscular carotenoid content in fish-fed pumpkin diets indicated absorption and utilization of carotenoids supplied through the diets. The significant improvement in growth performance and color with Diet PF5 makes it a good solution for enhancing the commercial value of ornamental swordtails.

Keywords: Carotenoids, Coloring agents, Ornamental fish, Pumpkin flower meal, *Xiphophorus helleri*

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ID 175

Effect of fishmeal replacement from *Spirulina* sp. and *Lemna minor* on growth and feed utilization of Red Tilapia (*Oreochromis mossambicus*)

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Abstract

Searching for alternative ingredients to replace fishmeal from aquafeed is a crucial part in fish nutrition studies. An eight-week feeding experiment was conducted to evaluate the effect of fishmeal replacement with alternative ingredients such as *Spirulina* sp. and *Lemna minor* on growth performance, feed utilization efficiencies and stress resistance of red tilapia *Oreochromis mossambicus*. Three experimental diets were prepared by replacing 50% of fish meal in control diet by alternative ingredients as SD (10% of *Spirulina* sp.), LD (10% of *Lemna minor*) and MD (5% *Spirulina* sp. and 5% *Lemna minor* mix) and dietary effects of each feed were compared with control diet which contain 20% fishmeal (CD). Each treatment had three replicates. 180 fish (2.10 ± 0.12 g) were distributed to 12 fiberglass tanks at an initial stocking density of 15 fish per tank. Tanks were randomly allotted to each treatment and fish were fed near satiety twice a day. Growth performance, survival rate, feed utilization efficiencies and stress resistance of the fish at the end of the experiment were compared with one way ANOVA. At the end of the experiment, 10 fish from each treatment were subjected to stress test (25 ppt). Results of this study show that the significantly highest body weights, mean feed intake, %Specific Growth Rate, %Average Daily Gain were observed from the diet of LD compared to CD. Feed Conversion Ratio were in the range between 1.06 ± 0.00 to 1.32 ± 0.03 and it was highest in the LD. Higher salinity resistance was observed from the fish in SD followed by LD. 100% survival was observed from all treatments during experiment. Although there is no significant difference in moisture, ash, or protein content in fish flesh, lipid content of flesh in SD (2.53 ± 0.00 %) was significantly higher that may occur due to higher absorption rate of *Spirulina* sp. rich with good fatty acid sources. This study concluded that the 50% of the fishmeal in CD diet can be replaced by *Lemna minor* as nutritious natural alternative low-cost ingredient without compromising growth, feed utilization and stress tolerance of red tilapia *Oreochromis mossambicus*.

Keywords: Fishmeal replacement, Growth performances, *Lemna minor*, *Oreochromis mossambicus*, *Spirulina* sp.

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ID 176

Developing habitat suitable model for Asian seabass (*Lates calcarifer*) culture in Southern, Sri Lanka

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Abstract

Site selection in aquaculture is considered as a mandatory step before establishing farming facilities. Habitat Suitability Models (HSM) is an effective tool that can be used for site selection. In Sri Lanka, there is less attention on this subject. This study focuses on developing an HSM to identify suitable habitats on the southern coast of Sri Lanka, for Asian seabass. For this study, five environmental variables (temperature, salinity, dissolved Oxygen, Nitrate, and Phosphate) were considered as model inputs; key drivers of habitat quality for Asian seabass. Environmental data were extracted from two Copernicus data products, namely Global Ocean Physics Re-analysis (GLORYS12V1) data (salinity and temperature) and Global Ocean Biogeochemistry Hindcast data (dissolved Oxygen, Nitrate and Phosphate). The data covered 21 years from 2000–2021 across approximately 290000 km² area between 2.5–6.5 °N and 78–84 °E, at resolution of 0.083° (~ 9 km) over 10 depth layers down to 13 m. Data were averaged on monthly basis and across the depth layers before running the HSM. The HSM was designed to exhaustively search the data to find optimal locations for Asian seabass culture in this study area and to classify the potential habitats into three different classes: 'Habitable', 'Moderately Habitable', and 'Uninhabitable' according to their optimal ranges and tolerance limits of each environmental variable. Profound seasonal variability was observed in the environmental dynamics in the study area, which drove corresponding variability in the model-predicted habitat suitability. A thorough sensitivity analysis revealed that the variability observed in temperature, dissolved Oxygen and Nitrate fell in the 'Habitable' range year-round. However, salinity and dissolved phosphate rendered the southwestern sector of the study area become seasonally 'Moderately habitable' or 'Uninhabitable'. Further analysis revealed that no part of the study area was identified as 'Uninhabitable' throughout the year. However, the result of this study suggests that offshore regions, particularly in the southeastern sector of the study area are more 'Habitable' for Asian seabass year-round and are preferable to be utilized as potential Asian seabass mariculture sites in southern coast of Sri Lanka.

Keywords: Asian seabass, Habitat Suitability Model Site selection, Mariculture, Site Selection

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**Food Technology, Nutritional Sciences, Livestock
Production and Aquaculture**

**Sub theme
Food Science and Technology**

Oral Presentations



Keynote Speech

Let's eat local – Exploring the richness of Australian native bush foods

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Abstract

For millennia, the Indigenous peoples of Australia have thrived off the land, forging a deep connection with the native flora and fauna that inhabit the continent. Central to their sustenance and cultural identity are the "Bush Foods," a diverse array of edible plants found in the Australian wilderness. As modern society increasingly embraces the ethos of locally sourced and sustainable food, there has been a resurgence of interest in these ancient food sources. Acacia seeds, alongside an assortment of berries, have long been staples in the diet of First Nation Australians, providing vital nutrients and sustenance. However, despite their historical significance, these native plants remain largely overlooked in mainstream food markets, primarily due to a dearth of knowledge regarding their biochemical properties and culinary applications. Addressing this gap in understanding, our recent research endeavors have sought to unravel the mysteries of Australian Bush Foods, shedding light on their nutritional composition and potential health benefits. By identifying key bioactive compounds within these plants and studying the impact of various processing methods, we aim to unlock the potential of these indigenous ingredients for broader consumption. The fruits of this labor have revealed a treasure trove of bioactive compounds, including protein, polyphenols, and flavonoids, that contribute to the nutritional richness of Bush Foods. Moreover, these compounds exhibit significant antioxidant properties, suggesting a range of potential health benefits for consumers. Armed with this newfound knowledge, food manufacturers are poised to spearhead a culinary revolution, harnessing the untapped potential of Australian native plants to create innovative and health-conscious food products. By incorporating Bush Foods into mainstream formulations, they can not only offer consumers a taste of Australia's rich cultural heritage but also provide a source of sustenance that aligns with modern dietary preferences. From nutrient-rich snacks to antioxidant-packed beverages, the possibilities for Bush Food-based products are as diverse as the Australian landscape itself. The renaissance of Australian native foods represents a convergence of tradition and innovation, offering a tantalizing glimpse into the culinary landscape of the future. As we continue to explore the depths of our natural surroundings, let us not forget the invaluable wisdom of Indigenous peoples who have stewarded these lands for generations. By embracing the bounty of the Australian wilderness, we not only nourish our bodies but also honor the legacy of those who came before us. So, let us savor the flavors of the Bush, and embark on a journey of culinary discovery that celebrates the rich tapestry of Australian native foods. Results from our research work indicate that these food materials are a rich source of proteins, polyphenols and flavonoids. Therefore, the incorporation of these food materials into food products may provide nutritional and health benefits due to their possible high antioxidant activities. Further, our results can provide food manufacturers with new information to assist them in developing new Australian Bush plant-based product formulations.

Keywords: Antioxidants, Australian Bush food, Flavonoids, Polyphenols

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ID 19

Development of a rapid – cooking rice from Sri Lankan basmati rice varieties and analyzing their physicochemical, cooking and sensorial properties

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Abstract

In the modern world, mainly due to urbanization, the day-to-day lives of people are becoming busier. The relatively long cooking time has discouraged the consumption of rice among busy people. Therefore, rapid-cooking rice was developed using three different locally grown basmati rice varieties as white basmati, red basmati, and super kernel and by three different cooking methods as boiling, pressure-cooking, and steaming. Each type of rice samples was washed, soaked in water and prepared by proposed cooking methods and subjected to rapid cooling and oven dried for 6 hours at $60 \pm 2^\circ\text{C}$. Nine different combinations of rapid-cooking rice were formed by applying each cooking method separately to selected rice varieties and studied their physicochemical and sensorial properties. The data obtained were analyzed by two factor factorial design using Minitab-17 statistical software. The selected rice variety significantly affects the changes in density, rehydration ratio, rehydration time, volume expansion, and solid gruel loss of rapid-cooking rice and the selected preparation method significantly affects the changes in density, optimum cooking time, rehydration time, volume expansion, water absorption capacity, and solid gruel loss of rapid-cooking rice. Both rice varieties and preparation methods do not affect the gelatinization temperature of rice. Super kernel rapid-cooking rice, prepared by the pressure-cooking method has the lowest density (0.41 g/cm^3), lowest moisture content (7.46%), lowest optimum cooking time (8 minutes), highest rehydration ratio (1.21), lowest rehydration time (5 minutes), highest volume expansion (1.81) and highest water absorption capacity (0.96). Sensory evaluation was carried out by thirty semi – trained panelists and super kernel rapid-cooking rice, prepared by the pressure-cooking method has the highest preference. The keeping quality of the selected combination by sensory evaluation was determined for a month in low-density polyethylene (LDPE), high-density polyethylene (HDPE), and metalized polyester (Al coated) packaging materials. The lowest absorbed moisture content (0.1687g) was observed in rapid-cooking rice samples packed in metalized polyester packaging. Super kernel rapid-cooking rice, prepared by the pressure-cooking method packed in metalized polyester packaging is selected as the most commercially viable rapid-cooking rice out of nine treatment combinations.

Keywords: Basmati rice, Keeping quality, Organoleptic properties, Physicochemical properties, Rapid cooking.

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Development of *Cassava pomace*-based films and evaluation of their physical, mechanical, and microstructural properties

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Abstract

The environmental pollution caused by conventional packaging materials like plastic and polythene has led to the exploration of biodegradable alternatives. Starch is a key component in developing such materials, but due to global hunger-related issues, starch is not suitable for use as a biodegradable packaging material. In the present study, the major industrial waste (*Cassava pomace*) of the cassava starch processing industry was effectively utilized to develop biodegradable films. The casting technique was applied to develop three packaging materials by combining different proportions of *cassava pomace* (CP) and plasticizer combinations. Developed films were examined for their characteristics including colour, thickness, density, moisture content, solubility, swelling index, mechanical properties, and microscopic properties. In contrast, concerning multiple aspects, each of the films demonstrated unique characteristics. The film with the lowest CP appeared to be thinner and lighter in colour; however, it tended to contain a greater amount of moisture. The lowest CP film exhibited an adhesive property that was well-suited for use as cling film. The intermediate CP film is distinguished by its superior mechanical properties, such as tensile strength and elongation at break which is more suitable for packaging films such as biodegradable bags. Conversely, the swelling index and thickness of the highest CP film outperform both other films, suggesting that it may have the capacity to absorb higher moisture content. The scanning electron microscopic images showed a consistent surface for all three samples, but the cross-sectional images of the highest CP film displayed internal fractures that corresponded to the lowest mechanical properties and flexibility. Thus, the highest CP film is more suitable for packaging materials such as plates. These films can serve as a viable, environmentally friendly, and biodegradable alternative to conventional packaging materials.

Keywords: Biodegradable films, Casting technique, Mechanical properties, Physical properties

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ID 66

Exploring the therapeutic dimensions of *Morinda citrifolia*: Antibacterial efficacy, phytochemical profiling, and the prospect of a health-promoting beverage

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Abstract

Morinda citrifolia, commonly known as noni, has attracted attention for its potential medicinal properties, especially in traditional Polynesian and Sri Lankan folk medicine. Considering the global need for novel antibiotics due to the emergence of antibiotic-resistant bacterial strains, this study investigates the antibacterial activity of *Morinda citrifolia* cultivated in Sri Lanka. The objective is to explore antibacterial efficacy, and identify active compounds within the plant, emphasizing its suitability for pharmaceutical applications. Focused on the unique environmental conditions of Sri Lanka, the research addresses a critical gap in the existing literature, where comprehensive studies on the antibacterial properties of *Morinda citrifolia* cultivated in this region are scarce. The investigation systematically evaluates variations in antibacterial activity by examining distinct plant components (roots, leaves, bark, and fruit) and utilizing diverse solvent extraction methods. Samples are meticulously collected from three major districts in Sri Lanka—Colombo, Gampaha, and Kalutara. Solvent extraction methodologies include methanol, petroleum ether, and acetone. Antibacterial efficacy is assessed against five microorganisms (*Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*) through a disc diffusion assay. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) are determined to ascertain the concentration inhibiting bacterial growth and ensuring eradication, while phytochemical screening elucidates active compounds within *Morinda citrifolia* extracts. Results of this study reveal solvent-specific variations in antibacterial efficacy, with methanol and acetone extracts demonstrating heightened effectiveness. Combined extracts exhibit augmented antibacterial activity, suggesting potential synergistic effects. MIC and MBC assessments confirm the bactericidal efficacy of *Morinda citrifolia* extracts, with methanol and acetone extracts consistently displaying the lowest values, both exhibiting MIC and MBC results of 100 mg/ml. Phytochemical screening reveals a diverse spectrum of active compounds within the plant, including terpenoids, steroids, saponins, phenols/tannins, carbohydrates, and flavonoids. This research, serving as the inaugural step in the development of a therapeutic beverage utilizing *Morinda citrifolia*, underscores the plant's potential application in novel antimicrobial therapies against resistant strains. The findings corroborate that *Morinda citrifolia* exhibits notable antibacterial resistance against pathogenic bacteria, albeit with efficacy levels lower than those of gentamicin. This underscores the therapeutic potential of *Morinda citrifolia* in terms of antibacterial efficacy and phytochemical constituents. The results strongly suggest the viability of developing a health-promoting beverage derived from *Morinda citrifolia*, though further research is warranted. Nonetheless, the study substantiates both the plant's antibacterial efficacy and the identification of key active compounds, accentuating its potential in pharmaceutical applications.

Keywords: Antibacterial activity, Medicinal properties, *Morinda citrifolia*, Phytochemical screening, Solvent extraction

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ID 68

Impacts of paper waste and paddy straw on the growth, nutritional profile, and antioxidant activity of *Pleurotus ostreatus* (American oyster mushroom) and *Pleurotus eous* (Bhutan oyster mushroom)

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Abstract

Pleurotus species are an extensively cultivated type of mushroom and are consumed as a nutritious, healthy source of food all over the world. Numerous agricultural wastes can be used to grow these mushrooms, such as sawdust, paddy straw, coconut coir, etc., which further contributes to the prevention of environmental pollution. In this study, two commonly cultivated oyster mushroom species; *Pleurotus ostreatus* (American oyster) and *Pleurotus eous* (Bhutan oyster) were grown separately on paper waste and paddy straw and the yield, nutritional composition, levels of bioactive compounds, and antioxidant activity were evaluated. The main objectives of this study were to determine the most nutritious oyster mushroom variety with health benefits and to investigate the best substrate to cultivate it. Various tests including the protein analysis using the Lowry assay, phenol sulfuric assay to determine total carbohydrates, qualitative tests for bioactive compounds, antioxidant capacity using DPPH assay, and total phenolic content assay were performed. Bhutan oyster cultivated on paddy straw showed significant results in the number of fruiting bodies (7.3 ± 2.3) and fastest growth (9.7 ± 6.7 days) compared to other groups. However, American oyster cultivated on paddy straw and paper waste had the highest protein ($5.5 \pm 1.5\text{g}/100\text{g}$) and carbohydrate contents ($8.2 \pm 0.9\text{g}/100\text{g}$) respectively. The bioactive compounds, terpenoids and polyphenols were present in all the samples. Furthermore, there was no significant difference in the total phenolic values although all the study groups exhibited substantial phenolic levels. Bhutan oyster cultivated on paper waste displayed a significantly low IC₅₀ or half-maximal inhibitory concentration ($23.4 \pm 26.2\mu\text{g}/\text{mL}$) compared to Bhutan oyster cultivated on paddy straw ($93.9 \pm 26.2\mu\text{g}/\text{mL}$), showing higher antioxidant properties. When considering the substrates, although paper waste took less number of days for the mycelium growth to complete, both substrates did not have any significant difference with respect to the water holding capacity. In conclusion, the outcomes for nutritional properties and antioxidant activity of both species grown on the two substrates were remarkably similar and showed promising results. Therefore, both Bhutan and American oyster mushrooms grown on the substrates of paper waste and paddy straw can be consumed as an affordable and good food source with many nutrients, antioxidants, and bioactive compounds.

Keywords: Antioxidant activity, Nutritional properties, Oyster mushroom, Paddy straw, Paper waste

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ID 79

Microencapsulation of *Streptococcus thermophilus* STI – 15 in Soy Protein Isolate – Inulin matrix to enhance their viability under varied storage conditions and pH levels

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Abstract

Probiotics must be safeguarded from severe environmental stressors such as harsh acidic conditions, high temperatures, excessive salt, and enzyme degradation, among others, to avoid a detrimental sensory influence on food incorporation. One of the potential ways for preserving probiotic bacteria appears to be microencapsulation. In the current study, *Streptococcus thermophilus* STI – 15 cells were microencapsulated in Inulin (IN), Soy protein isolate + Inulin (SPI + IN), Ultrasound treated soy protein isolate + Inulin (US-SPI + IN) as capsule matrixes and free cells (Unencapsulated cells) by freeze drying as the microencapsulation method. Activated STI – 15 cells were grown in MRS agar at 37°C for 24 h, cells were harvested and mixed with either IN, SPI + IN, US-SPI + IN in 300 mL separately and freeze dried to microencapsulate. Microencapsulated (ME) ST (10%) were dissolved in sterilized skim milk and stored at 5°C, -18°C and enumerated at 28 days to assess the storage survivability. Different aliquots of distilled water adjusted at pH 1.5, 2.5, 3.5, 4.5 and 5.5 using HCl and NaCl were inoculated separately with ME ST kept for 60 mins and survivability was investigated. A comparison between the effects of different pH values resulted pH 1.5 is more lethal than the higher pH values. It was found that the survivability of the probiotic bacteria in their free form was significantly ($p<0.05$) lower than that of the encapsulated form, demonstrating the effective role of the wall components in shielding probiotics from acidic pH (Gastro-intestinal pH). Among three different wall material types of US-SPI+IN showed the highest survivability of *S. thermophilus* STI – 15 in all pH values. Probiotic entrapped within US-SPI+IN significantly ($p<0.05$) showed the highest survivability during both refrigerated (5°C) and freezing (-18°C) storage for 28 days of period by resulting the lowest reduction of the viable cell count (0.27 and 0.19 log CFU/mL for refrigerated and freezing storage respectively). Microencapsulation by freeze drying in soy protein isolate - inulin matrices, as well as soy protein isolate modification using power ultrasonography, showed to be a promising microencapsulation strategy for improving probiotic survivability to storage and stress conditions such as pH.

Keywords: Freeze drying, Inulin, Microencapsulation, Soy Protein Isolate, *Streptococcus thermophilus*

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ID 98

Effects of gamma irradiation on shelf-life extension of Ambul banana (*Musa acuminata*)

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Abstract

Banana is one of the most widely consumed fruits globally, but it is also highly perishable, leading to significant losses in agricultural production. This research aimed to extend the shelf life of Ambul bananas through gamma irradiation. Three different gamma irradiation doses, namely 0.25 KGy, 0.35 KGy, and 0.5 KGy, were applied to the bananas. The study monitored the physicochemical characteristics of both irradiated and non-irradiated bananas at various time intervals: 0, 5, 9, 11, 13, 15, 17, 19, and 21 days, focusing on organoleptic properties until spoilage occurred. Before and after gamma irradiation, the shelf life of Ambul bananas was evaluated by observing the visual signs of decay. Control bananas ripened within 5 days, while the gamma-irradiated matured bananas exhibited ripening after 21 days, effectively extending the shelf life by 16 days. Notably, using a dose of 0.5 kGy increased the shelf life by 7 days compared to the control samples. Similarly, a dose of 0.35 kGy resulted in a shelf-life extension of 12 days compared to the control fruits. Bananas treated with a 0.25 kGy dose showed the longest shelf life, lasting 21 days. The study also analyzed the physicochemical properties of both irradiated and non-irradiated Ambul bananas during the experimental time periods. A sensory test was conducted on the 7th day of storage, involving a 9-point hedonic scale to determine the preferred sample. Thirty untrained sensory panelists assessed the sensory attributes of the fruit, and the data were subjected to a two-way ANOVA test with a 95% significance level. In conclusion, gamma irradiation proved to be an effective method for extending the shelf life of Ambul bananas. Among the doses evaluated, a 0.25 KGy dose was the most efficient in preserving the quality and freshness of the fruit compared to the 0.35 KGy and 0.5 KGy doses. This research offers valuable insights into mitigating post-harvest losses in banana production through gamma irradiation treatment.

Keywords: Ambul banana, Gamma irradiation, Physiochemical characteristics, Sensory evaluation, Shelf life,

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ID 102

Determination of the effect of sulphur fumigation on cinnamon quills with spatial variation of fumigation chamber and its effect on cinnamon tea

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Abstract

Sulphur fumigation is practiced on cinnamon quills and cut pieces to avoid fungal and insect attacks and to increase the characteristic golden yellow colour of Ceylon cinnamon. This study was conducted to evaluate the effect of sulfur fumigation on cinnamon quills with spatial variation of the fumigation chamber to assess the effect on cinnamon tea made from fumigated bark. Processed cinnamon quills were subjected to fumigation with a constant concentration of sulfur: 5g of sulfur per 1kg of cinnamon, within three spatial sizes of 80, 100, and 135 cubic feet for 15-hour period. Just after fumigation, sulfur content analysis, moisture content analysis, oil yield, colour, insect count, water activity, and colony forming unit count (CFU) were measured. Cinnamon tea, made from 5g of ground cinnamon put into 150mL of hot water, was tested for pH, titratable acidity, and refractive index. The colour of the cinnamon quills (L^* , a^* , b^*) was enhanced due to fumigation. The amount of residual sulfur in cinnamon quills after fumigation varied on the amount of cinnamon subjected to fumigation, but it did not vary on chamber size. In addition to this, there was an interaction effect of the above two factors, on the residual amount. Compared to the control sample, the live insect count of cinnamon quills was decreased because of fumigation, and the dead insect count was increased. The microbial count of fumigated cinnamon quills was lower than the non-fumigated quills, thus the shelf life of cinnamon quills was increased. Therefore, it is concluded that the colour values, insect count, and microbial count, of the fumigated quills were significantly varied with the chamber size and the number of cinnamon quills that were subjected to the sulfur fumigation process. The subsequent moisture content, oil yield, and water activity of cinnamon quills were not affected by fumigation. The pH value, titratable acidity, and refractive index of the samples of cinnamon tea of treated cinnamon quills showed significant differences from the control samples and it can be concluded that the cinnamon tea was affected by the sulfur dosage used.

Keywords: *Cinnamomum zeylanicum*, Cinnamon postharvest pests, Cinnamon tea, Microbial count, SO₂ fumigation

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ID 113

Physicochemical and physical properties of cow milk set yoghurt stabilized with sweet potato (*Ipomoea batatas* L.) starch isolated using different methods

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Abstract

Set yoghurt, one of the most widely consumed cultured dairy products in Sri Lanka is commonly stabilized with gelatin derived from animal body tissues. There is an increased consumer preference for plant-based food additives such as starch over gelatin for yoghurt gel stabilization. The properties of starch which depends on the isolation method affects the quality of the final product. Therefore, a study was designed to investigate the physicochemical and physical properties of cow milk set yoghurt stabilized with sweet potato (*Ipomoea batatas* L.) starch (SPS) isolated using 3 different methods. Sweet potato tubers were washed with potable water, peeled, and divided into 3 equal lots. Starch was isolated by blending each lot separately with distilled water (1:1) (SPS1), 1M NaCl (1:1) followed by centrifugation at 2200 rpm/15 min (SPS2), and distilled water (1:1) followed by centrifugation at 2200 rpm/15 min (SPS3). Experimental yoghurts (3% fat, 7% sugar) were prepared using gelatin (Control), SPS1 (T1), SPS2 (T2) and SPS3 (T3) as the stabilizer at the rate of 0.5% (w/w). Physicochemical and physical properties of SPS and yoghurt were examined using standard methods. Completely randomized design was employed with 3 replicates and the data collected were subjected to the analysis of variance (ANOVA) procedure followed by Tukey's test for mean separation using SPSS software (ver. 25). Moisture content of SPS was significantly ($p<0.05$) affected by the starch isolation method but remains in the range recommended for commercial starches. Isolated SPS was acidic and SPS2 had significantly higher pH compared to the other two. Water absorption capacity varied from 0.598 ± 0.004 mg/g in SPS2 to 0.780 ± 0.002 mg/g in SPS1 and was significantly different. At 80 °C, SPS1 showed the highest swelling power while solubility was significantly lower compared to SPS2. Titratable acidity and pH of yoghurt after gel stabilization indicated an uninterrupted starter culture activity and did not depend on the starch isolation method. Control yoghurt stabilized with gelatin had significantly higher pH compared to the yoghurt stabilized with SPS isolated using different methods whereas the titratable acidity did not show a special trend and was above the minimum level (0.6% lactic acid) prescribed for yoghurt. Water holding capacity of the yoghurt stabilized with gelatin was the highest confirming the effectiveness of gelatin in binding water in the yoghurt matrix while spontaneous whey syneresis was not detected in any of the treatments. The above results indicate the possibility of utilizing SPS isolated using the methods specified, to stabilize cow milk set yoghurt without affecting the quality.

Keywords: Set yoghurt, Sweet potato starch, Swelling power, Solubility, Water holding capacity

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ID 132

Prebiotic potential of the finger millet variety, “Oshadha” on *Lactobacillus acidophilus* (LA 5)

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Abstract

In Sri Lanka, finger millet [*Eleusine coracana* (L.Gaertn)] is the third most important cereal cultivated next to rice, corn and rich in carbohydrates, protein, dietary fiber, minerals including other phyto-nutrients. Probiotics are the “live microorganisms which when administered in adequate amounts confer health benefits to the host” which are generally regarded as safe (GRAS). According to the ISO 29981:2010, a probiotic functional food should contain 10⁸cfu/ml or g of the viable organisms at the time of expiry. Plant based probiotic food products could be better alternatives for many reasons. The present study evaluated the prebiotic potential of finger millet “Oshadha” variety towards LA 5 in terms of viable cell count and selected physico-chemical and nutritional properties. The “Oshadha” variety, harvested when 80 % of the ears become brown in color during “Maha” season was selected considering high nutrients and dietary fiber fractions that favor the survival of probiotics. Grains were sorted, washed, dried, milled, sieved through 0.5mm sieve and slurry was prepared by suspending in water at 1:11 (w/v) ratio and sterilizing. The slurry was inoculated with freeze-dried LA 5 culture in 2% (w/w) and incubated at 44 °C for 10 h. Microbiological, physico-chemical and compositional parameters of fermented, unfermented slurries were evaluated according to the standard protocols and were statistically compared. In fermented slurry, viable cell count, pH, acidity and viscosity were 8.65±0.14 log₁₀cfu/g, 4.35±0.01, 0.18±0.00% and 2418.43±2.80cP respectively whereas in unfermented slurry, pH, acidity and viscosity were 6.47±0.01, 0.04±0.01 and 583.30±2.74cP respectively. The physico-chemical parameters in fermented slurry were significantly varied (*p*<0.05) compared to the unfermented slurry. Among protein, carbohydrate, fat and ash, only ash content (2.56±0.36%) of the fermented slurry was significantly high compared to unfermented slurry (1.66±0.39%). In the fermentation, LA 5 utilizes the carbohydrate, produces lactic acid resulting reduction of pH and excretes exopolysaccharides (EPS) which increases the viscosity of the slurry. In conclusion, the “Oshadha” variety could be considered as a potential carrier for LA 5 with prebiotic potential. In Sri Lanka, this is the first study to report that the finger millet (Oshadha variety) is a potential LA 5 carrier with prebiotic characteristics.

Keywords: Fermentation, Finger Millet, *Lactobacillus acidophilus*, Prebiotic Potential, Probiotics

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ID 140

Consumer perception of bakery foods and development of a food safety cloud for the bakery industry in Sri Lanka

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Abstract

The advancement of food technology has led to the widespread use of various food additives in processed foods. However, excessive consumption of these processed foods containing high levels of additives has been linked to non-communicable diseases such as diabetes, cancer, and cardiovascular diseases. Bakery products hold a significant place in the day-to-day diet of Sri Lankans, incorporating a variety of additives including preservatives, antioxidants, emulsifiers, coloring agents, sweeteners, and thickeners. This study aimed to evaluate consumer perceptions of bakery food additives and to develop a Food Safety Cloud tailored to the bakery industry in Sri Lanka. Data on consumer perceptions were collected from 120 participants, focusing on additives such as calcium propionate, ascorbic acid, sodium stearoyl-2-lactylate, sorbitol, and mono-and-di-acetyl tartaric acid esters. The waterfall method was employed for system development, resulting in the creation of the Ruhuna Food Safety Cloud. Quick Response (QR) codes were generated for each bakery product examined. Findings indicated that a majority of consumers (65%) consume bakery products 2 to 3 times per week, with bread being the preferred item for most (60%), followed by buns (25%), and cakes (15%). However, the study revealed that the majority of respondents (80%) were unaware of the non-communicable diseases associated with food additives. Additionally, education level significantly influenced awareness of nutrient composition, effects of food additives, and recommended levels of additives in bakery products ($p < 0.05$). The Ruhuna Food Safety Cloud offers consumers access to comprehensive information on the types of food additives present in bakery products, including safety levels, recommended consumption amounts, and potential side effects associated with prolonged consumption. Designed with a user-friendly interface, this innovative platform empowers individuals to make informed decisions prior to purchasing safe and healthy bakery products. Further research is warranted to validate the effectiveness of the Food Safety Cloud.

Keywords: Bakery Products, Cloud Computing, Food Additives, Food Safety, Food Safety Cloud

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ID 141

Evaluation of physicochemical, nutritional and functional properties of selected mango varieties; with special reference to Hambantota district, Sri Lanka

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Abstract

The mango (*Mangifera indica* L.), one of the most popular tropical fruits, is well-known for its exquisite flavor and nutritional profile. More than 20 different mango varieties can be found in Sri Lanka. However, detailed studies on comparison of their comprehensive properties are limited. Therefore, this study was conducted to compare physicochemical, nutritional and functional characteristics of five different most commonly consumed mango varieties (TJC, Willard, *Vellaikolumban*, *Karratha colomban* and *Neelam*) commonly grown in Hambantota district, Sri Lanka. Mango drupes from the fifth stage of ripening level were randomly taken, and their physicochemical, nutritional and functional properties were tested in triplicates. Statistical significance was tested using ANOVA-One-way and Tuckey's post-hoc multiple comparison test highlighting significance difference ($P < 0.05$). Amongst all the tested varieties, the significant highest weight (328.63 ± 34.13 g) and thickness (7.91 ± 1.08 cm) were recorded by the variety Tom JC, and the variety *Karratha colomban* showed significantly highest length (12.56 ± 0.29 cm), pH value (6.74 ± 0.15) and total soluble solids (25.36 ± 0.05 °Bx). The variety Willard recorded the highest width (7.32 ± 0.12 cm) and the highest sugar content (22.34 ± 0.03 g/100 g), and the variety *Neelam* obtained the highest titratable acidity (0.28 ± 0.03 g/100 mL) and vitamin C content (24.73 ± 1.22 mg/100 g). According to the nutritional composition, *Karratha colomban* obtained the highest moisture content ($84.43 \pm 0.97\%$) and the highest fiber content ($2.06 \pm 0.50\%$). The highest protein content ($1.84 \pm 0.12\%$) was observed in both *Karratha colomban* and Willard. The variety TJC obtained the highest ash content ($0.83 \pm 0.24\%$) and the total carbohydrate content ($29.25 \pm 0.28\%$). The highest fat content ($0.63 \pm 0.04\%$) was observed the variety Willard. Considering the functional properties, the variety Willard recorded the highest flavonoid (107.43 ± 31.37 mg/100 g) and phenolic contents (32.09 ± 1.49 mg/100 g), while Tom JC recorded the highest antioxidant content (272.06 ± 0.00 mg/100 g). Overall, the study findings highlight that the *Karratha colomban* and Willard as the most nutritious varieties among the tested mango varieties, and all the tested varieties are a rich source of nutrients. Further, their nutritional, physicochemical and functional properties were found to be differ from each other.

Keywords: Functional properties, Mango varieties, Nutrient analysis, Physicochemical properties

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ID 154

Effect of preservation method on the shelf life of avocado (*Persea americana mill*) flesh powder

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Avocado, being a climacteric fruit, faces challenges like seasonal availability, limited shelf life, and sensitivity to handling, resulting in supply inconsistencies and potential waste. Therefore, this study aimed to preserve quality parameters of avocado flesh powder with the application of different packaging materials and storage temperatures while controlling the browning reaction in avocado flesh. Three methods were used to avoid browning in avocado pieces as citric acid, SMS, and ascorbic acid. Later, pieces were dried at $60\pm 2^{\circ}\text{C}$ for 5 hours and 30 minutes in a conventional oven, followed by grinding and sieving to obtain fine powder. Powder was packed using in Polyethylene Ziplock bags and vacuum seal bags and stored at ambient (27°C), refrigeration (4°C) and freezing (-18°C) temperatures to extend the shelf life. The physicochemical, functional, and microbial characteristics of avocado powder were evaluated using standard and recognized methods throughout a four-week storage period. Citric acid treatment showed the best results (L^* ; 32.08 ± 0.71 , a^* ; 30.53 ± 0.02 , b^* ; -1.62 ± 0.85) proving it as the best method for inhibiting browning of avocado flesh. The physicochemical, functional, and microbial characteristics of avocado powder were evaluated using standard and recognized methods throughout a four-week storage period. Notable fluctuations were observed in powder properties with different temperature and packaging material during the storage period. Vacuum packaging in freezer storage at -18°C proved to be the most successful in sustaining the quality of avocado powder among two packaging evaluated in this study showing strong activities against physicochemical (moisture content; 5.92%, pH; 5.51, peroxide value; 8.085 meq O_2/kg), and functional properties (DPPH radical scavenging activity; 20.88% and total phenol content; 166.9 mg GAE/g). Vacuum packaging at -18°C also demonstrated remarkable potential in maintaining the overall quality of the product compared to powder maintained at 27°C . Vacuum packaged avocado powder maintained at -18°C showed accepted color values (L^* dark/light; 49.82 ± 0.07 , a^* red/green; -0.520 ± 0.22 , b^* yellow/blue; 16.155 ± 0.94) after 4 weeks. Therefore, citric acid treatment was recommended for browning control in avocado flesh. Storage at -18°C was recommended for prolonged quality retention together with the utilization of vacuum packaging.

Keywords: Avocado powder, Packaging material, Quality change, Shelf Life, Storage Temperature

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ID 166

Determination of the effect of frying temperature, time, added asparagine, glucose content and precursor content on the acrylamide formation in fish roll

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Abstract

Food toxicants are formed in foods, during high temperatures (>120 °C) associated with deep-frying, baking, and roasting. Acrylamide has been declared as a "probable human carcinogen" by the International Agency for Research on Cancer. Acrylamide formation is affected by intrinsic and extrinsic factors of the food. The objectives of this study were to identify the main acrylamide precursor content (asparagine and total reducing sugar (TRS)) of raw materials and analysing the effect of various factors on acrylamide formation in fish rolls. The effect of frying temperature (160-180 °C), time (8-12 minutes), and added asparagine (0.3-0.9 g/100g flour) and glucose content (2.0-4.0 g/100g flour) on acrylamide formation in fish rolls were analyzed in this study. The raw materials were analyzed for their asparagine (chromatographic methods) and TRS (dinitro salicylic acid method) contents. The effect of studied factors on acrylamide formation was analyzed using the response surface methodology (RSM) and Box-Behnken method with 4 factors and 3 levels. The raw materials of fish roll: wheat flour, potato, B-onion, green chili, curry leaves, fish, bread crumbs and black pepper had asparagine contents about 0.22 ± 0.01 , 14.24 ± 1.33 , 1.41 ± 0.08 , 3.03 ± 0.01 , 6.76 ± 0.12 , 0.27 ± 0.00 , 0.08 ± 0.00 , and 2.35 ± 0.06 mg/g (dry basis), respectively and TRS about 3.34 ± 1.30 , 11.59 ± 0.60 , 154.63 ± 16.61 , 46.50 ± 0.70 , 10.86 ± 1.63 , 4.05 ± 0.87 , 45.15 ± 0.96 and 2.49 ± 0.33 g/kg (dry basis), respectively. The raw materials were enriched with RS, and asparagine acted as the limiting factor in acrylamide formation. According to RSM, acrylamide content had shown a strong positive correlation with frying temperature (0.715), and a moderate positive correlation with time (0.424). Time and temperature were the most critical factors in acrylamide formation in fish rolls. The acrylamide content had shown a small positive correlation with the asparagine (0.309) and the glucose content (0.222). Asparagine was the limiting factor in acrylamide formation in fish rolls. Therefore, it is critical to use raw materials with lower acrylamide precursor contents, while frying at optimized frying conditions (at 170 °C for 10 minutes).

Keywords: Acrylamide, Asparagine, Deep-frying, Reducing sugar, Temperature

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ID 174

Formulation of hot water soluble instant *Venivelgeta* powder; Study of physico-chemical properties and anticancer activity of the *Venivelgeta* hot water extract (*Coscinium fenestratum* (Gaertn.) Colebr.)

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Abstract

Venivelgeta (*Coscinium fenestratum*) is one of the most significant plants in the traditional medicine system. The boiled water extract of *venivelgeta* is used for the treatment of fever, pain relief, joint pain, allergies *etc.* The use of *venivelgeta* stem and powder is inconvenient due to bitterness, high bulkiness, and inaccurate measurements. This study aimed to optimize the formulation of hot water-soluble instant *venivelgeta* powder with sweetener by preserving medicinal properties and enhancing solubility for convenient consumption. The water extract of powdered *venivelgeta* was extracted with the decoction method (1.0 kg in 5.0 L of distilled water). The extract was converted by oven-drying and freeze-drying techniques. The efficiency of the freeze-drying method was higher, and it was obtained fine powder. The freeze-dried powder was subjected to physicochemical analysis and anticancer activity against MCF 7 and HCT 116 cell lines. The freeze-dried powder was used to prepare formulated hot water soluble instant *venivelgeta* samples, including formulation 01 (*venivelgeta* 0.50 g, cardamom 0.20 g, and sugar 2.0 g), formulation 02 (*venivelgeta* 1.0 g, cardamom 0.20 g, and sugar 2.0 g), and formulation 03 (*venivelgeta* 1.5 g, cardamom 0.20 g, and sugar 2.0 g). Formulation 01 was selected as the best in sensory evaluation. The physicochemical analysis of freeze-dried *venivelgeta* showed 6.33% w/w moisture content. The total polyphenol content was shown as 9.375 mg GAE/g. The turbidity level ranged from 163 NTU to 373 NTU in different concentrations of instant powder. The qualitative analysis of active functional groups of secondary metabolites reported as alkaloids, flavonoids, glycosides, and carbohydrates. The cytotoxicity effect on the MCF-7 breast cancer cell line and the HCT116 colorectal carcinoma cell line showed a decrease in the cell viability and the high concentration of instant powder extract caused an arrest of the cell cycle of both cell lines. In conclusion, it was demonstrated that the use of the freeze-drying technique was the most effective and efficient drying technique, both cell lines were sensitive to *venivelgeta* extract and instant powder has anti-cancer properties against both cell lines. The formulation 01 has the potential to develop as a commercial *venivelgeta* instant tea powder.

Keywords: Anti-cancer properties, Cell viability, Decoction method, Freeze-drying, *Venivelgeta* stem

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Precision Agriculture: Navigating the Digital Landscape

Oral Presentations



ID 51

Greening urban spaces: a review on the implementation of edible vertical gardening for human wellbeing enhancement

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Abstract

A total of 22 million people and 17% of families in Sri Lanka are considered to be food insecure. Malnutrition affects one-third of children under the age of five, while 40% of women are either overweight or obese. Changes in the climate are the root cause of extreme weather. Both an increasing population and crowded cities contribute to the occurrence of extreme weather events. As a result of paving surfaces absorbing more solar energy than vegetation, temperatures can rise by 6°C. Green architecture and more environmental consciousness are contributing to the expansion of urban gardening. Within the urban residential zones of Sri Lanka, vertical green spaces are preferable over horizontal ones due to the limited space available and the rising cost of those places. It is possible for the construction industry to adopt environmentally friendly building practices in order to address climate change, carbon emissions and concerns related to resource utilization. Vertical farming is a method of planting crops in a vertical orientation by using hanging pots or structures. This review examined the efficacy, environmental impact, and socio-economic benefits of edible vertical gardening in urban areas to improve human health. The direct benefits of edible vertical gardening include the cultivation of homegrown herbs and vegetables that are organic and healthy. High levels of nutrients derived from herbs and vegetables produced at home. There is a correlation between the presence of vertical gardens and a reduction in the occurrence of several respiratory disorders, as well as Sick Building Syndrome, cancer, stroke, and depression. Improve the indoor air quality, as well as urban farming, social functions and urban physical relief, all increase. In addition to fostering self-satisfaction, vertical gardens also strengthen family and intergenerational bonds. Accreditation from the National Green Building Council indicates that vertical gardening contributes to the improvement of society. The provision of a sustainable lifestyle, food security and the modernization of buildings is made available. Enhanced living circumstances, improved health and ecological landscape restoration are all benefits of city facade gardening. There are numerous advantages associated with vertical gardens, including environmental, economic, social, psychological, aesthetic, and socioeconomic.

Keywords: Edible vertical gardening, Food security, Human wellbeing, Sustainable cities, Urban agriculture

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ID 73

Harnessing precision agriculture techniques to mitigate climate change effects - strategies, challenges, and opportunities

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Abstract

Climate change is projected to significantly impact on crop production by altering temperature and water availability. To counteract these repercussions while sustaining development, mitigation and adaptation measures are essential. Proactive management of agricultural practices coupled with appropriate technologies has the potential to reduce greenhouse gas emissions while simultaneously increasing agricultural output and income. Precision agriculture emerges as a promising avenue mitigating the effects of climate change. By optimizing agricultural inputs, precision agriculture can achieve similar or greater yields at lower costs compared to conventional approaches. However, the scholarly literature on Precision Agriculture Techniques (PAT) is fragmented and lacks sufficient empirical evidence, particularly in terms of field investigations. This research aims to assess the potential of precision agriculture techniques in mitigating climate change effects, identify strategies for integrating precision agriculture with broader adaptation efforts and explore the obstacles and opportunities for widespread adoption. A comprehensive evaluation of existing literature establishes the framework categorizing PAT principles into recording, reacting and guidance technologies. The seamless integration of these categories holds the potential to improve agricultural output and quality while minimizing the environmental impact. Despite its potential benefits global adoption rates for precision agriculture techniques remain low, attributed to factors such as, high investment costs, small farm sizes, and the advanced age of farmers. Incentives aimed at enhancing the economic performance of farms, along with non-monetary support such as technical advice could potentially bolster PAT adoption. Precision agriculture presents a cost-effective strategy for lowering greenhouse gas emissions, and it is anticipated to garner universal support within the agricultural community. Therefore, its incorporation should be taken into consideration in both the current and the future agricultural strategies.

Key words: Climate resilience, Climate smart agriculture, Mitigation and adaptation strategies, Precision agriculture; Sustainable agriculture

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ID 80

"Brainy Bloom": An intelligent plant companion for diverse learning and well-being needs in children

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Abstract

In the context of contemporary dual-income households, where concerns about children's increasing time spent alone at home contribute to rising loneliness, hyperactivity, depression, and anxiety, this research introduces the "Brainy Bloom" smart plant pot as a potential solution. The detachment of modern children from the natural environment, coupled with a diminishing interest in plants amid increasing screen dependence, further underscores the need for constructive outlets. Engaging activities like caring for plants have emerged as promising interventions, especially for children facing challenges such as Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD). Crafted at the intersection of nature and technology, the "Brainy Bloom" addresses safety and usability concerns. Comprehensive testing, including Arduino Uno, soil moisture and water level sensors, GSM module, OLED display, and water motor, affirms successful integration and functionality. To ascertain user acceptance, a structured survey was conducted as part of the research methodology. Both primary and secondary data were employed, involving surveys and interviews with parents of children dealing with ADHD, ASD, hyperactivity, and social isolation. The collected results not only highlight positive user feedback but also underscore the "Brainy Bloom's" potential as an innovative tool tailored for specialized plant care. Acknowledging challenges in data collection due to hesitancy among individuals experienced with children having ADHD or similar conditions, the study involved 25 participants, with 54.5% males and 45.5% females, primarily within the age group of children below 15 years. Respondents reported engaging in enjoyable gardening activities, and a substantial majority believed that children with ADHD and ASD would readily accept the innovative 'Brainy Bloom'- smart plant pot. Despite a minor percentage expressing concerns about potential harm, the overall feedback showcased a positive inclination toward the smart plant pot, especially for children with ADHD or hyperactivity and ASD. The paper's conclusion emphasizes the "Brainy Bloom's" potential as a valuable and innovative tool catering to diverse user needs. Future works are oriented towards refining the system with advanced features, addressing identified limitations, and integrating safety mechanisms.

Keywords: ADHD, Arduino, ASD, Sensor, Smart Plant Pot

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ID 184

Fostering agricultural sustainability and climate resilience through Precision Irrigation Systems (PIS) in water-scarce regions; A perspective from the precision agriculture

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Abstract

Precision irrigation systems (PIS) have become a vital solution in countries facing water scarcity and food insecurities concerns worldwide. PIS provide a focused and effective strategy for the management of water resources to maximize the yield. On that note, the present study was conducted with the objectives of examining; (1) applications of PIS to enhance the agricultural productivity and (2) challenges in using PIS in mitigating the adverse impacts of climate change in regions facing water scarcity. A systematic review was conducted screening current scholarly literature (peer reviewed journal articles and reports) published in the English language in the Scopus database from 2013-2023. We used “*precision irrigation systems*”, “*climate change*”, “*sustainable agriculture*”, “*water scarcity*”, “*resilience and resistance to weather changes*”, and “*technical challenges*” as inclusive keywords for the screening process and results were analyzed using thematic analysis. We discovered that drip and sprinkler micro-irrigation systems fall within the category of precision water management technologies. They are commonly employed across the water-deficient regions. However, analysis findings underscore the manifold advantages of PIS in mitigating the challenges presented by climate change. First, these PIS facilitate farmers in the precise delivery of water and nutrients to crops, resulting in a reduction of water wastage by 12% or more. Further, PIS utilize remote sensors, weather data, and advanced technologies to accurately assess the specific water needs of individual plants. Besides, PIS play a significant role in promoting sustainable agricultural practices through the conservation of water resources and the prevention of soil degradation as PIS contribute to the maintenance of soil moisture equilibrium and the prevention of waterlogging or drought stress by selectively supplying water to specific areas. Enhanced water management practices have been shown to positively impact crop productivity while simultaneously reducing dependence on traditional irrigation methods. With regards to the challenges, the cost of implementation and technology, technical expertise, data management, site specific adaptability, lack of power supply and reliability, weaknesses in integration with existing farming practices, declined water quality and availability, and socio-economic and policy barriers are major constraints in implementing sustainable PIS to combat changing climate. In conclusion, we suggest that cross-border technology transfer, site specific solution, and strengthening existing policies and legislation coupled with raising awareness among stakeholders would be ideal solutions to effectively tackle the challenges linked to the extensive adoption of these PIS and facilitate their implementation on a broader scope.

Key words: Challenges and Technical Barriers, Climate Change Resilience, Precision Irrigation Systems (PIS), Sustainable Agriculture, Water-Scarce Regions

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ID 185

Global sensitivity analysis of cultivar trait parameters in the simulation of sugarcane-sucrose weight using Gaussian Process Emulation

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Abstract

Process-based models can assist in identifying beneficial management techniques for optimizing sugarcane yields. However, accurate model prediction requires parameterization, which can be time-consuming due to the large number of parameters associated with process-based crop models. Sensitivity analysis (SA) can help identify sensitive parameters and reduce parameterization efforts. However, SA can be computationally expensive, particularly for complex crop models. Gaussian process emulation offers a promising approach to alleviate the computational burden of SA. In this study, we conducted a comprehensive global SA using Gaussian process emulation to assess the impact of trait parameters on sucrose weight (SW) in the APSIM-Sugar model under irrigated (IR) and rainfed (RF) conditions in three different soil types (reddish brown earth, non-calcic brown, and alluvial) in Hingurana, Sri Lanka. Emulators, generated for various scenarios, demonstrated notable accuracy and were subsequently employed for SA. The results revealed that radiation use efficiency (RUE), green leaf number (GLN), sucrose fraction in the stalk (SF1), stress factor in the stalk (SF2), minimum stem sucrose (MSS), and transpiration efficiency coefficient (TEC) collectively accounted for over 90% of SW variation. Among these parameters, RUE was the most influential for predicting SW, with higher sensitivity under IR conditions compared to RF conditions. GLN and TEC were the second-most influential factors under IR and RF conditions, respectively. SF1, MSS, and SF2 followed in order of influence on SW under both IR and RF conditions in all soil types. These findings contribute to enhancing modeling precision and provide valuable insights for strategic management decisions, addressing the temporal and spatial variability of sugarcane yield in Hingurana, Sri Lanka.

Keywords: APSIM, Gaussian process emulation, Global sensitivity analysis, Sugarcane

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ID 186

Reviewing the carbon footprint landscape: a comparative analysis of organizational contributions to climate change

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Abstract

Global warming is a major issue mainly caused by the emission of greenhouse gases (GHG) due to anthropogenic activities. Calculating carbon footprint (CFP) is the valuable first step to quantify GHG emissions. Many organizations, including universities, fire brigades, rescue services, food manufacturers, hotels, and hospitals, are now estimating their CFP to monitor their impact on global warming and climate change. However, there is a lack of comparative studies about variations of organizational CFP in different sectors related to estimated methodologies, geography and effectiveness of mitigation strategies. This review study examines these variations among organizations and identifies effective emission reduction strategies to address climate change. The article screening process was conducted by considering the peer-reviewed, research articles related to the CFP of organizations published from 2005-2023, highlighting keywords such as “CFP of “organization”, “reduction”, “strategies”, and “worldwide” using the “Google Scholar” academic search engine. For the final data analysis, a total of 20 articles were obtained from the screening process. Results show that many methods exist to analyze CFP such as life cycle assessment, process-based approach, input-output analysis, and hybrid approach. Those methods were applied under different scopes (Scope 1: Direct GHG emissions. Scope 2: Indirect electricity GHG emissions. Scope 3: Other indirect GHG emissions), system boundaries, data sources, and emission factors. It was found that CFP can vary according to the location, size of land area, and developing status of the country. Organizational CFP in Asian countries ranges from 70 to 4650 tCO₂-e/Yr. In contrast, non-Asian countries, like Italy, Colombia, and USA ranged between 3500 and 13500 tCO₂-e/Yr suggesting that organizational CFP is a lower value in Asian countries than in European countries. Many studies show that most CFP occurs from indirect emissions and travel-related emissions dominate in most organizations under Scope 3. Organizations have taken necessary actions including adopting renewable energy sources, implementing energy-efficient technologies, green transportation, waste management practices, carbon capture and storage and carbon offset programs. Informing these effective responses to climate change will offer vital guidance for those involved in shaping public policy in different sectors.

Keywords: Carbon footprint, Emission reduction, Greenhouse gas, Organization

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Agricultural Economics, Entrepreneurship and Agribusiness

Oral Presentations



Keynote Speech

Voyage toward blue horizon: Future building with unutilized aquatic resource

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Abstract

The "Blue Economy" has been common with the concept of sustainability, especially among island countries. Though islands face a variety of challenges, the vast Exclusive Economic Zone (EEZ) and unique and "direct" aquatic connections between land and sea are the potential advantages on their developmental paths toward "hopes," predefined sustainable goals in 2015 by the United Nations. In Mauritius, the island country in the Western Indian Ocean, a comprehensive developmental project with aquatic resource uses has been carried out with scientific knowledge from Japan, one of the eastern Asian island countries. Stakeholders are co-working to build new models for their value chains and market channels as well as for shared knowledgebase for future generations. Young researchers have been learning and making efforts for the methodologies of economic development with a harmony of stakeholders. Development of the blue economy brings us an opportunity to develop a paradigm by researchers and arenas for young hopes in islands including Sri Lanka.

Keywords: Aquatic resources, Blue economy, Resource efficiency, Sustainable development

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ID 24

Intention of tea small holder farmers to engage in organic tea farming in Matara district

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Abstract

This research addresses the prevalent lack of comprehension among contemporary farmers regarding organic farming and its associated advantages. The investigation aims to elucidate the decision-making processes influencing farmers' choices in favor or against embracing organic farming, identifying both drivers and deterrents that shape these decisions. The theoretical framework employed for this study is the Theory of Planned Behavior (TPB), which elucidates the interconnectedness of social and interpersonal factors impacting intentions. The research integrates variables, including perceived usefulness of organic farming and personal characteristics of farmers (such as age, income, family size, education, and tea farming experience) into the conceptual framework to explore their influence on intention. This descriptive, quantitative, cross-sectional study involved a sample size of 59 participants selected through a list-based sampling approach. An interview schedule was devised to gather data from the selected farmers. Multiple linear regression analyses were conducted to discern relationships among variables, and Pearson correlation coefficients as well as Spearman correlation were computed to evaluate correlations between variables. The findings reveal that participants in the sample group scored significantly lower than the average ($p < 0.05$) in both attitude and intention towards organic tea cultivation. Additionally, all variables within the conceptual framework exhibited significant correlations ($p < 0.05$). Approximately 20.87% of the variance in intention toward organic tea cultivation is explicated by the factors integrated into the regression model. Notably, participants' intention diminishes by 0.404 for each one Likert scale score decrease in perceived behavioral control. This study provides valuable insights into the complex dynamics shaping farmers' intentions regarding the adoption of organic tea cultivation practices.

Keywords: Attitude, Intention, Organic farming, Subjective norms, Theory of Planned Behavior

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ID 27

Assessing farmer's capacity and resources for agritourism as a sustainable diversification strategy: Case study in Matale district

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Abstract

With agricultural lands covering over 42% of the national area and employing over 1/3 of the population, Sri Lanka faces the challenge of sustaining agriculture, contributing only about 8% to the GDP at present. Therefore, this study explores the potential of agritourism as a globally proposed strategy that serves economic diversification, environmental development, and landscape preservation while assessing farmers' capacity and resources with readiness for it. The objectives of the study are to assess the capacity of farmers and the resource availability for agritourism ventures and to identify the limitations and motives of farmers for agritourism. The significance of this study lies in its potential to provide insights into agritourism as a tool for sustainable agriculture diversification practices. Matale district, chosen for its diverse agriculture activities, serves as the study location and 66 potential medium-scale farmers were selected as the sample using stratified random sampling. Data collection employed a pre-tested structured questionnaire, group discussions, and secondary data. Results revealed that the major economic activities in Matale district are crop production (96%) and livestock production (18%). About 95% of the sample had electricity, water-sealed toilet facilities, and safe drinking water, essential for tourism operations. Nearly 75% of the community had adequate literacy to operate a small business, and many farmers had readily available family labor to use in agritourism operations. The sole income source for the majority of farmers was agriculture, indicating the importance of income diversification and supplementary income sources. More than half of the farmers had a basic idea about agritourism, and 77% mentioned they preferred to start agritourism operations. The awareness and preference of farmers for agritourism showed a statistically significant positive relationship based on the Pearson correlation test results. The most preferred agritourism activities by farmers were retailing, catering, participatory activities, and farm tours and stays. Motivations for agritourism initiatives included supplementary income, family business potential, and knowledge sharing, and hindering factors were lack of knowledge, financial constraints, risk aversion, and potential cultural conflicts. This study identifies the considerable potential for agritourism in Matale district, emphasizing the need for government support and training programs for farmers.

Keywords: Agritourism, Agriculture, Farmer awareness, Farmer preference, Resource availability, Sustainable

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ID 78

Exploring the export opportunities in value-added agricultural food products in Sri Lanka

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Abstract

Value-added agricultural food products refer to processed or transformed agricultural goods, and these products are often created by adding value through processing, packaging, branding, and incorporating additional ingredients or features. The export agriculture industry currently focuses on value addition to increase the economic value of agricultural goods due to the high demand for value-added agricultural food products in the global market. Sri Lanka has been exporting raw agriculture to a greater extent, which contributes less to this value-added agriculture global demand. As one of the developing Asian countries that are agricultural based, it faces a notable performance gap in this industry. Therefore, this study aims to explore the export opportunities for value-added agricultural food products in Sri Lanka. In alignment with research objectives, to identify the current export market and explore new export opportunities for value-added agricultural food products in Sri Lanka, a qualitative methodology has been adopted, and the study employs an expert purposive sampling method, selecting 20 participants for data collection. In this research, in-depth interviews and focus group discussions were conducted with specific groups of individuals. These included 5 agricultural sector experts, 6 current agricultural exporters, 5 Sri Lankan expatriates, and 4 foreign buyers. The data collected from these interviews and discussions were analyzed using a thematic analysis approach. Additionally, statistical data and information from sources such as the Export Development Board, the Central Bank of Sri Lanka, food and agricultural organizations, and global market research companies were also utilized in the analysis process. The study's findings reveal that coconut-based products, spices, fruits and vegetables, and tea possess considerable export potential within the value-added industry. Major export destinations include European countries, with a specific emphasis on tea for Middle Eastern countries. In addition, high-nutrition and immunity-developed products, convenience foods, animal cruelty-free products, and innovative beverages are identified as emerging product categories in global food trends. These trends have gained widespread traction worldwide due to their convenience for busy lifestyles and their perceived health benefits. This study is useful for entrepreneurs and exporters to identify the existing and emerging export opportunities in the value-added food sector in Sri Lanka.

Keywords: Entrepreneurs, Export opportunities, Food trends, Global demand, Value-added agricultural food products

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ID 131

Issues and challenges faced by small and medium scale (SMS) millers: Examine the applicability of the theory of transaction cost economics (TCE)

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Abstract

Millers play a critical role both upstream as well as downstream of the paddy/ rice value chain. The performance of SMS millers is critical, as their market contribution is 57 percent. Investment for a mill is highly specific and most SMS millers face numerous issues related to opportunism, bounded rationality, and uncertainty, which are the main concepts of TCE. Therefore, a questionnaire survey was conducted with 25 commercially operating SMS millers, randomly selected from the Ampara district, to examine the applicability of TCE in identifying their issues and challenges. Ampara District was selected as it is the second-largest surplus-producing district. The collected data were analysed using Microsoft Excel and the study found that the majority (52 %) of the SMS millers in Ampara incurred higher transaction costs while purchasing paddy either through collectors or stock-holding millers. Further, it revealed the market share of SMS millers in Ampara during the off-season became half in comparison to the peak of the season. The reasons might be opportunism, bounded rationality, and uncertainty issues in the industry in addition to the technological and financial limitations. Therefore, the study proposes the government to purchase a significant quantity of paddy during harvest to minimize the impact of market surplus on prices and release those stocks during the off-season to enable SMS millers to enhance their market supply and minimize business uncertainty through a continuous process throughout the year. Therefore, the government should have a mechanism to strengthen SMS millers towards a higher degree of vertical integration as adopted by large-scale millers. This study provides new insights for key players to address the issues/challenges in Ampara and is recommended to continue study in other districts as well to come up with fruitful policies. This study proves that the theory of TCE is applicable to secure the producers and consumers in the paddy/rice industry while improving the performance of SMS millers through encouraging vertical integration, facilitation of funding, and technical assistance, which has not yet been studied.

Keywords: Asset Specificity, Opportunism, Price fluctuation, Rice Value Chain, Small and Medium Scale Millers, Transaction Cost Economics

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ID 133

Exploration of initiatives to reduce transaction costs to have a fair price for paddy producers: Insights from Ampara and Anuradhapura, Sri Lanka

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Abstract

The major debate in the paddy and rice industry is the unfair price for the producer during the harvesting period. The root causes of the issues in the industry seem to be related to opportunism, bounded rationality, and uncertainty which are discussed in Transaction Cost Economics. Therefore, the study examined the initiatives to reduce transaction costs incurred by the farmer to have better prices. Hence, to predict, describe, and empower population-specific knowledge, descriptive research with an epistemological perspective was conducted through focus group discussions with five subject specialists of the Paddy Marketing Board (PMB), representing policy formulation at the national level and implementation at the regional level. Further, interviews with the District United Farmer Organization of Ampara and Anuradhapura were conducted. Accordingly, the study identified that the majority of producers do distress sales during the harvesting period causing a surplus in the market. The distress sale is to settle the loans obtained for the input supply and the immediate cash requirement as well as the absence of facilities for post-harvest operations. Therefore, farmers are compelled to sell their produce at lower prices due to lower demand. In addition, farmers can have lower market prices due to the farmer-specific and location-specific transaction costs. Other than purchasing paddy directly from farmers at a guaranteed price, PMB made effective initiatives to reduce transaction costs incurred by farmers. These initiatives include facilitating farmers' post-harvest operations through private mills at concessionary cost, bearing the transport cost by PMB, and providing empty bags to pack the paddy free of charge enabling farmers to have a better price. However, the study identified limitations in the funding capacity of PMB as a major challenge. The study proposed to legalize the exclusive powers of PMB to mandate purchasing only through authorized purchasers at the guaranteed price to minimize opportunistic actions, minimize the impact of bounded rationality issues faced by farmers, and strengthen the existing purchasing mechanism. This study provides new insights to key players on the requirements to address the issues in the industry through wider applicability in reducing transaction costs incurred by a farmer with a proper strategic approach.

Keywords: Bounded Rationality, Focus Group Discussion, Guaranteed Price, Opportunism, Price Fluctuation

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Poster Presentations



ID 02

Co-existence of *Bactrocera dorsalis* and *B. kandiensis* (Diptera: Tephritidae) in Karutha kolumban mango (*Mangifera indica*) variety

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Abstract

Fruit flies are a menace to global agriculture. In Sri Lanka, *Bactrocera dorsalis* Hendel is an invasive species, and *B. kandiensis* Drew and Hancock is an endemic fruit fly species. There is very little information available about how fruit flies co-utilize resources for oviposition. This work was thus carried out to study the co-utilizing potential of Karutha kolumban (Kc) mangoes by *B. dorsalis* and *B. kandiensis* for oviposition. A total of 340 Kc mangoes were identified as infected, which were collected in eight randomly selected mango cultivations every two months (on the availability of fruits) in 2022. Each fruit was incubated individually in plastic containers (18 × 14 × 13 cm) with pre-sterilized sand and muslin cloth cover (25°C, RH: 75–85%). After fifteen days, the number of adults (both species) that emerged per fruit was counted. Species were identified using taxonomic keys (*B. correcta* (Bezzi), *B. latifrons* (Hendel) were recorded as additional species). Among the number of fruit flies that emerged from incubated fruits, *B. dorsalis* (76%, n = 392) was higher than that of *B. kandiensis* (24%, n = 123). The utilization of Kc fruits by both species was 58% (Kc:n = 200), while only *B. dorsalis* used 22% (Kc:n = 78) and only *B. kandiensis* used 18% (Kc:n = 62) of mangoes for their oviposition and offspring performance. Among the emerged flies from co-utilized Kc, the highest number of individuals represented *B. dorsalis* (64%), followed by *B. kandiensis* (36%). Emerged adults of both species were high in the late fruiting season and in the sites of the intermediate zone. The enduring co-utilization of resources by *B. dorsalis* and *B. kandiensis* is highlighted in this work, and it is vital to know this relationship in order to develop integrated control strategies for both fruit fly species.

Keywords: *Bactrocera dorsalis*, *Bactrocera kandiensis*, Mango, Resource co-utilize

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ID 05

Development of a ready-to-eat multigrain milk product and analysis of microbial shelf-life of the developed product

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Abstract

Whole grains, rich in many essential nutrients, offer ideal breakfast components. The grain added food products have been popular all over the world due to their proven health benefits such as prevent cardiovascular disease, diabetes like health issues. Objective of this study was to formulate a ready to eat, milk-multigrain breakfast with enhanced shelf-life for children and adults, using locally available grains. The precooked multigrain mixture (W/W) contained ground 45% red rice (*Oryza sativa*), 25% red cowpea (*Vigna unguiculata*), 20% barley (*Hordeum vulgare*), 10% sesame (*Sesamum indicum* L.) and it was wet blended with UHT cow's milk and sugar (8%). Multigrain content with 35% (milk 57%) and 40% (milk 52%) products were selected as the best formulations based on a sensory evaluation done by 15 trained panellists. The processed products were pasteurized at 90-95 °C in glass jars for 30 min. Both products had 00 Colony Forming Units (CFU) for Total plate count, Yeast, and mould test even at day 10 with 700 ppm Potassium sorbate level. In Coliform test, gas was not formed in both products even at the day 07. pH at 1st, 5th, 7th, and 10th days were (6.69 ± 0.08, 6.65 ± 0.02, 6.68 ± 0.02, 6.07 ± 0.03) and (6.66 ± 0.05, 6.68 ± 0.02, 6.66 ± 0.02, 6.05 ± 0.02) in 35% and 40% products respectively. Water activity in both products was 0.99 ± 0.00 till 10th day. Titratable acidity (TA) was 0.01 ± 0.00 in 35% and 0.02 ± 0.00, 40% products till 7th day. On 10th day TAs were slightly changed to 0.05 ± 0.01 and 0.07 ± 0.01 in 35% and 40% products respectively. TA had a significant difference in 35% (P-value = 0.041) and 40% (P-value = 0.029) products at 1st, 5th, 07th and 10th days. Both products had the highest mean rank value (4.00) for TA at day 10. Taste had significant change (P-value= 0.018) in two products whereas other sensory parameters were remained slightly constant. Both products had 10 days of shelf life at 4°C refrigerated conditions although they were vulnerable to microbial spoilage as containing high nutrition density.

Keywords: Ready-to-eat; Multigrain; Shelf life; Water activity, Potassium sorbate

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ID 06

Assessment of pesticide residues in selected field vegetables from different cultivation types: A preliminary comparative study

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Abstract

In Sri Lanka, vegetables are cultivated using three distinct approaches: organic, Good Agriculture Practices (GAP), and conventional cultivation. Each method has its own set of principles, methods, and philosophies. However, it is noteworthy that several studies conducted in other countries have detected pesticide residues in organically grown vegetables. In Sri Lanka, no reports have tested pesticide residues in organically and GAP-grown vegetables. Therefore, the study aimed to assess pesticide residues in field-grown vegetables, comparing small-scale organic, GAP, and conventional cultivation. The study involved a total of 27 random selections of small-scale organic, GAP certified and conventional farmers in the Anuradhapura district, based on recorded data from the Department of Agriculture and the National Institute of Post-harvest Management for sample collection. During the sample collection process from farmers, specific details of pesticide applications were recorded. Three fresh vegetable species, namely brinjal, long bean, and chili were chosen for the study, each with three replicates. The sample preparation and extraction method utilized anhydrous sodium sulfate and ethyl acetate as the aqueous phase, followed by the detection of pesticide residues using Gas Chromatography with Mass Spectrometry. The findings revealed that among the long bean samples grown organically, there was a small peak observed for Acetamide pesticide residues in one of the samples, while the rest of all organic samples were free from pesticides. Among the conventionally grown samples, minor traces of Acetamide, Milbemycin insecticide, and Dithiocarbamate pesticides were noticed in long beans. Chilli had only Acetamide residues. Additionally, Gibberellic acid, a plant growth regulator, was found in both brinjal and long bean samples. Importantly, vegetables from GAP had no detectable pesticide residues. In conclusion, our preliminary study suggests that the applied methodology for the extraction procedure needs further development and quantification of the detected pesticide levels for comparison with the Maximum Residue Levels.

Keywords: Conventional, GAP, Organic, Pesticide residues, Vegetables

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ID 15

Minimization of the oxidative rancidity in Sri Lankan traditional confectionery Dodol by addition of Vitamin E (alpha tocopherol) and determination of changes in peroxide value

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Abstract

Dodol is a popular traditional confectionery in Southeast Asia, containing a mixture of carbohydrates, proteins, and a high amount of fats. However, this high fat content makes Dodol susceptible to damage, such as rancidity due to oxidation reactions, impacting its shelf life. Typically, Dodol can only last for seven days in storage before deteriorating. This oxidative reaction leads to unpleasant odors and flavors, reduces food's nutritional quality and color, and can potentially harm consumers' health due to the accumulated compounds. Determination of the Peroxide Value (POV) is the most generic method of measuring the oxidative stability of oils. One method to reduce this oxidative rancidity is addition of antioxidants, such as Vitamin E (alpha-tocopherol). In this study, Dodol samples were prepared by adding various concentrations of Vitamin E (alpha tocopherol) and the POVs were determined. Initial POVs in two commercial coconut oil samples were checked and they were 4.86 ± 0.00 meq/kg, 6.27 ± 0.05 meq/kg. Then three Dodol samples were prepared using the commercial coconut oil sample with least POV (4.86 ± 0.00 meq/Kg). The control sample, a sample with 600mg of Vitamin E per 1L of coconut oil, and a sample with 1200mg of Vitamin E per 1L of coconut oil had POVs of 4.56 ± 0.08 meq/Kg, 4.50 ± 0.09 meq/Kg, and 4.46 ± 0.05 meq/Kg, respectively, on the first day. By the seventh day, the POVs were 9.51 ± 0.03 meq/Kg, 7.51 ± 0.03 meq/Kg, and 5.08 ± 0.08 meq/Kg, respectively. One-way ANOVA results revealed that there was no significant difference ($P\text{-value} = 0.362 > 0.05$) on day 1, but a significant difference ($P\text{-value} = 0.00 < 0.05$) on day 07 in POV between Dodol samples at a 95% significance level. Overall, as the quantity of Vitamin E increased, Dodol samples had lower POV, the sample containing 1200mg Vitamin E/1L coconut oil showing the most promising results (5.08 ± 0.08 meq/Kg) on day 7. This suggests that using 1200mg of Vitamin E per 1L of coconut oil in Dodol manufacturing processes can enhance the shelf life of Dodol beyond seven days.

Keywords: Alpha tocopherol; Dodol; Peroxide value; Rancidity; Vitamin E

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ID 35

Evaluation of oyster mushroom (*Pleurotus ostreatus*) performance on organic nutrient source enriched substrates

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Abstract

The oyster mushroom, renowned for its nutritional and medicinal value, faces challenges in cultivation due to the widespread use of chemicals causing pollution and health risks. To counter this, the utilization of organic waste in mushroom cultivation has gained popularity. A field experiment was conducted to evaluate the effect of various organic waste materials on the performance of *Pleurotus ostreatus*. The effect of materials was investigated using nine treatments such T1- Banana leaves, T2- Banana leaves+vermiwash, T3- Banana leaves+Biogas slurry, T4- Paddy Straw, T5- Paddy straw+vermiwash, T6- Paddy straw+Biogas slurry, T7- Sawdust, T8- Sawdust+vermiwash, T9-Sawdust+Biogas slurry. Each treatment was replicated three times in a randomized complete block design. The data on spawn running time (days), fruiting bodies formation time (days), harvesting time (days), number of caps, cap diameter(cm), strip length(cm), strip girth (cm), yield, and biological efficiency were collected. The standout performer was the combination of banana leaves with vermiwash (T2). T2 showcased the shortest durations for spawn running (31 days), fruiting body formation (40 days), and harvesting (7 days), resulting in a substantial yield of 109.3 grams. It also recorded with the highest average number of caps (24) within the growth area. Moreover, T2 exhibited superior physical attributes with larger cap diameters (14 cm), strip length (8.7cm), and stipe girths (7.1cm), yielding 116.92 grams and an impressive biological efficiency of 15.27%. In conclusion, the use of banana leaves with vermiwash significantly improved the performance of oyster mushrooms, especially growth and yield. This method not only supports waste management but also presents a cost-effective cultivation strategy. By harnessing organic waste, this approach mitigates environmental concerns associated with chemical-based practices, fostering sustainable mushroom cultivation with heightened productivity.

Key words: Banana leaves, Biogas slurry, Paddy straw, *Pleurotus ostreatus*, Vermiwash

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ID 39

Effect of foliar application of Paclobutrazol on growth and yield of tomato cultivated in protected house in low country of Sri Lanka

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Abstract

This study was conducted to develop a protocol for tomato cultivation under 50% shade conditions inside protected houses to mitigate the problems arising with high temperature, using foliar application of Paclobutrazole (PBZ) to control plant growth while achieving optimum yield at the Faculty of Agriculture, University of Ruhuna. There were six treatments as T1(0 ppm/control), T2(25 ppm), T3(50 ppm), T4(100 ppm), T5(200 ppm) and T6(400 ppm) following Randomized Complete Block Design (RCBD) with five replicates. The treatments were applied 14 days' interval as a foliar spray. The vegetative and reproductive data were recorded at 14 days' interval. Data were statistically analyzed using ANOVA and means were separated by Dunnett's test at 5% probability level. The results revealed that there was a significant effect of PBZ on plant height increment, internodal length, stem diameter and leaf area. T1/control exhibited the highest plant height increment (136.80 cm) while T6 exhibited the lowest (76.40 cm). T1/control was recorded the highest internodal length (4.40 cm) for both internodes and T6 was recorded lowest (3.07 cm and 2.80 cm) for 3-4 & 7-8 nodes respectively. T1 was recorded as the highest (129 cm² & 248.10 cm²) and T6 was the lowest leaf area values (66.84 cm² and 94.50 cm²) for 7th & 14th leaf respectively. The highest stem diameter was shown in T6 (6.86 cm & 9.50 cm) while T1/control was recorded lowest (5.38 cm & 7.19 cm) at 2.5 cm and 7.5 cm above base of the stem, respectively. The number of leaves/plant and the chlorophyll content were not significantly different. The T3, T4, T5 and T6 were significantly lower than T1/control (131.00) on number of flowers/plant while T4(4.40) was only significant for the number of fruits/plant with T1/control (8.00). The T6(108.81 g) was significant compared to T1/control (215.48 g) on fruits weight. The diameter of fruits was significantly lower in T3, T4, T5 and T6 than T1/control (3.88 cm). The T2 was not significant with the T1/control for any reproductive parameter. The results indicate that applying 25 ppm PBZ with 14 days' interval effectively controls plant height (25.4% reduction) without negatively affecting yield.

Keywords: High temperature, Paclobutrazole, Protected house, Shade conditions, Tomato

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ID 45

Production of solid soap using pineapple peel and banana peel for sustainable utilization of agricultural waste

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Abstract

Soap plays a diverse role in our daily lives, from personal hygiene to cleaning. Its production process is called saponification, it varies depending on its intended use and can be in the form of bar or liquid. Soap acts as an anionic surfactant and becomes an all-purpose cleaner when combined with water. Agricultural commodities, especially fruits and vegetables, are rich in nutrients, but generate significant waste. The innovative practice of soapmaking utilizing fruit peels as waste presents a promising solution. This approach not only minimizes waste, but also harnesses the beneficial properties of these peels. According to that perspective, making solid soap from pineapple and banana peels offers a sustainable solution to traditional agricultural waste management. These peels are rich in potassium, saponins and antioxidants, that enhance the soap performance, and contribute to resource recovery, and waste reduction. A feasibility study was conducted to assess the use of pineapple and banana peels as the active ingredients for soap production to utilization of agricultural waste as a source of raw materials to produce valuable products. To the test procedure, one sample by each soap type with three replicates were used to take the final values. Laboratory test results confirmed that the pH (S1 - 9.33, S2 - 9.22) of the soap products within the standard level (8 - 10), while moisture content (S1 - 14.967%, S2 - 15.167%) slightly exceeded the standard level (10–14%). TFM (Total Fatty Matter) values of both samples are denoted as 66%, classifying them as grade 03 soap, with a slight increase (2.14%) in Free Alkali content (2.03 – 2.04 %). Sensory evaluation revealed no significant preference between the two soap samples overall. Gender-based distinctions emerged, with women favoring sample No. 02 while men preferred sample No. 01, emphasizing attributes such as color, scent, texture, and foam quality. By considering the availability, feasibility, and evaluation results, it is evident that, this environmentally friendly approach is not only minimizing the discarding of valuable agricultural waste but also meet the growing demand for eco-friendly personal care products.

Keywords: Agricultural Waste, Eco-friendly, Nutrients, Soap, Sustainability

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ID 46

Evaluation of different seed treatments to withstand submergence conditions of rice (*Oryza sativa* L.) at the early stage of growth

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Abstract

Rice (*Oryza sativa* L.) is a staple food widely cultivated as a lowland crop in Sri Lanka. Flooding significantly impacts direct-seeded rice planting in many rice growing areas of Sri Lanka. This study aimed to develop and evaluate various seed treatments to enhance crop performance and withstand submergence stress during the early developmental stage of the crop. The experiment followed a two factorial randomized complete block design (RCBD) with three replicates. Seed dormancy was eliminated by subjecting the seeds to 50°C for 5 days. Healthy seeds having more than 85% of germination percentage from three promising rice lines (BW-NP-14-7-5, N₂B₄, S₂B₇) and three rice varieties (Ld 368, Ld 253, Bw 372) were coated with Calcium Oxide (CaO) (20:6), Alginate (20:3), Sodium Lauryl Sulphate (SLS) (40:9) and primed with Calcium Chloride (CaCl₂) (20:3) on a dry weight basis (g). Untreated seeds served as control. Germinated seeds were completely submerged under 1m water level for twelve days. Among all treatments seed treated with CaCl₂ and Alginate resulted in a shorter mean emergence time, higher emergence index, and higher final emergence percentage. Significant interactions ($p < 0.005$) between seed treatment and variety indicated that submergence tolerance depends on both factors of the factorial experiment. Survival percentage on the 14th day recovery period showed significant differences ($p < 0.005$), with the highest survival percentage exhibited by Ld 253 under Alginate treatment. Rice varieties demonstrated varying responses to submergence stress, altering shoot and root growth dynamics. Although, plant height did not significantly differ among the seed treatments, shoot elongation rate post-desubmergence showed significant differences ($p < 0.005$). Root lengths were higher in all seed treatments compared to non-treated seeds under submergence conditions. The observed phenomenon of reduced plant height and enhanced root length resulting from seed treatments under submergence conditions suggests that the plants had tried to tolerate submergence stress through the quiescence strategy. A better vigour index of the seedlings in all rice lines and varieties except N₂B₄ was observed by CaCl₂ and Alginate under complete submergence. The results underscored the significance of CaCl₂ and Alginate as promising seed treatment agents to enhance submergence tolerance in rice.

Keywords: Coating, Direct seeded rice, Priming, Submergence, Tolerance

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ID 48

Genetic variability assessment for yield and yield attributing traits in F₂ generation of short duration rice (*Oryza sativa* L.)

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Abstract

To overcome challenges imposed unforeseen climate change in rice production, introduction of short duration rice varieties is considered as an effective strategy. In any breeding program for crops, genetic variability is an essential requirement for developing superior cultivar. The objective of this study was to estimate the genetic variability, find out the correlation among the different quantitative traits of F₂ generation twelve crosses to identify promising lines that can be used for developing high-yielding short-duration varieties, which are better suited for the Low Country Wet Zone (LCWZ) of Sri Lanka. The experiment was laid as a randomized population method and fifty plants were selected randomly for data collection in each population at the Rice Research Station, Labuduwa, Sri Lanka. The data were recorded on eighteen different agro-morphological traits. The F₂ crosses showed a varying response for days to heading, flowering and maturity. The majority of F₂ crosses reaches 50% flowering less than 65 days, of which Ld 253/Bg 252, Bg 308/Bg 252, At 311/Bg 252, At 309/At 311 and At 311/At 309 F₂ crosses reached this stage within 60 days. Therefore, these crosses pose the ability to complete their crop cycle relatively within a short duration. When considering the yield performance, At 311/Bg 252 and At 311/At 309 F₂ crosses showed higher number of effective tillers (10 and 12), thousand grain weight (17.38g and 18.9g) and yield per plant (16.82g and 21.8g), Genetic variability assessment indicated that above mentioned important yield attributing characteristics also showed a higher phenotypic coefficient variance and genotypic coefficient variance for all F₂ crosses. High heritability coupled with high genetic advance were also observed for above traits. Correlation analysis revealed that seed per panicles(0.203*),thousand grain weight(0.331**) and panicle length(0.129*) had the significantly positive contribution to grain yield. Overall, results indicated that among the F₂ crosses evaluated At 311/Bg 252 and At 311 / At 309 crosses can be considered as promising lines to develop short duration high yielding varieties adaptable for LCWZ of Sri Lanka. However, comprehensive physiological studies need to be conducted to investigate the adaptability of these crosses to the variable climatic conditions of LCWZ.

Key words: Crop duration, Genetic advance, Genetic variability, Heritability, LCWZ

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ID 52

Development of *Kothalahimbutu* (*Salacia reticulata*) aqueous extract incorporated drinking yoghurt

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Abstract

Salacia reticulata is a popular medicinal plant in Sri Lanka due to its beneficial therapeutic values. Herbal preparations of *Salacia reticulata* have been used for traditional treatment of numerous diseases for many years without adverse effects. As the diet plays a major role in health, foods which can provide a good state of health and to prevent the diseases have gained consumers' attention. Therefore, value added foods are developed all over the world using various ingredients. Hence the current study was undertaken to develop a value-added drinking yoghurt by incorporating aqueous extract of *Salacia reticulata* stem. This study was carried out using three (3) variables at two (2) levels with a view to identify the best formulation for the product according to factorial design. The sensory data was analyzed at $\alpha = 0.05$ level of significance by using IBM SPSS statistical software package. The sensorially best drinking yoghurt with the highest consumer acceptance was selected according to the sensory attributes followed by a three-step sensory evaluation. According to the Fried-man test results for third sensory evaluation, the sample which having 5% of extract, extract adding time (during inoculating time) and inoculating amount (3%) was selected as the sensorially best sample. The obtained mean rank values of the best sample for appearance, odor, taste, mouth feel, and overall acceptability were 4.03, 4.67, 4.47, 3.87 and 4.40, respectively. According to the Wilcoxon signed rank test results for the sensory evaluation between control drinking yoghurt sample and sensorially best drinking yoghurt sample, no significant difference was observed for sensory attributes as all the p-values were > 0.05 . The p-values obtained for the paired samples for appearance, odor, taste, mouth feel, and overall acceptability were 0.489, 0.110, 0.763, 0.309 and 1.00 respectively. *Salacia reticulata* extract incorporated drinking yoghurt can be developed as a functional food due to the therapeutic potential of *Salacia reticulata* aqueous extract.

Keywords: Aqueous extract, Drinking yoghurt, Functional foods, Kothalahimbutu, *Salacia reticulata* extract

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ID 54

Silicon enhances resistance to *Alternaria* blight leaf spot disease in radish plants (*Raphanus sativus* L.).

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Abstract

The family Brassicaceae comprises valuable and economically important species for human health and nutrition such as preserved or fresh vegetables, oilseeds, and condiments. Among those species, one of the prominent types of vegetables is radish (*Raphanus sativus* L.). However, the sustainable production of radishes is highly threatened by many biotic stresses, *Alternaria* blight leaf spot disease is one of the most prominent diseases caused by a necrotrophic fungal pathogen *Alternaria brassicae*. The onset of this disease results in the development of dark brown to black necrotic lesions on leaves and older leaf stems, characterized by concentric rings frequently encircled by a chlorotic halo. This ailment significantly impairs radish quality and yield by disrupting the photosynthetic mechanism. Silicon (Si) is a beneficial element that has the potential to stimulate disease resistance in plants. In this study, liquid silicon (0-1.5g/100mL/plant) was exogenously applied to three-week-old radish plants grown in pots with sterilized coir for six weeks with 7-day intervals and contaminations between treatments were controlled by having space between pots and without water draining out. Control plants were treated only with the nutrient solution. Plants were grown in a controlled environment with 25–35 °C temperature and 65–75% relative humidity. *A. brassicae* fungal strain was isolated and identified morphologically by visualizing it under microscopes with identical spore shapes. After identification, pure cultures were developed for inoculation by subculturing. Same-size (1 cm × 1 cm) agar pieces with isolated fungus were used to inoculate 45-day silicon-treated radish leaves under *in-vitro* conditions by conducting a detached leaf assay. During the assay, the lesion areas were observed to determine the virulence of the pathogen, and the area was measured using IMAGE J software. *A. brassicae* was able to infect all the silicon-treated leaves and control leaves after 24 hours post-inoculation (hpi). The level of virulence of the pathogen was identified by conducting a confirmatory experiment as Trypan Blue (TB) staining. According to the results, infection was more severe in control leaves compared to silicon-treated leaves and the lesion area was higher in control leaves ($179.08 \pm 6.8 \text{ cm}^2$) than in silicon-treated leaves, they showed lower lesion areas such as $186.38 \pm 3 \text{ cm}^2$, $67.31 \pm 1.6 \text{ cm}^2$, $56.5 \pm 3.8 \text{ cm}^2$ ($p < 0.01$). Data was statistically analyzed by performing One-way ANOVA. According to the results, the lowest infected area was observed in leaves treated with a 1.5 g/100mL/plant) liquid silicon.

Keywords: *Alternaria brassicae*, Radish (*Raphanus sativus* L.), Sodium silicate, Trypan Blue (TB), Virulence assay, Trypan Blue (TB)

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ID 55

Study the morphological and biochemical diversity of *Xanthomonas campestris* pv. *campestris*, the causal agent of black rot disease in brassica crops in Nuwara Eliya district

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Abstract

Severe outbreaks of black rot disease caused by *Xanthomonas campestris* pv. *campestris* (Xcc) were observed in brassica production fields in the world as well as in Sri Lanka. This pathogen enters plants through hydathodes and spreads within the leaf and stem vasculature. Current control methods for black rot have proven challenging due to its seed-borne nature, limited effectiveness of chemical treatments, and the absence of resistant cultivars. There are nine different Xcc races recognized worldwide. However, currently no records in Sri Lanka. Therefore, this study was done to find the morphological and biochemical diversity of Xcc in brassica crops. Xcc infected leaf samples were collected from different brassica crops representing seven agro ecological zones in Nuwara Eliya District. The pathogen was isolated with yeast dextrose calcium carbonate (YDC) medium. Their pathogenicity was confirmed with the cabbage plants. The colony morphology was observed on YDC medium and subjected to different biochemical tests. It was recorded high diversity of colony morphology including their shape (50% circular, 46% irregular and 4% filamentous), size (70% Large, 24% Medium and 6% in small), surface texture (54% glistening and smooth, 8% smooth and 10% rough), elevation (50% raised, 36% flat, 12% umbonate and 2% convex), opacity 88% opaque, 6% translucent and 6% transparent), margins (46% even, 20% irregular, 16% undulate and others showed entire colony type), texture (46% moist and viscous, 28% shiny and viscous, 16% dry, and others were sticky in nature). The predominant colony type was yellow, circular, large, smooth-glistening, raised, opaque, and viscous. Out of 51 isolates, 34 were catalase oxidation positive, KOH positive, hydrolyze starch, make liquefaction with gelatin and grew at 28°C. In the pathogenicity test, symptoms appeared 16, 19, and 24-days following inoculation. Isolates from radish, broccoli, and knol-khol exhibited higher pathogenicity. However, depending on the host and agro-ecological zone, the black rot pathogen of brassica crops demonstrates a variety of phenotypic features, biochemical properties, and virulence.

Keywords: Cabbage, Morphology, Pathogenicity, Virulence, *Xanthomonas Campestris*

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ID 57

Extending shelf-life of *Trichoderma viride* pers. broth formula using different parts of tamarind, *Tamarindus indica* L. to scale-up commercial production

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Abstract

Trichoderma viride is a promising bio control agent for various plant pathogens in sustainable agriculture. It can be multiplied in liquid and solid media, but liquid fermentation has a higher reproductive capacity than solid-state fermentation. High cost of substrates is one the major problems in scaling up of its commercial production. Early studies revealed that raw tamarind pulp alone supported the growth of *T. viride* however to maximize the availability of raw materials the potential of the extracts of seed kernel, leaf and fruit shell were also evaluated. Dissolving 10g in 100mL of distilled water served the base substrate to standardize the conidial production. The highest conidia were recorded 7 DAI in pulp extract (2.83×10^8 conidia/ml) followed by seed kernel (1.90×10^8), leaf (1.73×10^8) and fruit shell (1.64×10^8). These results revealed that pulp extract is a good source of medium for *T. viride* mass production rather than other tested extracts. Conidial production was obtained as high as 28.627×10^8 conidia/mL at 20g pulp dissolved in 100mL of distilled water at 3 WAI. The concentration ranging from 5 to 25g pulp per 100mL distilled water arrived the optimum conidial production at 3 WAI. The production of conidia was stabilized in standardized tamarind pulp extract as high as 61.68×10^8 conidia/ml for 25 g/100mL for 8 weeks. The results revealed for extending the shelf-life of broth was as high as 82.5×10^8 conidia/ml for 30-gauge polythene bag compared to materials. In the 30-gauge polythene bag at the concentration of 25g/100mL was significantly increased the viable spore production when compared with other materials tested. Seed kernel and fruit pulp extracts at the ratio of 3:1 on a volumetric basis was significantly increased the conidiation as 4.832×10^9 conidia/mL. Finally, the findings reveal that adjusting the concentration of the Tamarind pulp would yield the highest conidial production with an increased shelf life more than 2 months.

Key words: Conidia, Liquid formulation, Shelf life, *Tamarindus indica*, *Trichoderma viride*

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ID 58

Effects of different biochar applications on chilli stem rot disease incidence (*Sclerotium rolfsii*)

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Abstract

Chili (*Capsicum annum*) is a major, nutritionally rich, important, and commercial condiment crop. MI2 is known for its high pungency and demand in Sri Lanka. Recently chili plants have been affected by *Sclerotium rolfsii*. Therefore, this research aims to evaluate the effectiveness of different biochar applications on chilli stem rot disease by developing a low cost and environmentally sound disease- controlling method and improving the usage of biochar as disease controlling practice. The experiment was laid out in Randomized Complete Block Design (RCBD) with 3 replicates with seven treatments. The selected variety was MI2 and 40 plants were sown at the rate of two seedlings per hole. Paddy husk, mango sawdust, and coconut shell base biochar were used as treatments at two different application rates (1kgm^{-2} and 2kgm^{-2}). Biochar was mixed with the soil as an amendment. The sick plot method was used to inoculate the pathogen. It is a common method to assess the health and performance of plant to unfavorable conditions. Disease incidence, plant height and pod yield were recorded. Results revealed that, least number of disease (5.83 ± 3.82) % in T2 (2Kg/m^2 paddy husk biochar) while the (40.00 ± 6.61)% in T5 (coconut shells bio char 1Kg/m^2). The number of pods yield (70.00 ± 1.00) and plant height (54.56 ± 1.125) cm were also significantly higher T2(paddy husk biochar 2Kg/m^2) treated plants. The lowest number of pods yield (52.66 ± 1.52) and plant height (44.65 ± 3.58) cm was in T5 (coconut shell biochar 1Kg/m^2) except the control. Therefore, this study, 2Kg/m^2 paddy husk biochar is good for reducing chilli stem rot disease incidence. As future works, it is better to conduct field trials using sawdust of other species such as palu (*Manilkara hexandra*) and jackfruit (*Artocarpus heterophyllus*) to improve the effectiveness of biochar application.

Keywords: Biochar, Coconut shells, Mango Sawdust, MI2, Paddy husk, *Sclerotium rolfsii*

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ID 62

Development of an Egg fruit (*Pouteria campechiana*) and Winter melon (*Benincasa hispida*) Incorporated Jam

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Abstract

Egg fruit or canistel (*Pouteria campechiana*) is an edible fruit called as “Lavulu” and consider as an underutilized fruit which is fairly ignored compared to other tropical fruits. Ripen Egg fruit flesh is too dry and its stick to the gum and teeth. To enhance the flavor of Egg fruit should be processing to made value added product. This study investigated to develop an improved jam using Egg fruit with specific objectives such as; to evaluate the proximate compositions of prepared jam and to find out the best combination of Egg fruit for the jam preparation. The jam was modified with adding winter melon and then prepared five treatments such as; T1 (Egg fruit 25%: winter melon 75%), T2 (Egg fruit 50%: winter melon 50%), T3 (Egg fruit 75%: winter melon 25%), T4 (100% Egg fruit) and T5 (100% winter melon). Each treatment was replicated four times. Five sensory parameters of colour, texture, aroma, taste and overall acceptability were evaluated by a sensory panel using 5-point hedonic scale and data were analyzed by Friedman test. Processed Jam crude fiber, crude proteins, crude fat, Ash and moisture content were evaluated as proximate analysis. According to the sensory evaluation the egg fruit-based jam has significant effect on aroma and color in the sensory evaluation. In proximate analysis, moisture content of the produced jam was not significantly different when compared to other treatments. Crude protein percentage was significantly lowest in the T5 (Winter melon only) when compared to other treatments. Crude fiber percentage was significantly higher in the T4 (Egg fruit only) when compared to other treatments except T3 (Egg fruit: Winter melon; 75%:25%). Conclude that egg fruit incorporated jam is having more crude protein content and more crude fiber content, hence it is good in nutrition aspects. Also, there is no any significant difference in produced jam in every treatments hence replaced the winter melon based jam from the egg fruit based jam can increase the nutritional aspect of the jam. Further, this jam should be modified with another acceptable recipe to achieve better result.

Keywords: Egg fruit, Jam, Proximate analysis, Sensory evaluation, Winter melon

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ID 67

Evaluation of biodegradation rate of oil degrading microorganisms to degrade lubricant oil contaminated soil

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Abstract

Soil, an important natural resource facilitating numerous ecosystem services and interactions and anthropogenic impact on soil has altered the natural functioning of soil. Soil contamination with used lubricating oil (ULO) has emerged as a significant environmental issue in developing countries due to the growing demand for lubricating oil in both industrial and societal contexts. Consequently, there is an immediate requirement for the creation of innovative, ecofriendly, cost-effective methods to remediate soils contaminated with ULO. Nevertheless, the limitations of traditional soil remediation approaches have driven the exploration of bioremediation techniques that make use of naturally occurring microorganisms, including bacteria and fungi, which have been isolated from ULO contaminated soil. The present study was focused to investigate the biodegradation rate of used petrol engine oil contaminated soil using the *Pseudomonas aeruginosa* ATCC 27853, *Bacillus cereus* ATCC 10876, and co-culture between two strains while optimizing environmental conditions. Total petroleum hydrocarbon determination was carried out by using spectrophotometric method to analyze various environmental conditions that can impact their biodegradation activity including ULO concentration (ranging from 1% to 3% v/v), inoculum size (between 1% and 3% v/v), initial pH levels (7 or 7.5), incubation temperature (ranging from 25°C to 37°C), and rotation speed (0 to 150 rpm). The optimal conditions were determined to be 1% ULO, a 2% inoculum size, pH 7, incubation at 37°C, and rotation at 150 rpm. Under the optimized conditions *P. aeruginosa*, *B. cereus*, and their mixture efficiently degraded ULO and they achieved 31.95%, 33.1%, and 40.5% respectively, after 30 days of incubation. The utilization of *P. aeruginosa* and *B. cereus* strains presents an opportunity to create a cost-effective approach for remediating soil contaminated by used engine oil. Therefore, based on the findings of the study, it is evident that both strains effectively degrade ULO in contaminated soil, with the degradation capacity being strain specific. Future studies should assess strain compatibility with ecosystem functioning, particularly in terms of reducing post-treatment toxicity. Additionally, future research should explore the degradation capacity of these strains in conjunction with natural microbial communities in oil-contaminated sites to better understand their ecological interactions and optimize remediation strategies.

Keywords: *Bacillus cereus*, Bioremediation, Optimal environmental conditions, *Pseudomonas aeruginosa*, Used lubricating oil

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ID 81

Impact of harvesting time and ascorbic acid treatment on lenticel browning of mango (*Mangifera indica* L.) variety 'TomEJC'

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Abstract

Several factors affect mango fruit appearance and quality at the postharvest level. Lenticel browning in mango at postharvest stage is becoming one of the main problems in commercial cultivation as it is responsible for the quality loss of mango fruits in both domestic and international trade. Considering this aspect, a study was conducted to increase the postharvest quality of the mango variety 'TomEJC' by reducing postharvest lenticel browning. The effects of harvesting time and ascorbic acid concentrations on lenticel browning were tested with the samples obtained from Nelna Agri Development (Pvt) Ltd. The laboratory experiment was conducted at the Agronomy laboratory, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka. The first experiment included two harvesting times (morning and evening harvesting) with four replicates. The second experiment was arranged based on the result of the first experiment with four treatments (dip in normal water, dipped in 150, 200 and 250 ppm ascorbic acid concentrations) for 5 minutes with three replicates. During the storage period after applying the treatments, parameters such as lenticels increasing percentage, colour changing percentage, moisture loss percentage, texture decrease percentage and brix value were recorded observations. According to the results, harvesting time was significantly affected on lenticel browning increase percentage and moisture decrease percentage. Mango harvesting in the evening has a lower lenticel browning increasing percentage ($1.57 \pm 1.01\%$) and moisture decreasing percentage ($8.64 \pm 1.34\%$). According to application of ascorbic acid treatments, all ascorbic treatments significantly decreased lenticels browning percentage. However, the best results were recorded by dipping in ascorbic acid treatment at 250 ppm ($3.57 \pm 2.07\%$). In conclusion, mango harvesting in the evening and dipped in 250 ppm concentration of ascorbic acid could be recommended for reducing lenticel browning in 'TomEJC' at the post harvesting stage.

Keywords: Ascorbic acid, Harvesting time, Lenticel browning, Postharvest, TomEJC'

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ID 84

Physicochemical evaluation of *Ambul* banana treated with composite coatings of plant extracts to minimize the postharvest loss

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Abstract

Ambul banana is one of the most available and highest-selling fruits in Sri Lanka with a massive postharvest loss. In this research, edible coatings were formulated by combining three plant extracts namely, *Aloe vera*, *Neolitsea cassia*, and alginate extracted from *Sargassum crassifolium*, with glycerol as the plasticizer and treated on green commercially matured bananas aiming to minimize physicochemical changes during postharvest storage and extend the shelf life at ambient storage (29-32 °C and 70-75% RH). Bananas coated with high proportions of alginate and *Neolitsea cassia* (25% each) showed significantly lower weight loss ($25.10 \pm 0.63\%$) after 21 days of storage than the uncoated banana control ($39.40 \pm 0.93\%$) showing good moisture barrier properties of the coating. An interaction effect between optimum coatings and the change of color of the banana with storage time was identified, where the L^* of the control banana increased significantly by week four (56.34 ± 14.40). Deterioration of the brightness of the color of treated banana hands was comparatively lower, reporting a least L^* value of 42.52 ± 06.08 . The a^* of banana with storage was positively high in the control (7.76 ± 1.98) since the fruits turned brownish in colour due to overripe, while negative values were reported for the treated bananas due to low chlorophyll degradation. Similarly, the yellowness of the control banana also improved (47.16 ± 6.32) by week four, whereas the b^* values for the treated ones increased and yet were significantly lower than the control. With ripening, the control banana showed a considerable decrease in pH than the treated, and changes in titratable acidity (TA) content of the control and coated samples during the storage period too were statistically significant where the control showed the highest TA ($0.41 \pm 0.02\%$). The total soluble solids (TSS) content of both coated and control bananas increased throughout the storage period. The control sample reached a maximum TSS of $22.56 \pm 0.04\%$ after a 21-day storage. Overall, coating formulated with a high proportion of all plant extracts (2:2:2:2) showed the most promising results and extended the postharvest life of *Ambul* banana in ambient storage for 26 days, in comparison to 14 days of control banana samples.

Keywords: Ambul banana, Composite coatings, Plant extracts, Physicochemical properties, Postharvest life

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ID 86

Screening of different bitter gourd breeding lines for bacterial wilt disease (*Ralstonia solanacearum*) and develop disease control methods

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Abstract

Bitter gourd (*Momordica charantia*) is one of the famous highly medicinal value vegetable crops in the Sri Lanka. The bacterial wilt disease caused by *Ralstonia solanacearum* is known with negative effect in crop production. The studies related to screening of resistant varieties for this disease is less known. Therefore, this study was aimed to assess the resistance levels of various bitter gourd breeding lines against bacterial wilt disease and to develop an effective eco-friendly disease control method. The experimental design employed in this study follows Complete Randomize Design. Pathogen was isolated from diseased plant and pathogenicity test was done. Healthy bitter gourd plants were inoculated with bacterial suspension, and disease incidence was assessed within 14 days after inoculation. Data analysis was done using the SAS 9.4 version. Data were analyzed by Analysis of Variance and means were compared by Duncan's Multiple Range Test. The disease incident scale was considered according to the protocol of the Asian Vegetable Research and Development Centre. Different bitter gourd lines were screened for their susceptibility or resistance to bacterial wilt, resulting in the categorization of Neerogi (7%) and Thinnaveli white (9%) as resistant, MC43 as moderately resistant (18%), MG (25%) as moderately susceptible, Matale green (70%), Kalu karavila (65%), and Krishna (50%) as susceptible. In addition to this, five soil amendments were used for the effective control measures (paddy husk biochar (1 and 2 kg/m²), bordex mixture, champ fungicide, and lime powder). This investigation revealed that amending the soil with lime powder at a rate of 500 g/m² (T-5) proved to be the most suitable and effective method for controlling bacterial wilt disease and improving flowering and fruit formation. This method demonstrated not only high efficacy but also cost-effectiveness and environmental friendliness compared to other treatments. Additionally, Bordex mixture and Champ fungicide exhibited moderate activity in disease control. Findings of this research provide valuable insights into the management of bacterial wilt disease in bitter gourd cultivation, emphasizing the importance of adopting eco-friendly and cost-effective methods for sustainable agriculture.

Key words: Cost-effective, Eco-friendly, *Momordica charantia*, *Ralstonia solanacearum*, Resistance

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ID 87

Starch-degrading enzyme activity of soil microbial community isolated from Makandura (NWP), Sri Lanka

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Abstract

Starch-degrading amylases derived from microbial sources have a greater industrial potential as it is economical when produced in large quantities. Amylases are predominant type of starch-degrading enzyme that accounts for around 25 % of the enzyme market. The present study aimed to determine the amylase activity of soil microflora isolated from Makandura (NWP), Sri Lanka. The enzyme activity of microbial community was measured at 24 hrs intervals up to 96 hrs and subsequently, for the purified bacterial colonies (Colony 20, 21, 37) that were selected by starch degrading Index (SDI), & which were grown in nutrient medium with 2 % starch at 37 °C with 160 rpm. Further, the enzyme activity of the cultures was measured with continuous feeding of the fresh media. All the data were collected with three replicates for each, and the analysis was done by using R studio statistical software. The highest enzyme activity for the microbial community was observed in 24 hrs (143.07 mU/mL) while the lowest enzyme activity was observed in 96 hrs (15.21 mU/mL). The enzyme activity measured with the continuous feeding of the fresh medium had no effect in reviewing the declining trend of the enzyme activity suggesting that substrate was not a limiting factor. With respect to the enzyme activity of the purified colonies, the peak enzyme activity of 347.35 mU/mL was given by colony 37 at 72 hrs while the colony 20 and 21 gave 230.10 mU/mL and 230.23 mU/mL respectively in 48 hrs. The 60-80 % ammonium sulphate fractionation of clone 37 which was grown for 96 hrs gave the enzyme activity of 294.52 mU/mL which amounted to 22,089 mU from a 75 mL culture. Colony 37 which gave the highest enzyme activity can be used as a source of amylase-producing microbial strain after further characterization.

Keywords: Amylase, Enzyme activity, Soil microbes, Starch, Starch degrading bacteria

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ID 88

Effect of application of paclobutrazol on growth and yield of salad cucumber cultivated in protected house

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Abstract

Cucumber, variety CU13502 (*Cucumis sativus* L.) belongs to the family Cucurbitaceae that are popular in summer dishes and salads around the world. The objective of the study is to determine how paclobutrazole (PBZ) affects the growth and yield of salad cucumbers by developing shorter plants. Cucumber grown in 100% coir media, with foliar application and substrate application of PBZ following two factor factorial Completely Randomized Design (CRD) with three replicates. The two different methods of applying paclobutrazole to plants are as a substrate and a foliar spray. The treatments were, T1-500 ppm, T2-250 ppm, T3-125 ppm, T4 -62.5 ppm and T5 - 0 ppm /control. The treatments were applied at a 14 days' interval while vegetative and yield data were recorded. Data were statistically analyzed using analysis of variance (ANOVA). The means separation was performed using Duncan's multiple range test (DMRT) at 5% probability level. The results revealed that there was significant interaction between method of application and concentration of PBZ on vegetative and yield parameters of salad cucumber. The significantly lower internodal length was recorded in 500 ppm (30.23 mm), 250 ppm (33.75 mm) and 125 ppm (34.27 mm) of substrate application of PBZ. Further, higher internodal length was recorded in 0 ppm/control (86.64 mm) of substrate application and followed by 0 ppm/control (75.76 mm) of foliar application of PBZ. The significantly higher leaf length was recorded in all concentration of foliar applications of PBZ and 0 ppm/control (231.55 mm) and 62.5 ppm (165.88 mm) of substrate application of PBZ. When considering the average fruit weight, 62.5 ppm (190.34 g) of foliar application and 0 ppm/control (174.49 g) of substrate application of PBZ had shown the higher average fruit weight. Furthermore, the highest total yield was shown in 0 ppm/control (4502.07 g) of substrate application of PBZ and 62.5 ppm (3927.45 g) of foliar application of PBZ. Research findings can be concluded that foliar application PBZ in 62.5 ppm with 14 days' interval (from 15 days after seed sowing, until end of harvesting) reduce the vegetative growth while increasing the yield of salad cucumber.

Keywords: Foliar application, Paclobutrazole, Salad cucumber, Substrate application, Yield

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ID 93

Identification of microorganisms involved in the formation of styrene in *Cinnamomum zeylanicum* powder

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Abstract

Sri Lanka is the world's largest producer of the highest quality cinnamon quills, with distinct grades such as Alba, Continental (C grade), Mexican (M grade), and Hamburg (H grade). The cinnamon production process involves harvesting, processing, drying, grading, and potential cutting or grinding for the final product, often in powder form. The principal compound in cinnamon bark is trans-cinnamaldehyde. A malodorous compound, identified as styrene through GC-MS analysis, is formed with cinnamon powder over time due to microbial activity. This study focuses on identifying the microbes responsible for styrene production in cinnamon powder. Two samples of cinnamon machine powder categorized as old and fresh, were used for the analysis. Potential microorganisms from both samples were allowed to be grown on Potato Dextrose Agar (PDA) (with Chloramphenicol) and Luria Berta (LB) (with Amphotericin B) plates and their macro and micro-morphological characteristics were observed. In the old cinnamon machine powder sample five fungal species were isolated, while the fresh sample yielded one fungal species. Notably, one colony from old and fresh cinnamon powder samples exhibited both fungal and bacterial characteristics. Genomic DNA extracted, using the GES method, amplified a 550 bp PCR product for the ITS region, while no specific single band was obtained for the 16S rRNA gene suggesting that the unknown species is likely fungal. The morphological identification indicated characteristics of *Aspergillus* species when grown on PDA medium. This research revealed the possible existence of a microbial consortium with fungal characteristics. Further studies on microbial composition of cinnamon machine powder and its potential link to the formation of styrene may contribute valuable insights for quality control in the cinnamon industry.

Keywords: Cinnamon powder, Genomic DNA extraction, Microbial identification, Quality control, Styrene formation

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ID 96

Formulation and shelf-life evaluation of avocado (*Persea americana*) pulp incorporated instant buttermilk beverage

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Abstract

Buttermilk is a fermented dairy product that contains probiotics and avocado is a nutrient-rich fruit. The focus of this study was to develop a buttermilk beverage blended with Avocado pulp to increase consumer acceptability. Different concentrations (T1 = 0%, T2 = 10 %, T3 = 15%, and T4 = 20% w/w) of Avocado pulp were extracted and added to a conventional recipe of buttermilk. Sensory attributes, and overall acceptability were measured separately using thirty (30) trained panelists with five (5) points hedonic scale and selected the best formula with higher consumer acceptance. Selected formula and control samples were analyzed for pH, titratable acidity, and color within four (4) days intervals, and microbial tests were analyzed within 7 days intervals of 14 days. Proximate analysis was done for moisture %, crude protein%, fat %, Energy %, Carbohydrate %, and ash% in selected formula. All the parametric and non-parametric data were analyzed using SAS, SPSS, and MS Excel at 0.05 significant levels. Avocado-incorporated buttermilk beverage (T4 =20%) acquired the highest sensory acceptance. The titratable acidity for the T4 formula increases during storage life from 0.12 ± 0.005 to 0.46 ± 0.005 and the pH value declined from 6.48 ± 0.01 to 5.45 ± 0.02 . According to Sri Lankan standards, titratable acidity and pH value were within the acceptable limits for 14 days of storage period. Proximate analysis carried out according to the AOAC procedures revealed that the fat content was $1.00\% \pm 0.1$, protein content $5.60\% \pm 0.1$, Carbohydrate $8.60\% \pm 0.1$ and ash content $0.38\% \pm 0.03$, and energy $65.8 \text{ kcal}/100\text{g} \pm 0.1$ were in the acceptable limits. The coliform was 11.0 ± 0.5 in T4 beverage samples. It can be concluded that the incorporation of Treatment 4 = 20% of Avocado pulp maintained the best sensory attributes, and chemical and physiochemical parameters in fourteen (14) days of storage life without adding any chemical preservative.

Keywords: Avocado pulp, Buttermilk, Instant Beverage, Shelf life

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ID 107

Application of Quality Index Method, TVB-N and Histamine content to evaluate the quality of Indian Scad (*Decapterus russelli*) and Frigate Tuna (*Auxis thazard*) at different market conditions in selected suburbs of Colombo district

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Abstract

Assessing the quality of fresh fish is vital for several reasons, including ensuring consumer safety, maintaining product quality, complying with regulations, and achieving success in the competitive seafood market. This study aimed to explore how market conditions affect the freshness of Indian Scad (*Decapterus russelli*) and Frigate Tuna (*Auxis thazard*) in various suburbs (Peliyagoda, Mattakkuliya, and Kelaniya) of the Colombo District which were received fresh fish stuff daily. Indian Scad and Frigate Tuna were selected for 0th day of ice storage due to their demand, availability, and affordability. A total of 48 fresh fish samples from both species were collected randomly from retail stores and supermarkets in the mentioned suburbs. The samples were uniformly sized and transported through a freezing channel, then stored at -18°C until analysis. Physical parameters like weight and length were measured, and sensory analysis using the Quality Index Method (QIM) was conducted by trained panelists to assess fish freshness at the date of purchase. As soon as the sample was taken to the laboratory, the TVB-N test was conducted, and it was subsequently extracted for the histamine test. Supermarket samples consistently exhibited superior sensory attributes across quality parameters in each suburb. Sensory evaluation indicated that local market samples of both species had a better appearance compared to supermarket samples. TVB-N levels were lower in retail markets compared to supermarkets for both fish species. Among retail markets, Peliyagoda and Mattakkuliya had lower TVB-N values than Kelaniya. Despite significant differences ($P < 0.05$), TVB-N levels in both markets remained within acceptable limits (30-35 mg/kg). Histamine content was significantly ($p > 0.05$) higher in local markets than in supermarkets for both species, with Peliyagoda and Mattakkuliya showing lower levels than Kelaniya. The mean Histamine content of both fish markets showed a significant difference ($P < 0.05$) in both fish species. However, all Histamine values remained below the permissible limit (< 100 ppm). The study concluded that TVB-N levels were notably higher in supermarket-sourced Indian Scad and Frigate Tuna, while local market samples had lower TVB-N content. Histamine content was higher in local markets, but still below the maximum limit. Therefore, while there were variations in TVB-N and histamine levels between different markets and species, overall, the quality of Indian Scad and Frigate Tuna remained within safe limits for consumption in referred suburbs of the Colombo district.

Keywords: Frigate Tuna, Histamine, Indian Scad, QIM, Total Volatile Base Nitrogen (TVB-N)

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ID 121

Validation of media hold time for *Enterobacteria* Enrichment Broth Mossel and Glucose oxidative fermentative media used in microbiological analysis

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Abstract

Media hold time validation is a crucial microbiological process that ensures the effectiveness of microbiological media in testing for a specific period, thereby ensuring accurate results and allowing for the confident release of products. The research aimed to determine the storage time for prepared culture media in specific conditions in the Microbiology laboratory, focusing on media required for routine activities. Bile-tolerant gram-negative bacteria, belonging to the *Enterobacteriaceae*, *Pseudomonas*, and *Aeromonas* families, grow in bile salts and utilize glucose. They are identified through selective enrichment, subculture onto solid media, and confirmed using biochemical and fermentation tests. *Enterobacteria* Enrichment Broth Mossel (MEEB), Violet Red Bile Glucose Agar (VRBGA), and Glucose Oxidative Fermentative media (GOF) are used for the tests. In the current study, three validation batches from MEEB and GOF medium were prepared and stored them at 5 ± 3 °C. The stock cultures of test strains of *Escherichia coli* (*E. coli*), *Staphylococcus aureus* (*S. aureus*), and *Pseudomonas aeruginosa* (*P. aeruginosa*) were diluted to prepare a dilution series. The selected dilutions for *E. coli*, *S. aureus*, and *P. aeruginosa* were 10^{-4} , 10^{-4} , and 10^{-3} respectively. The dilutions were predetermined and utilized for growth promotion and inhibitory tests. For GOF media, *E. coli* was used for the growth promotion while *P. aeruginosa* was used for the inhibitory test. For MEEB media, *E. coli* and *P. aeruginosa* were used for growth promotion while *S. aureus* was used for the inhibitory test. The color of the medium in three batches of GOF was changed from green to yellow due to *E. coli* anaerobic fermentation reactions, while inhibitory test tubes remained green in the sixth week. At the sixth-week, MEEB medium showed turbidity levels of 1 for *E. coli*, 1 for *P. aeruginosa*, and 0 for *S. aureus*, confirming all three batches of MEEB were approved. The study found that MEEB and GOF semi-solid media can be stored for 30 days at 5 ± 3 °C in 200 mL glass reagent bottles and 10 mL test tubes with screw caps respectively.

Keywords: Enterobacteria Enrichment Broth Mossel, Glucose Oxidative Fermentative media, Media hold time validation, Growth promotion, Inhibitory tests

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ID 123

Influence of sulphate of potash and partially burnt paddy husk on cowpea (*Vigna unguiculata*) grown in saline soil

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Abstract

Salinity-induced soil degradation poses a significant challenge for both agriculture system and the environment. To overcome this issue an attempt was made to ameliorate the saline soil by adding sulphate of potash (SOP) and partially burnt paddy husk (PBPH). A pot culture experiment was carried out at Eastern University, Sri Lanka, from July to September 2023 with sulphate of potash alone and in combination with partially burned paddy husk (PBPH) to restore saline soil and to enhance cowpea growth in saline soil. The experiment was conducted in a complete randomized design in a 2x4 factorial arrangement with three replicates. To examine the impacts, various rates of K₂O (0, 43, 86, and 129 kg/ha) form of SOP, PBPH (0, 10 ton/ha), were combined. According to the findings, combining PBPH with SOP influenced the soil electrical conductivity favorably and decreased from 8.52±1.02 to 3.63±0.02 dS/m. The treatment combining PBPH with 86 kg/ha of SOP demonstrated significantly enhanced potassium and phosphorus uptake in amended soil condition. As 57.218±5.969 and 4.662±0.413 mg/g dry weight, respectively. The results of this study suggested that, by incorporating partially burned paddy husk with sulphate of potash, soil electrical conductivity, phosphorus uptake and potassium uptake by cowpea crop in saline soil can be improved.

Keywords: Cowpea, Partially burnt paddy husk, Phosphorus, Salinity, Sulphate of potash

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ID 128

Impact of vine training techniques on growth and yield of salad cucumber (*Cucumis sativus* L.) in protected house conditions

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Abstract

Growing salad cucumber (*Cucumis sativus* L.) in protected houses has gained popularity and the use of training and pruning techniques has become essential for optimizing fruit set, development and quality of the produce. Therefore, this study is aimed to investigate the effect of different vine training techniques on the growth and yield of salad cucumber (Variety. Hanyan- CU13502) grown in protected house conditions. Completely Randomized Design was used to design the experiment with six replicates and each replicate comprised three plants. Two treatments; one-stem training and two-stem training were compared to control, the common vine training technique used by farmers. Albert's fertilizer solution was used as a main fertilizer at 1.5g/L rate. Growth and yield parameters were gathered during vegetative and reproductive stages. Fresh fruits were graded according to the three levels; yield suitable for export market, local market and non-marketable yield based on the weight and the fruit appearance. Statistical analysis was conducted using ANOVA with SAS software and the mean separation was done using Dunnett's test. The number of leaves varied significantly between the two stem treatments and the control. A significant variation was observed in the length of the internode between 14 and 15 for both treatments compared to the control. The total number of fruits and average yield per plant were not significantly different between treatments and control. Similarly, treatments did not influence the appearance of the fruits hence the fruit grading. Since the two training systems did not show any significant difference for measured parameters compared to control treatment, it can be suggested that all three techniques are equally affect crop growth and yield under the experimental conditions. Based on the cost and benefit, higher labor cost is required in practicing control treatment as it requires periodic tracking and coiling down the vine. On the other hand, one- and two-stem training methods carries a significant risk as damages to the vine's foliage could cause the entire production cycle to abruptly collapse. Thus, the control treatment that removes foliage continuously and tracking and coiling down the vine can facilitate new fruiting sites and leaves. These three vine training treatments can sometimes result in notable yields with different varieties of cucumber. Therefore, further studies are needed to make a solid conclusion.

Keywords: Growth parameters, Marketable yield, Salad cucumber, Vine training

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ID 129

Comparative yield analysis of sweet potato (*Ipomoea batatas* L.) accessions under field and polysack cultivation technique

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Abstract

Globally, *Ipomoea batatas* serves as a key crop for ensuring food security, particularly for the low-income population. Land scarcity is an inevitable social consequence of urbanization, posing a challenge for farmers in locating suitable areas for agricultural activities. Polysack cultivation technique has the potential to enhance food accessibility by efficiently using limited spaces in urban and rural areas. This study examined the comparative yield analysis of seventeen native *I. batatas* accessions with five improved varieties under traditional field method and polysack cultivation techniques. The experiment was carried out at the field and polysacks at Agriculture Research Station, Thelijawila, according to a randomized complete block design with three replicates. Each replicate consisted of three plots in the field experiment and six sacks using the polysack method. Harvesting was done three months after planting. *TJ1*, *TJ4*, and *TJ14* showed an increased yield in polysack cultivation compared to field cultivation, whereas seventeen accessions decreased the yield in polysacks. *TJ20* and *TJ19* recorded the highest significant yield in the field and polysack cultivation, respectively. *TJ11* and *TJ1* were the second-best accessions in polysack cultivation. This study revealed the best *I. batatas* accessions for the two different cultivation techniques, providing valuable insights for future agricultural practices.

Keywords: DMRT, *Ipomoea batatas*, Polysack, Traditional field, Yield

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ID 130

Study the differences in vitamin B levels/contents of selected Sri Lankan traditional rice (*Oryza sativa* L.) varieties

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Abstract

Rice is one of the most widely consumed cereals in the world including Sri Lanka and the average annual per capita consumption of rice in Sri Lanka is approximately 107 kg. It is a good source of minerals (magnesium, phosphorous, manganese, selenium, iron) and vitamin B (folic acid, thiamin, pyridoxine and niacin) and is known to vary among rice varieties. To date, there are extremely limited studies on vitamin B contents of Sri Lankan traditional rice varieties. This study was evaluated vitamin B contents of ten traditional rice varieties of Sri Lanka (namely Herath Banda, Kalu Heenati, Kahawanu, Kurulu Thuda, Madathawalu, Murungakayan, Pachchaperumal, Pokkali, Rathel and Suwadel). Vitamin B was extracted from whole grain rice flour and simultaneously analyzed using High- Performance Liquid Chromatography coupled with a Diode-Array Detector (HPLC-DAD) set at operating wavelengths of 266, 270 and 275 nm. Results were expressed as mean \pm standard deviation of triplicate ($n = 3$) analysis on dry weight basis for whole grain rice and data were statistically analyzed using SPSS version 20. One-way analysis of variance (ANOVA) and Tukey HSD post-hoc test was used for the multiple comparisons of mean differences among the rice varieties. Results clearly showed that vitamin B content significantly ($p < 0.05$) varied between the studied rice varieties and B₁, B₂, B₃, B₅, B₆ and B₉ contents of were ranged from 4.1- 20.3, 0.7 - 7.7, 29.7 - 111.9, 7.7 - 93.9, 7.7 - 22.5 and 0.7 - 2.0 $\mu\text{g/g}$ (on dry basis) of whole grain rice respectively. Vitamin B₃ and B₅ were abundantly present in studied rice varieties. Among the studied rice varieties, vitamin B₁ was significantly highest (20.3 $\mu\text{g/g}$) in white rice variety, Rathel. The highest vitamin B₂ (7.7 $\mu\text{g/g}$), B₃ (111.9 $\mu\text{g/g}$) and B₆ (22.5 $\mu\text{g/g}$) contents were found in white rice variety, Suwadel. Vitamin B₅ was significantly highest (93.9 $\mu\text{g/g}$) in red rice variety, Pokkali whereas, the lowest (7.7 $\mu\text{g/g}$) was in Rathel. Almost all the studied rice varieties in their raw whole grain form contained vitamin B amounts higher than the Recommended Daily Intake (RDI) values. However, vitamin B is susceptible to losses during rice milling and cooking processes. Nevertheless, the knowledge of vitamin B contents and their variation among Sri Lankan traditional rice varieties may be important for achieving nutritional security or combatting vitamin B malnutrition in rice consumers through the development and distribution of new rice varieties rich in the vitamin B complex.

Keywords: Nutritional Security, Traditional Rice, Vitamin B, Vitamin Malnutrition, Whole Grain Rice

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ID 135

Isolation and identification of Endophytic fungi associated with *Adenanthera pavonina* (Madatiya) leaves and evaluation of their antimicrobial potential

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Abstract

Scientists are exploring the potential of fungal endophytes to create new medications, recognizing their high bioactive content and potential for treating various diseases. The current study aimed to identify and isolate endophytic fungi from *Adenanthera pavonina*, a plant that belongs to the family Fabaceae and to evaluate their antibacterial activity. *A. pavonina* leaf segments were pretreated by cleaning and air-drying, then stored at 4 °C. Healthy, younger leaves were selected and cut under aseptic conditions. The segments were then sterilized in 70% ethanol, rinsed with distilled water, and dried with a sterile cotton cloth and incubated on Potato Dextrose Agar plates, followed by subculturing to isolate pure fungal strains. Two distinct fungal species were identified using cotton blue staining and microscopic screening from plant tissues. They had two different hyphal types: one with a cotton texture and quick growth, and the other with a cloudy texture with slow fungal growth. The two fungal isolates were cultured separately on Sabouraud Dextrose Broth. The fungal biomass was separated, and metabolites were extracted into an ethyl acetate phase. Crude extracts of each fungal strain were collected, dried, and dissolved in ethyl acetate for disk diffusion assay. Four bacterial strains were used for antimicrobial assays: *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Enterococcus faecalis* by preparing streak plates using stock cultures. The turbidity of these suspensions was adjusted to the McFarland 0.5 solution. Once the correct turbidity was obtained, 100 µL of each microbial suspension was placed on Mueller Hinton Agar and prepared spread plates. The assay utilized a fungal extract as the test solution, with tetracycline antibiotic (0.02 g/mL) serving as the positive control and ethyl acetate as the negative control. Aseptically prepared antimicrobial disks were obtained, and each disk was loaded with 25 µL of the positive controller, negative controller, and test solutions. The experiment showed a clear zone of inhibition with tetracycline as the positive control, while ethyl acetate showed no antimicrobial effect in any plate. In contrast, the inhibition zone was not evident in the test samples. The fungal extract was found to be ineffective in inhibiting the bacterial strains.

Keywords: *Adenanthera pavonine*, Antimicrobial, Antibacterial, Crude extracts, Endophytic fungi

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A review of the negative impacts of climate change on the production of paddy in Sri Lanka and the climate change adaptation strategies to overcome those negative impacts

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Abstract

The negative consequences of climatic factors on paddy production have seriously impacted many small-scale farmers, as the agriculture sector is mainly known to be affected by the weather and climate in Sri Lanka. This review is mainly focused on the negative impacts of climate change on paddy production in Sri Lanka and the best adaptation strategies that can be applied to overcome those impacts. Therefore, one hundred and thirty research articles were reviewed in Sri Lanka. In Sri Lanka, the dry zone contributes 60% of the annual rice production. Achieving a grain yield of 8–10 tons of paddy per hectare in well-managed irrigated lowland rice lands in the Dry and Intermediate Zones of Sri Lanka is certainly practicable with current technology. The negative impacts on rice production are due to high temperature-accelerated spikelet sterility that can be aggravated by rising CO₂. Similarly, rising temperatures, either independently or with the combination of changing rainfall, will also cause a drop in paddy production. The past studies suggest that temperature rise by 4°C, together with a 50% rainfall intensification, led to a 32.13% decline in average rice yield, and 27.57% will be reduced with the combined effect of a 4°C temperature increase and a 50% decrease in rainfall. Climate adaptation strategies such as ensuring crop insurance, cultivating short-term paddy crops and drought-resistant crops, improving irrigation efficiency, changing the planting date, adopting aerobic growth conditions for rice varieties, introducing agricultural practices combined with endogenous paddy varieties, cultivating short- to medium-duration cultivars, introducing rice varieties that match high CO₂ concentrations, and introducing short-duration rice varieties were the findings to overcome the negative impacts of climate change on paddy production in Sri Lanka. These adaptation strategies should be connected in a proper way to have a connection with the national development policies and strategies to have an improved structure for a great yield. Further, the outcomes suggest that rural farmers should be given better awareness and knowledge of climate change to combat its negative impacts and the need for a good policy framework to ensure the stability of paddy production in Sri Lanka while moving to climate-smart agriculture practices.

Keywords: Adaptation strategies, Agricultural sector, Climate change, Dry zone, Rice production

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ID 138

Analysis of nutrient content of locally available selected leafy vegetables in low country intermediate zone, Sri Lanka

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Abstract

This study was conducted to study and compare nutritional values of 20 different leafy vegetables; {*Sarana (Trianthema portulacastrum)*, *Pethithora (Cassia tora)*, *Akkapana (Kalanchoe pinnata)*, *Thembu (Costus speciosus)*, *Mukunuwenna (Alternanathera sessilis)*, *Niwithi (Basella alba)*, *Kankun (Ipomoea aquatica)*, *Gotukola (Centella asiatica)*, *Kathurumurunga Sesbania glandiflora*, *Singappurukola (Sauropus androgynous)*, *Kirihenda (Celosia argentea)*, *Girapala (Commelina diffusa)*, *Thelkola (Ipomoea sepiaria)*, *Kemkola (Coccinia grandis)*, *Kura (Amaranthus viridis)*, *Penela (Cardiospermum halicacabum)*, *Diyameneriya (Commelina benghalensis)*, *Murunga (Moringa oleifera)*, *Gasniwithi (Talinum paniculatum)* and *Lunuwila (Bacopa monnieri)*} that are locally available in Sri Lanka. Leafy vegetables were planted in pots and were arranged randomly with three replicates using Completely Randomized Design. After one month of establishing, randomly selected five leaves of each main shoot for analysis. The proximate composition (moisture, ash, protein, fat, fiber) and functional properties (antioxidant activity, flavonoid and phenol contents) were determined. Statistical comparison was performed using one-way analysis of variance and probability values of less than 0.05 were considered as significant. The moisture content of leafy vegetables ranged between 80.41% and 91.45% while the crude protein content ranged between 0.38 and 3.49%. *Murunga* (3.49%) and *Kathurumurunga* (2.61%) were found to be the rich protein sources. The corresponding ranges for ash, fiber and crude fat were 0.95% – 4.02%, 1.39 – 5.50% and 0.24 – 1.76%, respectively. Flavonoid and phenol also rich in these leafy vegetables that ranged between 38.70 µg/mL – 523.58 µg/mL and 0.82 µg/mL – 237.93 µg/mL, respectively. *Kathurumurunga* (1082.15 mg/mL) and *Gotukola* (1233.25 mg/mL) demonstrated the higher antioxidant activity. Leafy vegetables with excellent nutritional qualities were identified in *kathurumurunga*, *murunga*, *penela*, *kemkola*, *gotukola* and *pethithora*. They would be introduced as valuable dietary components in the local diet to promote overall health and well-being.

Key Words: Comparison, Leafy vegetables, Local, Nutrition Content, Variation

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ID 142

Analyzing the effects of varying opening frequencies of hermetic storage structures on the oxygen (O₂) and carbon dioxide (CO₂) concentrations in maize

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Abstract

Hermetic storage is one of the cost effective, safe pests controlling method used by most of the grain farmers in the world. In Sri Lanka, maize weevil is one of the common pests affect for the stored maize and banning of pesticides during previous years caused to a vast problem for farmers. So, the current research studied the practical aspects of the hermetic storage of maize, because farmers usually open the storing structures during the storage period of grains. 5 L bottles were used as hermetic structures. Cleaned, dried (until 13 % moisture content), newly harvested maize seeds were filled into the 5 L bottles, keeping small space for air. For the emergence of F1 generation, unsexed maize weevils were artificially infested into separate small sized plastic containers with maize seeds. And after 7 days adult weevils were removed and after 21 days F1 generation will be emerged. Then emerged adult weevils (30 weevils) were artificially infested into hermetic containers and sealed the containers. Three treatments were taken for the study. T₁, T₂ and T₃ indicate the treatments respectively, opening the hermetic sealing weekly, biweekly and control. For each treatment three replicates were used. In every opening containers were opened for 10 mins. The study was conducted until 6 months. Each week, the concentrations of carbon dioxide (CO₂) and oxygen (O₂) were determined using gas chromatography. Treatment 1 had the highest mean oxygen concentration (14.83±5.76), while treatment 3 had the lowest mean oxygen concentration (10.85±3.29). Treatment 3 had the highest mean carbon dioxide concentration (9.11±3.37), while treatment 1 had the lowest mean carbon dioxide concentration (7.32±4.30) And the evaluated results revealed no significant differences among the treatments. This indicates that opening hermetic storage containers has no significant effect on the gaseous composition inside the containers.

Keywords: Gas chromatography, Hermetic storage, Oxygen concentration, Pest

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ID 143

Development and quality evaluation of Blue Butterfly Pea flower (*Clitoria ternatea* L.) based instant rice

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Abstract

Blue butterfly pea flower (*Clitoria ternatea* L.) is gaining attention, especially in the food industry, for its potential uses. Rice is Sri Lankans' staple food and the modern lifestyles have created a growing market demand for instant rice. This study aimed to develop *C. ternatea* flower-based instant rice using the rice variety BG 358. Initially, instant rice was prepared using five treatments. T1) Boiling rice (9 minutes), simmering, freezing (-20 °C; 24 hours), thawing, drying (70 °C; 2 hours), T2) Boiling rice (9 minutes), simmering, 2 minutes rinsing in cold water, freezing (-20 °C; 2 hours), thawing, drying (70 °C; 2 hours), T3) Preheating rice (93°C; 3 minutes), 11 minutes cooking (92°C), steaming, 2 minutes washing (cold water), freezing (-20 °C; 2 hours), thawing, drying (100 °C; 2 hours), T4) Cooking in a rice cooker (18 minutes), simmering, rinsing (cold water), freezing (-20 °C; 2 hours), thawing, drying (70 °C; 2 hours), T5) Cooking in a rice cooker (18 minutes), simmering, freezing (-20 °C; 24 hours), thawing, drying (70 °C; 2 hours). The best treatment was selected after a sensory evaluation by thirty untrained panelists. Moisture content of the product was recorded. Dehydrated *C. ternatea* were incorporated to the rice (1- 3% wt/wt) during cooking and the optimum amount determined by a sensory evaluation. Physicochemical properties, water holding capacity, volume expansion, anthocyanin content and antioxidant activity (DPPH radical scavenging activity) were evaluated after reconstitution (treated). Rice, cooked in a rice cooker for 30 minutes without incorporating *C. ternatea* was the control. Microbial quality of the product (50g; packed in LDPE, refrigerated) was evaluated for three months. Final moisture content of the best treatment (T2) was 9%. The optimum flower content (2% wt/wt) incorporated instant rice was reconstituted within 8 minutes by adding boiling water (100 °C) and its anthocyanin content (36.28 mg/100g of rice) and antioxidant activity (73.91% inhibition) were significantly higher ($p < 0.05$) compared to the control (anthocyanin not detected and 43.47% inhibition respectively) while physicochemical properties, water holding capacity and volume expansion were insignificant ($p > 0.05$). Microbial quality remained below 10^2 cfu/g throughout testing. This study suggests using *C. ternatea* flower to prepare instant rice.

Keywords: Anthocyanin, Antioxidant value, *Clitoria ternatea*, Instant rice, Reconstitution

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ID 144

Potential to use *Colocasia esculenta* (L) and *Ipomoea batatas* as solidifying agent in plant tissue culture

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Abstract

In-vitro propagation is a rapid multiplication technique to produce planting materials. Agar is commonly used gelling agents for in-vitro propagation of banana and other crop varieties. But agar is more expensive. Planting material can be produced quickly using the technique of *in-vitro* propagation. Even though it is expensive, agar is a popular gelling agent for diverse crop varieties to be propagated *in vitro*. This study was conducted to propose a cost-effective and locally available alternative gelling agent for in-vitro propagation of banana. The objective of the study was to find out a locally available, cost-effective gelling agent for banana in vitro propagation. Two different locally available crop varieties, "Taro root" (*Colocasia esculenta* (L) and "Sweet potato" (*Ipomoea batatas*) were used for the experiment and this study was conducted under five experiments. According to experiment 1, the best powder preparation method is normal starch extraction method. According to that method, get raw taro roots and sweet potato pieces and grind them using water. After that, using a muslin cloth, separate the starch. Experiment 2 was to determine the solubility ability and soluble temperature of Taro roots and sweet potato and the both the varieties were properly dissolved with water. In the second experiment, the solubility potential and temperature of the solvent were measured, and both varieties were successfully dissolved in water. Their best soluble temperature was 70°C for both taro roots and sweet potato solution. The results of the third experiment revealed that 100 g/L of taro roots and 80 g/L of sweet potato were the best concentration for solidifying the MS medium as instead of agar. According to visual observation MS + 100g/L of taro roots powder and MS + 80g/L of sweet potato powder a solid form from a day after the media preparation. This solid form did not change even in the eighth week. Further any biological contamination and color change were not noticed in both media, for 4 weeks. Even after eight weeks, there was no change in this solid form, and during the four weeks, no biological contamination or a change in color was observed in both medium. According to the cost analysis taro root and sweet potato medium are cost effective than agar medium. Taro root medium and sweet potato medium had a cost reduction of 91.6% and 90%, respectively, compared to agar medium. It can be concluded that sweet potatoes and taro root are cost effective gelling agents that serve as a good alternative for agar in tissue culture medium in banana plants.

Keywords: Agar, Gelling agent, Micropropagation, MS medium, Taro roots, Sweet potato

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ID 146

Establishment of a trained sensory panel at the Faculty of Technology, University of Colombo

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Abstract

Sensory evaluation of food is an integral aspect of Food Science and Technology as it is vital in new product development and existing product improvement. It is a scientific process and needs trained panelists. This study was conducted to establish a trained sensory panel at the Faculty of Technology, University of Colombo as there is no trained sensory panel in the faculty. ISO standard procedure 8586:2012 was used in the study. Initially, a Google-based questionnaire was developed and distributed among the faculty members to select candidates for the research study. Out of 112 individuals, 89 candidates who responded to the questionnaire consisting of academic staff, non-academic staff, administrative staff, and undergraduates were selected for the sensory study depending on their responses to the questionnaire. The selected candidates were then subjected to basic taste, odor, color, taste intensity, texture identification, and matching tests to evaluate their sensory abilities. The results showed that 87% of the candidates possessed an ability to memorize taste and smell, while 79% were selected based on their ability to identify taste intensity, and 77% were selected for odor identification. In the texture descriptive test, 85% of the candidates were selected, while in the color intensity identification test, 93% were successful. Totally 21% of candidates were selected as trained panelists (23 candidates out of 112 candidates) while 79% were rejected. Based on the performance test, all panelists chose the best biscuit sample, indicating their high level of competence. The performance of the selected 23 trained panelists was found to comply with the requirements of ISO 8586:2012. Selected trained sensory panel consisting of 23 panelists was established at the Faculty of Technology, University of Colombo. The panelists were found to be homogeneous and showed no significant differences in their sensory evaluation abilities. This product-oriented sensory panel can be used for scientific assessment of food products and sensory evaluation studies conducted by the Department of Food Science and Technology.

Keywords: Intensity identification test, ISO 8586:2012 Standard procedure, Performance test, Screening test, Sensory panel

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ID 147

Effect of different dimensions of grow bags and split application of albert's fertilizer on growth and yield of salad cucumber (*Cucumis sativus* L.) under protected environment

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Abstract

Cucumber (*Cucumis sativus* L.) is an important vegetable crop belongs to the family Cucurbitaceae. Owing to the ease of mitigating adverse weather conditions and management techniques, *C. sativus* is widely grown as a greenhouse vegetable. Efficient nutrient management measures and physical characteristics of the grow bag are more significant when considering the economic viability and potential benefits of *C. sativus* cultivation under protected environment. Therefore, this experiment was conducted to determine the effect of the dimensions of grow bags and split application of Albert's fertilizer on growth and yield of *C. sativus* L. Two-factor factorial experiment was arranged as Completely Randomized Design with six replicates. Factor one had three levels (three bag dimensions; D1-21×21×22.5cm³/standard size, D2-16×16×38.8 cm³ and D3-26×26×14 cm³) and factor two had three levels (three split fertilizer applications of Albert's solution at 1.5g/l rate; single application, two split and three split applications per day per bag). In commercial cultivations, the common practice was to apply 1.5g/l of Albert's fertilizer per bag per day. As growth parameter, plant height, number of leaves per plant, length between 14-15th internode and stem diameter of the plant were measured at a two week interval. Fresh weigh of fruits per plant, the number of fruits per plant, average weight of fruit and yield distribution according to market standards were quantified using a fruit scoring index. Data were analyzed using the SAS software program. Mean separation was done by using Duncan's Multiple Range Test at 5% probability level. Results revealed that the interaction effect between two factors or single factors of the experiment did not significantly influence growth and yield parameters measured in the study. According to the results, it can be suggested that the number of bags and yield per unit area could be increased when use bags with D2 dimensions. However, production costs will rise simultaneously due to increase amounts of inputs such as fertilizer, water and labor. Therefore, it is more effective to use the existing dimension of the standard size bags (D1) used by the commercial cucumber growers while applying fertilizer once a day rather than investing additional effort to change the size or shape of the bag or nutrition management regime for *C. sativus* variety, *Hanyan* (CU13502) which would raise production costs and demand more labor and energy.

Keywords: Albert's solution, Bag Dimension, *Cucumis sativus* L, Interaction Effect, Split application

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ID 148

Determination of diurnal variation of essential oil content and composition of leaves of *Cinnamomum zeylanicum* Blume

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Abstract

True cinnamon, *Cinnamomum zeylanicum* Blume also known as *Cinnamomum verum*, J. Presl. belongs to the family Lauraceae. Cinnamon leaf essential oil is used in the cosmetic, pharmaceutical, and food industries due to its distinct fragrance and therapeutic properties. However, information on the best leaf harvesting time for optimum content and composition of essential oil is scattered. Therefore, the present study was undertaken to evaluate the diurnal variation of essential oil content and composition of cinnamon leaf during the day. Leaf samples at three mature stages (fully mature, semi-mature, and immature) were harvested from 6.0 am to 6 pm at three-hour intervals. Harvested leaf samples were dried and distilled using a Clevenger-type apparatus with three replicates. Meteorological data (Light Intensity, Temperature, Relative humidity and Wind velocity) were recorded to understand their effect on leaf essential oil content and composition. Results demonstrated that the 6.00 am, 3:00 pm, and 6:00 pm periods provide the most elevated content of the leaf essential oil. Six major constituents of Eugenol, Cinnamaldehyde, Linalool, Eugenol acetate, Benzyl benzoate and β -Caryophyllene were identified as major constituents in leaf essential oil. Eugenol and Cinnamaldehyde contents were relatively higher at 6.00 am, 03:00 pm and 06:00 pm in leaves of all three maturity stages. Out of three maturity stages Semi mature stage of cinnamon leaves was given the highest essential oil content at the all-time intervals starting from 6 am to 6 pm (3.70%, 2.59%, 3.15%, 3.76% and 4.38%). The essential oil content of different maturity stages was varied as semi-mature>mature> immature stages. In conclusion, harvesting cinnamon leaves at the Semi-mature stage in the early morning or late evening hours (after 3 pm) could be recommended for optimum content and composition of essential oil.

Keywords: Cinnamon, Cinnamaldehyde, Essential oil, Eugenol, Harvesting time period, Diurnal variation

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ID 149

Evaluate the performance of Sago and Corn flour as solidification agents in *in-vitro* propagation of Sour banana

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Abstract

Sour banana (*Musa acuminata*) is an essential crop in the Musaceae family, valued for their flavour, nutrition, and year-round availability in tropical regions. However, the economic burden associated with agar, a key gelling agent in plant tissue culture, has prompted the investigation of cost-effective substitutes. The objective of the study was to observe the potential of corn flour and sago starch as replacements for agar in *in-vitro* propagation. Sago, derived from the tropical palm *Metroxylon sago*, is a carbohydrate-rich staple thriving in swampy environments. Despite its low protein and fat content, sago is energy-dense due to amylose and amylopectin. Corn flour, a gluten-free alternative from maize (*Zea mays*), enhances the nutritional profile of sago, providing versatility and essential nutrients. The experiment employed a Completely Randomized Design with three treatments: T1 (Sago), T2 (Corn flour), and T3 (Agar-control). Results revealed that Corn flour consistently exhibited the highest mean plant height figure 1, compare to Sago and Corn flour, it was no significant difference from Agar. It was no significant differences in sprouting initially in both gelling agents, Corn flour showcased the highest mean in total root number and average total wet weight of roots, indicating its positive impact on plant development. Although the two gelling agents did not cause any statistically significant difference in sprouting of bananas, corn flour showed the highest average total number of roots figure 3 and average total wet weight of roots figure here 5, indicating that it has a positive influence on plant growth. Cost calculations unveiled that Agar was the most expensive option. Sago and corn flour emerged as economically viable alternatives, demonstrating efficacy while aligning with sustainability principles. This research pioneers accessible and environmentally sustainable tissue culture practices, offering economically viable options for researchers. However, further studies on compatibility with different plant species, tissue types, and long-term effects on plant health and genetic stability are warranted. The adoption of sago and corn flour in tissue culture mediums underscores the significance of embracing sustainable practices in advancing scientific knowledge and discovery.

Keywords: Agar, Corn flour, Sago, Solidification agents, Tissue culture

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ID 151

Potential of Indian shot (*Canna edulis*) and Arrowroot (*Maranta arundinaceae*) as solidifying agent in tissue culture media of Banana (*Musa sp.*)

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Abstract

Banana is one of the most important food crops, grown in Sri Lanka for local market. One of the majors constraints in expanding the banana cultivation is limited supply of quality planting materials. Micropropagation techniques can be successfully applied for mass propagation of banana by the micropropagation is expensive thus increases the cost of production. This study was conducted to investigate Arrowroot (*Maranta arundinaceae* L.) and Indian shot (*Canna edulis*) as cost-effective gelling alternatives for agar. The study evaluated the different arrowroot and Indian shot flour preparation methods and optimal conditions for solubility and concentration. Flour preparation methods were the sun drying method, oven-dry method, and the conventional method (normal method). When using oven drying and sun- drying methods powder color and odor was changed. Among these three methods, the conventional method is the best method for both Arrowroot and Indian shot flour preparation. The solubility properties of arrowroot powder and Indian shot powder in distilled water were investigated under room temperature, 60°C, 70°C and 80°C. It was observed that gelatinization temperature for both arrowroot and Indian shot was 70°C. The solidify ability of arrowroot and Indian shot powder in distilled water were investigated under 60g/L, 80g/L, 100g/L and 120g/L. The solidify ability of arrowroot powder and Indian shot powder in Murashige Skoog (MS) medium solution were investigated under 100g/L. The experiment was identified 100g/L as the ideal amount for solidification in MS medium solution at 70°C. The cost benefit ratio of various gelling agent was also calculated by comparing their price with that standard price of agar. Arrowroot flour has shown a greater potential as a cheaper alternative gelling agent for medium according to the cost analysis. The local availability and low cost of arrowroot and Indian shot make them attractive alternatives to agar in plant tissue culture.

Key words: Alternative Gelling agents, Agar, Arrowroot flour, Indian shot flour

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ID 152

Optimizing growth and yield of curry chili in hydroponic systems using Sanjeewani biofertilizer and Albert's solution

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Abstract

When combined with biofertilizers and Albert's Solution, it provides an innovative approach to reduce costs and environmental impact while simultaneously providing a strategy to encourage plant growth and yield. The unidentified growth-promoting factors in biofertilizers lead to improved nutrient uptake and ultimately higher plant yields. Therefore, this experiment was conducted to evaluate the best ratio of Sanjeewani biofertilizer and Albert's fertilizer on better growth and yield performance of curry chili grown under hydroponic conditions. The experiment was carried out in the Faculty of Agriculture, University of Ruhuna, Kamburupitiya from July to October 2023. Vigorously grown 21-day-old curry chili plants were transplanted on open-top grow bags filled with coconut coir dust media. Sanjeewani biofertilizer was prepared by mixing cow dung, cow urine, and rice wash water 1:1:2 ratio. The treatments were T1-Albert's solution 100%, T2-Albert's solution 90%+Sanjeewani biofertilizer 10%, T3-Albert's solution 80%+Sanjeewani biofertilizer 20%, T4-Albert's solution 70%+Sanjeewani biofertilizer 30% and T5-Albert's solution 60%+Sanjeewani biofertilizer 40%. The experimental design was Completely Randomized Design (CRD) with five replicates. Plant height, internode length and number of leaves/plant were measured at 50% flowering stage and number of pods/plant, pod weight and pod length were recorded at harvesting. The collected data were statistically analyzed using Analysis of Variance (ANOVA) from SAS 9.1.3 version. Subsequently, differences among treatment means were compared by Duncan's New Multiple Range Test at the 5% probability level. According to the results, significantly higher plant height (126.2 ± 1.9^a cm), number of pods/plant (28 ± 2.5^a) and weight of pods (135.1 ± 2.6^a g) were recorded from T2 compared to other treatments. A significantly higher number of leaves/plant were obtained from T1 (158 ± 1.7^a), T2 (166 ± 0.9^a), T3 (145 ± 2.3^{ab}), and T4 (147 ± 2.1^{ab}). Further, length of the pods was significantly higher in T2 (13.3 ± 0.3^a cm), T3 (12.7 ± 1.4^a cm), T4 (12.9 ± 1.1^a), and T5 (12.8 ± 1.1^a). There was no significant effect on internodal length. Therefore, the study suggests that Albert's solution 90% + Sanjeewani biofertilizer 10% (T2) optimizes the growth and yield of curry chili under hydroponic conditions. Further, research could be done to examine the performances of the combination of inorganic fertilizers with biofertilizers under different growing media and environmental conditions.

Keywords: Albert's solution, Bio-fertilizer, *Capsicum annum*, Hydroponic systems

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ID 153

Study the physical properties of normal and hard seeds of Mung bean (*Vigna radiata*) and impact of different storage conditions on its hardness

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Abstract

Mungbean (*Vigna radiata*) plays a vital role in the Sri Lankan human diet, which contains a rich source of protein (14.6–33.0 g/100 g) and iron (5.9–7.6 mg/100 g). Under the current food crisis, mungbean is an ideal substitute to fulfill the country's protein requirement. Currently, the Sri Lankan government has imposed policies to limit importation and popularize mungbean cultivation in the country. Therefore, an increase in mungbean production can be expected in the near future. In Sri Lanka, mungbean is used in the form of boiled, spiced curry, confectionary, etc. However, hardseededness (*yak ata*), is a major problem for consumers as well as farmers. Hardseededness is a physiologically or genetically determined trait that results in seeds being impervious to water and remaining hard even after cooking. There are no proper criteria to separate mungbean hard seeds currently in the country. Therefore, this study was done to compare the physical properties (length, width, thickness, weight of 100 seeds, true density, and color), and cooking properties (boiling time) of both normal and hard seeds for the variety MI-5 and to explore the impact of various storage environments on the hardness. Hard seeds were identified by soaking for 12 hours in water, where soft/swollen seeds were categorized as normal seeds and hard/non-swollen seeds were categorized as hard seeds. Comparatively lower seed length (4.65 ± 0.17 mm), width (3.34 ± 0.07 mm), thickness (3.37 ± 0.05 mm), 100 seed weight (5.55 ± 0.10 g), and true density (1.55 ± 0.08 kg/m³) were obtained for hard seeds than normal seeds even if the values were not significant ($p > 0.05$). Therefore, seed size, 100 seed weight, and true density are not reliable parameters to separate hard seeds for the variety MI-5. Color values indicated significantly ($p < 0.05$) higher b* value for hard seeds. Therefore, further studies should be done to identify proper criteria for separating mungbean hard seeds. The storage trial was conducted at room (30 ± 2 °C) and cold (4 °C) temperature for 6 months. The results revealed that the development of hard seeds tends to decrease with storage time, while room temperature was more effective to store mungbean than refrigerated conditions.

Keywords: Hard seeds, Mungbean, Physical properties, Storage

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ID 160

Studies on growth and yield of *Capsicum annuum* L. as affected by different ratios of Albert's solution and fish tonic biofertilizer

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Abstract

It is now crucial to include ecologically friendly fertilizers in the sustainable agricultural aim to address the environmental problems associated with conventional approaches. It offers a way to save expenses and the environmental effect while offering a plan to promote plant development when paired with biofertilizers and Albert's Solution. Therefore, this study was conducted to evaluate the impact of different ratios of Albert's solution and fish tonic biofertilizer on the growth and yield of curry chili (*Capsicum annuum*) under controlled conditions. The experiment was carried out in the Faculty of Agriculture, University of Ruhuna, Matara from August to October 2023. Uniform and vigorous curry chili plants were transplanted on open-top grow bags filled with coconut coir dust media. Fish tonic biofertilizer was prepared by mixing fish waste and brown sugar into 2:1 ratio and fermented for 28 days. Thereafter, the mixture was diluted up to 1:30 before application to the plants. There were five treatments in the study as follows: T1-100% Albert's solution, T2-80% Albert's solution+20% fish tonic biofertilizer, T3-60% Albert's solution+40% fish tonic biofertilizer, T4-40% Albert's solution+60% fish tonic biofertilizer and T5-20% Albert's solution+80% fish tonic biofertilizer. And arranged as a Completely Randomized Design (CRD) with five replicates. Plant height, internode length and number of leaves/plants were recorded at 50% flowering stage and number of pods/plant, pod weight and pod length were measured at harvesting. Collected data were analyzed using Analysis of Variance (ANOVA) from SAS 9.1.3 version. Subsequently, differences between treatment means were compared by Duncan's New Multiple Range Test at the 5% level of probability. According to the results, significantly taller plants and greater internodal length were recorded from T1, T2 and T4 compared to other treatments. There was no significant effect of treatments on the number of leaves per plant. A significantly higher number of pods/plants was obtained from T3, T4 and T5 treatments. Further, weight of the pods and length of the pods were significantly higher in T4. Therefore, the study suggests that different ratios of Albert's solution and fish tonic biofertilizer improve the growth and yield of curry chili under controlled environmental conditions.

Keywords: Albert's solution, *Capsicum annum*, Fish tonic biofertilizer, Hydroponics

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ID 164

Study on the proximate compositions of dry fish powder and dry seaweed powder as functional ingredients for food applications

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Abstract

Goldstripe *Sardinella* (*Sardinella gibbosa*) and green seaweeds (*Ulva fasciata*) are underutilized sea food sources but can be used to food value-additions based on their' nutritional importance, abundance, and cost effectiveness. The objective of this study was to develop dry powders from both sources, fish powder (FP) and *Ulva* powder (UP), together as potential functional food ingredients for the food industry as a solution for malnutrition in the local community. Dry fish (*Sardinella gibbosa*) was collected from Rathgama harbor and fresh *Ulva fasciata* seaweed was collected from Thalaramba, Matara. The cleaned dry fishes were washed and sundried for 1 h before being oven dried at $120 \pm 5^\circ\text{C}$ for 30 min. Fresh seaweeds were cleaned, washed, dewatered, and dried overnight (8 h) at $60 \pm 5^\circ\text{C}$. Both dried samples were pulverized to fine particles, sieved, and stored in adequately sealed polypropylene bags at 4°C , separately. Then those powders were analyzed for moisture, crude protein, carbohydrate, crude fat, total fat, ash contents, and chromameter values in replicates ($n = 3$). For both FP and UP, Moisture% (19.68 ± 0.57 , 13.59 ± 1.48), Crude protein% (60.63 ± 0.97 , 12.59 ± 2.65), Carbohydrate% (1.96 ± 0.10 , 6.69 ± 0.56), Crude fat% (4.22 ± 0.93 , 0.34 ± 0.49), Total fat% (5.28 ± 0.17 , 2.38 ± 0.12), Ash% (15.81 ± 0.39 , 18.99 ± 0.31), and Crude fiber% (only present in UP - 47.09 ± 3.47). The chromameter values for dried fish powder (FP) are reported as 36.13 ± 1.45 (L*), -5.20 ± 0.62 (a*), and 11.70 ± 1.02 (b*). Similarly, for dried *Ulva* powder (UP), the values are presented as 54.90 ± 0.10 (L*), 8.10 ± 0.10 (a*), and 25.00 ± 0.87 (b*), representing the L*, a*, and b* values for both powders, respectively. This broader understanding contributes to the discourse on the use of these as functional foods based on nutritional composition and color aspects, concluding that they are promising functional food ingredients for sustainable and accessible food solutions.

Keywords: Dry powders, Functional ingredients, Proximate composition, *Sardinella gibbosa*, *Ulva fasciata*

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ID 165

Utilization of turmeric powder (*Curcuma longa*) to hinder the glycaemic impact of refined wheat bread

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Abstract

Type II diabetes is affecting almost every household around the world, affecting the lives of millions of people. Dietary and lifestyle patterns are major contributors to the onset and progression of type II diabetes. Although people are aware of diet being a reason for type II diabetes, low glycaemic and palatable food options are scarce. The general public prefers wheat flour-based products such as bread due to their taste and convenience. Since refined wheat bread is high glycaemic, the development of low glycaemic alternatives is a timely intervention. Locally available spices and herbs such as turmeric elicit hypoglycaemic properties and thus may reduce the glycaemic impact of bread once incorporated. The objective of the study was to utilize locally available spices such as turmeric in wheat bread in order to reduce the glycaemic impact of bread with a minimal effect on palatability and product quality. Initially, wheat breads incorporated with different percentages of turmeric powder were formulated and sensory evaluations were performed to select the best turmeric percentage according to sensory perceptions. The Appearance, Aroma, Texture, Taste, and Overall acceptability were evaluated using a semi-trained sensory panel of 30 panellists. The statistically selected best sample was used for the glycaemic index calculations along with a control bread. Healthy adults (12, 18-45 years of age, BMI 18.5-23.5) were selected voluntarily and were asked to come for blood collection with an overnight fast on several days. The standard (glucose), control (wheat bread), and test food (turmeric-incorporated bread) were given to consume and finger prick blood was collected in a 2-hour time window. The glycaemic index was calculated using D-glucose as the reference standard. The calculated glycaemic index for control bread and turmeric incorporated were 57.76 ± 14.25^a and 39.04 ± 14.16^b respectively. Therefore, it could be concluded that the incorporation of turmeric powder in minuscule amounts has hindered the glycaemic impact of wheat bread. This low glycaemic bread product will be highly beneficial for the diabetic community as well as the general public if commercialized.

Keywords: Bread, Glycaemic index, Nutrition, Turmeric, Type II diabetes

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ID 167

Development and quality evaluation of cookies using alternative flour types

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Abstract

Cookies are a variety of biscuits that are soft and generally sweet. Most of the commercially available cookies on the market are made using 100% wheat flour. But nowadays, many people are inclined to reduce the use of wheat flour and increase the use of alternative flour. The main aim of this study is to develop a nutritious cookie by incorporating alternative flour combined with wheat flour. The first composite flour combination was selected by a preliminary study which was done with wheat flour and cassava flour 50:50, wheat flour and pumpkin flour 70:30, wheat flour and soy flour 70:30 and wheat flour and rice flour 70:30. During the preliminary trials, one flour combination was selected. Banana flour was selected as another alternative flour type to increase nutritional composition of cookies. Then flour ration of wheat, cassava, soy of 40:30:15 keep the same value and changes were made to the rest 15% of flour as rice, pumpkin, and banana flour. Experiments were conducted as completely randomized design with triplicates and data were analyzed using ANOVA. According to the sensory evaluation flour combination of wheat: cassava: soy: banana (40:30:15:15) incorporated cookies was selected as the best product. Proximate nutrition composition, Physical property and shelf-life determination was determined for the selected best cookies compare with wheat flour. The results of proximate composition were recorded $12.43 \pm 0.32\%$ of proteins, $24.81 \pm 0.20\%$ of fat, $1.72 \pm 0.05\%$ of crude fibre and $5.21 \pm 0.01\%$ of ash. Thickness (mm), Diameter (mm), spread ratio, Volume (cm^3), Density (g/cm^3). The result of physical property was $10.42 \pm 0.04\%$, $49.85 \pm 0.09\%$, $3.56 \pm 0.02\%$, $20.44 \pm 0.02\%$, $20.44 \pm 0.02\%$. Total plate count of cookies was within the acceptable range ($<1000 \text{ CFUg}^{-1}$) during the research of period. According to the results, cookies could be stored without quality deterioration for 4 month using proper packaging (BOPP/PP). Therefore, it can be concluded that the 40% wheat, 30% cassava, 15% soy, and 15% banana flour cookies was the best and it could be stored at ambient conditions for four months.

Keywords: Banana flour, Cassava flour, Cookies, Soy flour

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ID 170

Preliminary study of management techniques through dormancy-breaking on weedy rice

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Abstract

Rice (*Oryza sativa* L.) is the staple food that is widely grown as a wetland crop in Sri Lanka. Weedy rice (*Oryza sativa f. spontanea*) is rated as one of the four most noxious weeds infesting rice fields worldwide. Seed dormancy is an evolutionary adaptation or a condition which seeds are prevented from germinating even under favourable environmental conditions. The extended dormancy is one of the survival mechanisms of weedy rice. Due to the shattering effect the time gap between after the maturity to on the date of the land preparation weedy rice seeds are laid on the top layers of the soil. The fallen seeds are mix with the soil and deposit in different depths of the soil during the land preparation process. Therefore, the objective of this study is to break the dormancy of weedy rice seeds which are deposited on ground layers of paddy fields and allowing to germinate on site. After the germination adaptation of control package recommended by the Department of Agriculture can be done. Dormancy breaking chemicals were tested for the effectiveness under the laboratory conditions. Weedy rice seeds were collected from three weedy rice infested fields (Dehiduwa, Naiduwa and Yatagala) from Galle District. Sodium Nitrite 1000ppm, Sodium nitrite 3000ppm, N propranol 2 ppm, N propanol 6 ppm, N Propanol 10 ppm, Propionic Acid 5ppm, and Propionic Acid 10 ppm were applied as seed treatments for the composite samples of weedy rice prepared and allow to germinate 100 seeds with three replicates in petri dish by keeping six days as it is. On the seventh day wash off the seed sample by distilled water and germination percentage was recorded. The procedure was repeated for eight weeks with three replicates by keeping one week interval. Sodium Nitrite 1000ppm was recorded significantly highest germination percentage compared with the control and the other chemicals in separately in three locations (Naiduwa, Dehiduwa and Yatagala) by the repeated measures analysis of variance (mixed procedure with time). Therefore Sodium Nitrite 1000ppm can be effectively used to break the dormancy of weedy rice in laboratory conditions. Further evaluation of chemicals and hormones in field level their residual effects before the use of techniques.

Keywords: Dormancy, Galle district, Preliminary, Sodium Nitrite, Weedy Rice

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ID 172

Acceleration of sugarcane (*Saccharum officinarum*) trash decomposition using *Trichoderma asperellum* mixing with cattle manure and High-graded Eppawala Rock Phosphate (HERP)

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Abstract

Sugarcane (*Saccharum officinarum*) is crucial for sugar and ethanol production, with the remaining plant material known as sugarcane trash in which slow decomposition impedes field productivity. Therefore, this study aims to accelerate this process using *Trichoderma asperellum* mixing with cattle manure, and High-Graded Eppawala Rock Phosphate (HERP) in water. An experimental pit consisted of 1kg of sugarcane trash collected from the Gal-Oya Plantations (Pvt) Ltd, Hingurana, Ampara, Sri Lanka. A preprepared *Trichoderma* mixing solution was used in treatments as 2 mL (T1), 4 mL (T2), 6 mL (T3), and with no supplement in the control (C) with equal amounts of cattle manure (50 g), and HERP (5 g) in 100 mL water and they were applied to the surface of trash. Each treatment consisted of 3 replicates in RCBD design. Three samples in each treatment were taken at 21 days, 42 days, and 56 days for the analysis. The moisture content (MC%), total organic carbon (%), organic matter content (%), were measured in trash while odor, color, pH, EC, and MC%, were measured as the parameters in treatments underlined soil in pits to see the effect of treatments on soil surface. The treatments underlined soil exhibited an unchanged soil color and a pleasant odor while there were no significant differences ($P>0.05$) in MC%, pH and EC of them at all stages. The control exhibited the highest TOC% at both 21 days (34.63 ± 4.85) and 42 days (22.46 ± 0.615), whereas T1 displayed the lowest TOC% at both stages (21 days: 19.09 ± 3.22 ; 42 days: 16.79 ± 2.15). However, there was no significant difference in TOC% among the treatments at 56 days. Significant differences ($P < 0.05$) in OM% were observed between the control and T1 at both 21 days (control: 34.63 ± 3.85 ; T1: 32.84 ± 5.54) and 42 days (control: 38.64 ± 1.06 ; T1: 28.87 ± 3.7) while no significant difference in OM% was observed among the treatments at 56 days. These findings suggest that T1 initially exhibited higher decomposition rates compared to the control, but this difference diminished by the 56th day of the study. Therefore, it is concluded that T1 can be effectively used in accelerating sugarcane trash decomposition at early stages.

Keywords: Cattle manure, High-grade Eppawala Rock Phosphate, Organic matter, Sugarcane trash decomposition, *Trichoderma asperellum*, Total organic carbon

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Young Graduates' Forum (YGF)



Keynote Speech

Nurturing agricultural brands for Sri Lanka's future

Tharaka Dias

Managing Director - Marketing, Director - Ambrum Solutions, 16/3, Elliot Place, Colombo 08, Sri Lanka.

Today, as we gather to celebrate the accomplishments of our talented agricultural graduates, we also look towards the horizon of possibility, envisioning a future where Sri Lanka's agricultural sector flourishes and thrives. In this future, branding will play a pivotal role in elevating our agricultural products, creating value-added propositions, and positioning Sri Lanka as a global leader in sustainable agriculture.

To the fresh graduates who have accomplished the required ISAE research standards, I extend my heartfelt congratulations on reaching this significant milestone in your journey. As stewards of Sri Lanka's agricultural heritage, you are uniquely positioned to shape the future of our nation's farming industry through innovation, creativity, and a commitment to excellence.

In the dynamic and competitive landscape of the global economy, branding has emerged as a powerful tool for differentiation, market penetration, and building consumer loyalty. From the verdant tea estates of Nuwara Eliya to the fertile rice paddies of Polonnaruwa, Sri Lanka boasts a rich tapestry of agricultural products that are ripe for branding and promotion. Imagine a future where Ceylon Tea is not just a beverage but a lifestyle brand synonymous with luxury, sustainability, and authenticity. Picture a scenario where Sri Lankan spices are coveted by chefs and home cooks alike for their unparalleled quality, purity, and flavor. Envision a world where organic fruits and vegetables from Sri Lanka are sought after for their health benefits, freshness, and traceability.

This future is within our grasp, but it will require vision, collaboration, and a concerted effort to cultivate and nurture agricultural brands that resonate with consumers both at home and abroad. It is not enough to simply produce high-quality agricultural products; we must also tell the story behind these products, highlighting the rich cultural heritage, sustainable practices, and ethical principles that set Sri Lanka apart on the global stage. Moreover, in the context of Sri Lanka's present economy, characterized by a rapidly growing middle class, increasing urbanization, and growing demand for premium products, the time is ripe to capitalize on the potential of agricultural branding to drive economic growth, create jobs, and uplift rural communities.

As you embark on your respective career paths in agriculture, I urge you to embrace the power of branding as a catalyst for change and innovation. Seek out opportunities to collaborate with fellow graduates, industry stakeholders, and marketing experts to develop compelling brand identities, creative marketing strategies, and impactful storytelling campaigns that showcase the unique value proposition of Sri Lanka's agricultural products.

In closing, let us celebrate the achievements of our agricultural graduates and the limitless potential that lies within each and every one of them to shape the future of Sri Lanka's agricultural industry through branding, innovation, and entrepreneurship. May you go forth from this moment with a renewed sense of purpose, a commitment to excellence, and a vision for a brighter, more prosperous future for our beloved nation. Congratulations, graduates for your valuable research work, and may your agricultural brands shine brightly on the global stage.

Young Graduates' Forum (YGF)

Oral Presentations



Isolation and characterization of *Vibrio* spp. from fish and packing water associated with ornamental fish exports

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Abstract

Ornamental fish export trade being a thriving industry, its substantial contribution to the Sri Lankan economy underscores the necessity to address the associated issues. Presence of pathogenic *Vibrio* spp. in export fish and packing water is a critical concern as they can pose public health hazards while failing to comply with quarantine regulations during export, leading to economic losses. The objective of this study was to isolate and characterize *Vibrio* spp. associated with fish and packing water in the ornamental fish export trade, to assess its microbial safety. Fish (n = 20) and packing water (n = 41) samples received by the Veterinary Investigation Center, Welisara for routine quarantine certification during the period from August to October 2023, were used in this study. Fish were dissected and bacterial cultures were attempted from internal tissues while water samples were pre-enriched in alkaline peptone water, before culturing. All cultures were attempted on Thiosulphate Citrate Bile-salts Sucrose agar at 37°C for a period of 24 hours. Bacterial colonies isolated were characterized by employing a series of biochemical tests. The occurrence of *Vibrio* spp. in samples obtained from different districts in Sri Lanka and different sources, were analyzed and compared by using Chi-square test. *Vibrio* spp. was isolated from both fish (10%; 2/20) and packing water (24.4%; 10/41). All *Vibrio* isolates from fish samples were identified as *V. cholerae*. The occurrence of *V. cholerae* in packing water samples tested was 60% (6/10) while it was 40% (4/10) for *V. parahaemolyticus*. There was no difference in the occurrence of *Vibrio* between samples received from different districts and between freshwater and marine fish tested ($p > 0.05$). In conclusion, *Vibrio cholerae* and *Vibrio parahaemolyticus* were isolated from ornamental fish and packing water samples. Remedial measures were suggested to the relevant ornamental fish farms to rectify the situation.

Keywords: Bacteria, Export, Ornamental fish, Packing water, *Vibrio*

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Phenotypic and genotypic studies of F₄ breeding lines for thrips resistance in rice (*Oryza sativa* L.)

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Abstract

Rice thrips, a pest causing 1.5% annual rice production loss, necessitates the development of thrips-resistant and high-yielding rice cultivars. This study assessed the phenotypic and genotypic characteristics of F₄ breeding lines for thrips resistance at Rice Research Station, Labuduwa, Sri Lanka during the *Yala* season 2023. Improved variety (At 362), thrips-resistant mother plants (Th 55-1 and Th 12-5), and their F₄ crosses (Th 55-1/At 362 and Th 12-5/At 362), and Dahanala as reference variety (traditional thrips resistance variety) were evaluated in this experiment. The field experiment was established according to a Randomized Complete Block Design with two replicates. Damage severity by thrips, trichome density, and other important yield-determining traits of rice were recorded. Genetic variability assessment for quantitative traits was conducted to assess the relative effectiveness of selection based on phenotypic expression of traits. The highest damage severity rank for thrips was recorded in the At 362 when compared with both crosses while the lowest rank was recorded in the Dahanala. Both Th12-5/At362 and Th55-1/At362 recorded higher trichome density values for long, medium, and short trichomes rather than Th12-5 and Th 55-1 and At 362. Both Th 55-1/At 362 and Th12-5/At 362 progeny lines had greater ($\geq 20\%$) genotypic and phenotypic coefficient of variation values for panicle number, tiller number, and panicle weight. The highest ($\geq 60\%$) heritability values were found for plant height, panicle length, and weight. Agronomic characteristics with the highest genetic advance ($\geq 20\%$) were panicle weight, plant height, and number of seeds per panicle. Both Th12-5/At362 and Th55-1/At362 progeny crosses showed moderate values of genetic advance (10%- 20%) for panicle length and thousand-grain weight. In conclusion, both Th55-1/At 362 and Th12-5/At 362 crosses exhibit crucial characteristics for thrips resistance, warranting further selection. Future research should explore additional morphological features, such as leaf cuticle structure and leaf wax composition, to enhance rice resistance to thrips damage.

Keywords: Damage severity, Genetic variability assessment, Heritability, Thrips, Trichome density

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Improving *Eichhornia crassipes* fiber as soilless nursery substrate for transplant production of vegetables

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Abstract

Soilless transplant production has revolutionized vegetable cultivation by creating a controlled environment to optimize yield and quality. An economically viable soilless substrate with desirable physical and chemical properties is imperative. Common water hyacinth (*Eichhornia crassipes*), a noxious aquatic weed in Sri Lanka, presents potential as a valuable substrate for compost and enhanced crop yields. This research aims to refine *E. crassipes* fiber as a soilless nursery substrate for transplant production. The study was conducted at the University of Ruhuna from July to October 2023. Physico-chemical parameters (bulk density, water holding capacity, pH, electrical conductivity, and particle size distribution) were assessed in five treatments: 100% cocopeat (control-T1), 75% cocopeat + 25% *E. crassipes* fiber (T2), 50% cocopeat + 50% *E. crassipes* fiber (T3), 25% cocopeat + 75% *E. crassipes* fiber (T4), and 100% *E. crassipes* fiber (T5), under a Completely Randomized Design (CRD). Substrate efficacy was evaluated using brinjal (*Solanum melongena*) (Variety-Raveena 135 F1) and tomato (*Solanum lycopersicum*) (Variety-Platinum 701 F1) seedlings. Parameters such as germination percentage, days to 80% germination, stem base thickness, leaves per plant, stem height, and seedling dry weight were recorded. Results indicated that substrates contained *E. crassipes* fiber exhibited superior physical and chemical properties. Notably, T4 showed a significantly higher ($P>0.05$) difference in leaves per plant and stem height. In conclusion, T4 emerged as the superior option for transplant seedling production.

Keywords: Coco peat, Common water hyacinth fiber, Improvement, Soilless nursery

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A feasibility assessment of livelihood options adopted by drought affected climatic migrants in agricultural communities

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Abstract

Crop productivity and rural livelihoods are stressed due to extreme weather conditions, which has become a threat multiplier from recent past. Drought is one such impact frequently affected on agricultural communities. Drought affected farmers adopt diverse adaptive measures as coping strategies. Thus, this study aims to assess multiple adaptation strategies adopted by climate change-induced agricultural communities in Anuradhapura and Trincomalee Districts, the main agricultural districts suffered due to prolonged drought in 2017. A mixed-methods approach was adopted to gather primary data employing a questionnaire survey (n = 60) and key informant discussions (n = 5). A simple random sampling technique was used to draw the sample for the questionnaire survey. Descriptive statistics were used to analyze the data including a vulnerability index. Crop diversification has been adopted by 90% of farmers as a coping strategy that lessens risk and uncertainty (33%). Drought-resistant short-term crops (brinjal, okra, cassava, turkey berry, chilies, and mushroom) are being cultivated. Results reveal a substantial increase in engaging with secondary livelihood options, including self-employment (41%), migration (3%), temporary jobs (10%), petty trading (6%), and inland fishing (3%). However, 95% of climate-induced agricultural migrants opt to return to agriculture in a normalized climate condition. The Alternative Livelihood Vulnerability Index (ALVI) revealed that Anuradhapura and Trincomalee districts have the same level of vulnerability for alternative livelihoods, with a 0.44 index value. By adding scenarios to the ALVI model for reference comparison, this realistic strategy can be applied to monitor vulnerability, allocate program resources for support, and assess the potential efficacy of programs or policies in areas with limited information. It identifies that adaptation strategies are mostly welcomed by climate change-affected farmers, deterring transformation to another livelihood.

Key words: Adaptation, Alternative livelihood, Alternative livelihood vulnerability index, Climate-induced migrants, Drought

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**Knowledge, adoption and economic performance of Vanilla (*Vanilla planifolia*) cultivation
- A case study in Kandy district**

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Abstracts

Vanilla (*Vanilla planifolia*) is a minor export crop in Sri Lanka since ancient time. Anyhow, Vanilla does not consider as a good source of income though the Vanilla is second most expensive crop in the world. This study aimed to evaluate knowledge level, adoption level toward recommended practices of Vanilla cultivation and economic analysis of Vanilla cultivation in Sri Lanka. As study area, *Ganga Ihala Korale* divisional secretarial division was selected which has the highest Vanilla growers in Kandy district. Eighty (53% from total population) farmers were randomly selected among 150 farmers who registered under *Ganga Ihala Korale* DS division extension office. Primary data was collected using structured questionnaire and face to face interview. Data was analysis by inferential analysis methods. Knowledge and adoption index was measured using three-point Likert scale. Result of this study revealed that, majority of farmers showed a high level of knowledge (97.5%) and adoption (95%) concerning the recommended practices for Vanilla cultivation. According to the Pearson correlation analysis, knowledge and adoption of the recommended practices of Vanilla cultivation were highly correlated ($r = 0.631$, $p = 0.00$). Relevant to the economic analysis, it was found that, the total annual variable cost was LKR 15,750 constituting 29.1% of the total cost. The total annual fixed cost amounted to LKR 38,214, representing 70.8 % of the total cost. Consequently, the total annual cost was LKR 53,964.29. The average annual yield was 73.38 Kg. Farmers' gross income per acre per annum was LKR 259,370.10, with a cumulative gross income from the establishment of plants up to the present reaching LKR 889,814.60. Further, net profits were LKR 205,405.90 per acre per annum. The benefit-cost ratio was 4.8, the gross revenue ratio was 0.21, and the expense structure ratio was 2.43. The payback period was 3.2, and the return on investment was 4.37. Accordingly, this study has concluded that Vanilla cultivation is profitable. The study underscores that Vanilla cultivation is not only profitable but also a promising source of income for farmers.

Keywords: Adoption, Benefit cost ratio, Knowledge, Profit

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Greening urban spaces: A comparative simulation study of vertical greening in diverse urban contexts in Colombo district

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Abstract

Vertical Green Systems (VGS) play an important role in creating more resilient and sustainable urban settings by efficiently tackling several environmental concerns while also contributing to a vibrant and healthier environment. Numerous researches on vertical gardening systems has shown that they have a favorable influence on urban sustainability and overall quality of life across social, economic, and environmental aspects. The purpose of this research is to evaluate the thermal benefits of VGS in various urban contexts, especially in the Colombo district, during hot, humid end-of-summer sunny conditions in August. The study compared the thermal benefits of several vertical greening configurations, taking into consideration plant percentage and orientations (100% East-West, 50% East-West, and 75% North-South). Selected VGS configurations were strategically employed across four locations using different fractions based on ENVI-met designs. The research includes the introduction of different fractions of ENVI-met designs to the site, using carefully chosen vertical green attributes, to assess the thermal advantages. Furthermore, air temperature at 1.5 m was retrieved from ENVI-met IDT data, and actual and predicted temperatures were compared. Under present conditions, the software validation exhibited great accuracy with a 0.9838 R^2 for simulated versus real ground measurements. The research findings revealed that applying various vertical greenery treatments in accordance with their vegetative proportions resulted in a significant decrease in outdoor temperature. Consistent with the research outcomes, the Colombo district observed decreases in temperature ranging from 1 to 2.5 °C after adopting various forms of VGS. Vertical Greenery Applications at full intensity (100%) and in the East-West direction yielded the most temperature decline, whereas 75% North-South configuration generated the least.

Keywords: Colombo district, ENVI-met, Thermal Benefit, Vertical Green Systems

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Aquacrop model and machine learning algorithms for sugarcane yield prediction: A performance evaluation in dry zone of Sri Lanka

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Abstract

AquaCrop, a leading crop simulation model, improves agricultural practices by simulating an extensive tapestry of diverse crop conditions. Nonetheless, the model's strong demand for inputs, which includes climate, agricultural, and management data, causes issues in many developing nations. As a result, the development of an exceptionally accurate model with minimum essential inputs becomes an absolute need. The purpose of this study was to (a) deploy the AquaCrop model to simulate sugarcane yield under various weather scenarios in Sri Lanka's dry zone, and (b) create and evaluate the performance accuracy of an intelligent model for predicting sugarcane yield using climatological inputs using Machine Learning (ML) algorithms. Observational datasets comprising four growth seasons were used to calibrate and validate AquaCrop default parameters for sugarcane farming in the research location. At the Sugarcane Research Institute in Udawalawa, one hundred scenarios were simulated on a field plot, and the AquaCrop model provided the corresponding yield values. For the prediction model, this study used three ML algorithms: Random Forest (RF), Support Vector Regression, and Gradient Boosting Regressor (GBR). These algorithms were tested in a variety of scenarios, using input variables such as minimum and maximum temperatures, sunshine hours, average relative humidity, rainfall, and wind velocity. The results revealed that the AquaCrop model was successfully validated in the specified study area, with an R^2 of 0.86. In the comparison of predicted and observed values, the GBR had an R^2 of 0.79 and an RMSE of 3.19 among the ML models. Similarly, the RF model generated an R^2 score of 0.74, indicating a good relationship between the projected and actual sugarcane yield data. As a result, it is evident that the GBR and RF algorithms are the best ML models for predicting the yield of sugarcane based on the research location's specific climatological variables. Additional research, extensive model validations, and integration into real agricultural systems are required to assure the effective use and acceptance of these models by sugarcane growers.

Keywords: AquaCrop model, Crop productivity, Machine learning algorithms, Performance analysis, Sugarcane yield prediction

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Near-infrared spectroscopy for quick detection of chemical property changes of repetitively heated coconut oil

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Abstract

In the low-temperature regions of Sri Lanka, coconut oil vendors frequently resort to repetitive heating practices to maintain the liquid state of the oil for commercial purposes. Recurrent heating of coconut oil leads to the formation of toxic compounds like peroxides and hydrocarbons, despite health risks. This research investigated the impact of repeated heating on the quality of various coconut oil varieties in Sri Lanka, addressing a gap in existing methodologies. These include virgin, refined, milk-extracted, copra-extracted, and commercially heated coconut oils that have been heated repeatedly. With the aid of Soft Independent Modelling of Class Analogy (SIMCA) and Partial Least Squares (PLS) models and Near-Infrared (NIR) spectroscopy, the study investigated the compositional changes of different coconut oil categories, revealing varying predictive capacities for different types. Virgin coconut oil exhibits robust resistance to degradation, evidenced by a Standard Error of Prediction (SEP) of 0.018 and a correlation coefficient of 0.904. Conversely, refined coconut oil displays increased susceptibility to quality alterations upon repetitive heating, as indicated by a SEP of 0.027 and a correlation coefficient of 0.742. Milk-extracted coconut oil shows a SEP of 0.015 with a correlation coefficient of 0.767, while copra-extracted coconut oil yields a SEP of 0.017 and a correlation coefficient of 0.734. Commercially scaled repetitively heated coconut oil registers a higher SEP of 0.037 and a correlation coefficient of 0.781, signaling substantial quality degradation under commercial heating conditions. Critical wavelengths for predicting peroxide value and heating durations are identified at 1012.751nm and 663.229nm, respectively. Notably, SIMCA models for each coconut oil type demonstrate 100% validation accuracy without inconsistencies and highlights the use of NIR spectroscopy for rapid quality assessment, detecting significant quality alterations caused by repetitive heating, especially elevated peroxide values. It emphasizes the potential of NIR spectroscopy as a rapid assessment tool for evaluating repetitively heated coconut oil quality and understanding its chemical transformations during repetitive heating. The research highlights the importance of adopting prudent culinary practices to mitigate potential health hazards associated with deteriorated oil quality.

Key words: Coconut oil quality, Culinary practices, Health impacts, NIR spectroscopy, Repetitive heating

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Development and advancement of *Bambusa vulgaris* (bamboo) shoot beer: An innovative approach to sustainable brewing

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Abstract

Bamboo shoots are widely used in Asian cuisine due to their mild flavor and nutritional richness, holding cultural and economic importance beyond their culinary versatility. Beer, a globally cherished alcoholic drink, has been crafted from water, malted barley, hops, and yeast. The present study innovatively integrates *Bambusa vulgaris* shoots into beer-making. *Bambusa vulgaris* shoots were peeled, washed, and boiled at 100°C for 1h to remove the HCN and ground to create an extract. The extract was boiled at 90°C for 10min to obtain zero HCN content, filtered, and distributed into containers. Sugar and roasted wheat were added, followed by local low-sugar yeast and ale yeast, initiating the fermentation process. The beer samples featuring diverse local yeast (LY) and ale yeast (AY) compositions, presented a flavor spectrum. T₁LY and T₂LY had 12%w/v sugar with 1%w/v and 2%w/v roasted wheat, respectively, while T₃LY and T₄LY had 15%w/v sugar with 1%w/v and 2%w/v roasted wheat, respectively. The selected best samples from previous sensory evaluations, were further developed using ale yeast fermentation where T₁AY comprised 12%w/v sugar and 1%w/v roasted wheat, while T₃AY presented 15%w/v sugar with 1%w/v roasted wheat. During fermentation, pH, brix, color, titratable acidity, alcohol concentration, and total sugar concentration were determined. After fermentation, beer samples underwent clarification, pasteurization, refrigeration, carbonation, and canning. The canned beers were labeled, and subjected to sensory analysis. In the sensory assessment with local low-sugar yeast, the beer sample T₃LY with pH 3.5±0.1, brix 4.4±0.0, alcohol percentage 8.0±0.0%, total sugar content 1.33±0.00% excelled in aroma, initial taste, overall acceptability, and highest color development. Preferences for aftertaste leaned towards samples with T₁LY with pH 3.5±0.1, brix 3.6±0.0, alcohol percentage 6.30±0.0%, total sugar content 2.09±0.00%. The beer samples T₁LY and T₃LY were selected for further analysis with addition of ale yeast as described in T₁AY and T₃AY. In the sensory comparison between local low-sugar yeast and ale yeast, differences emerged in aftertaste and texture. T₁AY, with a pH of 4.03±0.06, brix 4.5±0.1, 5±0.0% alcohol, and total sugar content at 5.62±0.06%, stood out for its sensorial appeal. The T₁AY bamboo shoot beer variation aligns with industry goals, offering sustainability and meeting environmental and consumer needs.

Keywords: Ale yeast, Bamboo shoot beer, Carbonation, Fermentation, Local low-sugar yeast

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Effects of temperature on CO₂ emissions from soils with different water repellency levels

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Abstract

Carbon dioxide (CO₂) is a major greenhouse gas with a high contribution to global warming and climatic changes. Since soils store a significantly large amount of carbon, even a minor fluctuation in temperature can substantially influence the soil organic matter (SOM) dynamics and CO₂ emissions. Soil water repellency (SWR) that reduces spontaneous wetting and water distribution in soils due to the presence of hydrophobic organic materials can influence SOM decomposition and CO₂ emissions. It is not clear how the temperature changes can influence CO₂ emissions from soils with different SWR levels. Therefore, this research aimed to examine the effects of temperature on CO₂ emissions from soils with different SWR levels. Soil samples were collected from 0-5 and 5-10 cm depths from a non-repellent (NR) *Swietenia mahogani* forest in Mapalana and an extremely water-repellent *Casuarina equisetifolia* (CE) forest in Hambanthota, Sri Lanka. A grassland soil was mixed with 10% CE litter powder to create a moderately water-repellent (MWR) soil. These soil samples were separately incubated at 60% water holding capacity and 20-80°C temperature range with 10°C increments for 8 h. The CO₂ emissions (NaOH trapping), SWR [Water Drop Penetration Time (WDPT) and Molarity of Ethanol Droplet tests], and SOM content (Walkley-Black method) were measured in incubated samples. The CO₂ emissions increased up to maximum at 40°C and beyond that decreased in all tested soils. The highest CO₂ emissions (0-5 cm depth) were observed in NR soils; however, there were no significant differences in CO₂ emissions between the three soil types ($p>0.05$). Results confirmed that the level of SWR did not affect the increasing and then decreasing trend of CO₂ emissions from soils with increasing temperature. There was a negative correlation ($R^2=0.68$) between CO₂ emissions and WDPT only in MWR soil. The SOM contents showed an overall decreasing trend with increasing temperature in all the three soil samples due to faster decomposition rates facilitated by elevated temperatures.

Key words: Casuarina, CO₂ emissions, Hydrophobic, Incubation, Mahogany

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Young Graduates' Forum (YGF)

Poster Presentations



A study on the potential of using carrot, beetroot and rosella extracts as natural colorants in sausage production

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Abstract

Natural color additives are increasingly demanded by sausage industry due to the health and safety concerns associated with the synthetic colorants. Aim of this study was to investigate the potential of using beetroot (*Beta vulgaris*), carrot (*Daucus carota*) and rosella (*Hibiscus sabdariffa* L.) extracts as alternatives synthetic colorants in sausage production. Sausages were made using 5% extracts of natural colorants while the control group included 0.015% canthaxanthin. The effects of different coloring agents on the physicochemical properties, microbiological properties and sensory properties were assessed over the 15-day storage period. The results were statistically analyzed using one-way analysis of variance (ANOVA) procedure followed by Duncan's multiple range test and the Friedman test. The protein, fat, moisture, and total solid contents of the sausages prepared with natural colorants were not significantly different ($p > 0.05$) from those values of the control. Moreover, throughout the storage period (days 1, 8, and 15), pH and water holding capacity were not changed ($p > 0.05$) due to treatments. Redness (a^*) and yellowness (b^*) values of raw and cooked sausage with carrot extract were significantly higher than those values of beetroot and Rosella. Despite color stability being a concern with natural colorants, the study demonstrated color of natural colorant treated sausages was stable during the storage period. The visual assessment indicates a substantial difference ($P < 0.05$) in the color attribute among the treatments, with the lowest score for color (4.77 ± 0.20) was reported by beetroot while the highest value was reported by carrot extract (6.10 ± 0.13). Sausages with added carrot extract and the control sausages exhibited higher overall acceptability ($P < 0.05$) compared to other treatments. Inclusion of natural colorants did not change ($P > 0.05$) the texture of sausage. There were no reports of the presence of *E. Coli*, *Salmonella*, or *Staphylococcus aureus* in any of the treatments. In conclusion, the incorporation of natural colorants derived from rosella, beetroot, and carrot did not significantly alter the microbiological characteristics or the proximate composition. Although the color values achieved for all three natural colorant treatments remained within the industry standards for sausage products, this study concludes that carrot extracts have the highest potential to be alternatives to the synthetic colorant canthaxanthin in sausage production.

Keywords: Beetroot, Carrot, Natural Colorant, Rosella, Sausages

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Combined effect of sugar level and ice cream mix to yoghurt ratio on the quality of vanilla flavoured frozen yoghurt

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Abstract

Frozen yoghurt is a frozen dairy dessert that combines the nutritional and health benefits of yoghurt with refreshing taste and texture of ice cream. Sugar level and the ice cream mix to yoghurt ratio (ICM: Y) are among the variables affecting the quality of frozen yoghurt. At present, various levels and ratios are used resulting in different quality end products and no studies have been reported on their combined effect. The objective of the present study was to investigate the combined effect of sugar level and ICM: Y on compositional, physicochemical, physical and sensory attributes of vanilla flavoured frozen yoghurt. 3×3 factorial arrangement of treatments (15, 20, 25 % w/w sugar and 60:40, 70:30, 80:20 IC: Y) in a completely randomized design was used with 3 replicates. The most acceptable frozen yoghurt was compared with a market control. Parametric data were analyzed by analysis of variance (ANOVA) procedure and T-test, while sensory data was assessed by Friedman test using SPSS (ver. 25). Significant ($p<0.05$) interaction effect was observed in between sugar level and ICM: Y on composition except ash percentage, pH, titratable acidity (TA) and overrun while no interaction on instrumental colour, melting rate, first dripping time and complete melting time of frozen yoghurt. pH and TA were significantly ($p<0.05$) different among the treatments. As expected, TA decreased with decreasing yoghurt level in the ICM: Y. Increasing sugar level decreased TA with few exceptions indicating its negative effect on starter microorganisms. The overrun% was significantly ($p<0.05$) different among the treatments and the highest was observed in the frozen yoghurt containing 20% sugar and 70:30 ICM: Y. Melting rate showed a clear increment with the increasing sugar level and ICM: Y. Correspondingly, first dripping time and the complete melting time showed a decreasing trend. Instrumental colour was not different among treatments. The most acceptable frozen yoghurt was obtained by mixing 70:30 ICM: Y with 25% sugar, which is having $46.12\pm2.65\%$ overrun and 1.28 ± 0.41 mL/min melting rate. Compared to the control, developed frozen yoghurt had significantly ($p<0.05$) higher percentages of dry matter, fat and carbohydrates and significantly ($p<0.05$) lower percentages of protein and moisture. pH and TA of developed frozen yoghurt was significantly ($p<0.05$) different compared to the control. Titratable acidity of the developed frozen yoghurt was 0.39% lactic acid (LA), which is considerably lower than the control (0.72% LA). Nevertheless, it is above the acceptable minimum value prescribed for frozen yoghurt which is 0.3% LA. Lightness (L^*) and yellowness (b^*) of developed frozen yoghurt was significantly ($p<0.05$) higher compared to the control. Developed frozen yoghurt showed quick melting properties which is less desirable. Above results suggested further investigations with different IC: Y at 20 to 25% sugar level to further improve the quality of frozen yoghurt.

Keywords: Ice cream mix, Melting rate, Overrun, Sugar, Yoghurt

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Optimizing the mass rearing technique for rugose spiraling whitefly (*Aleurodicus rugioperculatus*) and its parasitoid (*Encarsia guadeloupae*) under laboratory conditions

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Abstract

The rugose spiralling whitefly (RSW) *Aleurodicus rugioperculatus* is a serious pest that causes substantial economic losses in Sri Lankan coconut plantations. Chemical based approaches have been commonly employed to manage severe whitefly infestations; but, the emergence of biocontrol agents provides a promising alternative. *Encarsia guadeloupae* has been identified as the most common natural enemy for RSW. The study initiated taxonomic identification for RSW and *E. guadeloupae*, followed by an investigation into their mass rearing on six host plant species viz Coconut (*Cocos nucifera*), Banana (*Musa spp*), Fan palm (*Livistona chinensis*), Poinsettia (*Euphorbia pulcherrima*), Canna (*Canna indica*) and Ground nut (*Arachis hypogaea*) under controlled laboratory conditions. The primary objective was to determine the most suitable host plant species for rearing RSW and promoting the growth and development of *E. guadeloupae*. In order to evaluate the suitability of different host plants, parameters such as oviposition preference, life cycle development, and percentage of parasitism were examined. According to the results, fecundity estimates indicated that the oviposition preference of RSW was highest on coconut followed by banana. RSW successfully completed its lifecycle on all host plants except groundnut. Both coconut and banana proved to be conducive to the growth and development of *E. guadeloupae*. Parasitism levels of *E. guadeloupae* did not exhibit significance in whitefly-infested coconut (49.86%) and banana (52.71%). Based on our findings, coconut was identified as the most suitable host plant for mass rearing of RSW. Additionally, both coconut and banana were effective in promoting the growth and development of *E. guadeloupae*. These findings would contribute to the development of sustainable and effective biological control practices for RSW in coconut plantations.

Keywords: Banana, Coconut, Oviposition, Parasitism

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***In vitro* evaluation of *Trichoderma* isolates as biocontrol agents against *Rigidoporus microporus* (Fr.) overeem causing white root disease in cinnamon**

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Abstract

White root disease (WRD) caused by *Rigidoporus microporus* is a looming threat to cinnamon cultivations in Sri Lanka. The use of synthetic fungicides currently employed to control the disease is not compatible with the organic production of cinnamon. The current study was conducted to isolate *Trichoderma* species from cinnamon rhizosphere soils and to morphologically identify them and to screen the antagonistic effect of *Trichoderma* isolates obtained from rhizosphere soils of cinnamon, banana, and pepper against the causative agent of white root disease in cinnamon. Antagonistic activity of eight isolates was assessed employing a dual culture assay. Among these isolates, four were obtained from the rhizosphere soil of cinnamon (MA1, MA2, MA3, and MA4), while the remaining isolates were obtained from the rhizosphere soil of bananas (Tc, Tk, and T13) and pepper (MT). All dual culture assay plates were incubated for five days at 28 °C, and percentage inhibition of the radial growth of *R. microporus* mycelium was recorded. The findings unveiled considerable variations in the antagonistic capacity across the isolates. Statistical analysis revealed that the MA1 isolate exhibited a considerably greater efficacy in inhibiting the mycelial growth of *R. microporus* by 44.12 % at $p \leq 0.05$, compared to the other isolates used in the study. The MA2 isolate exhibited the lowest percentage inhibition (22.06%). This study revealed the feasibility of using *Trichoderma* isolates as effective bio control agent against *R. microporus* under *in-vitro* conditions. Screening of more *Trichoderma* strains and appropriate *in-vivo* testing is necessary to explore the possibility of applying potential *Trichoderma* species for controlling the WRD in cinnamon.

Keywords: Biocontrol, Cinnamon, *Rigidoporus microporus*, *Trichoderma*, White root disease

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Exploring herbal blends: *Osbeckia octandra* and *Atalantia ceylanica* leaves with tea for medicinally enriched beverages

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Abstract

Osbeckia octandra (Heen Bovitiya/HB) and *Atalantia ceylanica* (Yaki Naran/ YN) are endemic plants to Sri Lanka, have been traditionally used to treat various ailments. This research was planned to assess the preference differences among Ceylon tea (*Camellia sinensis* (L.) O. Kuntze) (100% tea), herbals (100%) and herbal blends (tea + herbals) and to identify the most preferred medicinally enriched beverage among the samples. Furthermore, chemical analysis of the most preferred blends and the most ideal blending proportions for commercial production was evaluated. Fresh HB and YN leaves were harvested in the Nuwara Eliya district, cleaned and dried at 45°C for 12 hours using a domestic oven. The dried leaves were ground and blended with FBOP (Fine Broken Orange Pekoe) and Dust-1 tea grades which were collected from the Ragala tea factory. These blends were mixed proportionally as FBOP-100% (T1), FBOP-75% & HB-25% (A2), FBOP-50% & HB-50% (A3), FBOP-25% & HB-75% (A4), HB-100% (H1), Dust1-100% (T2), Dust1-75% & HB-25% (B2), Dust1-50% & HB-50% (B3), Dust1-25% & HB-75% (B4), FBOP-75% & YN-25% (C2), FBOP-50% & YN-50% (C3), FBOP-25% & YN-75% (C4), YN-100% (H2), Dust1-75% & YN-25% (D2), Dust1-50% & YN-50% (D3) and Dust1-25% & YN-75% (D4). The samples were packed into tea bags, with each weighing 2 g. A sensory evaluation test was conducted with 30 panelists, evaluating aroma, color, and flavor using a five-point hedonic scale. The Friedman test was employed to identify significant differences between treatments. The best blending proportions were selected based on overall preference, composition of chemical analysis, cost and material availability. Treatments B2 and D2 were significantly different from other blends ($P < 0.05$) due to higher preference, lower cost, and ample availability of material. Hence B2 and D2 were determined as the most ideal blending proportions for commercial production. This research marks a promising milestone in the exploration of using native plants to benefit both the medicinal and commercial industries.

Keywords: *Atalantia ceylanica*, *Camellia sinensis* (L.) O. Kuntze, Endemic Plants, Herbal Tea, *Osbeckia octandra*

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Micropropagation of *Manihot esculenta*

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Abstract

Manihot esculenta (Cassava) is a key starchy crop cultivated across diverse regions worldwide. Due to the prolonged dormancy of its seeds and the slow pace of germination, farmers commonly propagate *M. esculenta* using stem cuttings. However, this method has led to an increase in viral and bacterial diseases, negatively affecting yield and threatening the loss of high-quality genotypes. This is one of the main drawbacks of this species for the pharmaceutical industry. Therefore, this work aimed at developing reliable methods for mass production of healthy, virus-free *M. esculenta* (Var. MU51) for industrial uses. The focus was on creating a micropropagation protocol for the variety MU51, involving optimal surface sterilization, effective hormonal combination for shoot proliferation and ideal media for meristem culture. According to the study, a 10% NaOCl solution, coupled with exposure duration of 15 minutes manifested the most noteworthy success rate in preventing contamination ($P < 0.05$). This outcome distinctly surpassed the efficacy observed with 5% and 15% Clorox solutions administered for 10 and 15 minutes respectively ($P < 0.05$). In the context of proliferation of shoots from *M. esculenta* nodes the application of 0.5mg/L BAP and 0.1mg/L NAA, 1mg/L BAP and 0.1mg/L NAA following a 5-weeks span, the nodal segments that underwent shoot proliferation exhibited comparable growth in both treatments without significant difference ($P > 0.05$). The initiation of meristem growth was carried out utilizing a solid Murashige and Skoog (MS) medium fortified with a blend of 0.1mg/L BAP (Benzylaminopurine), 0.25mg/L GA3 (Gibberellic acid), and 0.2mg/L NAA, in addition to a standard MS medium. Significantly, the hormonal MS medium demonstrated a significantly superior survival rate ($P < 0.05$). The current investigation underscores the optimal conditions for mitigating contamination risks and promoting desirable outcomes in *M. esculenta* shoot proliferation and meristem growth, thereby contributing valuable insights to the field.

Keywords: Cassava, *In vitro* culture, Meristem Culture, Micropropagation

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Exploring the potential of enhancing the foliage (*Dracaena sanderiana*) value chain

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Abstract

Sri Lanka has a diverse tropical climate and varied terrain provide an ideal environment for year round floriculture, ensuring a steady supply of products. This industry supports over 5,000 direct jobs and more than 15,000 indirect jobs within Sri Lanka. Foliage is a significant component of the floriculture sector. Sri Lanka exports around 15 million US dollars, contributing approximately 0.15% to the total merchandise exports. However, it is essential to address the decline in its contribution post-2019, highlighting the need to strengthen the capabilities of the floriculture industry. This research aims to enhance the value chain of foliage, focusing specifically on *Dracaena sanderiana*. It involves identifying key actors, their roles, and functions, while mapping critical value points within domestic and export markets. The methodology begins by identifying consumer-driven value attributes through a survey involving 90 participants. These 90 participants were selected using a convenience sampling method for the survey at the Suwasas flower Exhibition site in Gampaha and Kaluthara and Diyatha Uyana, Colombo. Results indicate that leaf color and plant height were more important factors in selecting plants from local and export markets. Subsequently, critical points were identified by analyzing at least five actors within each node of the value chain. Results revealed that processor node is the critical point in the *Dracaena sanderiana* value chain and they added the highest value to the product. Further, the research emphasizes the crucial roles of input suppliers, growers, wholesalers, and exporters. Results indicated that strong relationships are important for maintaining product quality in the export market. Based on the value attributes and marketing margins of this study, exporters are the key players in the *Dracaena sanderiana* value chain.

Keywords: Cut foliage, Export, Floriculture, Sri Lanka, Value chain analysis

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Exploring gender engagement among estate sector field workers in Nuwara Eliya district, Sri Lanka through a GEDSI approach

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Abstract

Gender assessment is crucial, especially among ground-level workers to ensure their welfare, living status and wellbeing. Thus, this research aims to find out gender roles and levels of participation among field workers in *Nuwara Eliya* tea estates. Three tea estates, namely *Gorakaoya*, *Katabola* and *Somerset* were selected as these exhibits accessibility to a significant resident labour population, particularly in terms of male labour force. A questionnaire survey (n=48) was adopted to glean quantitative data with equal representation of both men and women. The Moser framework was adopted to draw meaningful inferences. Results revealed that 87.5% of women perform all productive, reproductive and community roles while 68.75% of male labourers perform only the productive role. An equal percentage of male workers play both productive and community roles together with productive and community roles (6.25%). A significant level of decision-making power has been acquired by women workers (63%) due to their earning capacities, whereas the figures reported was 43% for men ($p = 0.006$). A significant level of gender disparity was observed with respect to resource accessibility which was analysed using the Wilcoxon sign rank test ($p < 0.025$) for all concerned types of resources. Female labour accessibility for career advancement was also low ($p = 0.00$). Moreover, it is evident that the existing reward system lacks in recognizing and compensating female labour contributions ($p = 0.02$ for savings; $p = 0.005$ for bank loan accessibility). In conclusion the study showed the connections between gender dynamics and disability inclusion and the persistent disparities in resource accessibility, and job empowerment. Introducing a loan system for entrepreneurial skill development and capacity-building programs can economically and socially empower individuals in the estate sector. Promoting equal male and female participation in estate-level societies will address social and labour productivity issues in the sector.

Keywords: Empowerment, Gender Roles, Moser, Participation, Tea Estates

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Impact of social networks on agricultural technology adoption: A case study of existing extension programs for paddy cultivation in Matara district

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Abstract

Agricultural technology adoption means the accept and integration of agricultural technologies and social networks are important to disseminate agricultural technologies among rural farmers. Social networks are patterns of relationships among people in the society and agricultural instructors, contact farmers and other farmers are the main social network actors in paddy farming communities. The study delves into the complex dynamics of social networks and how they affect paddy farmers' adoption of agricultural technologies, which are included in the *Yaya* development program, the *Weedy rice* program and the *Good Agricultural Practices (GAP)* program in *Matara* district. Structured questionnaire survey was conducted with seventy-five farmers from *Wilpita*, *Kamburupitiya* and *Malimbada*. *Wilpita*, *Kamburupitiya* and *Malimbada* were purposively selected as three study areas in *Matara* district whereas simple random sampling technique was used to select twenty-five farmers from each area. Results of UCINET (Version - 6.771) revealed that, *Wilpita* has the highest social network density (0.201) and *Malimbada* has the lowest social network density (0.144). Agricultural instructors have the highest centrality and due to that, most prominent actors of the social network are required to disseminate the technologies of agricultural extension programs in *Matara* district. The number of farmers, who continue the use of agricultural technologies of existing extension programs (41) is higher than the farmers, who do not continue the use of agricultural technologies (34) therefore, the adoption percentage for agricultural technologies of extension programs is high. Technology adoption has a positive correlation with both influence of actors in the social network ($r^2=0.626$) and trustworthiness about agricultural instructors ($r^2=0.425$). There was a negative correlation between technology adoption and trust of indigenous knowledge about paddy cultivation ($r^2=-0.377$) on technology adoption by the farmers. According to the above results, social network factors highly effects on agricultural technology adoption and due to that, introduction of contact farmers for each *yaya*, increase the number of AI officers, conducting training programs and introduction of social media platforms for networking are suggestions to improve the social network in *Matara* district. The research endeavors to contribute a nuanced understanding about the impact of social networks on agricultural technology adoption in *Matara* District, offering practical insights for stakeholders involved in agricultural extension services.

Keywords: Agricultural extension, Paddy cultivation, Social network, Technology adoption

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Community perception on tourism development in Kalpitiya, Sri Lanka

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Abstract

Kalpitiya, an area in Sri Lanka characterized by breathtaking natural beauty and rich cultural heritage, has recently seen a surge in efforts to develop tourism. The perceptions, expectations, and engagement with tourism activities of the local community play a pivotal role in shaping the sustainable future of tourism in a region. However, the grassroots level perception has not been fully explored yet. Therefore, the objective of the study was to assess how the community perceives tourism development activities in the region by identifying the socio-economic and environmental impacts of tourism development. The sample size was 100 local people randomly selected from 05 GN divisions, i.e. 20 per each out of 31 GN divisions of Kalpitiya district where many tourism development activities are going on. A field survey was conducted using a pre-tested structured questionnaire for the data collection. Community perception and awareness on tourism activities were used as main variables measured using five point Likert scale ranging from 1= not beneficial at all, 5= very beneficial and 1= not aware at all and 5= highly aware respectively. The statistical analysis of the collected data indicated that 69% of the community is aware of the tourism development activities taking place in Kalpitiya, with a mean score of 3.67 and a low standard deviation of 0.0853. However, the positive perception of tourism activities among the respondents is low with a mean score of 1.75 and a relatively high standard deviation of 0.902, suggesting that though the community is aware of the tourism development activities, they may not necessarily perceive them as beneficial. The respondents mentioned the most important benefits of tourism for them are improved revenue generation of local businesses, new employment, new residential places, and skill development opportunities with statistically significant means of 4.04, 3.97, 3.93, and 3.89 respectively. Increased solid waste and environmental pollution were stated as significant environmental impacts caused by the tourism industry as per the community's perception. Therefore, the study suggests implementing natural resources protection programs, solid waste and environment management programs in the area to reduce the negative impacts on the community and the environment. Additionally, the community proposed promoting the supply of direct and indirect goods and services to tourists by locals, developing policies and plans for tourism-based business development, and encouraging tourism-related employment opportunities for youth. These measures aim to enhance the socio-economic and environmental status through sustained tourism development in the area.

Keywords; Tourism, Community perception, Awareness

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Banana Fusarium Wilt disease detection based on UAV remote sensing

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Abstract

There is a significant threat to the global supply of bananas that is posed by the disease known as Panama wilt, which is also referred to as Banana Fusarium Wilt (BFW) in some instances. A significant dissatisfaction is caused by the fact that there are currently no viable treatment options available for BFW. The early monitoring of the disease and the evaluation of its distribution were the primary focuses of this research project, with intention of making a contribution to the decrease of BFW. A model that is capable of identifying regions or plants within a banana plantation that are either infested without BFW or free of BFW was developed as one of the specific objectives. The other specific objectives include the identification of an appropriate image processing technique, the determination of sensitive parameters for the selected technique, and the development of a model. Utilizing an unmanned aerial vehicle at a flying height of 20 m above the ground, multispectral images were captured over a BFW-affected banana plantation. A single flight, covering 3 acres, yielded images totaling 639 under standard operational conditions. The categorization model included two types of spectral features as inputs: three multispectral band images and one vegetative index (VI). A self-organizing data analysis approach was utilized to identify canopies that are infected with BFW. Comparative analysis demonstrated that canopies infected with BFW exhibited higher reflectance in the Normalized Difference Vegetation Index (NDVI) range and exhibited distinctive color variations in the NDVI region compared to canopies that were healthy. The research results indicated that VIs, such as NDVI were successful in accurately detecting BFW Disease. The study employed binary logistic regression to evaluate the spatial correlation between VIs and the presence or absence of BFW in plants. The algorithm effectively detected the disease and accurately delineated specific regions using landmarks. The study further employed Google Maps to quantify the distances between afflicted plants and nearby landmarks. The research findings provide valuable information for management of banana plantations, presenting practical methods for detecting plant diseases and providing recommendations to farmers in reducing the impact of Panama wilt disease on banana cultivation.

Keywords: Banana Fusarium Wilt, Multispectral Image, NDVI, Unmanned Aerial Vehicle

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Design, development and evaluation of a manual weeder for *Cyperus iria* L. in rice fields

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Abstract

Weeding is a crucial task in agriculture that ensures optimal crop growth by eliminating unwanted plants (weeds), which compete for resources and reduce crop yields. *Cyperus iria* L. (Thunessa) is a serious weed for rice cultivation and it has emerged as an aggressive weed of rice with the ability to multiply rapidly with abundant seed production capacity. *Cyperus iria* L., commonly known as rice flat sedge, is a persistent and invasive weed that poses a significant threat to rice cultivation. As rice-growing regions have developed weed control options without considering agroecosystem health, weed control has become increasingly important. This study presents the design and development of an innovative new weeder specifically tailored for the effective removal of *Cyperus iria* L. from rice fields. It features a robust frame equipped with specialized cutting mechanisms designed to sever the weed at its base of inflorescence while minimizing damage to the rice crop. It comprises of V-shaped iron spikes mounted on cutting bar that was attached to a power transmission unit. Two ground wheels were used to drive this weeder to forward direction and for the supply power to rotate cutting bar through bevel gears. Rotation of the ground wheels helps for forward driven movement of the machine and changes the direction of cutting bar rotation at the same time. The gear ratio between ground wheels and cutting bar was 1.0: 7.5. Weeding trials were conducted in three experimental plots, each sized 25 m² and three times per plot. Speed of the machine was measured using 5 m distance and test was replicated 5 times. Results indicated that theoretical field capacity, effective field capacity, field efficiency, average travel speed and weeding efficiency of the weeder were: -0.087 ha/h, 0.0463 ha/h, 53.26 %, 0.456 m/s and 69.93 %, respectively. This newly designed weeder is robust to control Thunessa in paddy cultivation.

Keywords: *Cyperus iria* L., Performance, Rice cultivation, Weeding, Weeder

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Designing a web-based crop management system with the aim of optimizing tomato yield

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Abstract

This study describes the design and implementation of a web-based crop management system for optimizing tomato cultivation processes. The major goal of this system is to provide specialized instruction and management tools to tomato farmers in Sri Lanka. The work began with the establishment of a comprehensive database, which gathered vast data from Sri Lanka's Department of Agriculture. This database contains a wealth of vital tomato-growing information, such as varietal specifications, climate requirements, and disease management measures. A key element of the system is a user-friendly login/sign-in interface for farmers. After registering and entering pertinent information, the system generates a personalized 90-day cultivation guide. This guide offers step-by-step directions for every stage of tomato cultivation, from seeding to harvesting. The main concerns such as fertilizer and organic matter application volumes, specific times for various agricultural activities, and pest and disease management are detailed. Furthermore, the system includes a novel function that allows farmers to estimate their yield and assess its production. This feature not only benefits in yield prediction but also in determining the efficiency and profitability of the growing process. This web-based system was built with a strong technology stack that includes HTML, CSS, JavaScript, Bootstrap, AngularJS for the front end, PHP for the back end, and a MySQL database. This combination provides a fluid, engaging, and responsive user experience while effectively managing large amounts of agricultural data. Overall, this study makes an important contribution to agricultural technology by providing a practical solution to improve the efficiency, productivity, and sustainability of tomato farming in Sri Lanka. This approach intends to empower farmers with data-driven insights and targeted counsel through the use of technology, ultimately leading to more successful and lucrative agricultural methods.

Keywords: Crop management system, Database, Technology stack, Tomato cultivation, Yield prediction

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Investigation into the efficacy of wood apple gum and natural plant extracts for natural sustainable surface coating development

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Abstract

For wall coatings on both interior and exterior surfaces, numerous substances can be used to improve aesthetics, protect against weathering, and provide practical advantages. These coatings provide walls with resilience, water resistance, and aesthetic value while also functioning as a layer of protection. The development of a natural surface coating made of plant extracts is critical for long-term sustainability. A natural surface coating is an environmentally conscious alternative to synthetic coatings. Our study prioritizes using plant extracts in the coatings to reduce harmful effects associated with the current coating industry and as a reaction to the growing demand for environmentally conscious products. Furthermore, it can boost local economic growth by using resources, preserve traditional knowledge, and limit the usage of toxic chemicals. This holistic approach promotes sustainability, environmental stewardship, health and safety, and cultural preservation. The experimental emphasis of the research is on the production of a natural surface coating utilizing wood apple (*Limonia acidissima*) gum and other natural extracts. The methods included coating formulation, testing, and application, as well as determining the best extraction technique for wood apple gum. There were four treatments in the study such as 20%, 50%, 60%, and 80% of wood apple gum with Dorana (*Dipterocarpus glandulosus*) oil and Haldummala (*Trachylobium verrucosum*), named as T₁, T₂, T₃, and T₄ respectively. This investigation explored the complex properties of coatings, looking closely at water resistance, viscosity, adhesion, pH levels, and aesthetic appeal. From the study, it was identified that horizontal cut that was 100% depth was the most effective technique to extract wood apple gum. The top-performing treatment (T₁) obtained a level 5B rating in adhesion and it exhibited ideal pH ranges and viscosities comparable to those of available wall coatings in the market. Furthermore, T₁ showed the maximum hardness level (8H), while all treatments showed promising signs of water resistance. The findings of this study may have a substantial influence on several sectors through the provision of environmentally friendly substitutes, reduction of environmental impact, enhancement of public health and safety, promotion of innovation, creation of new business opportunities, fulfilment of customer demands, and preservation of traditional values.

Keywords: Adhesion, Environmental sustainability, Natural plant extracts, Sustainable surface coatings, Wood apple gum

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Design and development of palm fresh fruit bunch thresher for the productivity improvement of palm oil production process

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Abstract

In conventional palm oil production process, fresh palm fruit bunches are sterilized before mechanical threshing to get rid of lipophilic microbes and soften the fruits pulp for easy stripping. The sterilization is executed at 130 °C-160 °C temperature and elevated pressure 0.15 - 0.4 MPa for about 60-90 minute. Steaming the entire bunch followed by conventional threshing necessitates large-capacity steam generators, bulky storage bins, and heavy machinery for threshing. The sand and impurities carried with the whole bunch can cause cavitation in the machinery and degrade the quality of the oil. As an alternative, this study proposed separation of palm fruits from the bunch and sterilize only the fruits to reduce the total sterilizing mass. The developed thresher includes 2.13m × 3m × 1m holding frame, half ellipsoidal shape loading rack and a rotary threshing spindle with 10mm carbon steel wire loop as the threshing elements. The machine was powered by 12Hp diesel engine with the ideal running speed of 2000 rpm. The speed was reduced to 860 rpm to run the spindle by using 6 inches driving pulley and a 14 inches diameters driven pulley. The threshing elements were fixed to the spindle with 40° angle to the rotating plane. The best shape and its angle of orientation, best element height from the holding rack, best spindle RPM were quantified by the trial-and-error method. Results show that the triangle shape smooth edge element with 40° angle orientation gave the maximum speed of threshing. The best element height from the loading track was 2 inch and gave a significant improvement of threshing to the other heights. The invented thresher was found to be accomplished 3.8TPH rate, which is more than double to the existing machine speed reported as 1.5TPH. The manufacturing cost including the skilled labour was 2600USD via the same capacity thresher is valued at 5000USD. The invented thresher and the proposed methodology have successfully demonstrated that the novel procedure is capable of avoiding the conventional bulk sterilization process and increases the overall process productivity by saving labour, time, energy and increasing the quality of overall crude palm oil production process.

Keywords: Mechanical design, Oil palm (*Elaeis guineensis*), Palm oil production, Steam sterilization, Threshing efficiency

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Analysis of morphological, nutritional, chemical and functional properties of selected culinary herbs: curry leaves, pandan leaves, lemongrass, java galangal and allspice

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Abstract

Sri Lanka is well known for its diverse culinary tradition where culinary herbs play a pivotal role. There are numerous varieties of culinary herbs available in Sri Lanka, and the current study was conducted to examine the morphological, nutritional, chemical, and functional properties of widely used culinary herbs namely curry leaves (*Wal-karapincha* (*Micromelum minutum*), *Meegon-karapincha* (*Clausena indica*)), pandan leaves (*Pandan-wangi* (*Pandanus amaryllifolius*), *Pandan-duri* (*Pandanus tectorius* spp.)), lemongrass (White-sheath lemongrass (*Cymbopogon citratus*), Red-sheath lemongrass (*Cymbopogon flexuosus*)), Java-galangal (*Kaempferia galanga*), and Allspice (*Pimenta dioica*). The vegetative parts commonly used in cooking purposes was selected to examine the properties, and accordingly, the immature and mature leaves of curry leaves, mature pandan leaves, mature leaf and sheath of lemongrass, mature java-galangal leaf, fresh immature and mature leaves, and dry leaves of allspice were taken for the study. Fresh grinded samples were taken for the analysis of nutritional, chemical and functional properties. The methanol extract of each sample was taken for the analysis of functional properties. ANOVA-One-way and T-test used for statistical analysis highlighting significance differences ($p < 0.05$). The leaf arrangement of *Wal-karapincha* leaves was found to be imparipinnate compound while *Meegon-karapincha* was paripinnate compound. *Pandan-duri* showed spines on the edge of the leaves while *Pandan-wangi* was spineless. Compared to white-sheath lemongrass the leaf blade of red-sheath lemongrass leaf was found to be sharper. Out of all the herbal species dry allspice leaves showed the highest fat content ($10.03 \pm 0.01\%$), crude protein ($7.88 \pm 0.01\%$), and crude fiber ($15.35 \pm 0.01\%$) contents. The lowest pH value was observed in the fresh mature leaves and dry leaves of allspice (4.53 ± 0.01 pH). Out of all the herbal species studied, the immature *Wal-karapincha* showed the highest titratable acidity ($0.83 \pm 0.05\%$). The highest values of total soluble solid content (2.27 ± 0.01) and total sugar contents ($56.92 \pm 0.01\%$) were observed in dried leaves of allspice. The immature leaves of allspice showed the highest total phenolic content (179.24 ± 0.01 mg GAE/g), total flavonoid content (119.17 ± 0.026 mg QE/g) and DPPH scavenging activity (6671.79 ± 0.08 mmol/g). According to the results each culinary herb showed significant differences in morphology, nutrition, chemical and functional properties. This research will stimulate further research and educate society about different culinary herb varieties.

Keywords: Allspice, Culinary herbs, Curry leaves, Java galangal, Lemongrass, Pandan leaves

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Comparative analysis of the water quality of six different coconut varieties grown in low country intermediate zone of Sri Lanka

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Abstract

Coconut water (*Cocos nucifera* L.) is a natural isotonic beverage, which has gained a significant popularity for its potential health benefits and refreshing taste. Knowledge about the properties of coconut water of different varieties is essential for consumers, researchers and producers to make informed decisions. This research endeavors to conduct a comprehensive scientific analysis comparing the water quality of six distinct coconut varieties namely Sri Lanka Green Dwarf, Sri Lanka Red Dwarf, *Ran Thambili*, *Gon Thambili*, CRIC 60, and CRIC 65. Thus, a range of physical (whole nut weight (kg), nut-circumference (cm), color (L*a*b*), nut-water volume (mL), specific gravity), chemical (pH, total soluble solids, titratable acidity), nutritional (proteins, fats, total sugars and minerals (Na, K)), and functional (total phenolic content, flavonoid content and antioxidant activity) characteristics of coconut water taken from coconuts at 11 months maturity were examined. The obtained data were statistically analyzed using one way ANOVA. Considering the physical properties, all the tested attributes except for color were found to be significantly varied among the tested varieties. pH, TSS and sugar content were found to be significantly varied ($p < 0.05$) among the varieties while the titratable acidity showed no significant difference. All the tested varieties found to be rich source of K⁺ (344.3 ± 43.5 to 854.5 ± 21.7 mg/L). The total phenol and flavonoid contents were high in *Gon thambili* (7.85 ± 2.58 mg GAE/100 mL, 0.260 ± 0.061 mg QE/mL respectively) whereas CRIC 65 contains high antioxidant content (10.507 ± 1.102 mg Trolox/g). It can be concluded that coconut water is a replenishing nutrient rich beverage for the human body and mature coconut water regarded as a waste in coconut processing industries, can be used as a potential source for value addition.

Key words: Coconut water, Functional properties, Nutritional properties, Physicochemical properties, Varieties

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Effects of heat and litter thickness on water repellency of burned forest soils

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Abstract

Soil water repellency (WR) is a global phenomenon that limits spontaneous water entry into soils. Forest soils under specific vegetation types, which are rich in hydrophobic materials often show WR. Forest fires burn organic litter materials in forest floors into ash affecting WR. Factors like fire intensity, litter thickness, and heating conditions can affect ash properties. Available findings on changes in carbon (C) contents in forest soils that are water-repellent (WRS) and non-repellent soils (NRS), and litter material under different heating temperatures in and soils remain uncertain. This study aimed to explore how different heat parameters and litter thickness influence hydrophobic conditions of litter ash and underlying soils, considering the C loss. Soil and litter samples were collected from Casuarina (Hambantota) and Mahogany (Mapalana) forests, representing WRS and NRS, respectively. Soil samples were placed in containers, the litter was added in three thickness levels (3, 6, and 10 cm), and then subjected to laboratory burning at eight temperatures (150, 200, 250, 300, 350, 400, 500, and 600°C) under two exposure durations (20 and 40 min). After heat treatments, WR was measured on both litter ash and soil surface using water drop penetration time test. Organic matter contents of soil and litter were determined by Walkley-Black and loss on ignition methods, respectively. Both Mahogani litter (ML) and Casuarina litter (CL) initially showed WR. On both litter ash surfaces, WR increased with increasing temperature up to 350°C and then decreased to disappear as the litter ash reached high burning level. CL showed a consistent surface WR was under all litter thicknesses. This might be because the narrow regular morphology of CL can facilitate homogeneous burning. ML showed the highest surface WR when the litter layer was the thickest. The broad irregular morphology of ML might influence relocation of hydrophobic volatile substances influencing WR at different litter thicknesses. Top layer of litter showed the lowest organic matter content for all three litter thicknesses, where the loss of organic matter decreased with increasing thicknesses. Weak to moderate correlations existed between SWR and organic matter contents. Organic matter contents showed strong negative correlations with temperature in both Mahogany and Casuarina litters. Results revealed that the litter thickness highly influence the surface WR in burned forest soils as well as the loss of terrestrial C to the atmosphere, and the increasing temperature and duration of exposure intensifies the C loss.

Key words: Forest fires, litter thickness, organic matter, water repellency

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Effects of heat on stable carbon fractions in repellent and non-repellent forest soils

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Abstract

Soil organic carbon (C), the main component of soil organic matter, consists of two major fractions as the labile C fraction (LCF) and the stable C fraction (SCF). Soil water repellency (SWR) is caused by the presence of organic materials and has important consequences for C mineralization. The proportion of SCF in water-repellent (WR) and non-repellent (NR) soils might be different due to the differences in content and composition of organic substances present in these soils. Forest fires can significantly impact soil C due to generated heat, and might change the amount of SCF. This study aimed to examine the effects of heat (heating temperature, T_H ; duration of exposure to heat, D_H) on SCF in WR and NR forest soils. Soil samples were collected from Mahogani Forest in Mapalana and Casuarina Forest in Hambantota, representing NR and WR soils, respectively. Soils samples were separately exposed to eight heating temperatures (50, 100, 150, 200, 250, 300, 350, and 400°C) for 20 and 40-min durations in triplicates, and then kept for 24 hours before testing. Total organic C (TOC) content (Walkley-Black method), SCF (size fractionation method), LCF (numerical method), and SWR (water drop penetration time, WDPT and molarity of ethanol droplet, MED tests) of the samples were determined before and after heating. SWR, TOC, and LCF in both WR and NR forest soils decreased with increasing T_H and D_H . The SCF in NR soil increased from 61% of initial value to 89%, whereas that of WR soil increased from 71% of initial value to 95%, after heating at 400°C for 40 minutes. Although the SCF% in WR soils was higher than that in NR soils, the increase in SCF and the decrease in LCF with increasing temperature did not show any significant difference between NR and WR soils. Results revealed that the SCF increases when the soil is exposed to higher temperatures, showing that the increasing temperature removes labile C more profoundly from the soil compared with stable C.

Key words: Forest fires, labile carbon, stable carbon, soil water repellency, total organic carbon

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Inaugural Session



Distinguished guests, invited speakers and research community gracing the Inaugural Session of ISAE 2024



Lighting the traditional oil lamp by the distinguished guests at the Inaugural Session of ISAE 2024



Coordinator of ISAE 2024 welcoming the gathering



Vice Chancellor of University of Ruhuna addressing the gathering



Chief Guest of ISAE 2024, His Excellency Mr. Badli Hisham Bin Adam addressing the gathering and presentation of the token of appreciation to the honourable High Commissioner by the Vice Chancellor, University of Ruhuna



Appreciation of the Guest of Honour of ISAE 2024, Mr. Shri Harvinder Singh Honourable Consul General of India



Appreciation of the Keynote Speaker of ISAE 2024, Prof. Zhongxiang Fang, University of Melbourne, Australia



Presentation of Research Awards for the academic staff of Faculty of Agriculture, University of Ruhuna



Co-Secretary of ISAE 2024 delivering the vote of thanks

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Scientific Sessions



Keynote speakers delivering their keynote speeches at the ISAE 2024



Research community sharing their research findings at the ISAE 2024

International Symposium on Agriculture and Environment (ISAE) – 2024

Young Graduates' Forum (YGF) – 2024



Dr. Tharaka Dias, Keynote Speaker of YGF delivering the keynote speech and presentation of the token of appreciation to Dr. Tharaka Dias by Senior Prof. Wasantha Kuamra



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Certificate presentation to the participants



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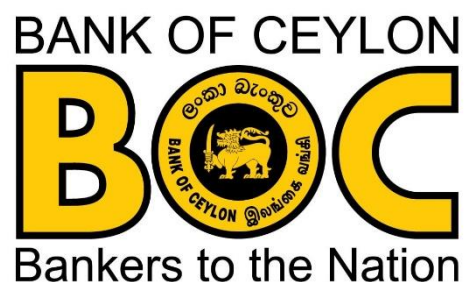
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