ISAE 2023

International Symposium on Agriculture & Environment
with Japan at Ruhuna Special Session

Sustainable Utilization of Agricultural Resources:
The Way Forward to Food Security and Economic Development

Proceedings

Faculty of Agriculture, University of Ruhuna, Sri Lanka

Proceedings of the International Symposium on Agriculture and Environment (ISAE) 2023

"Sustainable Utilization of Agricultural Resources:

The Way Forward to Food Security and Economic Development"

18th May 2023

Faculty of Agriculture

University of Ruhuna

Sri Lanka

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON AGRICULTURE AND ENVIRONMENT 2023

Published by
Faculty of Agriculture
University of Ruhuna
Mapalana, Kamburupitiya 81100
Sri Lanka.

Telephone +94 (0)41 229 2200
Fax +94 (0)41 229 2384
Website www.agri.ruh.ac.lk

ISSN: 1800-4830

Preface

With immense joy and excitement, the Editorial Board is proud to present the Proceedings of the International Symposium on Agriculture and Environment (ISAE 2023). The symposium, which will take place as a virtual event on May 18, 2023, is focused on the theme of "**Sustainable Utilization of Agricultural Resources: The Way Forward to Food Security and Economic Development** " which perfectly aligns with the current global interest in modern agriculture.

The world is facing a multitude of challenges related to food security and economic development. The ever-increasing population and changing climatic conditions have created significant obstacles to agriculture and food production, which are crucial for the well-being of humanity. Agriculture is a critical sector that provides food, raw materials, and income for billions of people worldwide. However, the sector is currently facing several challenges, including the overexploitation of natural resources, degradation of land and water resources, environmental pollution, climate change, and a lack of access to finance and markets.

Against this backdrop, it is imperative to develop sustainable solutions that ensure the efficient utilization of agricultural resources to address food security and economic development. It is also necessary to ensure that the current and future generations have access to sufficient nutritious food, and that agricultural practices are environmentally sustainable. To that end, the International Symposium on Agriculture and Environment (ISAE 2023) was established to provide a platform for experts in the field to share their knowledge, exchange ideas, and discuss innovative solutions that promote sustainable agriculture and food systems.

The symposium will feature keynote speeches, plenary sessions, and technical sessions covering various topics related to sustainable agriculture, including agroecology, crop production, livestock and fisheries, water management, climate-smart agriculture, food systems, value chains, and agribusiness. The symposium will also focus on the role of science, technology, innovation, and policy in promoting sustainable agriculture and food systems.

The Proceedings of the ISAE 2023 is an exceptional collection of knowledge compiled by renowned scientists, policymakers, planners, technologists, and thinkers on the theme of "Sustainable Utilization of Agricultural Resources - Way Forward to Food Security & Economic Development." The Editorial Board is confident that this volume will contribute significantly to the advancement of global agricultural research and development. This symposium will feature a diverse range of papers, with nearly 117 presentations scheduled across 6 thematic areas. The parallel technical sessions will focus on the following six thematic areas: **1) Crop Production and Productivity, 2) Innovative Agricultural Technologies & Environment, 3) Plant, Soil, Water and Environment, 4) Food Technology and Nutritional Sciences, 5) Livestock, Poultry, and Aquaculture, and 6) Agricultural Economics and Agribusiness Management.**

Moreover, the Proceedings will include insightful keynote speeches from renowned experts in the field. The inaugural session will feature a keynote speech by her excellency Mrs. Dewi Gustina Tobing, Honourable Ambassador of Indonesia to Sri Lanka and each technical session will host a keynote speech from an eminent scholar. Together, these speeches will provide an invaluable perspective on the current state of research and development in sustainable agriculture and its role in promoting food security and economic development. The Proceedings of the ISAE 2023 will offer readers a comprehensive view of the latest developments, challenges, and solutions related to sustainable agriculture. This volume will be an essential reference for policymakers, practitioners,

researchers, and students interested in sustainable agriculture and its role in global food security and economic development.

The Editorial Board and Publication Committee wish to express their profound gratitude to the esteemed chief guest, guest of honour, keynote speakers, and all authors for their valuable scholarly contributions and outstanding collaboration in compiling the Proceedings of ISAE 2023. The success of this substantial outcome is the result of the dedicated team effort of many individuals, including the coordinator, Dr. I.R. Palihakkara, as well as members of the publication committee and the Editorial Board. Their unwavering dedication and commitment are greatly appreciated and recognized. As the editor-in-chief of ISAE for the 6th consecutive time, I am pleased to extend my warmest wishes to all attendees for a rewarding and fulfilling experience during the virtual conference of ISAE 2023.

Good Luck and Stay Safe.

Professor Guttila Yugantha Jayasinghe

Editor-in-Chief

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Message from the Vice Chancellor

University of Ruhuna, Sri Lanka

Sustainable Utilization of Agricultural Resources: The Way Forward to Food Security and Economic Development

I am delighted to convey this message to the ISAE 2023 conference of the FOA-UOR. In today's world, the issue of food insecurity and famine poses a significant threat globally, with developing countries being particularly vulnerable. Sri Lanka is no exception to this challenge, and as a nation, it is crucial for us to build resilience in order to effectively address this issue.

The sustainable utilization of agricultural resources entails utilizing the available resources to benefit the current generation while also safeguarding the needs of future generations. This approach is essential in ensuring that we are able to address current crises, such as food insecurity, without resorting to catastrophic measures like mass famine and loss of life. By adopting sustainable practices, we can effectively manage our resources and ensure their availability for future generations. In this regard the most important thing is for the scientific community in agriculture to understand their academic social responsibility. They have to drop personal agendas and take the national needs to the forefront, not to show off but for practical action. The countries that have helped SL develop the agricultural experts do so, with the tax money of their people with the expectation that, it would benefit people including mothers and children of SL. It is imperative that beneficiaries never compromise the noble intentions of countries for personal gains tied to the agrochemical industry or political favors. Regrettably, we have witnessed such occurrences in our country over the past few decades, including the unfortunate events of ''Aragalaya'' in 2022. Having successfully endured significant challenges such as the 2004 tsunami, a 30-year civil war, and various political upheavals against democracy and moral principles, including the events of Aragalaya in 2022, it is now opportune to reflect upon the contributions of agricultural scientists in post-independent Sri Lanka. This evaluation should consider their impact, both positive and negative, on the nation's welfare since 1977, separate from the roles played by political authorities. One such question to be asked is, why is agriculture not industrialized even in smaller scales in SL? For example, organic fertilizer disaster of SL was not the brain child of one person. Those who advised included those who knew nothing and those who knew everything about it. These need honest answers.

For several decades, the FOA UOR farm has been operating at a loss, despite having 50 acres of land, a satisfactory labor force, and annual financial investments. The FOA has a team of 80 agricultural experts with various subspecialties. If the FOA UOR community can truly comprehend the necessary changes required to turn things around and make a profit without incurring millions of rupees in losses every year, we can begin to address the problems faced by Sri Lanka's agri-industry. If this trend continues, Sri Lanka will struggle to overcome the ongoing crisis, and the prospect of achieving sustainable agriculture and development will fade away. It is crucial for the academic community to demonstrate unwavering commitment in putting an end to corruption, wastage, mismanagement, erroneous decision-making, and the adoption of misguided development policies. However, this transformation requires visionary leaders who can guide the way forward. Finally, I wish to appreciate the Dean and the organizing committee for successfully hosting this event with physical participation of Ambassadors from Japan and Indonesia in the conference. I wish to thank both HE Hideaki MIZUKOSHI Ambassador of Japan and HE Dewi Gustina Tobing, Ambassador of Indonesia for their kind gestures in participating in this event. Further, I do appreciate both countries and specially Japan as a nation which has helped SL in development initiatives including support for higher/postgraduate education which include 47 PhDs in UOR out of which 17 are in the Faculty of Agriculture.

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 with the prevailing situation in the country. The Faculty of Agriculture, University of Ruhuna has very successfully organized two national and twelve international symposia in the past and the first edition of 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 broad theme of this year's symposium is *"Sustainable Utilization of Agricultural Resources: The Way Forward to Food Security and Economic Development"* highlighting the need of new strategies for agricultural and environmental management for enhanced productivity and to ensure prudent and sustainable use of biological and natural resources to sustain a healthy population on planet earth. Contemporary agriculture fulfils multiple roles and purposes, including producing more food for a growing population, supplying raw materials for expanding industrial and bioenergy sectors, conserving the natural resources, environment and biodiversity. In Sri Lanka, agriculture contributes significantly in providing rural employment, livelihoods and economic development. It is evident that the present economic crisis in the country has pushed many people towards agriculture and agro-based industries. 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. At the same time, there will be increasing efforts to address some of the negative impacts on environment caused by agriculture. Our country is in need of a solid approach in natural resource management to position Sri Lanka's agriculture sector towards effective and efficient fulfillment of its multi-functional roles.

The collaboration between scientists and institutions, as well as networking in research, plays a vital role in driving the progress of science and technology. It is hoped that the presentations and discussions held at this symposium will pave the way for future research and development of innovative technologies. Furthermore, these interactions aim to foster collaborations that contribute to the overall advancement of the nation. 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 virtual stay at the ISAE 2023.

Prof. Sudas D. Wanniarachchi
Dean/Faculty of Agriculture
University of Ruhuna

Message from the Coordinator – ISAE 2023

It is a special privilege for me, as the Coordinator of International Symposium on Agriculture and Environment (ISAE), to deliver this message for the inauguration of the 2023 session. This forum, which has been organized by the Faculty of Agriculture, University of Ruhuna, Sri Lanka, for over a decade, has now evolved in to a well-recognized hub of knowledge in the global research arena.

The main objective of this symposium is to provide an open platform for sharing research information and getting challenging inputs from expert global research community, thus encouraging further refining and advancement of the quality of research findings and knowledge dissemination.

Addressing the challenges prevalent in current global circumstances, it is a great pleasure of success to conduct this symposium as a hybrid session, achieving our expectations in sharing research knowledge.

I would like to acknowledge and highlight the significance of the esteemed presence of H.E. Dewi Gustina Tobing, the Ambassador of the Indonesian Republic to Sri Lanka, as the chief guest, as well as H.E. Mr. Mizukoshi Hideaki, the Ambassador of Japan to Sri Lanka, as the guest of honor. Their participation in this forum adds a special dimension to its importance. On behalf of the symposium organizing committee, I extend a warm welcome to them and express our heartfelt gratitude for gracing this occasion. Agricultural research and development have emerged as a significant driving force for many economies. This is because agricultural policy planning, decision making, technology transfer, and extension directly rely on them, resulting in sustainable agricultural practices that increase crop production, enhance affordable nutrition, and improve farmers' income and livelihoods. The theme of this year's symposium, "Sustainable Utilization of Agricultural Resources: The Way Forward to Food Security and Economic Development," holds immense importance in light of the global food crisis triggered by the aftermath of the COVID-19 pandemic. It also addresses the challenges of local food scarcity and complications arising from factors such as unprecedented currency devaluation and disjointed economic decision-making. The research work presented and discussed in this symposium plays a crucial role in addressing these issues and highlighting the significance of finding sustainable solutions for food security and economic development. The success of this symposium owes a great deal to the abundance of high-quality research papers that were submitted. I would like to extend my special thanks to all the academics and researchers who generously contributed their valuable work. Without their dedication and hard work, this symposium would not have been possible. I would like to express my heartfelt appreciation to the keynote speakers of the various sessions, whose expertise and contributions from diverse global locations and time zones have played a significant role in making this event a resounding success. Their valuable insights and knowledge have greatly enriched the symposium, and their participation is truly appreciated. I, also, take this opportunity to thank all the session panel heads and members, session facilitators and all the organizing committee members who became a great strength and rendered an invaluable support in making this symposium a success.

I sincerely appreciate everyone's contributions and urge all participants to strive for an even greater success, making this symposium a memorable and impactful event in the research arena.

Dr. I. R. Palihakkara
Coordinator- ISAE 2023

Message from the Chief Guest

Keynote Speech

Her Excellency Mrs. Dewi Gustina Tobing
Honourable Ambassador of Indonesia to Sri Lanka

I am delighted to be present at this significant event taking place at the Faculty of Agriculture, University of Ruhuna. I extend my sincere gratitude for the gracious invitation to deliver the keynote address.

The primary goal of this symposium is to foster a commendable endeavor in uniting agricultural and environmental professionals, researchers, and academics from both national and international backgrounds. By doing so, we aim to engage in meaningful discussions regarding the challenges faced in today's agricultural landscape and explore strategies to effectively overcome these obstacles and recover swiftly.

I would like to extend my heartfelt congratulations to Dr. Indika Palihakkara and his team for their exceptional efforts that have led to the resounding success of this symposium. I deeply value his unwavering support and proactive efforts in enhancing the relationship among various stakeholders in multiple countries, specifically in regards to agriculture and its interconnectedness with environmental sustainability.

Undoubtedly, agriculture holds significant importance in both the Indonesian and Sri Lankan economies. This vital sector encompasses expansive plantations, operated by either state or private entities, as well as smallholder farms predominantly managed by traditional agricultural households, often passed down through generations.

As outlined by the Balance Small Business, agriculture assumes a paramount role due to several compelling reasons. It profoundly affects communities by fostering livelihoods through the provision of sustenance, habitat preservation, and employment opportunities. Additionally, agriculture serves as a critical source of raw materials for various food and non-food products. Furthermore, it plays a pivotal role in bolstering economies by facilitating trade and contributing to their overall strength and stability.

Nonetheless, there remain obstacles that impede the full realization of its potential. Challenges such as inadequate technological advancements and complexities within the supply chain hinder the agricultural sector. These difficulties are exacerbated by extended periods of adverse weather conditions, such as drought, which result in shortages of essential commodities like rice, wheat, and other staple foods.

The agriculture sector in many developing countries is currently grappling with emerging challenges, including the rising demand for food traceability and the detrimental effects of climate change. As a result, it has become imperative for these nations to expedite the adoption of advanced technologies and foster innovation within their agricultural practices. The pace of implementation needs to accelerate significantly compared to previous efforts in order to effectively address these pressing issues.

Leveraging technology to enhance the agricultural sector has the potential to yield several benefits, including streamlining the distribution chain from farmers to consumers, minimizing the industry's substantial carbon footprint, and fostering more equitable economic growth within these countries.

As per the committee's request for an example showcasing Indonesia's best practices in cultivating oil palms and maximizing its economic potential, I would like to share some insights.

Oil palms are a type of vegetable oil that holds great importance as an edible product, contributing significantly to global food consumption patterns. In Indonesia, the cultivation of oil palms has been implemented as a successful model, demonstrating effective techniques and strategies that harness its economic benefits.

Oil palms have become an ubiquitous ingredient found in numerous products, making it challenging to avoid their presence. They are extensively used in a wide array of supermarket food items, ranging from chocolate, bread, biscuits, ice cream, to baked goods. The global demand for oil palms in the food industry continues to soar, surpassing the demand for other vegetable oils.

Similarly, in Sri Lanka, oil palms are widely utilized in consumer goods and serve as primary inputs for industries such as bakeries and confectionaries. Studies indicate that approximately 50% of all consumer products in Sri Lanka incorporate oil palms. The industries associated with oil palms provide employment opportunities to at least 100,000 individuals in Sri Lanka.

This clearly underscores the irreplaceable characteristics of oil palms. Their production makes a noteworthy contribution of 3.5% to the GDP of Indonesia and 3.8% to the GDP of Malaysia. These figures highlight the crucial role of oil palms in bolstering the economies of these countries and playing a part in poverty alleviation efforts.

Over the years, oil palms have emerged as one of Indonesia's most valuable commodities. In 2022, Indonesia secured its position as the world's largest producer of crude oil palms, with a staggering production of 46.73 million tons. This labor-intensive industry has played a tangible role in poverty reduction, benefiting over 17 million individuals. As a result, oil palms have contributed significantly to Indonesia's progress towards achieving the Sustainable Development Goals (SDGs) by 2030.

Considering the projected growth in the global market for vegetable oils, which is expected to increase from 199.1 million MT in 2020 to 258.4 million MT by 2026, it becomes crucial to ensure an adequate and consistent supply of vegetable oils. This is essential to prevent price volatility and shocks to the global economy, given the growing global population and the widespread use of vegetable oils across various industries.

Indonesia places significant emphasis on ensuring that its agricultural commodities, including vegetable oils, meet global sustainability standards. In this regard, certification plays a crucial role in the sustainability framework, forming the foundation for implementing sustainable practices that lead to improved efficiency and productivity.

In Indonesia, the oil palms industry has been committed to implementing sustainable practices through the 'Indonesian Sustainable Oil palms (ISPO)' program. This program covers oil palm management and supply chain certifications, including plantations, independent and organized smallholdings, and oil palm processing facilities across Indonesia.

In a manner similar to Indonesia, the oil palms industry in Sri Lanka has made considerable strides in adopting the principles of sustainable oil palm cultivation. This includes adhering to rigorous sustainability criteria encompassing social, environmental, and economic best practices.

During my visit to Sri Lanka, I had the opportunity to visit the Nakiyadeniya estate, which is an oil palms plantation. While there, I observed the various agronomic practices used in the cultivation process to gain a better understanding of the quality of the operation. I was impressed by the numerous initiatives undertaken by the estate's management in implementing sustainable agricultural practices across all of its plantations. Furthermore, I commend the estate for obtaining and consistently maintaining the Roundtable on Sustainable Oil palms (RSPO) certification. It is evident that the estate sets a benchmark for sustainable oil palms cultivation in Sri Lanka.

Misconceptions surrounding oil palms have emerged, primarily related to concerns such as deforestation, wildlife loss, and health implications. These issues have contributed to an unfavorable reputation for both oil palms and the industry as a whole. However, significant strides have been made in the past decade to address these concerns and align oil palm production with global sustainability goals. As a result, oil palm cultivation has become increasingly recognized as one of the more sustainable and economically viable crops available.

According to information from the official website of the Palm Oil Industry Association of Sri Lanka, there is a scientific fact about oil palms that is supported by Harvard nutrition experts: they state that oil palms are a better option than high trans-fat shortenings and likely even a better choice than butter.

Numerous studies have demonstrated the potential health benefits of oil palms, including their ability to reduce risk factors associated with heart disease and support optimal brain functioning. Additionally, oil palms are rich in tocotrienols, a type of vitamin E that functions as a potent antioxidant.

The claim that the oil palms industry contributes to deforestation is unfounded. In reality, oil palms cultivation requires less land and is more efficient compared to other vegetable oils. To put it into perspective, producing 80,000 MT of oil from coconuts would necessitate approximately 80,000 hectares of land, whereas oil palms would only require 20,000 hectares for the same amount of oil production.

On this special occasion, I would like to urge all stakeholders to support the growth of the agricultural sector in order to reinforce the global endeavors towards achieving food security for all. I am confident that all stakeholders attending this symposium are eager to provide the industry with their expertise and best practices, in order to promote the sector's growth while simultaneously enhancing the economic well-being and quality of life of the communities involved.

I would like to emphasize the significance of empowering farmers in Sri Lanka through the implementation of the 'smallholder model.' Such initiatives hold great potential to improve the quality of life for farmers engaged in the agriculture sector. By providing support and resources to smallholders, we can enhance their livelihoods and create sustainable economic opportunities.

In conclusion, I extend my heartfelt congratulations to the University of Ruhuna for organizing this immensely successful symposium. I also express my gratitude to all the participants for their valuable contributions and active engagement. As I conclude my remarks, I extend my best wishes to the symposium and all its stakeholders for their future endeavors.

Her Excellency Mrs. Dewi Gustina Tobing
The Ambassador of Indonesia to Sri Lanka

Message from the Guest of Honour

His Excellency Mr. Hideaki MIZUKOSHI
Honourable Ambassador of Japan to Sri Lanka

Congratulations on the holding of the "International Symposium on Agriculture and Environment (ISAE) 2023!"

I sincerely express my deep appreciation for all the efforts put in by the faculty and staff of the University of Ruhuna to make this grand event a reality.

I have heartfelt gratitude for having been invited to this event to address this wonderful audience here in this auditorium and online.

It is highly commendable that the organizers of the symposium have overcome many challenges even during the pandemic and the ensuing economic hardship and continued this important academic exchange program despite adversity. It is also heartening that many of the key actors in organizing this symposium are faculty members of the University of Ruhuna who have earned a Ph.D. from Japanese universities. Yesterday, we organized a gathering with the professors and lecturers of the University of Ruhuna who had studied in Japan. I was very impressed not only with the sheer number of those Japan alumni but also the attachment they showed to the relationship with Japan, making me to have a strong desire to work with you to deepen the relationship between the Embassy of Japan and the University of Ruhuna.

At the time of tremendous challenges for Sri Lanka, economically, politically and in terms of social cohesion, everyone's eyes are on how Sri Lanka would come out of the current economic crisis and get back on the development path.

While the primary focus of Japan's assistance to Sri Lanka at this very moment is on the IMF process and nailing down the debt restructuring, agriculture, and overall rural development, including livelihood improvement, empowerment of marginalized communities, nutrition and health condition support remain indispensable parts of our assistance. At this crucial moment, President Wickramasinghe is visiting Japan next week to attend the "Future of Asia" international conference, where he is expected to deliver a speech and have bilateral meetings with his counterparts in Japan. It is hoped that President will articulate the case for Sri Lanka toward the world and garner support for the country to move forward. It is also hoped that this visit will bring about positive impacts, directly or indirectly, on the development of agriculture and environmentally sound economic growth.

However, weathering the financial crisis at hand does not automatically promise future prosperity but it is essentially important that employment is secured, and production potential is achieved while extensive structural reforms are implemented.

In this sense, agriculture undoubtedly plays an important role in realizing Sri Lanka's balanced growth, and protecting the environment in the course would prompt innovation and sustainable development. It would be proven prescient of the University of Ruhuna to hold this symposium at this critical juncture for Sri Lanka. I hope the insightful speech by Ambassador Dewi Gustina Tobing and the discussions that follow will give us new perspectives in tackling the challenges facing agriculture and the environment.

As many of the faculty members here who have studied in Japan are well aware, Japan's landscape is largely agrarian dotted with a small number of industrial centers. Agriculture continues to be important for the life of the Japanese. Although the proportion of agriculture in Japan's GDP has shrunk over the course of Japan's industrialization, it still plays an important role not just in feeding

the population but in maintaining ecosystem, serving as natural protection against natural disasters, and providing testing grounds for the 21st century agriculture. Here, I would like to thank the organizer of this symposium for arranging a special Japanese session following this plenary session. We will showcase modern Japanese agricultural development and Japan's assistance to Sri Lanka in agriculture and related areas in greater details. I hope the participants of the Japan session find it informative and worth your time.

To conclude my remarks, I wish you all a very successful symposium and stronger connections between researchers, policy makers and everyone who is making a difference in agriculture and the environment.

Thank you very much.

His Excellency Mr. Hideaki MIZUKOSHI
The Ambassador of Japan to Sri Lanka

Pre-Symposium Visit

of

His Excellency Mr. Hideaki MIZUKOSHI,

The Ambassador of Japan to Sri Lanka

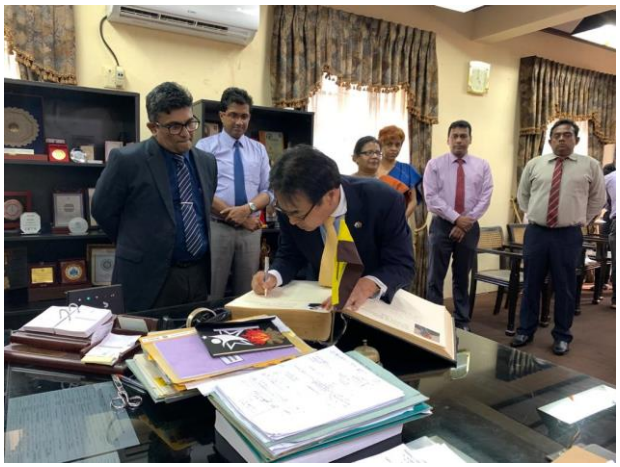
to

the University of Ruhuna, Sri Lanka

ISAE - 2023

Visit of Honourable Ambassador of Japan to Sri Lanka and Japan International Cooperation Agency (JICA) delegates to University of Ruhuna, Matara, Sri Lanka

His Excellency Mr. Hideaki MIZUKOSHI, the Ambassador of Japan to Sri Lanka and Japan International Cooperation Agency (JICA) delegates visited the University of Ruhuna, Matara on 17th May 2023 prior to the International Symposium on Agriculture and Environment (ISAE) 2023 organized by the Faculty of Agriculture, University of Ruhuna. His Excellency Mr. Hideaki MIZUKOSHI had a productive discussion with Ven. Dr. Akuratiye Nanda Thero, Chancellor – University of Ruhuna, Sri Lanka, Prof. E.P.S. Chandana, Deputy Vice-Chancellor – University of Ruhuna, Sri Lanka, and Dr. I.R. Palihakkara - Coordinator of ISAE 2023 and other officials of University of Ruhuna for possible interaction programs between Japanese Higher Educational Institutes and University of Ruhuna, Sri Lanka. His Excellency Mr. Hideaki MIZUKOSHI also visited Geoffrey Bawa's architectural constructions inside the university premises. Later in the evening of the same day, His Excellency Mr. Hideaki MIZUKOSHI and the Japanese Embassy of Sri Lanka hosted a dinner gathering for all the academic staff members of the University of Ruhuna who completed their postgraduate studies in Japan at Grand Navro Hotel, Matara to foster the development of the positive and productive relationship between two parties.



His Excellency Mr. Hideaki MIZUKOSHI, the Ambassador of Japan to Sri Lanka signing the visitors' book at the Vice Chancellors office, University of Ruhuna

Planting of a nationally important "Mee plant" at the main university premises to commemorate the visit of the honourable the Ambassador of Japan to Sri Lanka

Observation visits to witness the Geoffrey Bawa's architectural constructions inside the university premises

Dinner function hosted by the Japanese Embassy for the academic staff members of University of Ruhuna

Japan at Ruhuna

Special Interactive Session with

His Excellency Mr. Hideaki MIZUKOSHI,

The Ambassador of Japan to Sri Lanka

and

Japan International Cooperation Agency (JICA)

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Agricultural Development and Food Security: What Have We Learned?

Dr. Kazuo Ogata

Professor Emeritus, Kyushu University, Japan
Chief Advisor, JICA Expert, PRECIDA-UOJ

To ensure both food security and economic development, it is crucial to use agricultural resources sustainably. Food security, which is just as important to a nation as energy and military, refers to the availability of sufficient, safe, nutritious food that meets people's dietary needs and preferences for a healthy and active life, regardless of economic status or time. In this presentation I will show an example of Japanese agriculture to introduce the agricultural development and food security.

The full-scale modernization of Japanese agriculture began about 150 years ago with the revolution known as the Meiji Restoration. The development of rice yields in Yamagata Prefecture, one of the major production areas, shows the changes in varieties, technologies, and policies. Especially after World War II, there was a remarkable development in terms of production efficiency. However, structural changes in agriculture have progressed, and today Japanese agriculture faces the challenges of low food self-sufficiency, weak competitiveness in the global market, and aging farmers. Innovation in agriculture is one important means of overcoming these difficulties.

The concept of food security emerged in the 1970s, emphasizing the importance of people's access to food. Access has two components: economic and physical. All countries face the problem of food security, albeit on different scales and to different extents. There are three basic tools to achieve food security: domestic production, stockpiling, and imports. How these tools are balanced depends on the circumstances of individual countries.

Japan's food situation has become increasingly dependent on foreign countries over the past 50 years. Statistics for 2021 show a comprehensive self-sufficiency rate of only 38% on a calorie basis. The decline in self-sufficiency has been attributed to changes in lifestyles, but policy factors have also been criticized. The cold snap of 1993 severely damaged rice cultivation, and it was at this time that the government stockpile rice program was established. The global food crisis of 2008 did not have much impact on Japan, but the Great East Japan Earthquake of 2011 clearly demonstrated the important role played by logistics and retail in the restoration of the food supply chain.

Food security cannot be achieved by governments alone. It requires individuals and organizations at all levels of society to take ownership and understand the costs involved. For Japan, the benefits it receives from the rest of the world may be expanded by providing other countries with crop improvement technology, infrastructure development, administrative know-how, and other benefits. For example, it may be possible to expand the potential import volume of grains and stabilize prices. Multifaceted expansion of interdependence, rather than imports from specific countries, would be an effective means of building a reliable and stable food supply.

Planting the Seeds of Hopes and Friendship

Mr. Tetsuya Yamada

Chief Representative, JICA Sri Lanka Office

JICA is 'One Stop Shop of Japan's Official Development Assistance (ODA)'. Definition of ODA is provided by official agencies, including state and local governments, or by their executive agencies to promote the economic development and welfare of developing countries as its main objective. Under JICA's Vision 'Leading the World with Trust' and JICA's Mission 'Human Security and Quality Growth', JICA is implementing ODA projects including Technical Cooperation, Loan Aid, and Grants.

JICA has over 70 yeas' history of Cooperation in Sri Lanka. JICA has accepted more than 14,000 trainees in JICA training programs, dispatched over 3,000 JICA experts and 1,100 volunteers, and committed cumulative total of ODA Loans by JPY 1,127 billion. In terms of specific sectors, JICA has contribute to providing 3.5 million people with safe drinking water by water supply projects, developing 550 MW out of 4,535MW installed power generation capacity in Sri Lanka, constructing 86.5km out of total 272km of Sri Lanka's expressway network, and accepted approximately 200 Master/PhD Scholars. JICA is implementing lots of projects under its assistance strategy in Sri Lanka, 'Promoting Quality Growth', 'Development Cooperation for Inclusive Growth', and 'Mitigating Vulnerability'.

Looking back at the history of JICA's cooperation in Sri Lanka, agriculture sector takes the most of JICA's assistance. JICA has contributed to 'Transformation of Economy and Society of Sri Lanka', 'Improving Welfare of Farmers', 'Keeping Up with Current Needs of Time', 'From Upstream to Downstream', and 'Long-term, Human-to-Human Engagement' through implementing agriculture related projects.

Now JICA is implementing five agricultural projects. Currently JICA is focusing on overcoming this crisis and supporting farmers and government authorities to increase productivity, exploit export potential, make agricultural sector be resilient against shocks and crisis, and improve livelihood of rural population through the agriculture projects. After this firefighting stage, JICA has to make agricultural sector more resilient and vibrant by promoting digital Transformation (DX), providing higher education to farmers and relevant government officers, and increasing the number of skilled workforces in agriculture sector.

Message from the Chairman, National Science Foundation (NSF) – Sri Lanka

Emeritus Professor Ranjith Senaratne

Chairman, National Science Foundation (NSF) Sri Lanka
General President, Sri Lanka Association for the Advancement of Science (SLAAS)

It gives me great pleasure to be associated with the Japan - Ruhuna Special Interactive Session held on 18 May 2023 at the Faculty of Agriculture, University of Ruhuna in conjunction with the International Symposium on Agriculture and Environment (ISAE - 2023). Participation of His Excellency Mr. Hideaki Mizukoshi, Ambassador of Japan to Sri Lanka and Emeritus Professor Kazuo Ogata and Mr. Tetsuya Yamada of JICA at this interactive session affords a rare and valuable opportunity to discuss how the academic cooperation and research collaboration between the University of Ruhuna and Japanese Universities and relations between Japan and Sri Lanka could be further enhanced and nurtured in a mutually rewarding and reinforcing manner.

It is with profound gratitude that we recall the great generosity and benevolence extended by Japan to Sri Lanka and its people ever since diplomatic relations between the two countries were established in 1952. We can hardly think of any area or sector or field of activity that has not received Japanese assistance. Its contribution to socio-economic development, peace building & reconciliation and capacity building is unparalleled. Japan has provided postgraduate training - human capital development - to a substantial number of academics, scientists, and professionals in Sri Lanka. It, in the recent past, amounted to over 50 at the University of Ruhuna alone, of which over 30% has been at the Faculty of Agriculture, which now has a strong "Japanese flavour". The Japanese alumni in the country with their wide networks collectively constitute a powerful force, and it could potentially make a significant impact on the cooperation and relations between Japan and Sri Lanka. However, this potential hitherto remains rather untapped and underexploited.

As an Emeritus Professor of the University of Ruhuna and as Chairman of the National Science Foundation (NSF) and General President of the Sri Lanka Association for the Advancement of Science (SLAAS), I strongly feel that that institutions such as the Japanese Graduates' Alumni Association of Sri Lanka (JAGGAS) and JICA Alumni Association of Sri Lanka and their networks could be leveraged and harnessed to promote S&T, particularly through strategic engagement with institutions such as the Japanese Society for Promotion of Science (JSPS) to the benefit of humanity while fostering and consolidating relations between the countries.

The JSPS has established 11 overseas offices in different parts of the world, including N. America, S. America, Europe, East Asia, South-East Asia and Africa. The SAARC region comprises 8 countries which account for nearly 25% of world population. Sri Lanka because of its strategic location and cordial relations with all the member countries of the SAARC, shows promise as an ideal location to establish an overseas office of the JSPS which can contribute to enhancing the S&T base in the region which is presently at a low ebb. In addition, it will provide Japan with strategic access to a very important region in the world with a population over 2 billion.

As the General President of the SLAAS, I have proposed "**Science Diplomacy as a powerful force for national unity and friendship among nations**". Japan has been consistently supporting Sri Lanka in the process of peace building and reconciliation and even appointed a Special Peace Envoy to Sri Lanka, Mr. Yasushi Akashi, to facilitate and direct it. The profound unifying, bonding, and healing power of S&T to bring about unity, harmony and friendship among communities and nations is globally recognized and accepted with many success stories. Therefore, I wish to work with the relevant Japanese institutions to promote national unity and reconciliation through science diplomacy.

This special session, in my opinion, will lay a firm foundation for a mutually beneficial long journey, propelling the relations and cooperation between Sri Lanka and Japan to a new high. Therefore, I

wish to express my deep appreciation to Dr. Indika Palihakkara, coordinator of the ISAE - 2023, for organizing this historic event at the Faculty of Agriculture, University of Ruhuna at this decisive juncture.

Looking forward to working closely with the Japanese Embassy and JICA in a mutually rewarding and beneficial manner!

Message from the University of Tokyo Sri Lanka Office (UTokyo Sri Lanka Office)

Senior Professor H.D. Karunarathne

Vice Chancellor, University of Colombo, Sri Lanka
Director, UTokyo Sri Lanka Office
Chairman, Institute of Policy Studies, Sri Lanka

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan appointed the University of Tokyo for the implementation of "The Study in Japan Global Network Project" in South Asia. By following that, the international strategy group in the University of Tokyo decided to open the University of Tokyo Sri Lanka (UTokyo Sri Lanka Office) Office since 16th January 2020.

The main purpose of this office is to provide information on university placements and scholarship programs available in over 700 universities in Japan to students in Sri Lanka. As a start UTokyo Sri Lanka Office conducted their first study in Japan awareness session at High School Level on 2nd January 2020 at Visakha College Colombo. From there the UTokyo Sri Lanka Office was able to conduct over 241 awareness sessions covering over 23,000 high school students in Sri Lanka during the 2020-2023 period. Also, UTokyo Sri Lanka Office conducted their first study in Japan awareness session at University Level on 2nd January 2020 at Sabaragamuwa University of Sri Lanka. From there the UTokyo Sri Lanka Office was able to conduct over 8 awareness sessions covering over 1,500 university students in Sri Lanka during the 2020-2023 period. These awareness sessions explain the importance of Study in Japan, priority areas to study in Japan, requirements to Study in Japan, Japanese language and JLPT exams, admission and Visa Procedures and scholarship opportunities in Japan.

At the UTokyo Sri Lanka Office, we have been collaborating closely with the Embassy of Japan in Sri Lanka, Japanese graduates' Alumni Association (JAGAAS), The Japanese Language Teachers Association in Sri Lanka, Japan International Corporation Agency (JICA) in Sri Lanka, and other stakeholders in both Sri Lanka and Japan to enhance the relationship between Japan and Sri Lanka. Our joint efforts are aimed at promoting the education system in Japan for Sri Lankans.

These awareness sessions explain the importance of Study in Japan, priority areas to study in Japan, requirements to Study in Japan, Japanese language and JLPT exams, admission and Visa Procedures and scholarship opportunities in Japan.

Diversity of Food Culture and Cuisine

Focused on the Use of Ingredients in Contemporary Japanese and Sri Lankan Cuisine

Prof. Dilrukshi Rathnayake

Department of Modern Languages
University of Kelaniya

This paper focuses on the diversity of food culture and cuisine in contemporary Japanese and Sri Lankan cultures. The purpose of the paper is to identify the basic characteristics of ingredients used in Japanese and Sri Lankan foods and cuisine. Furthermore, it examines the differences in taste perception and consumption of regular daily meals between Sri Lankan and Japanese people.

Considering the food culture of Japan and Sri Lanka, several similarities can be identified. Both Sri Lanka and Japan consume rice as their staple food. Moreover, it appears that both cultures seek similar types of taste by using different ingredients (such as wasabi-pepper and umeboshi-lime pickle) in certain foods. However, even when the same ingredients are used, a completely different taste is produced due to variations in cooking and seasoning methods.

Regarding the differences in taste perception, a clear result emerged from a survey conducted with a sample of 20 individuals from each Japanese and Sri Lankan culture, aged between 23 and 50. The survey shows significant variations in taste perception between Japan and Sri Lanka. The percentage of Sri Lankan people who consume strong spicy foods is 47%, while no Japanese participants reported consuming such foods. Additionally, 27% of Sri Lankans prefer strongly sweetened food, and 53% consume moderately sweetened food, whereas the majority of Japanese individuals (53%) prefer to avoid sweetened food in their daily meals.

These findings indicate that Sri Lankan taste perception leans toward stronger flavors, while Japanese people tend to prefer milder tastes compared to Sri Lankans.

There is often a tendency to consider both Japanese and Sri Lankan cultures as sharing many similarities, given that they are both Asian countries. However, according to Ashkenazi (2003), although Japan is close enough to be influenced by Asian culture, it is also far enough off the coast to be less affected by continental features. Similarly, Sri Lanka is an independent island with less influence from mainland Asia, further suggesting cultural differences rather than similarities between Japan and Sri Lankan cultures.

Message from The University of Tokyo Alumni Association - Sri Lanka Chapter

Mr. Shantha Hewage

Senior Research officer
Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) Colombo 07

As an executive committee member of UTokyo Alumni Association. I welcome this opportunity to issue this message commemorating the inauguration of Japan at Ruhuna session in the ISAE 2023.

Sri Lanka Chapter of UTokyo Alumni Association is the 53rd such association globally and was inaugurated in 2017 under the auspices of His Excellency Sujimori Akito, the Japanese Ambassador to Sri Lanka and Mr. MORI Kazuhiro, Director of the Alumni Office, University of Tokyo.

A large number of distinguished Alumni from University Tokyo, representing the government sector, private sector and universities in Sri Lanka participated in this historic occasion and Dr. I.R. Palihakkara (Senior Lecturer- University of Ruhuna) was elected the founder president.

Our Association thrives to maintain a lasting and productive mutual relationship between Sri Lanka and Japan, especially with the University of Tokyo. Under this initiative, we have organized a number of successful interactive projects that are listed below.

Hands-on Experience in Field Work in Sri Lanka for UTokyo undergraduate and graduate students:

Initiated in 2018, this program already has continued for 04 times including the 2021 session held online due to the COVID-19 pandemic. The program comprises of one-week residential practical programs on tropical agriculture, especially tea cultivation, traditional agriculture, agroforestry, animal husbandry, cascaded village tank systems and eco-tourism. The program also included visits to University of Ruhuna, an architectural marvel by the renowned Sri Lankan architect Geoffrey Bawa.

Also, all the students and staff had an exclusive opportunity in experiencing Sri Lankan culture, hospitality and food and the participants were enthralled by the involvement and were really appreciative of the experience.

Research Programs on Madu River Wetland:

A research study was carried out covering the Madu River wetlands complex in March 2021 with the objective of studying the impact of the COVID-19 pandemic on small scale fishing communities sustaining around Maadu River area.

Publications:

Following research publications have been published as collaborative work with University of Tokyo and Ramsar Center Japan (RCJ).

Booklet on “Importance and propagation techniques of milky mangrove (*Excoecaria agallocha*)”
Ramsar sites in Sri Lanka- wetlands of international importance, a book published in three languages, i.e., Sinhala, Tamil and English, for the benefit of the societies in Sri Lanka.

Commemoration of World Wetland Day with the School Children:

In order to celebrate World Wetland Day (February 2nd) in 2020, the Faculty of Agriculture, University of Ruhuna and Central Environment Authority (CEA)of Sri Lanka with the partial financial support

from Ramsar Center Japan (RCJ), organized an awareness program for a group of school children from Matara District.

We are especially honoured and excited to witness that HE the Ambassador of Japan to Sri Lanka, Hon. Hideaki Mizukoshi a distinguished alumnus form University of Tokyo, is participating as the guest of honour and Dr. I. R. Palihakkara, also an alumnus from University of Tokyo coordinating the 2023 session of ISAE.

In this privileged outset I, on behalf of The Sri Lanka Chapter of UTokyo Alumni Association, wish all the very best of success for Japan in Ruhuna session and all the contributors and hope ISAE to nourish Sri Lankan Agricultural field through research, development, and knowledge dissemination.

PAPER INDEX – ISAE 2023

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Keynote Speech

Secondary Succession and Wildfires Change the Soil Properties of Abandoned Fields

Peter Šurda

Institute of Hydrology, Slovak Academy of Sciences, Bratislava, Slovakia

***Email -** surda@uh.savba.sk

Abstract

In 1989, Europe experienced a significant social transformation as the Iron Curtain fell and many Eastern European nations saw the demise of communism, ultimately bringing an end to the Cold War. This period also saw the emergence of democratic movements and the establishment of new political systems in these countries. In the 1990s, Slovakia underwent significant economic and social changes, including the transition from a centrally planned economy to a market-oriented one. As a result of this transition, there was a decline in the importance of the agricultural sector in Slovakia. As sandy soils are less fertile, their cultivation is often abandoned.

Abandonment can cause ecosystem recovery by replacing crop species with vegetation that disperses from the surrounding habitats and subsequently establishes itself (secondary succession). Vegetation and its changes during succession can induce soil water repellency. Hydrophobic layers on or near the surface of the soil can result in reduced infiltration occurring in irregular patterns, enhanced runoff and increased erosion rates. Although the burning of grass and crop residues is prohibited in many countries, farmers perceive it as a quick and inexpensive way to get rid of unwanted biomass, often in abandoned fields. Wildfires affect different physical, chemical and hydraulic properties of the soil, and the extent of their effects varies depending on the soil's intrinsic properties and the wildfire's characteristics.

The first objective of our research was to find the impact of secondary succession during more than 30 years of abandonment of agricultural fields on soil parameters, infiltration and surface runoff. The second objective was to estimate the impact of heating temperature on some properties (pH, soil organic carbon content (SOC), and water drop penetration time (WDPT)) of acidic sandy soil and its dependence on the duration of field abandonment. The sites are located in western Slovakia in the central part of the Borská lowland. The method of space-for-time substitution was used so that the fields abandoned at different times were treated as a homogeneous chrono sequence.

The changes in SOC, pH, water and ethanol sorptivity, hydraulic conductivity, WDPT, repellency index, time to runoff, and surface runoff coefficient characterized the impact of abandonment. Our findings indicate that abandoned soils, previously used for agriculture, exhibit a reduction in soil water content and pH, as well as a notable increase in soil water repellency and a decrease in infiltration. These changes can potentially lead to severe issues concerning surface runoff and soil erosion. The pH(H_2O) and pH(KCl) decreased monotonously, and ethanol sorptivity did not change significantly during abandonment. The time to runoff did not change between 10 and 30 years of abandonment significantly and could not be measured in arable field, where no runoff occurred. The dependence of the other characteristics on the duration of field abandonment was not unambiguous. Water sorptivity and hydraulic conductivity showed a decrease between 1 and 10 years, followed by a slight increase between 10 and 30 years of abandonment. On the other hand, soil organic carbon content, water drop penetration time, repellency index, and surface runoff coefficient showed an increase between 1 and 10 years, followed by a slight decrease between 10 and 30 years of abandonment.

Different heating temperatures significantly affect soil parameters from abandoned agricultural areas with different durations of secondary succession. We found that soil samples exposed to higher

heating temperatures (up to 400 °C) showed higher persistence of the soil water repellency characterized by WDPT. The pH values increased with the heating temperature. The SOC content showed the opposite trend and decreased with the heating temperature. The arable field had the lowest initial SOC content, while the 10-year abandoned field had the highest. Furthermore, the WDPT increased with temperature and ceased at 400°C in samples from all plots.

Abandoned fields with sandy soil underwent secondary succession and wildfires, resulting in a notable rise in water repellency that could contribute to the development of soil drought, heightened surface runoff, and soil erosion. To mitigate soil water repellency and its associated consequences in sandy soils, it is essential to maintain adequate soil water content, and mixed forest afforestation should be prioritized over pine afforestation.

Keywords: Abandoned fields, Heating temperature, Sandy soil, Soil parameters, Soil water repellency

Oral Presentations

ID 12

Calculation of vegetation changes in western, southern and eastern coasts of Sri Lanka by using GIS and remote sensing techniques

A.P Madarasinghe[1*], P.H.C.J Thennakoon[1], E.P.D.N Thilakarathne[1] and T.W.S Warnasuriya[2]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2] Faculty of Fisheries and Ocean Sciences, Ocean University of Sri Lanka, Tangalle, Sri Lanka

Abstract

Coastal vegetation provides protection against various water-related events and serves as a cost-effective alternative for both tsunami and general coastal protection in developing countries. The coastal zone is a highly dynamic area that experiences sudden changes due to natural and anthropogenic activities, and the coastal vegetation is also subject to rapid changes in response to these dynamics. To monitor these changes effectively, the use of GIS and remote sensing techniques is the most efficient method. Therefore, this study was conducted to analyze vegetation changes up to 2 km landward area from baseline in Western, Southern and Eastern coasts in Sri Lanka using geo-referenced Sentinel-2 (10 m resolution with less than 10% cloud cover) images. Sentinal-2 launched on 2015 and more clear images available from 2017. To conduct this study, data from the years 2017, 2018, and 2020 were utilized. The changes in vegetation were estimated by calculating the Normalized Difference Vegetation Index (NDVI) using ArcGIS 10.8 software. The findings indicate that the total vegetation cover on each coast underwent changes. Specifically, on the West coast, the vegetation cover was estimated to be 367.49 km^2, 376.01 km^2, and 371.90 km^2 in 2017, 2018, and 2020, respectively. From 2017 to 2018, the vegetation cover increased by 8.52 km^2, but decreased by 4.11 km^2 in 2020. On the Southern coast, the vegetation cover was calculated as 441.63 km^2, 446.84 km^2, and 436.25 km^2 in 2017, 2018, and 2020, respectively. Vegetation cover increased by 5.21 km^2 from 2017 to 2018 and then decreased by 5.38 km^2 in 2020. On the East coast, calculated as 433.43 km^2 in 2017, 386.62 km^2 in 2018, and 460.88 km^2 in 2020. Coastal vegetation decreased by 46.81 km^2 in the first two years and increased by 74.26 km^2 in 2020. Calculated Kappa coefficient is 88.6% for Accuracy testing. The changes observed in coastal vegetation could be attributed to various factors such as human activities, coastal development, or natural phenomena. Monitoring and analyzing coastal vegetation changes are crucial for maintaining coastal protection against both natural and anthropogenic activities, as well as for the planning of future development projects.

Keywords: Coastal vegetation, GIS, NDVI, Sentinel

[*] ***Corresponding Author:*** poornima95madarasinghe@gmail.com

ID 38

Effect of different growing media on growth and yield of cabbage (*Brassica oleracea* L. var Green Coronet) under controlled environmental conditions

U.D.T. Perera[1*], S. Subasinghe[1], K.K.L.B. Adikaram[2], H.K.M.S. Kumarasinghe[1], M.K.D.K. Piyaratne[2]

[1]Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka.
[2]Computer Unit, Faculty of Agriculture, University of Ruhuna, Sri Lanka.

Abstract

A study was conducted from August to November 2022 in a protected house at Faculty of Agriculture, University of Ruhuna to evaluate the effect of different growing media on growth and yield performances of cabbage (*Brassica oleracea* L. var Green Coronet) under controlled environmental conditions. The experiment was carried out in a Completely Randomized Design with four replicates. In this experiment, three different types of growing media were evaluated, namely coir dust, a 1:1 mixture of coir dust and sand, and sand alone. The particle size of sand was 0.2 - 2 mm in diameter. The application rate of the Albert's solution, a liquid inorganic fertilizer was 1.0 g/plant/day. Temperature and relative humidity inside the protected house were maintained at optimum levels by an automation system. Growth parameters (plant height, canopy diameter and number of loose leaves per plant) were taken at fortnight intervals while cabbage heads and total biomass were taken as yield parameters at harvesting. The data were analyzed using ANOVA and means were separated by least significant difference (LSD) at 5% probability level. Results revealed that there was a significant effect of growing media on plant height, canopy diameter, plant weight, head weight and head perimeter. Coir dust and 1:1 coir dust: sand media recorded significantly higher values for plant height, canopy diameter, plant weight and head perimeter over the sand media while coir dust alone medium gave significantly higher fresh weight of head than sand medium. However, fresh weight of cabbage heads from coir dust alone media was not significantly different from the fresh weight of cabbage heads obtained from 1:1 coir dust: sand medium. There is no significant effect from growing media for number of loose leaves per plant. Thus, cabbage can be successfully grown in either coir dust or 1:1 coir dust: sand media in hydroponics under controlled environmental conditions.

Key words: Cabbage, Growing media, Hydroponics, Protected house

Corresponding Author: pereradinusha707@gmail.com

ID 49

Effect of long-term chemical fertilizer application on the rhizospheric microorganisms of the rice variety Bw 372 grown in the low country wet zone of Sri Lanka

T.G.I. Sandamali[1*], N. Deshapriya[2] , M.G.N. Rupaasinghe[1], K.G.N. Sureshika[1]

[1]Regional Rice Research and Development Centre, Bombuwala, Sri Lanka
[2]Department of Botany, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka

Abstract
The use of chemical fertilizers in rice cultivation is prevalent in Sri Lanka, yet limited research has been conducted to assess their impact on soil microorganisms. Therefore, this study aimed to investigate the long-term effects of chemical fertilizer application on microorganisms in the rhizosphere of the rice variety Bw 372, grown in a paddy field located in the Low Country Wet Zone of Sri Lanka. During the 2017/2018 maha season, soil samples were collected from the rhizosphere of two-month old rice plants grown in a plot where chemical fertilizer was applied and a plot without chemical fertilizer for ten consecutive seasons. Eight samples were collected from each plot, with a plot size of 18 m^2. The collected soil samples were analyzed for pH, available phosphorus content, exchangeable potassium content, and organic matter content. Isolation and enumeration of rhizospheric bacteria and fungi were carried out by serial dilution and spread plate techniques. Phosphate solubilization ability and nitrogen fixation ability of isolated bacteria and fungi were evaluated on Pikovskya's agar medium and Burk's nitrogen free medium, respectively. Data was analyzed by using SAS statistical software package. Soil pH of the chemical fertilizer applied plot and plot without chemical fertilizer were 4.98 and 5.01, respectively. The results showed that although soil pH was not affected by chemical fertilization, available P content, exchangeable K content and organic matter content of paddy soil were increased by long-term chemical fertilization. Organic matter content of the chemical fertilizer applied plot and plot without chemical fertilizer were 15.67% and 11.84%, respectively. According to the results, long-term chemical fertilization significantly increased ($p \geq 0.05$) the total culturable bacterial population, fungal population in chemical fertilizer applied plot compared to the plot without chemical fertilizer application. Further, significantly higher number of free-living nitrogen-fixing bacterial isolates were recorded in the plot without chemical fertilizer compared to the chemical fertilizer applied plot. However, number of phosphate-solubilizing bacterial isolates and phosphate-solubilizing fungal isolates in each plot were not affected by long-term chemical fertilization. A total of 10 phosphate-solubilizing fungal isolates and 06 nitrogen-fixing bacterial isolates were recorded from rhizospheric soils in both plots.

Keywords: Chemical fertilizer, Free-living nitrogen-fixing bacteria, Phosphate solubilizing bacteria, Phosphate solubilizing fungi, Rhizospheric microorganisms of rice

Corresponding Author: tgisandamali@gmail.com

ID 56

Effect of different silicon sources on floral quality and vase life of two commercially important varieties of cut roses (*Rosa hybrida* L.)

G.Y.A.D.D. Perera[1*] and P.E. Kaliyadasa[1]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka

Abstract

Rosa hybrida L. is an important commercial cut flower in Sri Lanka with high demand in the local as well as the export markets. However, failure to meet expected quality standards in cut flowers is an obstacle in expanding this profitable industry. This study aimed to assess the impact of specific silicon treatments on enhancing the vase life and cut flower quality of two rose varieties, namely Grand Gala (GG) and White Success (WS), in a greenhouse trial arranged in a Completely Randomized Design (CRD) with three replications per treatment. Rose plants, two months after bud grafting and grown in a standard growth medium of topsoil, cow dung, and sand (in a 5:4:2 ratio) were subjected to different treatments to evaluate the effect of selected silicon treatments on their cut flower quality and vase life. The treatments included foliar sprays of sodium silicate (Na2SiO3) at concentrations of 0, 50, 100, and 150 ppm, and drenching with potassium silicate (K2SiO3) at concentrations of 0, 80, 150, and 200 ppm, both applied on a weekly basis for five weeks. The experiment was set up in a Completely Randomized Design (CRD) with three experimental units per treatment. Incorporation of rice husk ash (RHA) into growth media at establishment (0, 50, 80, and 100 ppm) and drenching with K2SiO3 (150 ppm) significantly improved the stem length (cm), basal and apical stem diameters (mm), bud size (mm) and full bloom size (cm), and fresh weight (g) of flower buds in both cut rose varieties (Grand Gala and White Success) when compared to their respective controls ($p<0.05$). The basal diameter (mm), bud fresh weight (g), bud (mm), and full bloom size (cm) of variety GG were enhanced by the RHA 100 ppm treatment. The plants treated with K2SiO3 (all levels) stored a significantly high amount of silicon in all different parts of the cut flower. In variety GG, silicon was deposited more in the leaves, while it was highest in the flowers of variety WS. The highest vase life of around 12 days for GG was observed in plants treated with 100 ppm of Na2SiO3 and 80 ppm of K2SiO3. This was followed by 150 ppm of K2SiO3, which was not significantly different from the previous two treatments, but was significantly better than all other treatments ($p<0.05$).Moreover, lightness (L*) of petals significantly reduced in WS while significantly highest redness (a*) is reported in GG cut flower petals treated with 150 ppm and 200 ppm of K_2SiO_3 drench ($p<0.05$). This study demonstrate that silicon sources have beneficial effects on improving the floral quality characters of the two cut rose varieties grown under greenhouse conditions. n conclusion, it can be recommended that applying a K2SiO3 drench of 150 ppm is the most effective treatment for enhancing the overall quality parameters in both varieties.

Keywords; Floral quality, Rice husk ash, Roses, Silicon, Vase life

Corresponding Author: dillanjel@gmail.com

Acknowledgement: This work was funded by Uva Wellassa University of Sri Lanka (Grant no. UWU/RG/2019/002)

ID 57

Analysis of the bacterial microbiome by PCR method and determination of Lead and Cadmium contents by Atomic Absorption Spectrometry in commercially available liquid organic fertilizers

D.L.I. Yasara[1,2], K.D.B.M. Wijeratne[2]

[1]Institute of Chemistry Ceylon, Rajagiriya, Sri Lanka
[2]Genetech School of Molecular Diagnostics, Colombo 8, Sri Lanka

Due to the negative impacts caused by the extensive use of inorganic fertilizers, there is an increasing need for organic fertilizers to address environmental issues such as land degradation, eutrophication, and contamination. However, organic fertilizers may also contain heavy metals and other contaminants in addition to nutrients. Hence, it is crucial to examine the quality and suitability of organic fertilizers. The current investigation was focused to analyze the bacterial microbiome and the heavy metal content in three brands of commercially available liquid organic fertilizers (A, B, and C) in the Sri Lankan market. The fertilizer samples were cultured in a Liquid Broth (LB), and the bacterial DNA was extracted by the boiling method. PCR amplification was carried out with universal bacteria and *E. coli* primers followed by the Agarose Gel Electrophoresis. Universal bacteria DNA (371 bp) was detected for all three brands of fertilizers and *E. coli* DNA (101 bp) was detected only in one brand of fertilizers. Determination of heavy metals was achieved by open-vessel acid digestion of fertilizers. The concentrations of Lead (Pb) and Cadmium (Cd) in Liquid Organic Fertilizers were determined by the Standard Addition method using Flame Atomic Absorption Spectroscopy (FAAS), at wavelengths of 283.3 nm for Lead (Pb) and 228.8 nm for Cadmium (Cd), respectively. The concentrations of Lead (Pb) in the three fertilizer brands were 0.355 ± 0.004 mg/kg, 0.315 ± 0.004 mg/kg, and 0.363 ± 0.005 mg/kg, whereas the concentrations of Cadmium (Cd) were 0.011 ± 0.001 mg/kg, 0.013 ± 0.001 mg/kg, and 0.009 ± 0.001 mg/kg, respectively. The molecular analysis shows the presence of Universal bacteria and *E.coli* in fertilizers. The results of the heavy metal analysis confirmed that both Lead (Pb) and Cadmium (Cd) concentrations lie within the acceptable limits (Pb = 1.0 mg/kg, Cd = 0.5 mg/kg) as of SLS 1702:2021 for all three brands. Detection of *E.coli* may exert adverse effects on the environment as well as human health and the results of this study are of special scrutiny in the review of human health risk assessments. Thus, this study has significance in determining the quality of the liquid organic fertilizers available in the local market.

Key Words: Atomic Absorption Spectrometry, Boiling Method, Liquid Organic Fertilizers, Open Vessel Digestion, Polymerase Chain Reaction (PCR)

***Corresponding Author*:** isuri.iyd@gmail.com

ID 58

Potential of biochar amendment in ameliorating acid sulfate soil under different water management regimes

Hettihewa G.D [1*], Sandamali T.G.I[2], Sandanayake S[3], Vithanage M[3] and Dissanayaka D.M.S.B[1]

[1]Department of Crop science, Faculty of Agriculture, University of Peradeniya, Peradeniya
[2]Regional Rice Research and Development Centre, Bombuwela
[3]Ecosphere Resilience Research Center, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda

Abstract

Acid sulfate soils (ASS) are not readily suitable for crop cultivation, because most crops are intolerant to soil acidic conditions. The occurrence of ASS in the Wet Zone of Sri Lanka has been a significant barrier to paddy cultivation. Phosphorous (P)-deficiency coupled with Aluminium (Al)-toxicity are the key constraints for crop growth in ASS. This study aimed at investigating the changes of nutrient availability in ASS in response to addition of biochar and different P sources under two water management regimes. An incubation soil experiment was conducted at Regional Rice Research and Development Center, Bombuwala as a two-factor factorial experiment in a complete randomized design with 3 replicates for a period of one month. ASS collected from a farmer paddy field was used for the experiment. Treatments comprised of application of Triple Super Phosphate (TSP) (35 kg/ha) to the recommendation of the Department of Agriculture, Sri Lanka for rice crop, Rock Phosphate (RP) as the same rate of P_2O_5 of TSP application, rice husk biochar (5% of dry weight of soil) and unfertilized control soil. All treatments were evaluated under two water management regimes, Continuous Flooding (CF) (2-cm water level above the soil) throughout the experimental period and Alternate Wetting and Drying (AWD) (2-cm overlying water for one-week, removed and kept drying during succeeding week). After one month, soil was sampled and analyzed for pH, electrical conductivity, available P, Potassium (K), total Nitrogen (N), and bioavailable concentrations of Al, Iron (Fe), Zinc (Zn), Manganese (Mn), Copper (Cu) and Cobalt (Co). Biochar addition significantly ($P<0.05$) increased soil pH (CF 3.17±0.00, AWD 3.19±0.01) bioavailable K (CF 133.33±6.67 mg/kg, AWD 153.33 ± 6.67 mg/kg) and Mn concentrations (CF 10.38±0.36 mg/kg, AWD 13.94±2.03 mg/kg) in soil and there was no any significant influence on the availability of other metals in ASS. Across two water management regimes, bioavailable Al concentration of soil amended with biochar was reduced respectively by 64% and 49% compared to those of soils amended with TSP and RP. The results indicate the potential of amending biochar to increase pH and alleviate Al toxicity in ASS which should be further confirmed by a long-term experiment in the field.

Keywords: Aluminium toxicity, Biochar, Phosphorous deficiency, Soil acidity

Corresponding Author: ag16053@agri.pdn.ac.lk

ID 59

Soil-based screening method for iron toxicity tolerance in rice

W.R.K.D.W.K.V. Wickramasinghe*, V. Lakmali, D. Chandrakanthi, K.K.D.Chandrasekara, S.Umange, H.A.I Sajeewani and S.M.G.D David

Division of Agronomy, Regional Rice Research and Development Centre, Bombuwela

Abstract
This experiment was conducted to find out the suitability of soil-based screening method for iron toxicity tolerance in rice varieties. According to the Fe content of soils, more than 300 ppm Fe content of soils is considered as hot spot soils and below than this level considered as normal soils. Two set of pots were filled with normal soil (Fe=208 ppm) and hot spot soils (Fe=848 ppm) which were taken from two locations of the research field at RRRDC, Bombuwela. These two types of soils were externally treated with different concentrations of $FeSO_4.7H_2O$ to induce Fe^{+2} levels in soil. Seven rice varieties which are known and unknown to iron toxicity tolerance (Bw 267/3, Bw 364 and Bw 372 as tolerant, Bw 272-6b as susceptible and Bg 366, Bg 359 and Ld 408 as unknown) were screened. For each rice variety, five Fe stress levels (0 mg Fe^{+2}/Kg of soil, 100 mg Fe^{+2}/Kg of soil, 300 mg Fe^{+2}/Kg of soil, 500 mg Fe^{+2}/Kg of soil and 1000 mg Fe^{+2}/Kg of soil) were induced by using $FeSO_4.7H_2O$ after four weeks of planting. Leaf bronzing scale (LBS) was recorded according to the scale of Standard Evaluation System for Rice (IRRI, 2002) at six weeks after planting. Mean values of leaf bronzing scale (LBS) was subjected to the Chi Square Test. Results showed that LBS was not significantly different among the two soil types, but significantly different among the induced Fe^{+2} levels in the soil and among the rice varieties used. Rice variety Bw 272-6b and Bg 359 showed LBS higher than 5 in 500 mg Fe^{+2}/Kg of soil induced treatment. However, 1000 mg Fe^{+2}/Kg of soil treatment showed that LBS above 7 in both tolerant and susceptible rice varieties screened and that level is not suitable for screening. Paddy soils treats upto 500 mg Fe^{+2}/Kg of soil by using $FeSO_4.7H_2O$ can be used to screen the tolerance level of rice varieties successfully. Results showed that Bw 267-3, Bw 364, Bw 372, Bg 366 and Ld 408 tolerant to iron toxicity and Bw 272-6b and Bg 359 susceptible to iron toxicity.

Key words: Hot spot soil, Iron toxicity, Leaf bronzing scale, Susceptible, Tolerance,

Corresponding author: wickramasinghekalani@yahoo.com

Acknowledgement: This research was funded by Sri Lanka Council for Agricultural Research Policy

ID 62

Variation of soil nutrients, root growth, and litterfall production across three agroforestry systems: A short-term study

W.M.A.S. Senavirathna*, R.H.G Ranil, T. Sivananthawerl, S.P. Nissanka and D.M.S.B. Dissanayaka

Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Peradeniya

Abstract

Litterfall and subsequent decomposition is a fundamental process underlying the input of nutrients to the soil in terrestrial ecosystems. The aim of this study was to investigate soil nutrients, root growth, litterfall and potential nutrient return to soil in three diverse agroforestry systems; home gardens(*Mangifera indica, Artocarpus heterophyllous, Coffea spp.*) gliricidia-coffee mixed plantation, and teak monoculture plantations. The study was conducted at the University of Peradeniya Experimental Station at Dodangolla during September-December 2022. Litter samples were collected into 2 m × 2 m litter traps, which were established 1 m above the ground in each agroforestry system. Initial soil samples were collected at 1 m distance away from the downside of litter traps at two soil depths (0-15 cm and 15-30 cm). Ingrowth cores (15 cm diameter and 30 cm depth) were inserted at 1 m distance from the litter traps and roots grown in to the cores were sampled after 4 months. The amount of litterfall, nitrogen (N), phosphorus (P), and potassium (K) contents in the litter and soil samples, and root growth into ingrowth cores were measured. Soil nutrient contents did not change significantly across agroforestry systems, except the higher P contents in the samples from home gardens (0-15 cm depth) than those from others. The highest total litterfall was recorded in teak plantation (823 g/4m^2±107.8) followed by home gardens (748 g/4m^2±111.8) and gliricidia-coffee mixed plantation (536 g/4m^2±30.77). The greatest root growth was observed in gliricidia-coffee plantation, while home gardens showed the lowest. Gliricidia-coffee plantation produced litters with the highest N(6015.61mg±428.9) contents and return of N through litterfall was also the highest, while home gardens and teak plantation had the highest K(875.29mg ±62.83,1591.74mg±106.95) and P(3409.44mg±357.17,2494.46mg±173.59) return respectively. Species composition could determine the type and the amount of nutrient return to the soil through litterfall.

Keywords: Home gardens, Litterfall, Nutrients, Plant nutrients in the soil, Root growth

*__Corresponding Author__: ag14053@agri.pdn.ac.lk

ID 66

Comparison of ignition method with Walkley and Black method for the determination of organic matter content in selected paddy soil samples in Sri Lanka

K.A.G.Uresha, E.A.V.S.Edirisinghe, E.D.C.T.Chandrasekara, N.A.S.A. Neththasinghe, L.D.B. Suriyagoda*

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

Abstract

Rice (*Oryza sativa* L.) is cultivated largely using external inputs such as inorganic fertilizers and pesticides. Apart from that, the addition of crop residues, organic matter, organic fertilizers, or soil amendments are also required to enhance the productivity of rice farming. Usually, organic matter content in soil is determined by Walkley and Black method which is costly and uses carcinogenic chemicals such as potassium dichromate. In order to avoid these disadvantages, soil organic matter content can be determined by obtaining the weight loss through ignition of soil samples using muffle furnace. Therefore, this study was conducted to determine the fidelity of ignition method compared to the chemical method for the determination of soil organic matter of selected paddy soil samples in Sri Lanka. A total of 35 soil samples were collected representing paddy lands in Gampaha (20), Rajanganaya (7) and Polonnaruwa (8) areas. Then the organic matter content of each soil sample was tested using both Walkley and Black method and ignition method. In the Walkley and Black method, organic matter content was determined by the oxidation of soil using potassium dichromate. In the ignition method, soil samples were heated to 375 °C for 3 hours using muffle furnace. Regression and correlation analysis were performed to study the relationship between two methods. According to the results both methods made close estimations of the organic matter content i.e. regression coefficient of 0.95 with a R^2 of 0.89. Moreover, ignition method slightly underestimated (6%) the organic matter percentage compared to the chemical method. As the soil organic matter content determined using both methods were in good agreement, ignition method can be used as an alternative method for the testing of organic matter in paddy soil samples.

Keywords: Chemical method, Moisture, Oxidation, Underestimate, Weight loss

***Corresponding Author*:** lalith.suriyagoda@gmail.com

***Acknowledgement*:** Financial assistance from the World Bank, under the Accelerating Higher Education Expansion and Development (AHEAD) (Grant No AHEAD/RA3/DOR/AGRI/PERA-No16*)*

ID 78

Selecting suitable traditional rice varieties to Galle district through farmer, consumer preference

W.G. Maya Wickramasinghe[1], M.C. Millawithanachchi[2] and L.M. Abeywickrama[3]

[1]Office of the Assistant Director of Agriculture (Galle /Eastern Zone), Labuduwa, Akmmemana, Sri Lanka
[2]Agricultural Research Station, Labuduwa, Akmmemana, Sri Lanka
[3]Faculty of Agriculture, University of Ruhuna, Sri Lanka

Abstract
Farmers' interest to cultivate traditional rice varieties in Low Country Wet Zone (LCWZ) was increasing with high price, low input demand and other nutritional attributes. Yet most of the traditional varieties grown by the farmers are not adaptable for the LCWZ. This study was aimed to identify the best performing traditional rice varieties in Galle district base on yield, agronomic characters and preference of the farmers and consumers. Selected eleven traditional rice varieties *(Suwandel, Dhanahala, Beheth Heeneti, Pachchaperumal, Rathdel, Ranthembiliel, Kuruluthuda, Kahata Wee, Herath Banda, Gonabaru, Kahawanu)* cultivated by the farmers in Galle District and two improved varieties (Ld 368 and Bw 372) were evaluated at Rice Research Station, Labuduwa in Randomized Complete Block Design with two replicates during 2017/18 *Maha* season. At the maturity stage a field day was conducted with the participation of farmers, officers of Department of Agriculture and University staff. Varieties were evaluated by voting based on visual observations. Based on the performances at Research level, five selected traditional varieties and two improved lines were tested as observational trials at 30 farmer fields in Galle district during 2018 *Yala*. Same varieties were tested in 5 farmer fields in Randomized Complete Block Design during 2018/19 *Maha* season. Ld 368 was the shortest variety, *Kuruluthuda*, Bw 372 and *Rathal* were not significantly different form Ld 368. *Kahata Wee* recorded the highest panicle length and flag leaf and leaf width. When the seed per panicle is considered, panicle weight, and number of filled grains per plant, higher values were recorded by the improved variety Ld 368 with low shattering. Bw 372, *Kuruluthuda, Herath Banda, Raththembilal* also recorded lower shattering while *Beheth heenati*, *Kahatawee, Suwandal* and *Dahanala* recorded higher shattering percentage indicating the inferior agronomy of traditional varieties. *Kuruluthuda, Pachchaperumal,* and Bw 372 also recorded higher values for filled seeds per plant. Ld 368 was the highest yield recorder, *Kuruluthudu* and *Kahawanu* also recorded similar yields. According to participatory evaluation ranks, *Kahawanu, Kuruluthuda* and *Suwandal* were preferred by the evaluators. Improved varieties Ld 368 and Bw 372 performed better with higher yield in farmer field testing. Out of traditional varieties *Gonabaru* recorded better yields in 3 locations, *Kuruluthuda, Rathal* and *Suwandal* also recorded more than 3t/ha in 3 locations. According to farmer preference and yield performance *Gonabaruru* and *Kuruluthuda* were most preferred and followed by *Suwndal and Rathal*.

Keywords: Consumer preference, Farmer preference, Low Country Wet Zone, Traditional rice varieties

Corresponding Author: mayawick1@gmail.com

ID 102

Isolation and identification of novel and efficient lipolytic fungi from coconut oil-contaminated soil

U.T. Senanayake[1*] and P. Samaraweera[1]

[1] Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka.

Abstract

Lipases are biocatalysts that possess remarkable abilities to hydrolyze triacylglycerols, breaking them down into glycerol and fatty acids. These enzymes also catalyze reversible reactions, including esterification, transesterification, and interesterification. The applications of lipases have greatly expanded across various industries, notably in food, pharmaceuticals, cosmetics, detergents, textiles, pulp and paper, leather, medical applications, and many others. Among all living organisms that produce lipases, filamentous fungi are excellent extracellular lipase producers, and fungal lipases have the ability to function at extreme temperatures and pH, are stable in organic solvents, chemo-selective, and abundant. Many research studies have been conducted in this area; nevertheless, there are many more lipolytic fungal species to be identified and characterized. Thus, the current study was conducted to isolate and identify the novel lipolytic fungi from coconut oil-contaminated soil. The soil samples were collected from four different areas (A: Normal soil sample from mini Sinharaja area, Faculty of Science, University of Peradeniya, B: Compost sample from Gampaha area, C: Coconut oil-contaminated soil sample from oil mill in Gampaha, D: Coconut oil-contaminated soil sample from oil mill in Kandy). The collected soil samples were cultured in the PDA medium, and fungal species were isolated using streak plate and point inoculation techniques. The fungal strains that were found to be positive by phenol red and Tween 20 tests were subjected to para-nitrophenyl palmitate assay to analyze the lipolytic activity of each species. The selected strains were identified using morphological characteristics and molecular methods. Out of the 12 isolated species, 10 species gave positive results for lipolytic activity, and those were identified based on colony morphology and microscopic view (slide culture technique). Based on the results of the para-nitrophenyl palmitate assay, DNA from three species with the highest lipolytic activity were extracted using the phenol-chloroform method and heating method, and ITS regions were sequenced. Through BLAST search and phylogenetic analysis, the most efficient fungal species capable of lipolysis were identified as Rhizopus arrahizus (the most efficient), followed by Aspergillus niger (the second most efficient), and Aspergillus nomius (the third most efficient). In order to establish these fungal species as viable sources of lipases for industrial applications, further enzyme characterization and media optimization studies are necessary.

Keywords: Fungal lipase, Industrial application of lipase, ITS gene, pNPP assay, Phenol red test and Tween 20 test

[*]***Corresponding Author:*** uvinis@sci.pdn.ac.lk

ID 107

Vegetative propagation of lemongrass as affected by variety, slip height, potting media and pruning

R.M.A.P. Rathnayake[1], M.K.T.K. Amarasinghe[1*] and H.K.M.S. Kumarasinghe[1]
[1]Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Abstract
Lemongrass belongs to the family Graminae which ranks among the top ten oil bearing crops in the world essential oil market. Lemongrass oil is used for numerous purposes including pharmaceutical, cosmetic and food and beverage industry. Few decades ago, lemongrass was one of the key export crops in Sri Lanka, but currently less abundant due to low productivity, quality and absence of proper protocol for commercial production. Therefore, a pot experiment was conducted at Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka from November 2020 to March 2021 to study the effect of variety, slip height, potting media and pruning on tiller count of lemongrass. Two commercially cultivating lemongrass varieties; *Cymbopogon flexuosus* (V1) and *Cymbopogon citratus* (V2), two slip heights; 6" (H1) and 9" (H2) and four potting media; soil: sand: compost: 1:1:1(P1), soil: sand: poultry manure: 1:1:1(P2), soil: sand: poultry manure: 1:1:2(P3) and soil: sand: poultry manure: 1:1:3(P4) were arranged in 2×2×4 Factorial Randomized Complete Block Design (RCBD) with four replicates. 12" × 10" pots were prepared using gauge 300 black polythene to plant lemongrass cuttings. Pruning effect was evaluated as a separate experiment and pruning was done two months after planting. Tiller count per plant was recorded. Results revealed that, main effect of variety and potting media had a significant effect on the number of tillers produced per plant ($p<0.05$). Slip height and other interaction effects did not show any significant effect on tiller count. V1 had significantly higher tiller count (4.65) over V2 (4.17) in experiment 01. In experiment 02, significantly higher tiller count also showed in V1 (5.07) with compared to V2 (4.33) while P4 had resulted higher tiller count (31.25) over P1 (15.00) before pruning. Further, pruning significantly induced tillering ability of V1 (26.75) over V2 (19.97) while P4 (31.25) with compared to other media. Therefore, it can be concluded that, cultivating *Cymbopogon flexuosus* (V1) using potting mixture soil: sand: poultry manure: 1:1:3 (P4) with pruning two months after planting resulted higher vegetative propagule production.

Key words: lemongrass, potting media, pruning, slip height, tiller count

[*]***Corresponding Author:*** thulani@crop.ruh.ac.lk

ID 110

Evaluation of intraspecific morphological diversity of selected short duration rice *(Oryza sativa* L.*)* genotypes in low country wet zone of Sri Lanka

W.A.K.R. Welivita[1*], M.C. Millawithanachchi[2], E.K.E.C. Nayana[2], and D. M. Gamage[1]

[1] Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Mapalana Kamburupitiya (81100), Sri Lanka
[2] Rice Research Station, Labuduwa, Sri Lanka

Abstract
Erratic climatic changes pose a significant threat to rice cultivation, making it challenging to meet the current demand for rice. To overcome this challenge, the adoption of short-duration rice varieties can prove to be an effective solution to sustain rice production. The current study aimed to characterize a germplasm of 39 newly improved short-duration rice genotypes 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 of Sri Lanka. The experiment was laid as a randomized complete block design (RCBD) with two replicates at the Rice Research Station, Labuduwa, Sri Lanka. The data were recorded on nineteen different agro-morphological traits. The varietal differences of these thirty-nine rice genotypes were analysed through an ANOVA and mean comparison was carried out using Duncan's Multiple Range Test (DMRT). A hierarchical dendrogram was created to identify the similarities and differences between these genotypes through cluster analysis. The rice germplasm exhibited sufficient morphological variation for most of the qualitative and quantitative traits. Highly significant differences ($p<0.05$) were observed for the traits such as plant height; effective tiller number; days to heading, flowering, and maturity; flag leaf characteristics; internodal length; root characteristics; grains per panicle; grain characteristics such as grain length, grain width; 1000 grain weight; and yield per plant. Based on the cluster analysis, approximately nineteen genotypes formed a cluster of high-yielding rice varieties, characterized by their ability to reach the flowering stage in less than 65 days. Similarly, the rice genotype IRLON 9 stood out by reaching the flowering stage in just 63 days, while producing a higher grain weight (27.9 g) and yielding more per plant (21.9 g). Likewise, IRLON 61 exhibited a higher yield per plant (39.6 g) with a short flowering period of 65 days. These particular genotypes exhibit excellent performance for various traits, which can be utilized for the development of short-duration, high-yielding rice varieties in future breeding programs.

Keywords: Clustering, Flowering, Morphology, Short duration, Yield

***Corresponding author*:** ruwandikawelivita@gmail.com

ID 117

An overall analysis of trace metal pollution in inland and coastal sediments of Sri Lanka

S.H.K. Narmada[1*], A.S. Mahaliyana[1] and N.P.P. Liyanage[1]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka

Abstract

Trace metal contamination in sediment layer is a major issue that aquatic environments encounter. Trace metals have a higher affinity to partition to the sediment layer posing ecological and public health risk. In Sri Lanka, a number of studies have reported trace metal contamination in sediments in both inland and coastal water bodies. Since individual studies are inadequate to assess the overall status of the contamination, this study aims to evaluate the status of trace metal pollution in both inland and coastal sediments based on a meta- analytical approach. Studies reporting trace metal contamination in sediments were acquired from the literature search conducted in Google Scholar followed by a grey literature search. After screening, 21 articles reporting the sediment contamination in past 30 years were analysed. Altogether, published results of over 490 samples were considered for this analysis. Range and median values were calculated. Nonparametric Kruskal-Wallis test was performed comparing trace metal contamination between inland and coastal sediments. Geo-accumulation index was calculated to assess the status of the sediment contamination. Predominantly detected trace metals in sediments were Pb, Cd, Cu, Cr, Zn, and As. In both inland and coastal sediments reported median concentrations followed the order Zn>Cr>Pb>Cu>As>Cd and the reported concentration ranges were 28.99-2672.00, 2.51-845.33, 16.00-1197.00, 3.60-7485.00, 0-188.00, 0-105.66 for inland sediments whereas 31.00-569.52.00, 0.26-270.00, 0.03-121.66, 1.96-96.00, 0.088-10.00,0.01-3.91 for coastal sediments in mg/kg, respectively. From the available data, significant differences were observed in the contamination level of Pb, Cu, Cr and Zn between inland and coastal sediments ($p<0.05$) whereas there was no significant difference ($p>0.05$) in the respective As and Cd concentrations. In coastal sediments, calculated geo-accumulation index for each studied trace metal indicated the contamination status as "Unpolluted" ($I_{geo<}0$). In inland sediments, Pd, Cd and Zn indicated a "Heavy pollution" ($3 \leq I_{geo} \leq 4$). Contamination of Cu and Cr indicated a "Moderate to Heavy pollution" ($2 \leq I_{geo} \leq 3$), while As indicated a "No pollution" ($I_{geo} \leq 0$). Overall, there was a high level of trace metal contamination in inland sediments compared to the coastal counterparts. This could be due to high anthropogenic intervention in inland waterbodies that responsible for trace metal loading. The findings of the present study provide an overall picture of the trace metal pollution of aquatic sediments in Sri Lanka.

Keywords: Coastal; Freshwater; Geo-accumulation index; Sediment pollution; Trace metals

[*]***Corresponding Author:*** kethakeenld@gmail.com

ID 122

An estimation of technical efficiency in turmeric production in Sri Lanka: A stochastic frontier approach

M.I.D Perera[1*], Sajitha Dishanka[1]

[1*]Faculty of Management & Finance, University of Colombo, Sri Lanka
[1] Department of International Business, Faculty of Management & Finance, University of Colombo, Sri Lanka

Abstract

Despite the abundance of agricultural resources in the country, turmeric is not being fully utilized as an export item. The sector still faces several production deficiencies, primarily due to input-related challenges. Hence, measuring efficiency and identifying the variables affecting inefficiency is critical. For this purpose, a cross-sectional survey of 200 turmeric-producing farmers from six districts in Sri Lanka and DEA (Department of Export Agriculture), namely; Kurunegala, Gampaha, Matale, Kandy, Kaluthara, and Ampara, were undertaken using a multistage random sampling approach. The data relating to inputs and output under turmeric production and farmer characteristics were identified through a structured questionnaire. The data were analyzed using maximum likelihood estimates of the stochastic frontier production function and technical inefficiency model. According to the study, the average technical efficiency of the turmeric sector in the study area was 74%, with a 26% margin for improvement through better use of available resources and technology. The results of the Cobb-Douglas production function and stochastic frontier production function for all the selected districts in Sri Lanka confirmed that the size of the land and the number of seeds were the significant inputs determining turmeric production in Sri Lanka. The results of the inefficiency model have confirmed that family size and experience of farmers significantly negatively impact technical inefficiency, and they are significant at 1% and 5%, respectively. Other characteristics such as age, gender, education, other income, registered in EDA and credit accessibility were insignificant in determining the technical inefficiency of Turmeric production in the country.

Keywords: Famer characteristics, Inefficiency, Stochastic frontier approach, Technical efficiency, Turmeric production

Corresponding Author: p.dilhani89@gmail.com

ID 126

Structural characteristics, biomass, and above-ground carbon stock of mangrove forest, Sampalthivu lagoon, Trincomalee, Sri lanka

J. Thanathyashayini[1*], A.P. Abeygunawardana[1] and E.P.D.N. Thilakarathne[1]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University of Sri Lanka

Abstract

Mangroves are the major source of blue carbon which store the atmospheric carbon (C) in soil and biomass. Sampalthivu Lagoon is a part of a complex of wetland that includes pigeon island, a well-known tourist destination and hotspot for biodiversity. The study aims to assess the diversity and structural characters of this lagoon which undergo rapid alternations due to human interventions and changes of hydrological regime. The seven sites were selected considering the mangrove distribution. The community structure, biomass and Above-Ground Carbon stock (AGC) were assessed by laying 3 belt transects perpendicular to the shoreline at each site. The diversity was estimated using diversity indexes and to compare diversity between sites. The total biomass and total AGC were estimated using the allometric equations respective to mangrove species. Six true mangrove species; *Excoecaria agallocha*, *Lumnitzera racemosa*, *Aegiceras corniculatum*, *Rhizophora mucronata*, *Avicennia marina*, and *Avicennia officinalis* under 5 families and 4 mangrove associate species were recorded. *E.agallocha* was the dominant and most important species with high abundance and high importance value index (IVI) of 185.012. The highest value of Shannon diversity index (1.46), Simpson index (0.73), Pielou's evenness index (0.38) and Margalef's richness index (1.5417) recorded in site 4 with high species richness and abundance. The lowest Shannon diversity index (0.75), Simpson index (0.42), and Pielou's evenness index (0.20) recorded in site 2. The lowest Margalef's richness index (0.4809) recorded with low species richness and high abundance. Hutcheson's t-test result revealed that, there was a significant difference in diversity between site 2 and 4 (p<0.005). Further, Site 2 and 4 shared lowest Sorensen similarity index (0.36), which exhibit the unique assemblage of mangroves in each site. *R. mucronata* were recorded the highest total biomass (2.98 t ha^{-1}) and AGC value of 1.38 t C ha^{-1} because of high mean DBH value. The lowest above ground biomass (0.0178 t ha^{-1}), below ground biomass (0.015 t ha^{-1}), total biomass (0.039 t ha^{-1}) and AGC (0.0089 t C ha^{-1}) values were recorded in *A.corniculatum*. The study is the first record which provides baseline information about biodiversity and structural attributes of mangrove forest in Sampalthivu lagoon. The structural characters of mangroves and carbon sequestration capacity are the important tool for future restoration activities. The present study highlights the requirement of year around study to understand structural and functional dynamics in the mangrove ecosystem.

Keywords: Above Ground Carbon; Biomass, Diversity; Sampalthivu; Structural characteristics

[*]***Corresponding Author:*** aqt17017@std.uwu.ac.lk

Acknowledgement: Sincere thanks to Coast Conservation and Coastal Resource Management Department (CDA), Trincomalee and Marine Environment Protection Authority (MEPA), Trincomalee for their technical and resource support for this research study.

Poster Presentations

ID 44

Effect of different organic fertilizer products on growth and yield of rice in low country wet zone

K. A. A. L. Weerasingha, M.G.N. Rupasinghe*, A. A. C. Krishani, J. B. K. Kannangara, A. R. Millavithanachchi, S. D. Umange

Soil Science Division, Regional Rice Research and Development Center, Bombuwala, Sri Lanka

Abstract

Rice grown under organic conditions has become important to conserve both consumers' and soil health while ensuring the food security. A field experiment was conducted to evaluate the four different types of organic fertilizer products on growth and yield of rice plant in 2022 *yala* season at Regional Rice Research and Development Center, Bombuwala. Three and half months aged fertilizer responsive popular rice variety (Bw 367) was tested with no fertilizer, commercially produced compost, solid fertilizer pellets (CSP), liquid fertilizer (LF), and bio fertilizer. Rate and time of applications were done following the manufacture's protocol. The standard level of potassium, nitrogen, phosphorous and colony count should be higher than (1%), (1%), (0.5%) and 10^9 CFU, respectively. All the fertilizer products were up to the standards of Sri Lanka Standard Institute. The treatments were applied into $18m^2$ plots arranged in randomized complete block design with three replications. Growth and yield related parameters such as plant height (PH), number of productive tillers per plant (PTP), shoot dry weight (SDW), Number of filled grains per panicle (FGP) and 1000 grain weight (TGW) and yield (tons/ha) were recorded at the harvesting stage. The data were statistically analyzed by analysis of variance using SAS version 9.4. Duncan's multiple range test at $p \leq 0.05$ was used to separate the means. According to the results, both SDW (2.21g/plant) and PTP (6/plant) were highest in LF treated plants. The compost recorded the statistically highest FGP and it was 18% increment than the control. Both compost and CSP treated plants showed the statistically similar yield and TGW. Among the applied organic fertilizers, soil applied solid fertilizers performed better over the others while liquid and bio fertilizers seem less effective in increasing the yield when applying alone.

Keywords: bio fertilizer, compost, liquid fertilizer

*__Corresponding Author:__ neranjanirupasinghe@gmail.com

ID 52

Diversity analysis of selected traditional rice accessions with representative four new improved rice varieties tested under low country wet zone of Sri Lanka

L.A.R. Amarathunga[1*], W.D.P. Weerasinghe[1], D.M. Withanawasam[1], N.N. Yakupitiyage[1], J.K.D.J. Sandareka[1], G.D.A. Priyantha[1], W.G. Fonseka[1], S. D. Rathnayaka[2] and M.W.H. Gayan[2]

[1]Regional Rice Research and Development Centre, Bombuwela, Sri Lanka.
[2]Rubber Research Institute, Agalawatta, Sri Lanka.

Abstract
The genetic diversity analysis of indigenous rice accessions can be used to broaden the genetic base and identifying high yielding genotypes for rice improvement. Therefore, this study was carried out to understand the different morphological parameters among fourteen traditional rice accessions compared to four new improved rice varieties based on IRRI standard evaluation system of rice. Twenty-one days old seedlings were transplanted in the field as three row plots. Each row contains twenty-one single plants. The trail was laid out as randomized complete block design (RCBD) with three replicates. Data analysis was done by using SPSS with two complementary procedures i.e., complete linkage cluster and principal component analysis (PCA). At 5.34 distance in the dendrogram, two main clusters were observed except Bw 367 new improved variety (NIV) which showed completely different behavior. In the first cluster, except one variety (Bw 272 – 6b) all others are traditional varieties. Although it is a NIV it was derived using Kahata wee which is a traditional variety. Therefore, it had close characteristics to the group of traditional varieties. In the second cluster, 3 rice varieties were resulted and interestingly only one were traditional variety i.e., Pachchaperumal and two were new improved varieties i.e., Bw 364 and Ld 253. This result also revealed by the clear minus value in the scatter plot of PC1 vs PC2. Principal component analysis showed that the first three principal components (PCs) having eigen values greater than 1 accounted for 73.8%. The first PC individually explained nearly one third (33.9%) of the total variation whereas the first two principal components cumulatively explained the 59.0% of the total variation. The rice variety Bw 367 showed the highest positive PC 2 scoring reflecting the highest contribution from leaf length, leaf width, culm diameter, blade pubescence and collar colour. According to those characters Pachchaperumal, Bw 364 and Ld 253 were grouped together due to clear minus value. Using these findings, it is easy to use morphologically distinct varieties for better and accelerate results in plant breeding program with further analysis.

Keywords: Improved varieties, Morphological diversity, Rice, Traditional accessions

Corresponding Author: akilaruwani@gmail.com

ID 67

Relationships between pH, electrical conductivity, and organic matter content of paddy cultivated soils in Sri Lanka

E.A.V.S.Edirisinghe, K.A.G.Uresha, E.D.C.T.Chandrasekara, N.A.S.A. Neththasinghe, L.D.B. Suriyagoda*

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

Abstract

Rice (*Oryza sativa* L.) is widely cultivated as a low-land crop in most of the Asian countries. To cater the increasing demand for food, large extent of paddy lands is being cultivated using external inputs, such as crop residues, organic matter, and inorganic fertilizers. In order to improve and/or maintain higher crop productivity, soil conditions need to be maintained at favorable range required by the crops. Some of the key soil factors determining the productivity are soil organic matter content (OMC), soil pH, and electrical conductivity (EC). Therefore, the objectives of this study were to determine soil OMC, pH, and EC of selected Sri Lankan paddy soil samples and to develop relationships between those variables. A total of 35 soil samples representing paddy fields in Gampaha (20), Rajanganaya (7), and Polonnaruwa (8) areas were collected. The pH and EC of each soil sample were measured using pH and EC meter using 1:5 soil: water ratio. The OMC was determined using Walkley--Black method. Regression and correlation analyses were performed to study the relationships between these variables. There was a moderate negative relationship between soil pH and organic matter content (R^2=0.130 p<0.05), and a moderate positive relationship between EC and organic matter content (R^2=0.361p<0.05). With the increase of OMC soil pH was reduced due to the release of organic acids, and EC was increased due to the increased cation pool. These relationships between soil pH, EC and OMC need to be considered in sustainable soil management.

Key words: Acidity, Organic carbon, Rice

***Corresponding Author*:** lalith.suriyagoda@gmail.com

***Acknowledgement*:** Financial assistance from the World Bank, under the Accelerating Higher Education Expansion and Development (AHEAD) (Grant No AHEAD/RA3/DOR/AGRI/PERA-No16)

ID 68

Evaluation of F_1 hybrids of rice *(Oryza sativa* L.*)* and their parental lines to develop short-age rice varieties adaptable for low country wet zone of Sri Lanka

M.B.G.I. Udeshani[1*], M.C. Millawithanachchi[2], E.K.E.C. Nayana[2], and D.M. Gamage[1]

[1] Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Mapalana Kamburupitiya 81100 Sri Lanka
[2] Rice Research Station, Labuduwa, Sri Lanka

Abstract

As the staple cereal in Sri Lanka, the demand for rice is increasing significantly. To meet this accelerating demand, hybrid rice production has become a promising strategy to increase rice production amidst erratic weather changes. In this study, the F_1 generation of five single crosses, At 311/Rathal, Ld 253/R2 13, Bg 314/ At 313, Ld 253/ At 362, and At 313/ Bw 312 along with their eight parental lines (At 311, Rathal, Ld 253, R213, Bg 314, At 313, At 362 and Bw 312) were used to evaluate their agro-morphological characteristics related to yield and crop duration parameters to develop short duration high yielding hybrid rice varieties suitable for the Low Country Wet Zone of Sri Lanka. The field experiment was laid following the Single Seed Decent Method with two replicates at the Rice Research Station, Labuduwa, Sri Lanka during Yala 2022. Data were recorded on twenty different important agro-morphological characteristics. The differences among the F_1 hybrids and their parental lines were analyzed through ANOVA and mean comparison was carried out using Duncan's Multiple Range Test (DMRT). The heterosis of the F_1 crosses was calculated using the mid-parent values. The findings revealed that all the F1 hybrids required fewer days to reach heading (60-69 days) and flowering (65-74 days) compared to their corresponding parental lines. Three crosses, namely At 311/Rathal, Ld 253/R2 13, and At313/Bw312, reached the heading stage in only 60-66 days, indicating their potential to be used in the development of short-duration varieties. There was negative heterosis for days taken to maturity in three of the F1 crosses (At 311/Rathal, Ld 253/R2 13, and Bg 314/At 313) which is usually desirable for developing short-duration varieties. All hybrids showed higher tillering capacity (7-15) than their respective parental lines. The highest yield per plant (40.95 g) was recorded from At 313/ Bw 312 cross while At 311/ Rathal cross also showed a higher grain yield (33.25 g). Further, all the F_1 crosses showed very strong positive heterosis values for important yield-determining parameters in rice such as the number of effective tillers (25%-106%), seeds per panicle (5%-41%), thousand-grain weight (7%-37%) and yield per plant (95%-171%). Considering the above yield determining and crop duration attributes, At 311/Rathal and At 313/Bw 312 crosses were identified as better performing F_1 hybrids among the five crosses that have the potential to utilize for developing short durational high yielding varieties in the future rice breeding programmes. However, further studies are required to confirm the stability of these crosses in successive generations.

Keywords: F_1 hybrids, Heterosis, Parental lines, Short duration rice varieties

Corresponding author: imeshaud15@gmail.com

ID 71

Study of the metamorphic changes of *Abudefduf vaigiensis* (Indo-Pacific Sergeant) during larval recruitment.

R.M.K.S. Gimhani[1*], K.Radampola[1], R.D.N.Wijesinghe[1]

[1]Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka

Abstract

Abudefduf vaigiensis is a highly exploited reef fish species for the marine ornamental fish industry. The morphological and histological transitions during the metamorphosis of *A. vaigiensis* are important to study their life cycle. Samples are collected from Dodanduwa area in May 2022. The fish were classified into three size categories, with 10 fish collected for each category. Specifically, the size categories were Small-SC (less than 9cm), Medium-MC (ranging from 12cm to 15cm), and Large-LC (greater than 16cm). Fish were examined to find out the differences in external morphology, gut composition, and histology in the stomach and intestine. Morphometric parameters (Total Length, Standard Length, etc.) increased with the body size but the meristic counts were independent of body size except for the number of transverse bands. Length-weight relationship for MC ($ts=2.754$, $b=3.934$, $p<0.05$) and LC ($ts=4.112$, $b=5.238$, $p<0.05$) groups depicts allometric growth, while fish in small size class showed an isometric growth ($ts=-1.0214$, $b=2.893$, $p>0.05$). Fulton's condition factor (K) in SC (1.11 ± 0.19) showed significantly better condition of fish compared to that of fish in MC and LC groups. Individuals from different size stages undergone a difference in pigmentation and showed more black strips in MC and LC (6 stripes) than in SC (5 stripes). The terminal mouth and the incisor-type teeth forming a cutting plate indicated scraping feeding habits. Gut component analysis suggested that larger fish scrape on harder substrates. Relative gut length (RGL) denoted that gastrointestinal tract undergoes rapid remodeling and the RGL of larger fish (2.83 ± 0.13) was higher than smaller fish (1.83 ± 0.13). Histological studies revealed that the thickness of tissues in the stomach and intestine increases with the growth of the fish. This study showed that histological and morphological changes occur in accordance with the development of *A. vaigiensis* from juveniles to adults.

Keywords: *A. vaigiensis*, Larval recruitment, Morphology, Ontogeny

***Corresponding Author*:** kalani.rathnayakes@gmail.com

ID 83

An assessment of phytoremediation potential of *Ipomoea aquatica* (Kangkong) in carp rearing water

N.D.A. Sewwandi[1*], K. Radampola[1], K.K.T. Nuwansi[2]

[1] Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka
[2] The National Aquatic Research and Development Agency (NARA), Crow Island, Colombo 15, Sri Lanka

Abstract
Phytoremediation is the use of aquatic plants to decrease, extract or remove organic and inorganic compound from the water and soil. Removal of nutrients such as nitrogen and phosphorus, reduces the adverse impacts on the aquatic ecosystem. This study was conducted for 28 days to investigate the phytoremediation potential of *Ipomoea aquatica* in carp rearing water. The experiment was consisted with two different stocking densities of Kangkong plants as 6 PT (6 plants/tanks with fish), 9 PT (9 plants/tanks with fish) and C (control–only fish without plant). *Cyprinus carpio* var. *koi* (3.85±0.05 cm and 0.80±0.04g) were stocked at the stocking density of 08 fish/tank. Kangkong seedlings (height-13.00±1.80 cm) were potted and fixed into floating Styrofoam raft. Fish were fed twice a day at the rate of 5% BWt/day for the first two weeks and then 7% BWt/day. No significant difference was found among the treatments for growth parameters of fish. Ammonia levels of 9 PT (0.14±0.07 mg/L) and 6 PT (0.16±0.08 mg/L) were significantly lower than that of the control (0.52±0.48mg/L) at the end of the study period. Nitrite (1.5±0.00) mg/L and nitrate (1.67±0.08) mg/L levels did not show any significant difference between the treatments. The phosphate concentration was significantly higher in 9 PT (0.80±0.03 mg/L) than 6 PT and control. No significant differences were found among treatments for plant height (cm), shoot length (cm), root length (cm), number of leaves, % shoot length, % root length, plant dry weight (g), root dry weight (g), and total biomass (g). However, wet weight of plants, shoots and % weight gain, shoot dry weight (g) and surface area of the leaves (cm^2) were significantly higher in 6 PT and % root dry weight is significantly higher in 9 PT than 6 PT. Based on the results of plant growth parameters and water quality parameters, 6 PT could be recommended as the best stocking density for the phytoremediation purpose.

Keywords: Phytoremediation, Stocking density, Water quality parameters

***Corresponding Author*:** ashasewwandi9510@gmail.com

ID 112

Effect of different bio filter materials on water quality and growth performance of *O. niloticus* reared in a simple recirculating system

D.M.S.I. Gunadasa[1*], K. Radampola[1], K.S.S. Atapaththu[2]

[1]Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka.
[2]Department of Limnology & Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka.

Abstract
Bio filter is an essential component of the Recirculatory aquaculture system (RAS), which is an environmentally friendly culture system used in aquaculture industry. The present study evaluated the effect of different bio filter materials on water quality and growth performance of *O. niloticus* reared in a simple recirculating system. Control treatment (CT- with no bio filter) and three treatments using bio filters with different filter material ie: PC (Lids of plastic pet bottles), BB (bio balls), and RT (clay roof tiles) were maintained for 35 days. Each treatment had three replicates (12 tanks). Six fingerlings of *O. niloticus* (1.54±0.54g) were stocked in each tank (21.6 L). CT tanks were supplied with continuous aeration and water was partially exchanged every three days. Bio filters were operated for 24h with no water exchange during whole period. Growth and feed performance of fish and water quality parameters, (Temperature, DO, pH, Ammonia, Nitrite, Nitrate, phosphate, Ca^{2+} Hardness, Salinity, TDS, Conductivity) were analyzed throughout the study period. Final body weights (12.23±2.62 - 14.36±4.70g) and lengths of fish (9.10±0.73 - 9.30±1.06 cm) were not significantly different among treatments. CT showed significantly lower %ADG, %SGR and higher FCR values compared to that of fish in all bio filter treatments. Ammonia concentration of water in CT was ranged between 0.57±0.04 - 1.77±0.07 mg. Ammonia-N and nitrite-N were increased during first 7 days and then started to decrease in all bio filter treatments. However final nitrate-N in all Bio filter tanks (PC-14.39 ±1.80 mg/L, BB-12.59 ±0.38 mg/L, RT-12.92 ±0.34 mg/L) were significantly higher at the end of study period compared to CT treatment (1.71 ±0.15 mg/L). Conductivity, phosphate, salinity (ppt), TDS (g/L) and Ca^{2+} Hardness recorded significant higher values in Bio filter treatments. DO and pH were not significantly different among treatments. Growth performance, ammonia oxidizing efficiency and water quality parameters of bio filter treatments were better compared to control treatment. The results suggests that the Lids of plastic pet bottles (PC) and Pieces of clay roof tiles (RT) could be used as an alternative filter media instead of commercially used bio balls.

Keywords: Bio Balls, Bio filter, Filter medium, Nitrification, *O. niloticus*

[*]***Corresponding Author:*** sandaka118@gmail.com

ID 135

Effect of different planting times on grain filling capacity of rice (*Oryza sativa* L.) in low country wet zone of Sri Lanka

K.V.S. Priyadarshani[1*], W.M.N.D. Gunathilaka[2] and D.M. Gamage[1]

[1] Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Mapalana Kamburupitiya 81100 Sri Lanka
[2] Rice Research Station, Labuduwa, Sri Lanka

Abstract

In Sri Lanka, rice spikelet sterility and poor grain filling capacity have been reported as major problems in all agroecological zones which are highly dependent on climatic parameters. By manipulating the transplanting dates of the rice crop, it is possible to manipulate the climatic conditions that impacted on rice crop in a given time. Therefore, this study was designed to investigate the effect of different transplanting dates on the grain-filling capacity of rice and thereby develop an understanding of how climatic parameters contribute towards poor grain filling. This study was conducted as a field trial at Rice Research Station, Labuduwa using 25 improved rice varieties adaptable for the Low Country Wet Zone (LCWZ) of Sri Lanka. The experiment was laid as a Two Factor Factorial Design with two replicates using two different transplanting dates (one-month intervals in between) during the Yala 2022. Flowering time was set to synchronize with low and high rainfall intensities by early (P_1) and late planting (P_2), respectively, based on meteorological data at Labuduwa, Galle. Agro-morphological diversity of important yield-determining traits was evaluated at two different transplanting dates and the data were analyzed using analysis of variance. Results indicated that planting date had a significant effect ($p<0.05$) on important morphological traits such as planting height, number of tillers, the weight of panicles, length, and width of roots, dry weight of roots, number of unfilled grains per panicle, filled seeds percentage and unfilled seeds percentage. The existence of a difference in filled seed percentage (P_1-78.25% and P_2-86.3%) at two planting dates indicated that the transplanting date had a significant impact on the filling capacity of rice grains. The interaction between variety and planting date was significant ($p<0.05$) for filled seed percentage implying that grain filling capacity of rice can be determined by both genetic and environmental factors. One of the main reasons for changes in the filling capacity of rice could be the changes in the precipitation pattern, high temperature (29.6^{o}C – 31.5^{o}C) together with high relative humidity (85%-90%) prevailed during the flowering stage of rice. Relatively low rainfall was received during the first part of July corresponding to the first transplanting date. These environmental factors might have affected spikelet fertility during the flowering stage and thereby affect grain filling capacity. As a way forward, further in-depth studies are required to examine the exact effect of climatic parameters of LCWZ on spikelet sterility and its impact on rice grain filling capacity.

Keywords: Flowering, Low Country Wet Zone (LCWZ), Spikelet sterility, Transplanting dates

***Corresponding author*:** susanthika11@gmail.com

Crop Production and Productivity

ISAE - 2023

Keynote Speech – Oral Session I

Environmental Fate of Pesticides - Transport, Transformation and Eco Toxicological Effects

Dr. Uta Ulrich

Institute for Natural Resource Conservation, Kiel University/Germany

***Email -** uulrich@hydrology.uni-kiel.de

Abstract
Pesticides are a tool to ensure a sound harvest to foster human nutrition and economic income for farmers. Besides this benefit, pesticides have the potential to harm the environment due to their (eco)toxic effects and their fate in the environement related to their physical-chemical properties. When applied to agricultural fields, several mechanisms in terms of transport, retention and degradation take place. Pesticides do not stay at the target area where they are sprayed but are transported via air or water flow and reach non-target areas continuing their toxic effects. The velocity and extent of the relocation is driven by the adsorption coefficient kf of each compound. A high sorption potential leads to retention in soil enabling degradation processs. The persistence of a pesticide displayed as DT_{50} (dissipation time) governs the time period of the pesticide's (eco)toxic effects. The more persistent the compound, the longer this period lasts. The applied pesticide (parent compound=PC) can be transformed into another compound (transformation product=TP) in the environement by slightly changing the molecule structure. This transformation is enabled by phytolysis, hydrolysis, chemical and microbiological degradation in all compartments. The number of generated TPs from a PC cannot be assessed due to the high number of options. Nevertheless, most TPs are more mobile and persistent than their PC causing high concentration peaks and positive findings even years after the application of the related PC. The (eco)toxicity of TPs greatly varies and has to be assessed individually; it can partly be higher than their PC's (eco) toxicity. Besides the wanted toxic effect to target organisms at target areas, unwanted effect on non-target organisms and at non-target-areas. Direct effects occur at organism/species/population levels and are obvious such as impairment or even poisoning of certain species leading to changes in the community composition. The recovery of the species can last from short-term to long-term or can be irreversible. While these direct effects are detectable/measureable, indirect effects are challenging to observe and to quantify. They affect the ecosystem and its functions. Indirect effects include the loss of shelter and foraging areas by changes in the structure and diversity of habitats. Further, food resources vanish due to changes in the community composition and cause further loss species.

1 Introduction

Pesticides are compounds, which ensure the best possible growth options for agricultural crops. They harm or kill weeds competing for water (herbicides), nutrients and light (herbicides), pathogenic fungi (fungicides) and negatively affect insects (insecticides). These three groups of pesticides are the main representatives among the group of pesticides. The use of pesticides increases the yield of farmers to a certain extent, supports an adequate income and contributes to human nutrition. Besides this socio-economic benefit, pesticides are (mainly) synthetic chemical compounds and cause adverse effects on the environment. They harm terrestrial organisms on the field and aquatic organisms when washed out of the target area into surface water (Wijewardene et al. 2021; Lorenz et al. 2017; Schäfer et al. 2012). Pesticide loss from agricultural fields is known to be a major threat to ecosystem health and functioning in the aquatic environment. Surface and groundwater have shown seasonal concentration peaks due to specific application patterns, which pose a significant risk to aquatic organisms and are therefore a major concern. To protect ecosystems and human

drinking water resources, it is essential to understand the environmental fate of a pesticide after application and the controlling factors

2 Transport of pesticides

The environmental fate of pesticides is mainly governed by their chemical properties, hydrological parameters and soil conditions. The pesticide persistence (detention time 50, DT_{50}) and mobility expressed by the ability to sorb to soil particles (sorption coefficient, kf) control their relocation from the target area and the distribution in terrestrial and aquatic non-target areas. A high persistence leads to frequent and long-lasting detections of pesticide concentrations while a high sorption coefficient increases the sorption of a pesticide to soil, reduces the relocation from the target area and leads to lower concentrations of a sorptive than a mobile compound (Baran et al. 2021).

Pesticides are transported with the water flow either dissolved or particulate (bound to soil particles) and are considerably affected by the prevailing and antecedent climatological and hydrological conditions (Dhakal and Sullivan 2014) (Figure 1). Hence, high pesticide concentrations are observed after rainfall events (Imfeld et al. 2020; Willkommen et al. 2019; Doppler et al. 2014) but highest concentrations occur, when a rainfall event of high intensity follows a pesticide application at one of the subsequent days (Willkommen et al. 2019; Capel et al. 2001). Potential transport pathways are surface runoff and subsurface-leaching to drainage systems or groundwater (Doppler et al. 2012; Brown and van Beinum 2009; Leu et al. 2004). Air-borne transport via spray drift during the applications procedure as well as by long-range transport by air or rainfall are further pathways for pesticide relocation from the target area (Krahner et al., 2021; Schönenberger & Stamm, 2021; Kreuger and Lindström, 2019).

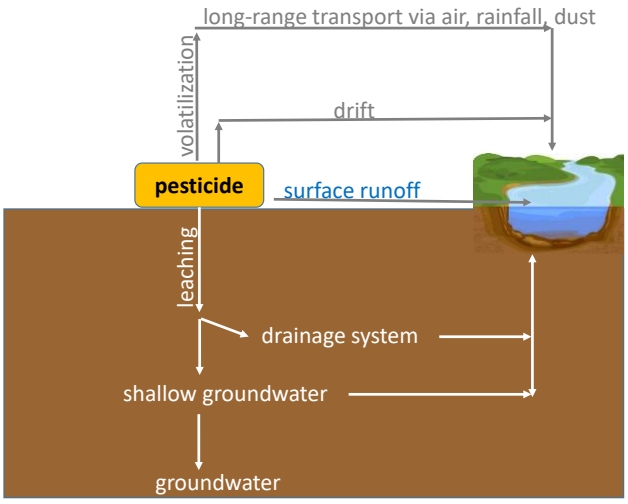

Figure 1: Transport of an applied pesticide from target area

Pesticide transport is significantly impacted by soil conditions such as organic carbon content, soil type, and soil water content, as noted by Gupta and Gajbhiye (2002). High concentrations of organic carbon and high percentage of loam/clay in the soil increase the chemical sorption potential for pesticides and hence, reduces their distribution in the environment (Schäffer et al. 2018; Luks et al. 2021). The current and antecedent soil water content is a crucial environmental factors since it controls the water-dependent pesticide transport through the soil (Willkommen et al. 2019; Lewan et al. 2009). A high soil water content triggers leaching of pesticides (Pallud et al. 2004). Pesticide leaching is accelerated by preferential flow, when soil water with dissolved compounds percolates

very fast through macropores from earthworms, roots and shrinkage cracks, hence sorption and degradation processes are slowed down (Vogel et al. 2015; Rosenbom et al. 2014; Jarvis et al. 2012).

3 Transformation of pesticides

After released to the environment, a pesticide undergoes physical, biological or chemical transformation processes and the applied parent compound (PC) is altered into a transformation product (TP) (Fenner et al., 2013). Depending on its vapor pressure (Henry constant), the compound can be transformed from liquid to gaseous phase. In air in a Swedish catchment, a total number of 36 pesticides were detected, and 70 pesticides in rainfall (Kreuger and Lindström 2019; Kreuger et al. 2017), while 26 different pesticides (median) were measured in air up to 100 m distant to agricultural fields in South Africa (Veludo et al. 2022). The concentrations and combination of pesticides in the samples varied seasonally and spatially (Veludo et al. 2022; Kreuger and Lindström 2019). Solar radiation enables photolysis on surfaces and up to a certain depth in the water phase and changes the molecule structure (Hensen et al. 2019; Wu and Linden 2010; Burrows et al. 2002). Hensen et al. (2019) observed the formation of nine TPs for terbutryne in a photolysis experiment. In addition, chemical processes and degradation by microorganisms convert the PC into TPs (Avila et al. 2021; Aldas-Vargas et al. 2021; Marín-Benito et al. 2019). These studies point out the dependency of these transformation processes on a high number of parameters such as pH, temperature, dissolved organic matter/organic carbon content and activity of microorganisms. Exemplarily, the transformation processes of a pesticide in general and of the oilseed rape herbicide metazachlor are shown in Figure 2.

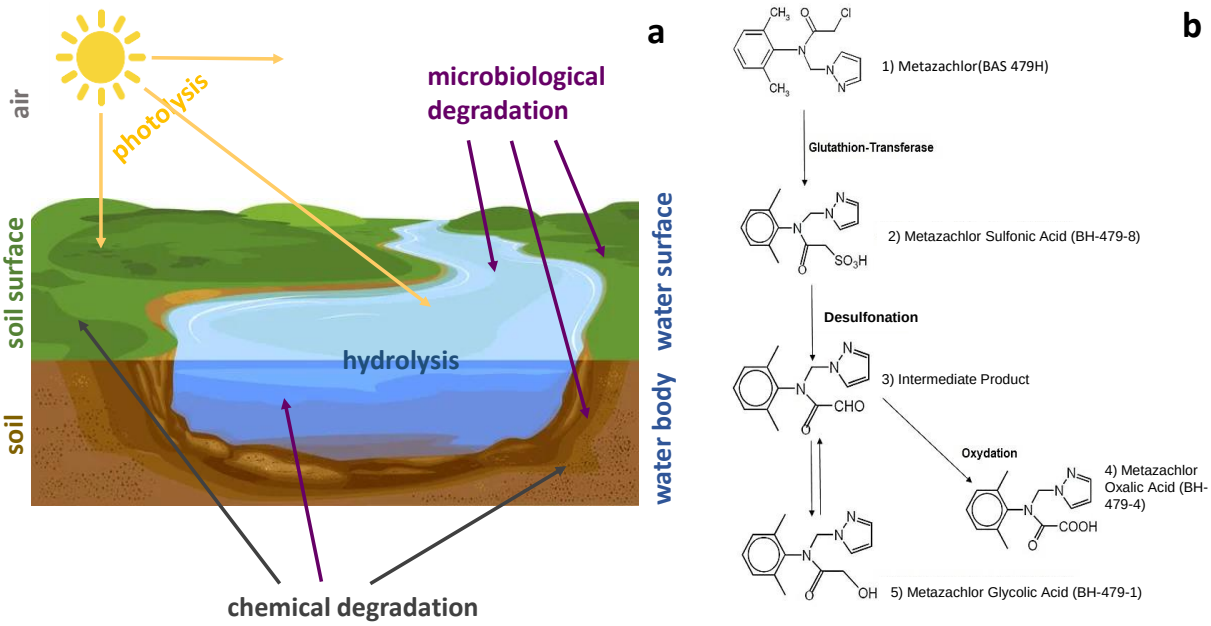

Figure 2: Transformation processes of (a) pesticides, general scheme (source of river cross section (b) Transformation of metazachlor after Laue et al. (1996) in soil

Due to this transformation, the PC characteristics are altered as well. Belfroid et al. (1998), Boxall et al. (2004) and Kiefer et al. (2019) observed an increase of polarity and a decrease of the organic carbon adsorption coefficient of the observed TP/PC combination by a factor of up to 10. Furthermore, TPs tend to show a higher persistence than their PC (Boxall et al. 2004; Fenner et al. 2013b; Lewis et al. 2016; Kiefer et al. 2019). In terms of ecotoxicity, Sinclair and Boxall (2003)

observed that 70% of the TPs in their study showed a similar or lower ecotoxicity for fish, daphnids or algae than their corresponding PC but in 30%, the TP was more toxic.

4 Occurrence of pesticides in water bodies

The occurrence of pesticides in water bodies has been observed for more than 50 years due to the intense usage in agriculture over decades. They have been detected in surface water bodies all over the world (e.g. Chow et al., 2020; de Souza et al., 2020) and vary in terms of detection frequency, concentration range, applied pesticide and analysis spectrum/-method. For example, in South-Asian countries, insecticides like DDT, endosulfan and chlorpyrifos were the prevalently measured pesticides in surface water, while glyphosate, diflufenican and bifenox as herbicides were dominant in Europe (Sarker et al. 2021; Mohaupt et al. 2020). In the study of Mohaupt et al. (2020), the environmental quality standards (EQS) were exceeded in 5 to 15 % of the surface water samples, mainly by insecticides (2007-2014) but since 2014, primarily by herbicides. These results demonstrate the threat of surface water bodies.

5 Ecotoxicological effects of pesticides

Unwanted effects of pesticides in the environment occur because the total amount applied can be relocated from the target area, harm non-target organisms and have longer effects than intended. In general, an effect of the pesticides impact can be limited to a couple of days to kill organisms harmful to the crop/fruit or weeds. Often, combined effects can occur when more than one pesticide is in the environment . The ecotoxicological effect of mixtures is not well understood due to its complexity. Besides additive effects, synergistic effects can occur leading to toxicities up to 660 times higher compared to additive effects (identified in laboratory investigations) (Liess et al. 2020; Weisner et al. 2022). Figure 3 reports effects in target and non-target areas.

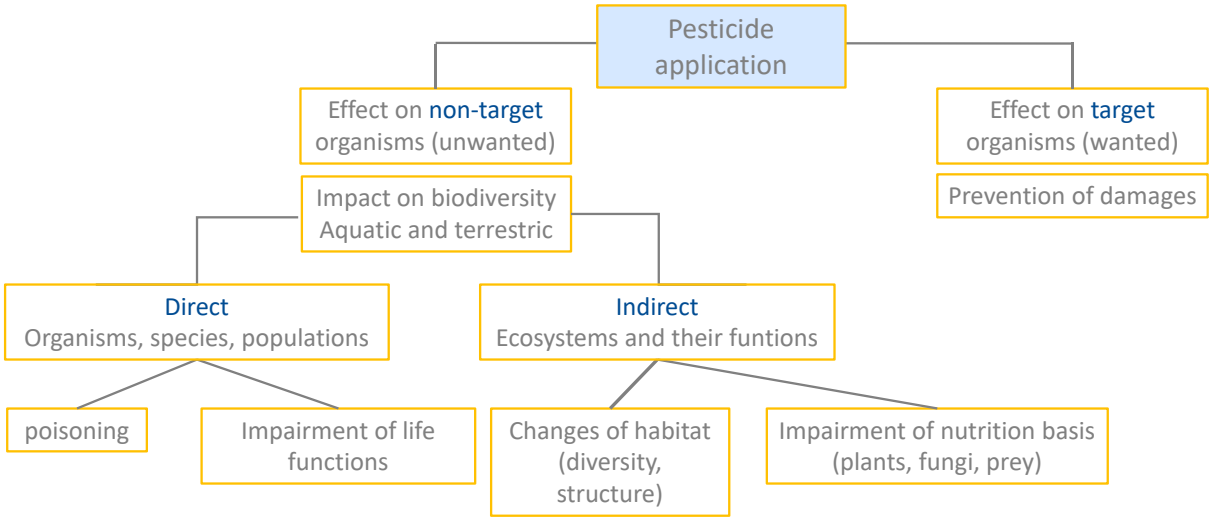

Figure 3: Direct and indirect effects of pesticides in the environment

6 Adverse effects of pesticide on organisms linked to aquatic habitats

Pesticides are intended to eliminate or harm organisms that compete with crops for nutrients, light, and water, or those that have a negative impact on the crops. As a side effect, non-target organisms are endangered as well. Studies about ecotoxicological effects on different species/species groups have been carried out under field conditions or in laboratory experiments. Exemplarily, effects on organisms of different trophic levels are presented.

Phytoplankton are primary producers and present the base of the food web. Inhibition of their growth, photosynthesis, and reproduction were identified as direct negative effects of pesticide exposure (Rico-Martínez et al., 2012). Indirect effects alter top-down selection pressures, such as predation and competition and hereby, often mask the direct negative effects of pesticides (Fleeger et al., 2004). Both effects on phytoplankton affect densities, growth and traits changing the structure, composition and function of the phytoplankton community (Lozano et al. 2019; Schäfer et al. 2011; Cedergreen et al. 2004).

For invertebrates, a general decrease of sensitive species (Ephemeroptera, Plecoptera, Trichoptera), revealing the overall degradation of the community was observed (Liess et al. 2021; Schneeweiss et al. 2022). At sublethal concentrations, the reproduction of invertebrates (insects) after pesticide exposure was hampered and caused an increase of the recovery time of the species, especially if the exposure affected juvenile life stages (Schäfer et al. 2017), while crayfish (*Procambarus fallux*) suffered from delayed development and reduced mobility (Velisek et al. 2020). Amphibia *Anura Amphibia* suffered from histological alterations in the liver (Riaño et al. 2020), mouth and intestine malformations and reduced swimming activity (Rutkoski et al. 2020).

Fish are highly mobile and can leave their habitat when living conditions change adversely. This hampers representative studies on the toxic effects of pesticides on this trophic level (Malaj et al. 2014). In a study analyzing 91 European river basins, the ecological status at the sites decreased strongly with increasing chemical risk for fish (Malaj et al. 2014). More process oriented studies observed pesticide effects on the fish biotransformation system and an increased oxidative stress as main consequences (Santana et al. 2022). In addition, neurotoxic effects and a change of behavior were revealed at sublethal concentrations (Redondo-López et al. 2022).

7 Conclusion

The environemntal behavior of pesticides is a complex topic and driven by various factors. The contamination of atmoshpere, soil, water and food has been demonstrated in numerous studies worldwide. Many impacts such as, indirect effects such as loss of habitats and food resources as well as trophic-level interactions are not integrated into approval or regular monitoring of pesticides. To protect human health and the functionality of ecosystems, it is essential to understand the behavior of pesticides in the environment and adapt the pesticide management according to the current state of art.

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Keynote Speech – Oral Session II

New Tools in Plant Disease Assessments

Mathews Paret

Plant Pathology Department, and North Florida Research and Education Center, University of Florida

***Email -** paret@ufl.edu

Abstract

The field of plant pathology is currently experiencing an array of fascinating transformations on a global scale, particularly in the realm of research, development, and commercialization of innovative tools for plant disease assessments. The utilization of spectral sensing technologies, such as multi-spectral and hyper-spectral sensing, is revolutionizing field scouting practices and enabling more accurate and timely assessments of disease severity and hotspots in agricultural fields. Machine learning and Artificial intelligence-based tools for image and object classification of plant diseases imagery at the microscopic and macroscopic level is opening up opportunities for field classification of plant diseases (and other biotic and abiotic issues) for farmers around the world including in remote places. This also have scope in improving triaging of plant samples coming to plant disease diagnostic labs in places where these facilities are available, and discovery of invasive diseases. Non-destructive testing techniques like Raman spectroscopy is increasingly being used for detecting changes in plants associated with plant diseases, and characterization of pathogens. Field-based detection of DNA/RNA targets of plant pathogenic viruses, bacteria and fungi by Recombinase Polymerase Amplification is increasingly becoming commercial. This is also focused on development for use by non-skilled personnel. This presentation will offer a comprehensive overview of the latest research findings conducted in our laboratory, as well as insights from other prominent research groups in the field. Our discussion will revolve around the transformative potential of these cutting-edge techniques for farmers worldwide. By highlighting the advancements in plant disease assessments, we aim to demonstrate how these new tools can revolutionize farming practices and contribute to improved crop health and yield. The practical applications and benefits of these techniques will be explored during the presentation, with emphasis placed on their relevance and impact in addressing the challenges faced by farmers on a global scale.

Keywords: Amplification, Artificial Intelligence, Machine Learning, Raman spectroscopy, Recombinase Polymerase, Sensing

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Oral Presentations

ID 04

Abundance variation of *Bactrocera dorsalis* and the fruiting phenology of *Mangifera indica* in wet and dry zones of Sri Lanka

W.M.C.D. Wijekoon [1*], G.A.S.M. Ganehiarachchi[2], H. C. E. Wegiriya[1] and S. P. Vidanage[2]

[1] Department of Zoology, University of Ruhuna, Sri Lanka
[2] Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka

Abstract
Bactrocera dorsalis Hendel (Diptera: Tephritidae) is one of the major pests in the mango industry in Southern Asia, whereas there are no documented statistics of the population variation of *B. dorsalis* with mango (*M. indica*) phenology in Sri Lanka. Hence, the present study was conducted to estimate the abundance variation of *B. dorsalis* with the fruiting phenology of two varieties [(Karutha kolumban (Kc) & Willard (Wld)] of *M. indica* in wet and dry zones of Sri Lanka. In dry and wet zones, eight (8) study sites were selected. For the Kc variety, from the wet zone Balangoda and Niyagama, and from the dry zone Udawalawe and Kakirawa were selected. For the Wld variety, Kahawaththe and Hiyare from the wet zone and Barawakubuka and Dambulla from the dry zone were selected. A fruit fly trap (5 cm diameter, 10 cm height, and a methyl-eugenol coated sponge inside) was hung (1.5- 4 m above the ground level) in a mango tree at the center of each site. Trapped flies were collected once a month from January 2021 to January 2022 and new traps were replaced in each sampling round. Captured flies were identified using standard taxonomic keys. Out of the 1059 *B. dorsalis* flies captured from sites in the wet zone, 49.7% were found in Kc cultivated sites while 50.3% were found in Wld sites. Similarly, out of the total 1109 *B. dorsalis* flies recorded from sites in the dry zone, 47.5% were caught from Kc sites and 52.5% were from Wld sites. Study shows that *B. dorsalis* abundance increases about five folds during the main mango season (March to July) of the wet zone ($P<0.05$) and about three folds increase in the main mango season of the dry zone (October to January) ($P>0.05$) compared to their lowest abundance recorded in the year. In short mango seasons of both zones, *B. dorsalis* showed a slight increase of the abundance ($P>0.05$). The both *B. dorsalis* high abundance and the main mango season exist in the distinct wet season of both dry and wet zones. In both zones, the variation of *B. dorsalis* abundance was non-significant between Kc and Wld varieties ($P> 0.05$). Crop phonological studies in relation to the population ecology of *B. dorsalis* are vital to implementing effective pest management methods.

Key words: *B. dorsalis,* Climatic zones, Mango phenology, Sri Lanka

[*]***Corresponding Author***: chandanadammika1984@gmail.com

ID 15

In vitro screening of beet (*Beta vulgaris* L.) germplasm for water stress induced by Polyethylene Glycol

N.D. Kolombage, P.I.P. Perera* and A.S. Jathunarachchi

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila

Abstract

Kalpitiya is a key area for vegetable production and beet is one of the dominant crops cultivated there. Low soil water retention due to the permeable sandy soil and evaporation due to high temperature and windy condition are major constraints for crop cultivation that is surmounted by excessive irrigation using groundwater. The introduction of beet varieties which are tolerant to low water availability could be a long-term solution. Three commercial beet varieties; Red Atlas, Chariot, and Maravilla Andina were screened for adaptability to low water availability by adding Polyethylene glycol 6000 (PEG 6000) into the *in vitro* culture medium. In the two-factor factorial experiment, varieties were tested with four PEG levels: 0, 20, 40, and 60 g/L. The Completely Randomized Design was used with 30 replicated seedlings. Seedling growth parameters including the number of leaves, the number of roots, shoot dry weight, and root dry weight were recorded 30 days after sub-culturing and the Analysis of Variance was performed to analyze the data. The results revealed that the early vegetative growth of plants was significantly impacted by artificially induced water stress levels in the beet varieties where an interaction effect was observed in some parameters. The number of leaves was significantly reduced with the increased stress in all three varieties. The number of roots was increased in the variety Chariot at the 60 g/L PEG level whereas Maravilla Andina and Red Atlas showed a comparable number among the different levels. The shoot dry weight was comparable in the tested PEG levels in Chariot and Maravilla Andina. In Red Atlas and Chariot, the root dry weight was decreased and in Maravilla Andina, the parameter was comparable at all four levels. Maravilla Andina resulted in comparable performance among the different water stress levels for the number of roots, shoot dry weight and root dry weight whereas the other two varieties showed a decrease in two parameters. Therefore, Maravilla Andina can be identified as the potential variety for adapting to the stress condition occurs due to low water availability. However, further experimentation is required for identifying the most adaptable variety.

Keywords: Beet, *In Vitro*, Kalpitiya, Polyethylene Glycol, Water Stress

Corresponding Author: prasanthi@wyb.ac.lk

Acknowledgement: This work was funded by the AHEAD Research Grant (AHEAD/DOR/051)

ID 16

Effect of temperature on early development of in vitro raised Beta vulgaris varieties

N.S.A. Nuwarapaksha, P.I.P. Perera*, A.S. Jathunarachchi

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management. Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), 60170, Sri Lanka

Abstract

Beta vulgaris is one of the major vegetable crops cultivated in Kalpitiya, one of the significant vegetable-growing regions in Sri Lanka. High daytime temperatures basically above 30°C reduce the productivity of the crop. Farmers tend to cool down the cropping land-using irrigation systems by over-utilizing the groundwater, that causes the intrusion of seawater into the groundwater table in the peninsula. In this context, the selection and recommendation of beet cultivars that can tolerate higher temperatures could be a long-term solution to continue cultivation with limited water utilization. The present study was conducted to screen three commercially grown beet varieties (Maravilla Andina, Royal Red, and Red Ace) under *in vitro* conditions using two temperature levels, 34 °C for 8 h followed by 28 °C for 16 h provided in a growth chamber and the seedlings maintained at 28 °C continuously (control). Murashige and Skoog medium was used as basal medium. The factorial experiment was arranged in a Completely Randomized Design with 30 replicates. All the cultures were maintained at 2500-3000 lux light intensity and 16 h photoperiod. After 45 days, the number of leaves, number of fibrous lateral roots, shoot dry weight and total root dry weight were recorded as growth parameters. The data were subjected to analysis of variance. The temperature level has a significant effect on seedling growth ($p<0.05$), except for root dry weight and varieties showed significant differences except for shoot dry weight ($p<0.05$). Among the varieties, Maravilla Andina showed significantly higher growth performance under higher temperature level for shoot and root dry weight ($p<0.05$) where the other two parameters had a significant reduction. All the parameters were significantly reduced in Royal red. The same happened in Red ace except for number of roots where a comparable performance was observed. Based on the results Maravilla andina has more potential for tolerating higher temperature levels. However, further studies are required for making a recommendation for the farmers.

Keywords: *Beta vulgaris*, *In vitro* screening, Kalpitiya, Temperature stress

*__Corresponding Author:__ prasanthi@wyb.ac.lk

Acknowledgement: This work was funded by the AHEAD Research Grant (AHEAD/DOR/051)

ID 20

Selection of drought-tolerant chili (*Capsicum annuum* L.) varieties for Kalpitiya peninsula using *in-vitro* techniques

G.D.S.H. Ekanayake, P.I.P. Perera*, A.S. Jathunarachchi

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), 60170, Sri Lanka

Abstract

Chili is one of the major crops grown in Kalpitiya peninsula which belongs to the North Western Province in Sri Lanka which has a year-round drought conditions. The major constraint for chili cultivation in Kalpitiya is water stress due to water deficit and high temperature. Farmers tend to apply intensive irrigation methods for overcoming water and heat stress and large amounts of nitrogen fertilizer to compensate for the leachate through irrigation water due to the sandy nature of the soil. It leads to extensive contamination of the groundwater table. One of the potential strategies to overcome this problem is the cultivation of the chili varieties more adaptable to the drought condition. This study was carried out to screen drought-tolerant chili varieties suitable for cultivating in the Kalpitiya area that was done through *in-vitro* selection by using an artificial stress inducer, Polyethylene glycol 6000 (PEG 6000). In the factorial experiment in the Completely Randomized Design, three chili varieties (Galkiriyagama selection, MICH HY 2, Vijaya F1) were screened using half-strength Murashige and Skoog medium supplemented with four PEG levels, 0, 20, 40 and 60 g/L using 30 seedlings containing two leaves. After 30 days of subculturing, early vegetative growth parameters; the number of leaves, number of roots, shoot dry weight and root dry weight were recorded and subjected to Analysis of Variance. A significant effect of artificial drought was observed for the number of leaves ($p<0.0001$). Furthermore, a significant difference was observed among the varieties for all parameters ($p<0.0001$), thus can be used for screening purposes. Galkiriyagama selection showed a significant reduction in all parameters at the 60 mg/L except for shoot dry weight where a comparable performance was observed. Vijaya F1 showed a comparable performance for all parameters except for number of roots with a significant decrease at the highest PEG level. MICH HY 2 showed either a comparable or increased performance for all parameters thus shows a higher potential for tolerance to the drought condition. However, further studies are required for selecting best drought-tolerant chili varieties for cultivating in Kalpitiya area.

Keywords: *Capsicum annuum* L., Kalpitiya, Polyethylene glycol, Water stress

Corresponding Author: prasanthi@wyb.ac.lk

Acknowledgement: This work was funded by the AHEAD Research Grant (AHEAD/DOR/051)

ID 32

Studies on seed setting and pollen viability of two pineapple cultivars (Kew and Mauritius) in Sri Lanka

K.A.D.N. Kaushalya[1*], I. Kalubowila[2] and U.G.A.T. Prematilake[1]

[1] Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University of Sri Lanka
[2] Department of Agriculture, Fruit Research and Development Institute, Kananwila, Horana, Sri Lanka

Abstract

The pineapple (*Ananas comosus* var. *comosus*) is a tropical fruit crop in the family Bromeliaceae. Commercially pineapple is propagated by vegetative material without new combinations of genes. Pineapple is self-incompatible and seeds are only produced if cross-pollination occurs among varieties. The use of sexual reproduction of pineapple is restricted to breeding purposes carried out for developing new hybrids. This study attempted to investigate the seed setting and pollen viability of Kew and Mauritius cultivars as a tool for the hybridization process in the pineapple breeding program at Fruit Research and Development Institute Horana. Results of cross-pollination between the two varieties indicated that the Mauritius variety produced 04 seeds per floret, whereas the Kew variety produced 03 seeds per floret. But the median seed setting per floret in the two varieties is not significantly different. Pollen viability for both cultivars was best around 9 a.m. which was evaluated from 9.00 a.m. to 3.00 p.m. using a 1% Acetocarmin test. It steadily decreases from morning to evening. Both the Kew and the Mauritius types are crossable, as well as Mauritius has greater seed setting and pollen viability than the Kew. By crossing the Kew and Mauritius cultivars in the morning, successive pollination and seed set can be achieved.

Keywords: Kew, Mauritius, Pineapple, Pollen viability, Seed setting

Corresponding Author: nipunikulathunga06@gmail.com

ID 36

Identification of whitefly species (Hemiptera: Aleyrodidae) of coconut palms in Colombo and Gampaha districts

K.M.D.N. Karunarathne [1]*, N.S. Aratchige [2], M.K. Meegahakubura [1], P.H.P.R. De Silva [2], D.H. Dilrukshika [2], D.P.M. Silva [2] and K.G.B.A. Samarasinghe [1]

[1] Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka
[2] Crop Protection Division, Coconut Research Institute of Sri Lanka

Abstract
The Whitefly (Hemiptera: Aleyrodidae) has become a key pest in many crops in the world. Since 2019, whiteflies have been reported as significant pests in coconut plantations in Sri Lanka. The whiteflies have spread to the major coconut growing areas of the country and therefore, causing yield reductions mainly in king coconut palms. Therefore, management of the whitefly infestations in coconut plantations is of paramount importance. The whiteflies and their related arthropods in coconut plantations have not been extensively studied in Sri Lanka. Hence, the current study represents the first effort to identify the species of whiteflies, associated arthropods, and alternative host plants in the Colombo and Gampaha districts. Between February and June 2022, a random survey was carried out to gather coconut leaf samples infested with whiteflies and document alternative host plants from five distinct geographical locations in the Colombo and Gampaha districts. Pupal stages of whiteflies from the collected samples were prepared for taxonomic identification at the Crop Protection Division of the Coconut Research Institute of Sri Lanka. The diversity of whitefly species in the sample locations was calculated using the Shannon-Weaver diversity index. A total of four whitefly species were identified from both districts, with three species being common, namely Aleurodicus dispersus, Aleurodicus aff. cocois, and Paraleyrodes minei, while Aleurotracheulus atratus was the fourth species. Among these, Aleurodicus aff. cocois was found to be exclusively associated with coconut palms. The locations of Katunayake and Kaduwela had the highest diversity of whiteflies. Besides whiteflies, several other arthropods like scale insects, ants, caterpillars, spiders, mealybugs, and mites were identified in association with whiteflies. The locations of Uswetakeyiyawa and Peliyagoda had the highest diversity of these arthropods. The most commonly found alternative host plants for whiteflies in coconut plantations were Indian almonds (Terminalia catappa) and bananas (Musa paradisiaca).

Keywords: *Aleurotracheulus atratus; Aleurodicus.* aff*. cocois; Aleurodicus disperses; Cocos nucifera; Paraleyrodes minei;* Whitefly

*__Corresponding Author:__ karunarathnadilakshi18@gmail.com

Acknowledgement: The authors express their gratitude to the Crop Protection Division staff at the Coconut Research Institute of Sri Lanka for their assistance in collecting the samples.

ID 37

Comparative evaluation of three edible mushroom types based on yield attributes

H.K.A. Karunathilaka[1*], Shrinath Wijesekara[2] and G.L. Siriwardhana[3]

[1] Agriculture Research Station, Thelijjawila
[2] District Training Center, Thelijjawila
[3] Agriculture Research Station, Thelijjawila

Abstract
The objective of this study was to identify a high yielding edible mushroom type/s adaptable to the southern region based on yield attributes. Two types of wild mushrooms with proven culinary attributes were compared with that of cultivated Pleurotus species. Hence, the present investigation was carried out at Agriculture Research Station, Telijjawila from 2019 to 2020 to modify the cultivation technique employing different substrates on ways to accelerate the fructification process, which was delayed in the previous study. The objective of this trial was to compare the growth of two wild mushroom strains of the milky type (Calocybe) with that of the commonly grown Pleurotus ostreatus mushroom in the southern region. The trial consisted of five treatments: T1- 100% sawdust, T2- 75% sawdust + 25% SMS (Spent Mushroom Substrate), T3- 50% sawdust + 50% SMS, T4- 25% sawdust + 75% SMS, and T5- 100% SMS. The experiment was conducted in the mushroom shed using a completely randomized design (CRD) with 25 bags. It was carried out over two consecutive cropping periods, from December 2019 to April 2022 and from May 2022 to September 2022. The spawns of the wild mushrooms and oyster mushrooms were prepared at the research station and then inoculated separately into sterilized compost substrates. The cultivation practices were conducted in accordance with the recommendations of the Department of Agriculture (DOA). The growth parameters, including morphological characteristics, asymmetry index, and yield, were compared among the different treatments. A 3×5 factorial experiment was used to analyze the interaction effects, and the data was analyzed using the SAS (Statistical Analysis System) package. In contrast to the higher growth rate observed in the *Pleurotus* strain during the vegetative phase, the results showed that both wild strains had significantly higher yield values at $p>0.05$ in all treatments. The highest yield was obtained in the treatment where SMS and sawdust were used in equal ratios. In terms of market potential, the extended shelf life with an asymmetric index ≥1 in both wild mushroom types would certainly attract both traders and consumers. Additionally, both wild mushrooms showed less vulnerability to insect pest damage.

Key words: Pleurotus, Vegetative growth, Wild mushrooms, Yield

***Corresponding Author*:** anothu@gmail.com

ID 72

Molecular identification of two local T*richoderma* isolates and evaluating the efficacy of several *Trichoderma* preparations to manage Root-knot Nematodes (*Meloidogyne* spp.)

S.M.N.S. Samarakoon[1], K.M.D.W.P. Nishantha[2*] and D.M. De Costa[3*]

[1]Postgraduate Institute of Agriculture, University of Peradeniya
[2]Horticultural Crop Research and Development Institute, Gannoruwa, Peradeniya
[3]Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya

Abstract

Root-knot nematodes (*Meloidogyne* spp.) are sedentary, endoparasites that severely affect the yield of a wide range of crops grown in Sri Lanka. In the integrated management of root-knot nematodes, biological control by locally-available antagonists is encouraged. *Trichoderma* spp. is a widely available biological control agent in many agricultural habitats in the country and has been identified as a potential biocontrol agent against root-knot nematodes. However, studies on the formulation of the local isolates of Trichoderma as a bionematicide using low-cost agricultural material as organic carriers are scarce. Hence, this study aimed to identify two local isolates of *Trichoderma* by molecular methods and to evaluate the efficacy of different agro-based preparations of the above *Trichoderma* isolates to control *Meloidogyne* spp. infecting tomato. The two *Trichoderma* isolates were identified as *Trichoderma erinaceum* (TI) and *Trichoderma koningiopsis* (TII) using *ITS1* and *ITS4* molecular marker-based sequence analysis. Seven different preparations of the *Trichoderma* isolates were bio-assayed on second-stage juveniles (J2s) of *Meloidogyne* spp. for mortality. Using a pot experiment, the efficacy of seven preparations was evaluated on nematode infestation ability based on root gall index, egg mass and root-knot formation ability. In general, liquid-based and compost-based preparations of *Trichoderma* performed better in laboratory bioassays and increased the percentage mortality of J2s. The highest percentage J2 mortality at the 24th h after treatment resulted in T2 (molasses-based liquid preparation) and T6 (Tricho-compost) treatments of *T. erinaceum* and T4 (mixture of compost and fungi-maize grain powder) of *T. koningiopsis*. A maize grain powder-based T1 (*T. erinaceum*), showed higher performances when applied as a soil treatment by reducing egg mass and root-knot production which was on par with the recommended nematicide application. The present study revealed the potential of using the locally-isolated *T. erinaceum* and *T. koningiopsis* for the control of *Meloidogyne* spp., infecting tomatoes by targeting J2 mortality and infection to tomato roots by J2s. Further investigations on the field efficacy of the selected preparations are needed to introduce these biopreparations as bionematicides.

Keywords: Biocontrol agent, Bioformulation*, ITS 1,* and *ITS 4*

[*]***Corresponding Authors:*** wpnishantha@yahoo.com, and devikadecosta@gmail.com

ID 82

Optimization of a cost-effective DNA extraction protocol and PCR conditions to amplify *rbc*L marker in *Rhinacanthus* species

M.R.C.D. Sisirakumara[1*], N.U. Jayawardana[1] and Y. Somaratne[1]

[1] Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Sri Lanka

Abstract

Rhinacanthus is an important genus that belongs to the family Acanthaceae. Species in this genus are used in traditional medicine to treat a variety of disease conditions. *Rhinacanthus flavovirens*, a recently discovered endemic herb in Sri Lanka known as *Maha Anitta* in traditional medicine, has lately been brought up for its medicinal properties and molecular level identification. For molecular biological investigations of an organism, it is necessary to extract pure, high molecular weight genomic DNA. However, the presence of high levels of polysaccharides and polyphenols in plants of this genus interferes with pure DNA isolation and downstream reactions such as PCR amplification. The primary aim of this study was to optimize the cost-efficient protocols for DNA isolation and PCR, to attain optimal amplification of selected primers using R. flavovirens. A comparison was made between the CTAB-based DNA extraction method, with some modifications, and the SDS-based approach. The DNA extraction using a modified CTAB method, which included 2M NaCl, 2.5% CTAB, 3.0% β-mercaptoethanol, and 4.0% PVP, resulted in a DNA yield of 79.43ng/L. The A260/A280 value was 1.940, indicating minimal levels of contamination. The PCR program was optimized to produce robust and reproducible amplification products using universal plant barcoding primers from the *rbc*L region by modifying the temperature and time intervals during denaturation, annealing, and elongation. An initial denaturation at 94°C for 3 min followed by 30 cycles at 94°C for 30 sec, annealing at 50°C for 30 sec and extension at 72°C for 1 min, followed by one final extension at 72°C for 10 min produced optimal amplification. PCR results showing high intensities of amplification also indicate that the extracted genomic DNA was of good quality and uncontaminated by interfering substances. The findings of this study demonstrate that the improved protocol for DNA isolation and PCR can be used to facilitate future research on molecular identification, genetic diversity analysis, and phylogenetic studies of *R. flavovirens*, as well as the development of conservation strategies for this rare and endemic species in Sri Lanka and other *Rhinacanthus* species.

Keywords: Cetyltrimethylammonium Bromide (CTAB), Polymerase Chain Reaction (PCR), *rbc*L, Rhinacanthus

***Corresponding Author*:** chathurangidsk@gmail.com

***Acknowledgement*:** The authors express their gratitude to the Bandaranaike Memorial Ayurveda Research Institute for supplying the plant materials used in this study.

ID 89

Improvement of elephant dung as soilless substrate for tomato cultivation under protected house conditions

H.K.M.S. Kumarasinghe*, I.D.T.R. Jayawardhane

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

Abstract
Plant growth and yield are better in soilless substrates than soil media. Elephant dung is an underutilized bio-waste which contains many important minerals required for plant growth. Therefore, a study was conducted to compare plant growth and yield responses of tomato in elephant dung based soilless substrates in Faculty of Agriculture, University of Ruhuna, Sri Lanka under protected house condition. There were six treatments as T1(coco peat 100%/ control), T2(elephant dung 100%), T3(elephant dung 75% + coco peat 25%), T4(elephant dung 50% + coco peat 50%), T5(elephant dung 75% + half burnt paddy husk (HBPH) 25%) and T6 (elephant dung 50% + HBPH 50%) replicated in five times and laid out with Completely Randomized Design (CRD). pH, electrical conductivity, water holding capacity (WHC) and substrate height reduction were recorded at the end of the experiment. As vegetative parameters plant height and number of leaves per plant were recorded while days taken to 50% flowering and total fruit weight per plant were measured as reproductive parameters. Data were analyzed using ANOVA and mean comparison was done by Dunnett's test at 5% probability level. Significantly the highest (7.5) and lowest (5.8) pH values were recorded in T2 and T1, respectively. EC values of T1 and T6 were not significantly different. The highest (2.85 dS/m) and lowest (1.38 dS/m) EC values were reported in T1 and T5, respectively. T2 showed the significantly highest WHC (47.06%) comparing to T1(28.64%). The significantly highest substrate height was recorded in T1(20.12cm) and the lowest was recorded in T2(7.96cm). There was no significant difference among T1 and T6 in plant height. The significantly highest plant height was recorded in T1(76.08cm) and T6(67.56cm) while representing the lowest value from T2(45.12cm). When compared to T1(12.8), significantly the lowest number of leaves at 50% flowering stage were recorded in T2(10.8) and T3(11.6). When compared to T1(43), T2 has taken significantly longest days (47) to 50% flowering. There was no significant difference between T1(1090.72g) and T6(913.56g) in total fruit weight per plant. T3(287.64g) showed the lowest among the treatments. Partially decomposed (two weeks after excretion) elephant dung can be improved by adding 50% HBPH in volume basis to obtain better growth and yield of tomatoes.

Keywords: Elephant dung, Improvement, Soilless substrate, Tomato

Corresponding Author: sarathkumarasinghe@yahoo.com

ID 90

Development of *in-vitro* propagation protocol for lisianthus (*Eustoma grandiflorum*)

P.V.G.D.N. Vihanga* and P.E. Kaliyadasa

Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University of Sri Lanka

Abstract

Eustoma grandiflorum, also known as Lisianthus, is a member of the Gentianaceae family and is highly valued in the global floriculture industry due to its unique characteristics, particularly its exceptional shelf life. Since lisianthus has the qualities of an "ideal cut flower", its demand is increasing throughout the world. This study was aimed to develop cost effective, uniform plants for commercial production of Lisianthus throughout the year by using *in-vitro* techniques. The effects of different combinations and concentrations of plant growth regulators (PGR) and charcoal on new shoot and root induction of Lisianthus explants was studied. The experiment was arranged as two factor-factorial Completely Randomized Design (CRD) along with 15 replicates. The half strength MS medium supplemented with 0.75 mgL^{-1} Indole-3-Butyric Acid (IBA) + 0.5 mgL^{-1} Napthalene Acetic Acid (NAA) + 0.5 mgL^{-1} Gibberellic Acid (GA3) with charcoal was the best media for the new shoot initiation and increment of shoot height of Lisianthus. The MS medium with 0.5 mgL^{-1} Thidiazuron (TDZ) + 2 mgL^{-1} Indole-3-Butyric Acid (IBA) with charcoal recorded as the best media for both root initiation and increment of root length of Lisianthus ($p<0.05$). The application of these protocols in commercial production of this valuable cut flower species can be cost-effective, as they involve minimal use of PGR compared to existing literature.

Keywords: Charcoal, Explants, Lisianthus, Plant growth regulators

***Corresponding Author:** nethmivgamage678@gmail.com

ID 91

Optimization of tissue culture protocol to production of planting materials of *Pyrus communis* L.

N.W.M.S.N. Madhushani[1], L.G.I. Samanmali[2*] and P. E. Kaliyadasa[1]

[1]Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka

[2]Plant Virus Indexing Centre, Homagama, Sri Lanka

Abstract

Pear (Pyrus communis L.), belonging to the family Rosaceae, is an economically important clonally propagated crop widely cultivated in temperate climate zones and the fifth most widely grown fruit in the world. The Department of Agriculture in Sri Lanka has identified two types of local pear varieties in Sri Lanka as Ragala and Rahangala pears. Currently, grafting is the most common method of propagating pears in Sri Lanka. At the commercial level, Pears are difficult to propagate through grafting due to poor success rates. This study aimed to (a) develop a protocol for producing pear planting materials using tissue culture techniques with an efficient sterilization protocol and (b) select the best media composition for pear shoots multiplication. Ragala and Rahangala pear varieties were used to optimize the surface sterilization procedure at different NaOCl concentrations (10, 15, and 20%) and shaking times (10, 20, 30 min) using shoots with fifteen replicates in a completely randomized design. Data was analyzed using a two-way ANOVA. According to the results, different treatments had significantly affected the survival rate of both Ragala and Rahangala pear varieties ($p<0.05$). The shoots sterilized with 20% NaOCl for 20 minutes and established in MS medium with fungicide and antibiotic were the best sterilization treatments with the highest survival percentage. *In-vitro* raised pear shoots were separated from seedlings and transferred to five different 6- Benzyl Amino Purine (BAP) concentration (1.0, 1.5, 2.0, 2.5 and 3.0 mg L^{-1}) combinations with 0.1 mg L^{-1} Naphthalene Acetic Acid (NAA) containing MS medium for stimulate the multiplication stage. The experiment was laid out in completely randomized design with twelve replicates and data was analyzed using a one-way ANOVA. There was a significant difference ($p<0.05$) between the treatment combinations on the number of shoots and height. Among those, MS medium containing 2.5 mg L^{-1} BAP + 0.1 mg L^{-1} NAA was reported the best shoot regeneration. The above stated effective sterilization procedure along with shoot multiplication protocol could be used in development of complete *in-vitro* propagation protocol for commercial production of pears.

Keywords: BAP, *In-vitro* propagation, MS medium, NAA, Surface sterilization

Corresponding Author: samanpvic919@gmail.com

ID 103

Evaluation of morphological variations in randomly selected fifteen traditional yard long bean (*Vigna Unguiculata* L.) accessions

M.B.F. Zamha[1*], H.A.P.A. Shyamalee[2], A.L. Ranawake[1]

[1]Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Sri Lanka
[2]Agricultural Research Station, Thelijjavila, Matara, Sri Lanka

Abstract

The yard long bean is an essential nutritious legume that belongs to the family Fabaceae. It is widely grown in South Asia for its immature pod and is a popular crop in Sri Lanka. Evaluation of morphological variability of traditional yard long bean accessions could reveal the genetic potential of the germplasm. In the present study, fifteen traditional yard long bean accessions collected from different Sri Lankan locations were characterized. The study was carried out at Thelijjavila research station according to a randomized complete block design (RCBD) with three replicates with ten plants in each replicate. Four qualitative characters (growth habit, flower colour, pod colour, and seed colour) and nine quantitative traits (plant height, days for first flowering, number of pods per peduncle, number of pods per plant, pod length, pod width, pod weight, pod yield, and number of seeds per pod) were evaluated using IBM statistical software 22. ANOVA, principal component analysis (PCA), cluster analysis and 2D scatter plot were used to evaluate the morphological variation among accessions. Dunkan's Multiple Range Test (DMRT) grouping among the accessions exhibited a significant variation among the accessions. Plant height, days for first flowering, number of pods per peduncle, number of pods per plant, pod length, pod width, pod weight and number of seeds per pod varied between 112-284 cm, 34-41, 1.4-1.8, 2.2-8.4, 22-75 cm, 1.1-1.8 cm, 8-35 g per pod, 11-19, respectively. *TJ-150* recorded the highest pod yield per plant (289.8 g per plant), followed by *TJ-Rathu* (276.9 g per plant) and *TJ-151* recorded the lowest pod yield (51 g per plant). Three principal components were extracted from the nine assessed traits explaining the total cumulative variance of 79.31% while principal components PC1, PC2, and PC3 explained 38.6%, 27.2% and 13.3% of the variance, respectively. Five morphologically distinct clusters were gained at cluster distance five. The presence of the accessions on all four quadrants of the 2D-scatter plot visualized a broad diversity available among the accessions. According to Pearson's correlation analysis, the number of pods per plant (r = 0.516), days for the first flowering (r = 0.5), average pod weight (r = 0.47), and the number of seeds per pod (r = 0.432) had the highest positive correlations with pod yield per plant (g/plant) at 0.05 significant level which emphasizes the yield determinants of yard long bean. The findings of the study will be helpful for future breeding programs in yard long bean improvement.

Key Words*:* Accession, Diversity, Morphological trait, Yard long bean, Yield attributes

***Corresponding Author*:** zamhabuhary@gmail.com

ID 125

The potential of using cut sets of seed potatoes (*Solanum tuberosum* L.) to propagate CONNECT and GRANOLA varieties

H.M.S.J Herath[1], R.B.H.K. Wanigasekara[2*] and S.R.W.M.C.J.K. Ranawana[1]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2] Hayleys Agriculture Holdings Ltd., Nuwara Eliya, Sri Lanka

Abstract
Potatoes (Solanum tuberosum L.) are vegetatively propagated using whole tubers, and due to the high cost of seed potatoes, it is extremely difficult for the majority of smallholder farmers to buy imported seed potatoes of high yielding, new varieties. Use of cut sets of seed potatoes instead of whole tubers would be a better solution to reduce the cost of production. However, there are limited scientific evidences that compare the performances of cut and uncut seed potatoes. Thus, the potential of propagating potato using cut sets of seed potatoes with proper wound healing treatments was assessed at a farmer field in Blackpool, Nuwara Eliya, Sri Lanka during February-June, 2022. Two separate experiments were conducted in the field and polybag pots. In the field trial, six wound healing treatments (uncut, fresh cut, fresh cut with lime paste, cut and cured for 5, 10, 15 days) were tested on two potato varieties CONNECT and GRANOLA using two-factor factorial Randomized Complete Block Design (RCBD) with three replicates. In the pot study, seven different wound healing treatments (Uncut, cut with wood ash paste, cut with wood ash + 1% sodium bicarbonate mixture, cut with wood ash + margosa oil + palm oil mixture, cut with mancozeb, cut with lime paste and cut without paste) were tested on CONNECT variety using Completely Randomized Design (CRD) with four replicates. In the field trial, variety × wound healing treatment interaction was significant ($p \leq 0.05$) for tuber weight per plant, leaf area, and plant height. Wound healing treatment had significant effect on tuber yield per plant, number of tubers and number of off shaped tubers in the pot study too. Fresh cut and cut with lime paste treatments showed statistically similar tuber yield as compared to uncut seed potatoes of CONNECT variety in both field (1.1-1.3 kg plant^{-1}) and pot experiments (0.7-0.9 kg plant^{-1}). Yield was reduced significantly (45% reduction) in plants propagated by cut sets compared to whole tubers in GRANOLA. In conclusion, cut sets of potato seed tubers would be a better alternative to whole tubers particularly for variety CONNECT that reduces cost of seed potatoes.

Keywords: Lime paste, Mancozeb, Margosa oil, Tuber yield, Wound healing

Corresponding Author: harsha.wanigasekara@agro.hayleys.com

Poster Presentations

ID 14

In vitro screening of three beet (*Beta vulgaris*) varieties adaptable to low nitrogen levels

B.U.C. Batangala, P.I.P. Perera* and A.S. Jathunarachchi

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), 60170, Sri Lanka

Abstract

Beet (*Beta vulgaris*) is a cool-season vegetable grown in Kalpitiya. The area consists of sandy Regosol soil and due to the high permeability, and high evaporation rates the agricultural lands in this region require frequent heavy irrigation. Consequently, the crops need to be applied with high fertilizer doses frequently to compensate for the leachate with irrigation water. It causes a gradual accumulation of nitrogen in groundwater that has already reached alarming levels causing health concerns. Cultivation of crops adaptable to low nitrogen levels is a long-term sustainable approach to overcome this problem. Hence, the present study was conducted to screen three commercially grown beet varieties for their adaptability to low nitrogen supplements under *in vitro* conditions. A factorial experiment was conducted in a completely randomized design with three varieties (Chariot, Ruby Queen and Red Ace) and four Nitrogen levels supplemented through altered concentrations of NH_4NO_3 [875 (control), 656.25, 437.5 and 218.75 mg/L] in the MS Medium using 30 seedlings. Seedling characteristics including the number of leaves, number of roots, shoot dry weight root dry weight were recorded at the end of 30 days of subculturing the two leaved seedlings onto the media containing four nitrogen levels. The data were subjected to Analysis of Variance using R statistical package. An interaction effect was not observed in the tested parameters. A significant difference was not observed among the four nitrogen levels for the number of roots, shoot and root dry weight in all three varieties whereas the number of leaves was affected by the nitrogen level in all three varieties. In Chariot, a significant increase was observed in the number of leaves in the media containing 656.25 and 437.5 mg/L compared to the lowest level 218.75 mg/L. However, the lowest level was comparable to the control whereas in Ruby Queen and Red Ace a significant reduction was observed at the lowest level compared to the control. Therefore, the variety Chariot was identified as the most potential variety that is adaptable for cultivating soils with reduced nitrogen, compared to the other two varieties tested. Further study is required to estimate the actual performance of the identified varieties under *in vivo* conditions.

Keywords: Beet (*Beta vulgaris*), *In vitro* screening, Kalpitiya, Nitrogen use efficiency

Corresponding Author: prasanthi@wyb.ac.lk

Acknowledgement: This work was funded by the AHEAD Research Grant(AHEAD/DOR/051)

ID 28

Effect of red seaweed (*Kappaphycus alvarezii*), **and brown seaweed** (*Sargassum crassifolium*) **extracts on growth performance of *in vitro* propagated anthurium** (*Anthurium andraeanum*)

R.K.J.C.D.Weerarathna[1*], H.M.I.Herath[2], B.V.A.S.M.Bambaranda[1]

[1]Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University of Sri Lanka
[2]Floriculture Division, Royal Botanical Garden, Peradeniya, Sri Lanka

Abstract
The use of low-cost alternatives for *in vitro* culture media and plant growth hormone is crucial to minimize the cost of production. This study evaluated the bio-stimulatory effects of *Kappaphycus alvarezii* (KA) and *Sargassum crassifolium* (SC) seaweed extracts on the growth performance of *in vitro* propagated *Anthurium andraeanum* (Anthurium). Ten treatments with sixteen replicates for each treatment were used in this study. Murashige and Skoog (MS) basal medium with and without 6-Benzyl Amino Purine (BAP) were used as the two control treatments. Other treatments were prepared by separately incorporating 5% and 10% of KA or SC extracts into MS medium with and without BAP. Initial plant height (35±5 mm), number of leaves (5±2), number of roots (2±1), and number of shoots (0±0) were recorded before establishing the plantlets. The experiments were conducted for a period of three months. Shoot and root formation, shoot elongation, and leaf generation data were analyzed using one-way ANOVA. The control medium supplemented with BAP recorded a maximum plant height of 45.75 mm, a maximum number of leaves as 18.43, a maximum number of roots as 6.88, and a maximum number of shoots as 5.19. The control without BAP recorded a maximum plant height of 43.44 mm, a maximum number of leaves as 13.38, a maximum number of roots as 6.75, and a maximum number of shoots as 2.44. Anthurium plantlets in MS medium (without BAP) with 5% KA extract recorded significantly higher ($p<0.05$) plant height (70.25±12.09 mm), and number of roots (10.44±1.95). But a higher number of leaves (21.75±4.67) recorded in this media than in the controls without significance ($p>0.05$). The highest number of shoots (5.94±2.90) was recorded in MS medium supplemented with BAP and 5% KA extract without significance ($p>0.05$) compared to the controls. MS medium with 10% SC and without BAP recorded higher plant height (62.69±1.43 mm) and number of roots (7.94±2.47) without significance ($p>0.05$) compared to controls. The study revealed that KA extract can be incorporated as an additive in *Anthurium andraeanum* tissue culture media due to the abundance of nutrition and hormones required for successful growth.

Keywords: *Anthurium andraeanum*, *Kappaphycus alvarezii, Sargassum crassifolium*, seaweeds, Tissue culture

***Corresponding author*:** chandimadilu@gmail.com

ID 40

Exploring the potential of incorporating spent button mushroom compost (SMC) to nursery potting mixture of betel (*Piper betle* L.)

W.V.D. Wansekara[1*], D.M.P.V. Dissanayaka[2] and U.G.A.T. Premathilake[1]

[1] Department of Export Agriculture, Faculty of Animal science and Export Agriculture, Uva Wellassa University, Sri Lanka
[2] Intercropping and Betel Research Station, Department of Export Agriculture, Dampalassa, Narammala, Sri Lanka

Abstract
Spent Button Mushroom Compost (SMC) is a valuable by-product of mushroom cultivation. However, this is not adequately utilized in agriculture. The potential of incorporating SMC into betel nursery potting mixture was evaluated. The study was conducted at Intercropping and Betel Research Station, Narammala. The Department of Export Agriculture (DEA) Recommended potting mixture [T1; top soil: sand: coir dust: cattle manure (1:1:1:1)] was used as the control treatment with four different SMC incorporated potting mixtures [T2; SMC: top soil: coir dust: sand (1:1:1:1), T3; SMC: top soil: sand (1:1:1), T4; SMC: top soil: coir dust: sand: poultry manure (1:1:1:1:1), T5; SMC: top soil: sand: poultry manure (1:1:1:1)]. The experiment was conducted as a complete randomized design with five replicates. Single nodal "Ratadalu" stem cuttings were used as planting materials. The pH, Electrical Conductivity, and nutrient composition (N, P, and K) of potting mixtures were analysed initially. Under growth parameters, the number of leaves per plant, shoot length, shoot diameter, fresh weight of roots and shoots, dry weight of roots and shoots and root volume were recorded in two weeks interval. Significantly ($p<0.05$) the highest growth shoot length (29.84±7.12 cm), shoot fresh weight (10.46±3.99 g), root dry weight (0.15±0.11 g) were observed in the T3 potting mixture at 9th week after planting. Furthermore, T3 showed the highest shoot dry weight (0.70±0.30 g) ($p<0.1$) significance level. Moreover, T3 potting mixture showed more similar performances to the DEA recommended potting mixture. In addition to growth parameters, nutrient analysis indicated higher (0.46%), N (0.17%), P (0.01%), K (0.28%) values respected for T3 potting mixture. Therefore, comparing SMC incorporated potting mixtures, the T3 nursery potting mixture showed the best performance for betel. Hence, present study concluded that spent button mushroom compost can be incorporated in the nursery potting mixture of betel.

Keywords: Betel, Growth parameters, Nursery potting mixture, Spent button mushroom compost

***Corresponding Author:** deshaniwansekara@gmail.com

ID 45

Studying the genetic diversity and variability of selected rice varieties

K.M.D. Wasana[1], A.R. Millavithanachchi[1], D.M. Withanawasam[1*], W.D.P. Weerasinghe[1], W.G.Fonseka[1]

[1] Regional Rice Research and Development Centre, Bombuwela

Abstract

Breeding rice varieties for high yield along with resistant to abiotic and biotic stresses and accepted grain quality parameters are timely needed. Genetic diversity is important for the success of any plant breeding programme. Morphological characters have been used to assess the genetic variation among the population of rice. The present study aimed to study the genetic diversity and variability of selected rice varieties at the Regional Rice Research and Development Centre, Bombuwala (6° 57' 0" N, 80° 0' 0" E), Sri Lanka during the *Yala* 2022 season. Eighteen rice varieties were selected for the experiment including exotic and local varieties. Data were collected from three replicates, five randomly taken plants per each replicate. Plant height (cm), culm length (cm), panicle length (cm), numbers of productive tillers per plant, numbers of filled grains per panicle, numbers of unfilled grains per panicle, grain yield per panicle (g), grain yield per plant (g), hundred seed weight (g), grain length (mm), grain width (mm), grain breadth, kernel length (mm), kernel width (mm), kernel breadth were recorded according to standard evaluation system, 2014. After Hierarchical clustering, K mean cluster analysis was followed for meaningful clustering and it revealed two major clusters.

Cluster one was consisted with Bw 367, Bw 374, At 362, At 307 and IRLON 07A-107 while cluster two was consisted with New Basmathi, Red Basmathi, Pusa Sugand, Jasmin Rice, IRLON 121(2018), IRLON 122 (2018), IRLON 221 (2018), IR 81866 33-3-1 (BLB 81), IRFAON 421, IRFAON 417, Pusa Basmathi, Basmathi 370, Basmathi 442. Some characteristics contribute more to obtain high diversity at least significant at $P \geq 0.05$. Main anticipation of general cultivation is high yield. Therefore, cluster one has ideal morphological traits could be used in general cultivation as showing higher values of yield components' traits as higher numbers of filled grains per panicle, highest grain yield per panicle and highest grain yield per plant. In addition, it can be used as parents for breeding high yielding varieties. Varieties in cluster two has international market accepting grain size and that can be used to incorporate more advantageous characters lacking in varieties in cluster one.

Key Words: Morphological traits, Rice, Two step cluster analysis

Corresponding Author: witha1974@gmail.com

ID 46

Evaluation of yield and yield related characteristics of selected advance rice breeding lines under low country wet zone conditions in Sri Lanka

T.G. Chamalie[1], W.D.P. Weerasinghe[1*], D.M. Withanawasam[1] and N.T. Prathapasinghe[1]

[1] Regional Rice Research and Development Centre, Bombuwela, Sri Lanka

Abstract

Identification of proper genetic materials with reliable characters to enhance crop productivity through higher yielding potentials, resistant and tolerant against biotic and abiotic stresses under different climatic conditions is required. The study was conducted to evaluate the selected advanced rice breeding lines under different cross combinations with their respective check varieties under low country wet zone conditions of Sri Lanka. The experiment was conducted as randomized complete block design (RCBD) with three replicates in 2022 *Yala* season. The five selected advanced rice breeding lines of Bw20-1281, Bw20-1285, Bw20-612, Bw19-1398, Bw19-1430 and two check varieties of Bw451 and Bg403 were used. Agronomic characters of plant height, culm length, reproductive characters of panicle length, days to 85% maturity and yield related characters of number of panicles per unit area, number of productive tillers per plant, number of filled grains per panicle, panicle weight, 1000 grain weight and grain yield were measured in average ten plants at different growth stages according to the standard evaluation system for rice developed by the International Rice Research Institute. Significant differences were observed among the tested entries and check varieties for all the evaluated traits. Among the yield components, Bw20-1281 had the highest number of filled grains per panicle, Bw19-1430 had the highest 1000 grain weight, while Bw20-1285, Bw19-1430, Bw451, and Bg403 had the highest number of productive tillers per plant. In addition to that the highest number of panicles per unit area was recorded by Bw20-612. Considering about yield components such as number of panicles per unit area and 1000 grain weight, Bw20-612 behave better than the other tested entries and it has non lodging type steady plant architecture also. Therefore, Bw20-612 was selected as the potential rice germplasm to be used in the future testing in varietal improvement programme of the research Centre.

Key Words: Advanced breeding lines, Agronomic. Genetic, Grain yield Rice

****Corresponding Author:*** deepika.weerasinghe@yahoo.com

ID 48

Effect of different botanicals on the control of Cercospora leaf spot (*Cercospora* spp) and white rust *(Albigo* spp) diseases in leafy vegetable cultivation in the low country wet zone

H.K.A.Karunathilaka and W.M.S.Gunasekara

Agriculture Research Station, Thelijjawila

Abstract

Leafy vegetables refer to the edible leaves of plants, which may be accompanied by tender petioles and shoots. These vegetables are widely available across the world owing to their unique characteristics. Among all leafy vegetables, the sessile weed (*Alternanthera Sessillis*), locally known as *Mukunuwanna* is the most commonly consumed in Sri Lanka. Heavy use of agrochemicals is a major problem with leafy vegetables because it poses serious health risk. Thus, it ought to be a top priority to find out how to manage pests and diseases in leafy vegetables cultivation without using chemicals. This experiment was conducted at the Agriculture Research Center, Thelijjawila during 2021 January to October to evaluate the curative effect of sprays of mancozeb (2 g/L), spent mushroom substrate (1:3 w/v), cinnamon leaf extract (1:4 w/v) against Cercospora leaf spot and white rust diseases in sessile weed. The experimental design was Randomized complete block design(RCBD) with 3 replicates. *Mukunuwanne* variety "Pliyandala selection" was used in the experiment. Disease severity percentage and yield (Mt/ha) were recorded. Disease severity percentage was calculated using the ratio of number infected leaves to number of non-infected leaves of randomly taken plants using 1×1 quadrat. Data were analyzed using STAR statistical software package. Among the three treatments use of Mancozeb (2 g/L) found to be promising over other two and compared the control as well. However, Cinnamon leaf extract (1:4 w/v) and spent mushroom substrate (1:3 w/v) showed similar level of disease severity. The two diseases could be controlled at a significant level with any of the tested treatments and also gave a yield advantage.

Key word: Botanicals, Health hazard, Commercial formulations, Leafy vegetable

Corresponding Author: anothu@gmail.com

ID 51

Seasonal stability analysis of selected advanced rice breeding lines developed at Regional Rice Research and Development Center (RRRDC), Bombuwela in Sri Lanka

D.M. Withanawasam[1*], N.T. Prathapasinghe[1], G.D. Nelumshili[1] and W.D.P. Weerasinghe[1]

[1]Regional Rice Research and Development Centre, Bombuwela

Abstract

This study was focused to study the adaptability and stability of four newly developed rice lines i.e., Bw19-1410, Bw19-1458, Bw19-1468 and Bw19-1377 in RRRDC, Bombuwela with four recommended popular rice varieties i.e., Bg 359, At 362 and Bw 367 across *Yala* 2021, *Maha* 2021/2022 and *Yala* 2022 cropping seasons. AMMI and Biplot analysis of PB Tool 1.4 software showed the genetic and environment (GE) interaction for the grain yield. Based on the AMMI model, Bw 19-1468 is the most adaptable to all seasons which the mean closer to the grand mean (3.12 t/ha) and the PCA scores nearly zero. Further, Won where biplot graph give us which genotypes are doing well in which environments. Bw 19-1377 had given higher yield than At 362 in *Yala* 2021 but At 362 has given more yield than Bw 19-1458 in *Yala 2022*. As well as Bw 19-1377 has given more yield in *Yala* 2021 and *Maha* 2021/22 than Bw 19-1410 grown in same seasons. Although such an ideal genotype may not exist in reality, we consider genotype is more desirable if it is closer to the ideal genotype. Therefore, At 362 which fell into the center of the concentric circles, were most favorable genotypes in terms of higher yield ability and stability, compared with the rest of the genotypes. The performance of Bw 19-1377 was the most variable (least stable), whereas Bw 367 and At 362 were highly stable with high grain yield. The GGE biplot way of measuring representativeness is to define an average environment and use it as a reference or benchmark. The average environment is indicated by small circle of the figure. Therefore, *Maha* 2021/22 was the most desirable test environment followed by *Yala* 2021 and *Yala* 2022. Considering all facts that, AMMI and GGE biplot analysis is an effective tool for Gene by Environment data analysis to achieve understandings about the target environment, the test environments, and the genotypes stability analysis. According to the analysis, At 362 is the most stable over seasons and *Maha* 2021/22 was the most desirable environment for these lines/varieties.

Key Words: Adaptability**,** Rice, Stability, Yield

Corresponding Author: witha1974@gmail.com

ID 55

In vitro evaluation of antagonistic effect of Trichoderma spp. against white root disease of rubber

B.D.N.P. Aberathna[1]*, G. Chandrasena[1], T.H.P.S. Fernando[2]

[1]Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2]Department of Plant Pathology and Microbiology, Rubber Research Institute, Sri Lanka

Abstract
Trichoderma is one of the most studied and applied fungal biocontrol agents. Secondary metabolites play a significant role in antagonistic activities of some biocontrol species of *Trichoderma* resulting in the suppression of plant pathogens. White root disease, caused by *Rigidoporus microporus*, is rapidly spreading in Sri Lankan rubber plantations, posing a serious threat. In this study a laboratory experiment was carried out to identify the antagonistic effect of two native *Trichoderma* spp. and their secondary metabolites on *Rigidoporus microporus. Trichoderma* spp. (strain 01) with *Rigidoporus microporus* and *Trichoderma* spp. (strain 02) with *Rigidoporus microporus* were inoculated into Potato Dextrose Broth medium and 12 days old culture filtrates were prepared. Five concentrations 15%, 30%, 45%, 60% and 75% (v/v) of the culture filtrates were tested using the Poison Food Technique on *Rigidoporus microporus* with three replicates. There was a significant interaction between *Trichoderma* spp. and concentration of the culture filtrates ($p < 0.05$). It showed the highest mean percentage growth inhibition by both strains at 75% concentration and least mean percentage growth inhibition at 15% concentration. The mean percentage of growth inhibition at 75% concentration of *Trichoderma* spp. (strain 01) was 71.39% and *Trichoderma* spp. (strain 02) was 71.45%. The mean percentage of growth inhibition at 15% concentration of *Trichoderma* spp. (strain 01) was 41.89% and *Trichoderma* spp. (strain 02) was 13.32%. The results indicated that *Trichoderma* spp. strain 01 and 02 produce a thermo stable toxic substance to inhibit white root disease causative pathogen *Rigidoporus microporus* because it has not lost its functionality even after being sterilized. Higher the concentration of the secondary metabolites, greater was the growth inhibition of the pathogen *Rigidoporus microporus.*

Keywords: Biocontrol, Inhibitory effects, *Rigidoporus microporus, Secondary metabolites, Trichoderma* spp.

Corresponding Author: aberathnanuwanka@gmail.com

Acknowledgement: This work was funded by the Rubber Research Institute of Sri Lanka

ID 60

Analyze the seed quality of *Capsicum annum* (cultivar Grossum) by maintaining an optimum number of fruits in the plant

W.M.D.Dilrukshi[1*], Nilanthi Dahanayake[1], A.S.Balasooriya[2], U.Priyadarshana[2]

[1]Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka.
[2]Hayleys Quality Seed Company (pvt) Ltd, Boralanda, Badulla, Sri Lanka.

Abstract
The Bell pepper, a member of the Capsicum annum species in the Solanaceae family, belongs to the Grossum cultivar. This plant produces fruits in a variety of colors such as red, yellow, orange, green, white, and purple. The quality of capsicum annum seeds is influenced by the quantity of fruits produced by the plant. As the number of fruits per plant increases, the quality of capsicum annum seeds gradually decreases after reaching a certain level. To assess the seed quality of capsicum annum, this study aimed to maintain an optimal number of fruits on the plant. The objective of this study was to determine the correlation between the number of fruits per plant and seed quality. Fruits setting in the plants; 8-9fruits/plant, 10-12fruits/plant, 13-15fruits/plant, 16-18fruits/plant, more than 18fruits/plant were used as treatments. Hand pollination of capsicum annum was found to be successful at a rate of approximately 75-80%. Various metrics such as dry weight of seeds per pod, number of seeds per pod, seed volume, dry weight of 1000 seeds, germination percentage, and seed viability percentage were recorded. While the number of seeds per pod, germination percentage, and seed viability percentage were not affected by fruit setting, other selected parameters were found to be significantly impacted. It was observed that maintaining 13-15 fruits per plant resulted in the highest number of fruits with quality seeds. The highest recorded values were for dry weight of seed per pod (0.533g), seed number per pod (86 seeds), seed volume (147 seeds/g), dry weight of 1000 seeds (7.45g), germination percentage (85%), and viability percentage (86.33%). Based on these results, it can be concluded that maintaining 13-15 fruits per plant is the most effective strategy for fruit setting of capsicum annum (Hybrid Variety) under greenhouse conditions.

Keywords: Capsicum annum, Fruit Setting, Germination, Quality, Seeds

***Corresponding Author*:** darshanidilrukshi5i@gmail.com

ID 64

Nitrogen uptake and yield performance of finger millet-mung bean intercropping system under different moisture regimes

A.G.U.N. Senevirathna[1*], D.M.S.B Dissanayaka[1], S.H.N.P. De Silva[1]

[1]Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

Abstract

Finger millet (FM/ *Eleusine coracana* (L.) Gaertn.) is widely grown in arid and semi-arid regions around the world to ensure future food and nutritional security as well as a potential crop for drought-prone cropping lands. FM can be intercropped with legumes to enhance productivity of cropping systems. An experiment was conducted at the Department of Crop Science, Faculty of Agriculture, University of Peradeniya to investigate the nitrogen (N) uptake and yield performance of FM-Green gram (GG/ *Vigna radiata* L. Wilczek) intercropping system under well-watered and drought conditions. The experiment was conducted as two factor factorial in Completely Randomized Design (CRD) with three replicates per treatment. In a pot experiment, two crop species were grown as monocropping and intercropping under two moisture levels (well-watered and moisture-stressed condition). Soil moisture in well- watered condition was maintained at 80% of the field capacity and moisture-stress was imposed with 40% of the field capacity. All the data were analyzed using Statistical Analysis System (SAS) software. Parametric data were analyzed using Analysis of Variance (ANOVA) and mean separation was done through Duncan's Multiple Range Test. Plant dry weight (g/plant) and uptake of N (mg-N/plant) were measured. FM produced similar shoot and root dry weight irrespective of the moisture treatment and cropping system. However, moisture stress reduced the dry weight of FM (11.4 g/plant to 7.2 g/plant). Intercropping had no yield advantage either in well-watered or moisture-stressed condition. Moisture-stressed condition significantly ($P<0.05$) decreased the panicle dry weight of FM (5.4 g/plant to 2.3 g/plant). Irrespective of the moisture treatment, FM grown with GG accumulated more N (155.3 mg-N/plant) than those cultivated in monocropping system (109.2 mg-N/plant). From the results, it can be concluded that, FM-GG intercropping provides N uptake advantage for FM. However, N uptake advantage could not translate into yield advantage of FM either in well-watered or moisture-stressed condition.

Keywords: Drought, Finger millet, Green gram, Intercropping, Nutrient uptake

Corresponding Author: ag16162@agri.pdn.ac.lk

Acknowledgement: This work was supported by the Peradeniya University Research Grant (URG/2019/44/Ag) received by D.M.S.B. Dissanayaka.

ID 77

Combined Effect of Rooting Media and Indole – 3 – Butyric Acid (IBA) on Quality of *Epipremnum aureum* Cuttings

R.M.T.D. Attanayake[1], Y.M.H.M. Dasanayaka[1], H. K. L. Dilshan[2], W.A.B.H. Hettiarachchi[1], K.M.S.D. Sandarenu[1], S.N.W. Gamage[1], P. A. S. C. Wickramasinghe[2], C. R. Dayarathna[2] and H.M.P.C. Kumarihami[1]*

[1]Department of Crop Scienc, Faculty of Agricultur, University of Peradeniya,
[2]Mike Flora (Pvt) Ltd., Rambukkana, Sri Lanka

Abstract

Epipremnum aureum, 'Marble Queen' is a common foliage plant that is used extensively in interior scaping, making it an economically important species. Stem cuttings are the most common and simplest propagation method for producing new Marble Queen plants, and both rooted and unrooted cuttings are exported. The present production process for exporting rooted cuttings of Marble Queen takes around 3 months. Therefore, the study was conducted to evaluate the effects of different rooting media, and the application of Indole – 3 – Butyric Acid (IBA) on various shoot and root morphological characteristics in Marble Queen stem cuttings. The experiment was completely randomized in a factorial 2×4 design (2 rooting media × 4 doses of IBA) comprising ten replicates and was conducted as two parallel experiments under the production of rooted and unrooted cuttings. In experiment one, the rooting performance at the production of rooted cuttings was evaluated while in experiment two the rooting performance at unrooted cuttings production was evaluated after an export simulation (48 hours cold storage at 21 ºC). In this study single nodal cuttings of Marble Queen were treated with 0 mg·L^{-1}, 250 mg·L^{-1}, 500 mg·L^{-1}, and 1000 mg·L^{-1} concentrations of IBA, and rooting trials were carried out in coir dust and oasis media. The variance analysis was performed on the data. Duncan's multiple range test (DMRT) and Chi–square tests were used to evaluate the difference in mean values of parametric and non - parametric data, respectively. The results showed that the rooting medium has a significant effect on root growth. Coir dust recorded the highest number of roots per cutting, roots-to-shoot fresh weight ratio, and average root diameter in both experiments. Meanwhile, the oasis medium recorded minimum days to bud and root initiation, as well as a higher number of buds in both experiments. The 500 mg·L^{-1} concentration of IBA recorded early rooting and a higher number of roots. Thus, oasis medium with 500 mg·L^{-1} IBA application can support early root and shoot growth of Marble Queen stem cuttings. However, coir dust with the same concentration may be more suitable for efficient growth and development.

Keywords: Indole – 3 – Butyric Acid, Marble Queen, Propagation, Rooting media, Stem cuttings

Corresponding author: prathibhani@agri.pdn.ac.lk

***Acknowledgment*:** We acknowledge the research support provided by Mike Flora (Pvt) Ltd., Rambukkana, Sri Lanka.

ID 84

Development of N-enriched *Azolla* biofertilizer, for *Amaranthus viridis* by amalgamating natural and organic waste ingredients.

K.A.D.D. Kuruppu[1*], K. Varnika[1], K. Jeyavannan[1] and G. Mikunthan[2]

[1]Department of Biosystems Technology, Faculty of Technology, University of Jaffna,
[2]Dept. of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Kilinochchi

Abstract:
Chemical fertilizers cause a slew of societal and environmental problems and it is urged to explore the potential of locally available substances to supplement major nutrients to the crops. Nitrogen (N), can be supplemented with the aquatic fern, *Azolla* (*Azolla pinnata*). Several authors claimed that *Azolla* can be easily grown and compatible to mix with N-based locally available resources. This study aims to develop an N-enriched Azolla bio-fertilizer for the cultivation of *Amaranthus viridis* by amalgamating natural and organic waste ingredients. Hence an attempt was made to increase the pellet-forming efficiency of the modified Portable Pellet Forming Device (PPFD) with a newly added wingnut, cross knife, spring, and flat washer. The N-enriched *Azolla* pellets were produced from locally available natural and organic waste. The purpose of PPFD is to use it for small-level and efficient pellets production. Organic pellets were prepared by using *Azolla*, *Aloe vera*, cow urine, distillery spent wash (DSW), termitaria, wild indigo and extruded by PPFD. The experimental design was arranged in CRD with 6 treatments with 5 replicates. The following treatments T1=*Azolla*+*Aloe*+termitaria (8:4:2), T2=*Azolla*+wild indigo+termitaria (8:4:2), T3=*Azolla*+cow urine+termitaria (8:4:2), T4=*Azolla*+DSW+termiteria(8:4:2), T5=*Azolla*+*Aloe*+cowurine+wildindigo+DWS+termitaria (8:1:1:2;2), T6 control=top soil+urea (8:8) were used for investigations. The following data such as leaf length, leaf width, plant height and the number of leaves of *A. viridis* were taken after the germination. Data were analyzed by using the SAS version 9.1.3 software. The results indicateed that T5 gave the best results for the number of leaves (7.4), leaf width (2.8cm), length (3.58cm), plant height (14.14cm) of *A. viridis* plant compared to other treatments. It was also determined in the tests that 5.98% amount of nitrogen in 1g of pellet (T5). In this study, within the first week, a rapid increase in the number of leaves (6.4cm) was observed in (T3). Exploring the possibility of other N supplements to improve the efficiency of nitrogen products and the combination of pellets can be used as a means of N supplement to grow *Amaranthus* plant.

Keywords: *Azolla*, Biofertilizer, Nitrogen-rich, Organic waste, Pellet forming device

***Corresponding Author*:** dilukshidananjanee@gmail.com

ID 95

Rapid propagation of *Syzygium zeylanicum* and *Memecylon umbellatum,* native tree species with high landscape potential in Sri Lanka

J.M.W.A. Jayaweera*, G.Y.A.D.D. Perera and P.E. Kaliyadasa

Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka

Abstract
The climate in Sri Lanka is ideal for growing a wide range of ornamental plants, which are widely used in the landscape industry for both aesthetic and functional purposes. Despite the presence of many native plants with high potential ornamental values, a large number of exotic plants are currently favored for landscaping. Given the difficulty of seed propagation and the scarcity of successful propagation techniques for commercialization, this study aims to develop a successful propagation technique for two selected ornamental native trees: *Syzygium zeylanicum* (Yakadamaran) and *Memecylon umbellatum* (Korakaha) which are having a high ornamental value. In the present study, softwood and semi hardwood cuttings were treated with two different Plant Growth Regulators (PGR) at a rate of 8000 ppm (IBA and IAA) along with non-treated control and established in sand : coir dust (1:1), sand : coir dust : topsoil (1:1:1) media. The experiment was carried out in three factor factorial Completely Randomized Design (CRD) with 10 replications comprising 12 treatment combinations inside a propagator under a net house. The study was conducted separately for each species as two different experiments. After a 3-month period following planting, the number of shoots, number of roots, and survival percentage were recorded. It was found that the interaction effect of cutting type, potting media, and hormone type was significant in terms of the number of shoots and roots ($p<0.05$), but not for survival percentage in S. zeylanicum. Moreover, interaction effect of only potting media and hormone type is significant *($p<0.05$)* on number of shoots and roots in *M. umbellatum.* Overall, semi hard wood in the sand: coir dust: topsoil mix medium treated with IAA is recommended as it provided a well-developed quality root system along with a moderately high survival rate in propagation of both species.

Keywords: Landscape, *Mememecylon umbellatum,* Native, Propagation, *Syzygium zeylanicum*

***Corresponding author*:** warunianupama96@gmail.com

ID 98

Forecasting rainfall anomalies to minimize the risk in agriculture: A case study in Agalawatta

P.W. Jeewanthi[1]*, T.M Henricus[1], S.R.W.M.C.J.K Ranawana[1], B.W.Wijesuriya[2]

[1]Department of Export Agriculture, Uva Wellassa University of Sri Lanka, Passara road, Badulla, 90000, Sri Lanka.
[2]Biometry Section, Rubber Research Institute of Sri Lanka, Dartonfield, Agalawatta, 12200, Sri Lanka.

Abstract
Rainfall anomaly has wide-ranging and substantial effects on the global economy, environment, industry, and communities. Forecasting rainfall anomalies aids in the implementation of drought mitigation methods and actions before they arise. An early assessment of drought conditions will be made possible by accurate rainfall prediction using time series data analysis. . The Standardized Precipitation Index (SPI) is a drought monitoring index that was created to identify rainfall anomalies in comparison to previous data in the same place for particular time intervals. Monthly rainfall data were collected from the meteorological station in the Rubber Research Institute of Sri Lanka for the period of 1980-2021. SPI values in 1, 2, 3, 5, 12 months' time scales were calculated representing monthly, Inter-monsoons, North East monsoon, South West monsoon and annual rainfall totals respectively. The slightly positive trends in January, August, September, and October They are significant at a 30%–50% confidence level. They are positive trends because their Sens' slope values were positive magnitude. The first Inter Monsoon season's slightly negative trends they were significant at a 30% to 50% confidence level. It is a negative magnitude since Sens' slope value is minus. February has moderately positive trends. It is significant at a 5%–30% confidence level, and Sens' slope value is positive. Also, April and July had a moderately negative trend. They have a negative Sens' slope value and significance at a 30% -5% confidence level. Other months have no trend, because they are not significant at any confidence level. Moreover, according to the findings of this research, Seasonal Auto Regressive Integrated Moving Average (SARIMA), (1,0,1) (1,0,1)[12] model is the most suitable time series model for forecasting rainfall anomalies in Aglawatta, Sri Lanka.

Keywords: Forecast, Rainfall anomalies, Seasonal Auto Regressive Moving Average (SARIMA), Standardized Precipitation Index (SPI)

*** Corresponding Author:** wasana.wish@gmail.com

ID 99

Effect of different seed priming methods for improving seed germination and seedling growth of some selected crops

G.P.A.N. Weerasuriya[1], S.R.W.M.C.J.K. Ranawana[1*], P.W. Jeewanthi[1] and B.W. Wijesuriya[2]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2] Biometry Section, Rubber Research Institute, Agalawaththa, Sri Lanka

Abstract

The deterioration of seed quality during prolonged storage, as well as issues such as uneven and poor germination, weak vigor, and inadequate seedling growth, are significant challenges in crop production. As a result, the development of new techniques such as seed priming is crucial in addressing these challenges. Seed priming involves regulating the hydration level of seeds to facilitate pre-germination metabolic processes while inhibiting radical emergence. Current study evaluated the effect of different organic and chemical priming methods on germination and seedling growth of some selected crops. Non-expired seeds of Tomato (*Solanum lycopersicum*), Chilli (*Capsicum annuum*), Capsicum (*Capsicum annuum*), Cucumber (*Cucumis sativus*) and old/expired seeds of Maize (*Zea mays*), Luffa (*Luffa acutangular*) and Okra (*Abelmoschus esculentus*) were evaluated separately. Moringa dry (MD) and fresh leaf extract (MF), coconut water (CW), cow urine (CU), rice-husk ash (RA), distilled-water (DW), sucrose solution (SS), eggshell and vinegar extract (EV) and KNO_3 at different concentrations and soaking times were used as priming treatments. Non-primed seeds were used as the control. Experimental design was Completely Randomized Design with three replicates (10 seeds each). Cluster analysis was done to categorize treatments based on the similarity of performances in mean germination time (day), time spread of germination (day), germination rate index (% day $^{-1}$), seedling vigor index and average seedling dry weight (g) using SAS OnDemand for Academics. Significant difference between clusters were evaluated using One-way Analysis of Variance under Generalized Linear Model. Treatments in the best performing cluster were ranked based on their germination performances. Accordingly, for: Chilli–MD @20%(w/v) for 12 hrs soaking time; Capsicum–CU @10%(v/v) for 12 hrs; Tomato–MD @10%(w/v) for 12 hrs; Maize–CU @5%(v/v) for 12 hrs; Okra–CW @50%(v/v) for 48 hrs were identified as the treatments with higher ranks. There was no significant difference between treated and non-treated seeds of Luffa and Cucumber ($P>0.05$). In conclusion, organic primers identified above such as cow urine, coconut water and moringa dry extract with specific concentrations and soaking times that showed higher ranks in germination performances can be successfully employed to enhance germination and seedling growth of all tested crops, except for Luffa and Cucumber. Priming of old/expired seeds of Maize with cow urine @5%(v/v) for 12 hrs and Okra with coconut water @50%(v/v) for 48 hrs can potentially enhance their germination ability.

Keywords: Expired seeds, KNO_3, Organic primers

Corresponding Author: chandima@uwu.ac.lk

ID 101

Evaluating The Growth Performances of Young and Mature Tea (*Camellia sinensis*), Treated with Different Particle Sizes and Application Rates of Cinnamon Bio-Char

H.D.H.P. Thilakarathna*, I. R. Palihakkara

Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Abstract

Bio-char is one of the ideal soil amendments used for improvement of tea (*Camellia sinensis*) growth and productivity through enhancing the adsorption of soil nutrients. A field experiment was designed using two factor Factorial Randomized Complete Block Design to study the effect of Cinnamon bio-char on the growth performances of young and mature tea plants were evaluated with three levels of particle sizes (0-2, 3-4, 5-8mm) and application rates (25, 37.5, 50 g per plant).The research was conducted from July 2022 to September 2022 at the field numbers of 10 (young tea field, TRI 2027) and 11(mature tea field, TRI-2026), Talgaswella State, Talgaswella belongs to WL1a agro-ecological zone. Young plant height, number of leaves per plant, number of branches per plant and leaf chlorophyll content were measured as the growth parameters and for the yield parameter tea yield was measured in every two-week interval. The results exhibited that all growth and yield characters of tea were significantly ($P \leq 0.05$) influenced by levels of particle sizes and application rates. Within this three-month period, plants treated with the large particle size (5-8mm) and the highest application rate (50g per plant) of bio-char showed maximum growth performances of young tea. Whereas the plants treated with the minimum particle size (0-2mm) showed maximum yield of tea. Hence, it is concluded application of 50g of Cinnamon bio-char per plant with particle size of 5-8 mm showed best performance of young tea plantations and application of Cinnamon bio-char with the rate of 25, 37.5 or 50 g per plant with particle size of 0 –2 mm is best for increment of tea yield.

Keywords: Bio-char, Cinnamon, Growth Performances, Tea

****Corresponding Author:*** 2017ag4441@agristu.ruh.ac.lk

ID 111

Potency to use aqueous extractions of pesticidal plants to manage termites in the sugarcane ecosystem of Sri Lanka

P.M.D.B. Weerasekara[1*], K.M.G. Chanchala[2]

[1] Department of Export Agriculture, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka
[2] Division of Crop Protection, Sugarcane Research Institute, Uda Walawe, Sri Lanka

Abstract

Termites caused major economic damage to sugarcane plantations. An experiment was conducted at the Sugarcane Research Institute (SRI), Uda Walawe, Sri Lanka, with the objective of determining potential plant extracts that have insecticide properties to manage termites during germination and the early plant growth phases of sugarcane. Three plant species that are available in the sugarcane ecosystem were selected for the field study, i.e., *Leucaena leucocephala* (Ipil-Ipil) pods and leaves, *Gliricidia sepium* (Gliricidia), and *Lantana camara* (Gandapana). The immature pods and mature leaves of the pesticidal plants were used for the experiment. Filtrate of blended withered plant parts was used for sett treatment at planting. Three pretermite infested plots with six rows of 5 m length and 1.37 m row spacing were established with three nodal setts of variety SL 96 128. Twenty seed setts were planted in each row according to the recommended practices. Data on plant characteristics (germination, plant height, length of the third leaf, width of the third leaf, root mass), and damage were observed four weeks after planting. All the plant extracts had significantly less sett damage compared to the non-treated control. Among them, the lowest sugarcane sett damage was recorded on *G. sepium* leaf extract treated sugarcane setts (9.33 ± 2.85) followed by *L. camara* treated setts (11 ± 2.89). Germination and plant characters were not significantly affected by extractions compared to the non-treated control. The highest germination was recorded on Fipronil treated sugarcane setts (19 ± 2). The highest leaf number was recorded on the non-treated control (4.47 ± 0.32). The highest plant height was recorded on *L. leucocephala* pod treated sugarcane setts (9.16 ± 1.49). Moreover, , *L. leucocephala leaf extract treated sugarcane setts showed the highest root weight (*1.38 ± 0.79). Therefore, aqueous extracts of *Gliricidia sepium* leaf and *Lantana camara* leaf are effective in managing termite damage in sugarcane setts at the planting and early growth stages.

Keywords: Aqueous extract, Pesticidal plants**,** Termites

Corresponding Author: diliweera@gmail.com

Acknowledgement: This work was funded by the Sugarcane Research Institute, Uda Walawe, Sri Lanka (CP/1/22)

ID 123

Effect of selected plant growth regulators in callus induction of papaya (*Carica papaya* L. CV Horana Hybrid- 01) from immature leaves

G. K. K. L. Priyadarshani[1*], Ms. R. N. I. Perera[2], Prof. P. E. Kaliyadasa[1]

[1]Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2]Fruit Research and Development Institute, Kananwila, Horana, Sri Lanka

Abstract

Carica papaya, a member of the *Caricaceae* family, has gained immense popularity as a tropical fruit owing to its remarkable characteristics such as rapid growth, high yield, prolonged fruiting season, and outstanding nutritional and therapeutic benefits. Horana Hybrid – 1 is the first papaya hybrid variety in Sri Lanka and is a high yielder. Tissue culture techniques are important to produce clonal plants as well as in crop improvement programs of papaya. The aim of this study was to evaluate the effect of hormone combination for callus induction of Horana Hybrid- 1 papaya cultivar and to introduce the best surface sterilization procedure for immature leaf explant. A protocol was developed for surface sterilization with 20% of Sodium Hypochlorite (NaOCl), 70% of Alcohol and 0.1% of Mercuric Chloride (HgCl2). Three different hormone types in different combinations were studied separately in Factorial Completely Randomized Design-(FCRD) with four replicates. Immature leaf explants were established in Murashige and Skoog (MS) medium with five level of 6-Benzylaminopurine (BAP) (0.5, 1, 1.5, 2, 2.5 mg/L) and 2,4- Dichlorophenoxyacetic acid (0.1, 0.5, 1, 1.5, 2 mg/L). Explants were established on MS medium with five level of 6- Benzylaminopurine (BAP) (0.5, 1, 1.5, 2, 2.5 mg/L) and Naphthalic acetic acid (NAA) (1, 1.5, 2, 2.5, 3 mg/L). Number of survived explants were recorded one month after establishment. Best sterilization procedure was treatment 02, which is 20% of Sodium Hypochlorite (NaOCl) for 20 minutes, 70% of Alcohol for 2 minutes and 0.1% of Mercuric Chloride (HgCl2) for 1minute. Immature leaf explants cultured on 1.5 mg/L BAP and 0.1 mg/L 2,4- D combination where most suitable for quality callus induction. The immature leaf explants cultured on 0.5 mg/L BAP and 1.5 mg/L NAA combination where most suitable for better callus induction. By utilizing a combination of two primary hormones, successful initiation of callus from immature leaf explants in papaya was achieved.

Keywords: Callus Induction, Immature Leaf, Selected Plant Growth Regulators, Surface Sterilization

****Corresponding Author***: krishlakmali42@gmail.com

ID 127

Development and evaluation of natural sunscreen using *Wrightia antidysenterica* and *Nyctanthes arbor-tristis* flower extracts.

H. B. M. K. Kularathna[1], H. D. Jayasekara[1*], V.P. Bulugahapitiya[1]

[1] Department of Chemistry, Faculty of Science, University of Ruhuna, Sri Lanka

Abstract

Due to the link between sun exposure and skin deterioration, the application of sunscreen becomes essential, particularly in Sri Lanka, which experiences higher levels of solar radiation. *Wrightia antidysenterica* and *Nyctanthes arbor-tristis* are two floral species found abundantly throughout the country and are renowned for their exceptional traditional medicinal properties. These flowers contain polyphenolic compounds that exhibit noteworthy antioxidant activity, which is associated with sun protection abilities. This study aimed to formulate herbal sunscreen using the above flowers and evaluate their efficacy and stability. The maceration and sonication techniques were used to prepare the extracts (using ethanol, methanol, ethanol-water mixture as solvents) for each flower. Qualitative phytochemical screenings were carried out following the standard protocols. Quantitative analysis was done for phytochemicals using gravimetric and spectroscopic methods. Evaluation of anti-oxidant capacity was done by 2, 2-Diphenyl-1-picrylhydrazy (DPPH) and Ferric Reducing Anti-oxidant Power (FRAP) assays. Five sunscreen formulations (F1-F5) were prepared from each extract by incorporating different concentrations of each extract based on oil in water (o/w) methodology, and further formulations were evaluated for the quality and the stability (pH, viscosity, homogeneity, thermal stability and long-term stability). The effectiveness of the sunscreens was assessed through the spectroscopic method, which determines the sun protection factor (SPF). The qualitative phytochemical analysis of the extracts from both species revealed the existence of crucial phytochemicals, including flavonoids, terpenoids, polyphenols, diterpenes, glycosides, and saponins, which have significant sun protection properties. The IC50 values were computed for the methanolic extract of *W. antidysenterica*, ethanolic extract of *W. antidysenterica*, and ethanolic extract of N. arbor-tristis, which were found to be 126.34 µg/mL, 144.17 µg/mL, and 160.23 µg/mL, respectively. Additionally, the mean values of the Ferric Reducing Antioxidant Power assay (FRAP) were 706.07 ± 3.49, 562.43 ± 2.46, and 164.47 ± 8.52, respectively, indicating that these extracts contain significant natural antioxidants. Out of the various formulations that were prepared, SPF values of (23.10 ± 0.09, 23.45 ± 0.08), pH values of (6.23, 6.14), and viscosity of (44358, 45563 centipoises) were observed for F4 and F5. The thermal stability, and homogeneity conditions were in good state. In conclusion, the identified floral species possess significant sun protection activity and have potential for use in the production of sunscreen. However, to facilitate commercialization, in vivo investigations need to be conducted.

Keywords: DPPH assay, FRAP assay, Phytochemical Screening, Sun Protection Factor (SPF), Sunscreen

***Corresponding Author**:* himali@chem.ruh.ac.lk

ID 133

Evaluating the growth and performances of young and mature tea (*Camellia sinensis*) treated with different particle size and application rate of bamboo biochar in WL1a, Sri Lanka

I.M.L.B. Jayarathna[1], Palihakkara I.R.[1*], Hiranjan bulugahapitiya[2]

[1] Department of Crop Science, Faculty of agriculture, University of Ruhuna, Mapalana, Kamburupiya, Matara, Sri Lanka.
[2] Thalgaswella state, Elpitiya plantations Pvt Ltd, Mapalagama, Galle, Sri Lanka

Abstract

Continuous cultivation of tea plants in the same soil and excessive use of agrochemicals can lead to a decline in the physical, chemical, and biological properties of the soil in tea plantations. As a solution, bamboo biochar has gained popularity among tea planters as an eco-friendly, cost-effective organic soil amendment. The main objectives of this study were to (a) Evaluate the ability of bamboo biochar for the growth performances of young and mature tea plants, (b) determine the most suitable particle size and the rate of application of bamboo biochar and (c) determine the ability of used organic activator and the concentration of the activator that can be used for charging bamboo biochar. In this study, bamboo biochar was prepared using the drum method and applied to the field using a randomized complete block design, with nine treatments based on three application rates (25g {X1}, 37.5g {X2}, and {X3}50g/plant) and three particle sizes (2mm {S1}, 4mm {S2}, and 8mm {S3}). Young plants were evaluated for increases in plant height, leaf number, primary and secondary branches, and leaf chlorophyll content, while mature plants were only assessed for changes in yield and leaf chlorophyll content. The data collected was analyzed using SAS statistical software and the best treatment combinations for each parameter were determined through mean separation using the Duncan Multiple Range test. The statistical analysis revealed that all parameters were significantly affected by the treatments. S1X1 (25g/plant with 2mm) was the best treatment for the increment of secondary branches in tea plants. Best treatment combination for the increment of the mature plant leaf chlorophyll content was S1X3 (2mm with 50g/plant). However, the limited application period was the main reason for minimum significant results for each parameter.

Keywords: Bamboo biochar, organic, soil amendment, Tea plant, yield

Corresponding Author: irpalihakkara@gmail.com

ID 139

Identification and characterization of mutations in genes involved in GA_3 biosynthesis and signaling pathways of a white seeded dwarf rice variety

K.N. Wedagamage[1*], D.S. de Z Abeysiriwardena[2] and M.P.C.S. Dhanapala[1]

[1]Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka
[2] CIC Agri Businesses, Pelwehera, Dambulla, Sri Lanka

Abstract
Rice is one of the major cereals in the world and many African and Asia countries consume rice as a staple food, including Sri Lanka. However, the existing rice yield is not enough to fulfil the requirement. Because a considerable amount of yield lost has been reported every season due to the lodging of the rice plants. Therefore, several breeding programs have been conducted to incorporate the traits responsible for lodging resistance in rice. Dwarfism in rice is one such characteristic to develop lodging resistant varieties. Changes in the genetic material of rice are responsible for dwarfism, including genetic mutations and involvement of plant hormones. Since gibberellic acid involves different developmental processes in plants, mutations in gibberellic acid biosynthesis and signalling pathways are considered as the major reasons for dwarfism. This study is based on a white seeded dwarf rice variety which was found among the progeny of CIC *Tikiri*. A comprehensive study was conducted to find the causes of dwarfism based on the involvement of gibberellic acid in dwarfism. Mutations were identified using a genetic identification process through PCR amplification, and DNA sequence alignment of selected genes. PCR amplification was done using *OsGA3ox2* and *OsSLR1* primers, targeting the genes that produce key components in the gibberellic acid biosynthesis and signalling pathways; GIBBERELLIN 3BETA-HYDROXYLASE 2 and DELLA genes, respectively. The amplified regions were aligned, and a base pair comparison was done to identify the mutations in the respective regions. When compared with the mother plant "CIC *Tikiri*" species, certain changes within the sequences have been observed. These changes cause the gain of different amino acid sequences in DELLA and GIBBERELLIN 3BETA-HYDROXYLASE 2. As a result, the functions of these proteins are altered. These changes might cause dwarfism in the white seeded dwarf rice variety. However, phenotypic identification using a hormonal assay needs to verify the involvement of gibberellic acid in dwarfism of the white dwarf rice variety.

Keywords: DELLA protein, dwarfism, gibberellin, high-yield rice varieties, OsSLR1, OsGA3ox2

Corresponding Author: kalaniwedagamage@gmail.com

Agricultural Economics and Agribusiness Management

ISAE - 2023

Keynote Speech

Crop Biotechnology in Developing Countries

Hugo De Groote

International Maize and Wheat Improvement Centre (CIMMYT), PO Box 1041-00621, Nairobi, Kenya

***Email -** h.degroote@cgiar.org

Genetically Modified (GM) crops have now been successfully deployed in both developing and developed countries for the last 25 years. This paper presents a literature overview of their use in developing countries, and a synthesis of their benefits and their risks.

Much of the basic research has been provided by the public sector, but most applications, including GM crops, were developed by private companies in developed countries for their farmers. However, current economic benefits to farmers are equally divided between developed and developing countries. Moreover, a majority of users are small-scale farmers in developing countries, in particularly from Bt crops.

Biotech crops have also been shown to benefit the environment, by reducing pesticide applications and tillage, and to increase biodiversity in non-target mechanisms. Environmental risks such as insect resistance and gene flow are clearly possible, but have not had major effects. The crossover of biotech genes into local varieties has not yet demonstrated, seems likely to happen and would be hard to contain.

Further applications of GM technology to address the specific needs of poor farmers and consumers in developing countries look promising. *Ex ante* impact assessment indicates that GM biofortified crops have a high potential to reduce micronutrient deficiencies. Moreover, several other GM technologies under development PPPs are under development, to address the needs of poor farmers, including crops resistant to abiotic stresses (drought, low fertility, and salinity). These can increase yields, food security, and income, while reducing variability.

However, several factors hinder the use of GM crops in developing countries and prevent them from reaching their full potential, causing costly delays. First, the specific needs of developing countries are addressed by public research institutes in national and international systems, but their resources and capacity are limited and, therefore, need to be expanded. Secondly, awareness of biotechnology and knowledge of the benefits and risks of GM crops and food is limited. Consumers in developing countries, both urban and rural, need better information and need to be engaged in the ongoing debate. Thirdly, the regulatory system is cumbersome and expensive. Evaluations need to be objective and scientific, and based on objective risk assessment. Clear and transparent safety rule decision mechanisms are needed including the opinions of farmers and consumers. The cost of these evaluations and the regulatory process should be balanced with the perceived risks and the potential benefits.

Finally, GM crops are not risk-free, as with any biological intervention. Proper evaluation on a case-by-case basis is needed for every combination of trait, crop, and agroecological system. Continuous monitoring is therefore needed, including effects on the environment and on food systems and health.

Oral Presentations

ID 09

Corporate social responsibility as a key performance indicator to value the outputs and outcomes of research associated with the commercial agriculture sector in Sri Lanka

P.C. Abeysiriwardana[1,2*] and U.K. Jayasinghe-Mudalige[2]

[1] Ministry of Education (Research and Innovation Section), Sri Lanka
[2] Faculty of Agriculture & Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP) 60170, Sri Lanka

Abstract
Growing interest is there amongst the institutes involved with research and development work, remarkably from the developing country perspectives, to embed Corporate Social Responsibility (CSR) as a key factor in judging the value of those key outputs/outcomes that they generate through research. Yet, there exists a scarcity of first-hand information coming out from methodically carried out research and development work. This leads to a situation where the research institutes are heavily relied on "pure theory" and/or "strategies" that originate from alien contexts. In support of closing this gap in the literature, this study aimed to gather expert views on the merit of taking into account CSR as a Key Performance Indicator (KPI) to evaluate such outputs/outcomes as that facilitates developing a framework accommodating such KPIs inside a well-defined Performance Management System (PMS). The whole study was set to characterize two phases, i.e. initially, 10 top-level administrators of leading research institutes functioning in commercial agriculture sectors in Sri Lanka were subjected to an in-depth interview guided by probing questions to gather data, followed by a Thematic Analysis assisted by the MAXQDA qualitative Data analysis software. The analysis produced Single-Case Models and Code Maps reflecting 5 Themes aligned with another 12 Sub-themes, 32 Categories, and 119 Codes. The results, in the aggregate, underscored the importance of Context, Policy attributes, Enablers and Organizational benefits to be gained from a well-defined PMS. It revealed that research practices related to CSR were mentioned sparingly in the interviews and codes related to them were not prominently co-occurred with codes related to institutional management or research collaborations. However, the contextual issues that warrant more and improved awareness of CSR in PMS with particular emphasis on strengthening the linkage among CSR, commercialization and research collaboration, etc. were mentioned in association with the theme "Research for Society's Benefits". This points out the importance of setting Digitally-enabled KPIs in a Data-driven PMS that includes themes of this caliber and judges precisely the value of outputs/outcomes from research and conceptualizing them in a KPI-KPD framework to enhance the quality of the existing PMS.

Keywords: Commercial agriculture, Corporate Social Responsibility (CSR), Key Performance Indicators (KPIs), Performance management

Corresponding Author: abeysiriwardana@yahoo.com

ID 13

Impact of institutional environment towards entrepreneurship inclination among agriculture diplomats: A case study in Advanced Technological Institute- Gampaha, Sri Lanka

H.M.P.M. Dayarathne*

Advanced Technological Institute-Gampaha ,Naiwala, Essala, Weyangoda, Sri Lanka

Abstract

Entrepreneurship is a key strategy to solve the problem of unemployment, especially in developing nations including Sri Lanka. Institutional environment has a great impact on entrepreneurship efforts. Although many researches were conducted to assess the relationship between institutional environment and entrepreneurship in the world, Sri Lanka is lack of such studies. To fill this research gap, the present study was developed to discover the relationship between entrepreneurship inclination and institutional environment of Agriculture diplomats in Sri Lanka Institute of Advanced Technological Education (SLIATE). The data was collected from all the students (133) who followed the Higher National Diploma Technology Agriculture program in Advanced Technological Institute-*Gampaha* which is a sub-institute of SLIATE. The study focused on three dimensions of the institutional environment: Regulatory, Normative and Cognitive and the students' perception of desirability and feasibility of being entrepreneurs were identified for all three dimensions. A Pre-tested survey questionnaire was employed to gather primary data and reliability and validity of the scales was assessed by Chronbachs' alpha values and means of exploratory factor analysis. To evaluate the influence of the institutional environment for entrepreneurial intention, a t test was practiced. The results revealed that the regulatory environment influences both feasibility (t=2.677, P=0.008) and desirability (t=2.616, P= 0.041), while Cognitive environment only influences the feasibility (t=1.755, P=0.042). Normative environment also influences for both feasibility (t=1.268, P=0.007) and desirability (t=2.361, P=0.028). The study concluded that all three dimensions of the institutional environment are significantly impact on being entrepreneur. Therefore, to improve the entrepreneurial efforts, regulatory factors such as industrial policy, appropriate trade-off between market concentration and productivity performance should be considered by the government. It is also a key to improve the normative and cognitive environments for entrepreneurship development.

Keywords: Agriculture, Entrepreneurship, Entrepreneurship inclination, Institutional Environment

***Corresponding Author*:** manoridayarathne@gmail.com

ID 54

Identification of entrepreneurial readiness and challenges for economic home gardens located in tea small holdings in Doluwa Divisional Secretariat in Kandy district

D.M.H.B.Dissanayake[1*], M.K.S.L.D. Amarathunga[1], M.G.P.P. Mahindarathne[1], M.R.N. Dhammika[2]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla 90000, Sri Lanka
[2]Tea Small Holding Development Authority, Kandy region

Abstract

Despite the fact that there is a significant potential to transform home gardeners into economic home garden-based entrepreneurs, the tea smallholding sector in Sri Lanka has only a limited number of such entrepreneurs due to various reasons. This study aims to explore the entrepreneurial readiness, challenges and potentials for being an economic home garden-based entrepreneur. A cross-sectional explorative study was conducted. Stratified purposive sampling technique was used to select 50 tea smallholders who participated and another 50 smallholders who did not participate for the extension programs, in four *Grama Niladhari* Divisions in Doluwa Divisional Secretariat in Kandy District. A field survey administrating pretested structured questionnaire and focus group discussions were undertaken to collect primary data. The relative severity index was used to identify the importance of the various challenges faced by them. Potential areas for business startups were also identified. Both descriptive analysis and multiple regression models were used for data analysis. Paired t-test which was done between above two groups resulted that there is a significant difference between them ($P<0.05$) and also, tea smallholders who participated to the extension programs showed highest mean value, which confirms that they acquire more entrepreneurial readiness than the other group. The descriptive analysis revealed that the entrepreneurial readiness of the economic home garden-based tea smallholders is high (75.42%). Female participation and their entrepreneurial readiness are higher than that of male. Both female and male farmers with no formal education have higher entrepreneurial readiness (74%). Multiple regression analysis revealed that entrepreneurial readiness has a significant positive relationship with motivation related to financial stability ($p < 0.001$), entrepreneurial ability of farmers ($p < 0.1$), their identified opportunities, ($p < 0.05$) and the number of extension providers who gave frequent technical advices ($p < 0.05$) whilst a significant negative relationship is shown with education ($p < 0.05$) and experience ($p < 0.05$). The compost-based products, floriculture, liquid fertilizers, vanilla cultivation, and seed production were identified as potential areas for small-scale business startups. The major challenges faced by entrepreneurs were pests and disease attacks, scarcity of skilled labor, shortage of inputs, adverse effects of climate, and low yields. In conclusion, the economic home gardeners based on tea small holdings have higher entrepreneurial readiness. Among them, those who have prior participation to extension programs showed more entrepreneurial readiness. Entrepreneurial readiness of such holdings could be uplifted by motivating, strengthening their entrepreneurial abilities by conducting more extension programs and increasing service providers, identifying appropriate and potential agribusiness and giving them viable solutions for major challenges and limitations. Hence, policymakers should give due attention on above aspects for the encouragement of tea small holders to establish economic home garden as an extra income source for improving their lively hood.

Keywords*:* Challenges and potentials, Entrepreneurial readiness, Economic Home gardens, Tea small holdings,

Corresponding Author: bhanuka.dissanayake24792@gmail.com

ID 100

Poverty incidence of farm households under differential access to water and exogenous prices: A Study in the Kirindi Oya Irrigation and Settlement Project

H.M.N.S. Harankahawa[1*] and P. Weligamage [1]

[1] Department of Agricultural Economics and Business Management, Faculty of Agriculture, University of Peradeniya, Sri Lanka

Abstract

Approximately 40% of global agricultural production relies on irrigation, which is a critical shared resource for increasing agricultural output, with surface irrigation being the most prevalent method. The Kirindi Oya Irrigation and Settlement Project (KOISP), which is a significant surface gravity irrigation system in the Hambantota District of Southern Sri Lanka, has well-established evidence of income disparities among farm households as a result of differential access to irrigation water. The initial focus of this study is to examine the prevalence of inequality in the distribution of irrigation water among farms, along with the incidence of income poverty. Additionally, the study aims to investigate the impact on poverty incidence resulting from changes in the supply of irrigation water quantities and exogenous market prices of inputs and outputs related to rice cultivation. The theoretical basis is the model of profit-maximising farm households. A secondary data source and a previously estimated production function were used to simulate production, net farm incomes, and poverty incidences. The baseline for the measure of water inequality is the Department of Agriculture's recommendation for minimum irrigation water requirement for paddy at the vegetative phase. The base period scenario (2006/07) was compared with the current period scenario (2020/21). The study's results showed that there were significant discrepancies in the amount of water received by farmers across different seasons and subareas of the system ($P<0.05$), with approximately 60% of farmers in the New Irrigation Area (NIA) having limited access to water during both cultivation seasons. The average water quantity received in the Old Irrigated Area (OIA) was 17% higher than the NIA. Household income increases with every unit of additional water received ($P<0.05$). The result of the binary logistic regression indicated that the water access ($P<0.05$), exogenous prices; agrochemicals ($P<0.05$); machinery ($P<0.05$), seeds ($P<0.05$) and rice ($P<0.05$) significantly influence the net income and the poverty status of households. Additional water allocation caused an apparent reduction in the poverty incidence in NIA. Changes to exogenous prices caused a distinct reduction in poverty incidence in both seasons of the current period (2020/21), which was more prominent in Maha, and a higher number of poor households were in OIA compared to NIA.

Keywords: Farm budgets, Farm household income, FGT indices, Rice farming, Water access inequality

Corresponding Author: nadinih@agri.pdn.ac.lk

ID 114

Floriculture industry in Southern province of Sri Lanka in the aftermath of the COVID-19 pandemic

S.H.S.Chamalke, S.Y.Munasinghe, H.I.G.K.Anuruddi, D.L.C.K.Fonseka* and P.H.M.Dharmasena

Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Abstract

Over the past few years, the floriculture industry in Sri Lanka has experienced significant growth and has emerged as one of the major sources of foreign exchange for the country. Despite this, the industry has been negatively impacted by occasional internal and external surges in recent times. The most recent COVID-19 pandemic together with the economic crisis has resulted in a dual shock on floriculture markets, affecting supply and demand in both international and domestic trade. Therefore, there is a need to analyze the current situation of the sector and possible interventions for its expansion. The scope of the study includes recognizing the current status of different entities engaged with the floriculture industry in southern province. A field survey was conducted in Galle, Matara, and Hambantota districts covering 20 secretariat divisions from July to September 2022. In-depth interviews were conducted with 100 floriculture producers selected by snowball sampling method. A pre-tested questionnaire with formal and informal discussions was employed to gather data. Data were subjected to descriptive analysis and correlation was tested between relevant parameters. According to the results, majority of the respondents were middle-aged (26-50 years old) males (86%) who were self-employed (75%). Their monthly income from floriculture operations has been drastically reduced between August 2019 and August 2022 due to the production loss with the chemical fertilizer ban in 2022 (Pearson Correlation Coefficient ρ= .613). Nearly 46% of the respondents gradually halted their production during the time period from January to September 2022 due to the reduction of demand and higher input costs. Meanwhile, lack of fertilizer availability in the markets diverted them to use organic fertilizers (41%) and some of them (27%) completely avoided using any fertilizer. On-site planting material production and using tissue cultured materials have been reduced by 38% and 13% respectively due to a lack of labor and profits from January to August 2022. Some respondents (20.6%) expect government support to establish shade net houses and to introduce new varieties (21.73%). Only 20% of the producers are using online platforms such as Facebook and Instagram to market their produce. Almost 60% preferred of developing a virtual platform to connect different stakeholders in the sector of Southern Province. Weaknesses in the available extension services, lack of market awareness, and limitations in government interventions are some other issues identified. Therefore, connecting different entities in the sector is critical for better corporation and promotion of the floriculture sector in the Southern province Sri Lanka.

Keywords: COVID-19, Floriculture, Present situation, Southern province

***Corresponding Author:** dlckumari@crop.ruh.ac.lk

ID 119

Supply chain risk management of an agribusiness enterprise: A case study of the largest plant nursery in Sri Lanka

T. Wakkuburage, M. Edirisinghe, U. Wanigasinghe, S. Wijesooriya, T. Suraweera and C. Wickramarachchi

Sri Lanka Institute of Information Technology, Malabe, Sri Lanka

Abstract
Almost all business enterprises are susceptible to risks of different forms. Hence, to a great extent, the success of running the day-to-day business operations and realizing their strategic goals depend on the effectiveness of managing risks they encounter. This paper presents a case study that examines the supply chain risk management of a leading plant nursery agribusiness in Sri Lanka. Although the supply chain risk management has been of interest to researchers and practiced by business managers as early as 1990s, its application of agriculture and agribusinesses commenced only recently. Furthermore, studies on supply chain risk management in plant nursery agribusiness enterprises are very remote. Taking ISO 31000 risk management framework as the conceptual basis, this research investigated the elements of risks encountered and how they were mitigated, in one of the largest and a very sophisticated plant nurseries in Sri Lanka as a case study investigation. This is a 40-acre nursery complex, namely Sevana Plant Nursery, which is based in Ampara District, Sri Lanka. The data collection was mainly through in-depth interviews, document review and participant observation. The research team visited and spent time with them in two occasions. The findings verified that this nursery has faced numerous risks over the past 29 years due to various factors, such as Tsunami, the Covid-19 pandemic, cyclones, Easter bombings, social unrest, and economic decline. The business primarily employed avoidance and reduction as their risk mitigation strategies. The management, with their extensive experience in plant nursery operations, not only demonstrated their effective risk management capabilities but also exhibited resilience in the face of supply chain risks on numerous occasions. The plant nurseries and agribusinesses, both large and small, can learn several important lessons in supply chain risk management through this research. Future research could be directed towards detailed studies on specific sub-processes supply chain risk management process of plant nursery agribusiness such as risk analysis and mitigation.

Keywords: Agribusiness, Plant nurseries, Risk management strategies, Supply chain risk management

***Corresponding Author*:** colinie.w@sliit.lk

ID 136

Goal orientations and typology of women entrepreneurs: An empirical study in Gampaha district

M.T.G.W. Karunarathna[1*], M.G.P.P. Mahindarathna[2] and B.C.H. Maduwanthi[3]

Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka

Abstract

Although women make up over half of the population in Sri Lanka, their economic engagement remains significantly low. Promoting their entrepreneurial endeavors would not only improve their standard of living but also contribute to the growth of the economy. Understanding the goals, typologies, and determinants of typologies is crucial in practical situations, especially with the increasing importance of women entrepreneurs. However, most studies on entrepreneurship in Sri Lanka have primarily focused on men, neglecting the significance of women entrepreneurs. This study examines goal orientations, typologies and determinants of the typologies of women entrepreneurs in Sri Lanka. Goal orientations were reviewed by using push and pull factors. Typologies were recognized based on Goffee and Scase model. The multinomial logit model was used to identify the factors affecting on typologies. The sample was 150 registered women entrepreneurs in the Gampaha district. A simple random sampling method was adopted for the study. Primary data were collected using an interviewer-administered questionnaire, which was done through direct and telephone interviews. The survey results showed that insufficient family income is the main push factor for venturing into business. The primary motivating factor identified was the hobby or passion for the business. Additionally, the sample did not include any radical women entrepreneurs. A new typology was identified and named "Conventional – Innovative." The majority of women entrepreneurs were conventional followed by domestic. The least number of respondents belong to the new typology. Education is significant with the Innovative typology and Conventional – Innovative typology. The current business age was significant with the domestic and Innovative typology. Marital status, number of children and previous employment status was significant with none of the typologies. A similar study in other districts can determine whether radical women entrepreneurs exist in Sri Lanka. It is good to know the goals and typologies of women entrepreneurs while making policies related to their loan schemes and programs. These findings can be incredibly valuable in promoting women's entrepreneurship, particularly in economically disadvantaged countries like Sri Lanka, where research of this nature is scarce.

Key words: Goal orientations, Goffee and Scase model, Typology, Women entrepreneurs

Corresponding author: gayanthiwathma@gmail.com

Poster Presentations

ID 02

Consumers' determinants of selection of fruits and vegetables with minimum postharvest losses in Matara DS division

HAGK Sathsarani[1*]

[1]Department of Agribusiness Management, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya

Abstract

Postharvest loss can be defined as the degradation in both quantity and quality of a food production from harvest to consumption. Present study was undertaken to identify the Consumers' determinants of selection of fruits and vegetables with minimum postharvest losses in Matara DS division. Currently, consumers take certain determinants into account when purchasing fruits and vegetables. The determinants that influence the selection of fruits and vegetables with minimal post-harvest losses can be either internal, external, or a combination of both. These determinants are taken into consideration to minimize post-harvest losses. Primary data analysis was mainly based on the responses received through the questionnaire, by using the SPSS software and MS Excel 2013. Durban-Watson value was 2.330. Therefore, the independence of the observations had been met. Using the enter method, significant model emerged ($F_{7,44}=4.117$, $P< 0.001$, Adjusted R square=0.300). The finding of the results showed that the most of consumers aware (98.1%) about postharvest losses, but they have not sufficient awareness (69.2%) about causes for postharvest losses. Consumers perceive high waste and adverse health effects as significant problems associated with low-quality fruits and vegetables. Regression analysis results indicated that the maturity stage of the commodity, minimum microbial activities, and pest attacks significantly impact consumer satisfaction. Physiological deteriorations did not have a significant impact on consumer satisfaction. When considering external determinants for selecting fruits and vegetables, market premises sanitation and storage conditions in the market were significant factors influencing consumer choices. However, appropriate packaging, washing, and grading levels were not found to be significant determinants.

Keywords: Consumers, Determinants, Fruits and vegetables, Postharvest, Losses

Corresponding Author: kaveeshasathsarani630@gmail.com

ID 03

Small and medium-sized farmers' perspectives on rubber production; A case study in Monaragala district, Sri Lanka

B.P. Siriwardena*, W.M.D.M. Samarasinghe, K.G. Ketipearachchi

Department of Agro-Technology, University of Colombo Institute for Agro-Technology and Rural Sciences, Sri Lanka

Abstract

Rubber cultivation is a relatively new industry in the *Monaragala* District of Sri Lanka and has been rapidly expanding. While there have been studies conducted on farmers' perspectives on rubber production, there is still a lack of information about the rubber sector in the district. Understanding farmers' perspectives on this sector is critical to improve the rubber sector in Sri Lanka. The aim of this study is to gain an understanding of farmers' perspectives on rubber production and identify potential solutions to address the major drawbacks in the industry and improve rubber production. The population of the study was small and medium-sized farmers in the *Monaragala* District. Within the 11 GN divisions, 110 farmers from the *Monaragala* District were chosen as the sample size using the stratified sampling technique. The farmers' primary data were collected using a pretested structured questionnaire with the desired constructs. The economic variables of the study were determined using a five-point Likert scale. Farmers claimed that there is no appropriate price for rubber, even though natural rubber is in high demand all over the world. The responses generally refuted the statement that "cost of production became acceptable" (p value<0.05) and that the use of machinery in rubber growing was increasing (p value<0.05). In the Monaragala district, the rubber industry has created both direct and indirect job opportunities (p value<0.05). The sample respondents mentioned three significant constraints: a lack of fertilizers, a lack of water, and wild animal attacks (36.36%). Farmers suggest a few agronomic measures, such as productive cover crop establishment, regular soil loosening to make the best use of fertilizer and water for cultivation, as well as guards to protect early planted plants from wild animals (p value<0.05). Aside from that, they advocated for increased cultivation on vacant lands in the Monaragala district, an efficient extension system, high-quality planting materials, and the formation of rubber farmer cooperative societies. Not a reasonable price for rubber, higher production costs, and a lack of available labour in certain regions were mentioned by farmers as their primary concerns. By addressing these issues and obstacles, it is possible to increase rubber production in the region.

Keywords: Farmers, Monaragala district, Perspectives, Rubber production

Corresponding Author: buddhika@uciars.cmb.ac.lk

ID 10

Effectiveness of imposing maximum retail price for regulating the market price of rice: A case of Colombo and Gampaha districts in Sri Lanka

S.M.S.Palitha Bandara [1*], G.C.Samaraweera [2] and T.S.L.W.Gunawardana [3]

[1] Paddy Marketing Board, Sri Lanka
[2] Department of Agricultural Economics and Agribusiness, Faculty of Agriculture, University of Ruhuna.
[3] Department of Business Management, Faculty of Management and Finance, University of Ruhuna.

Abstract
The artificial creation of rice scarcity and the unusual price increase harm the consumers and make frequent complaints against large-scale millers for earning excessive profit. In order to stabilize and regulate the price in the market, the government imposed a maximum retail price (MRP), and that retail market price ≤ MRP if the imposed MRP is effectively implemented. However, the effectiveness of this in order to regulate the rice price in the market is quite questionable, as very limited literature has discussed this issue yet. Hence, the purpose of this study is to assess the effectiveness of imposing MRP to regulate the price of rice in the market in the Colombo and Gampaha districts. Secondary data on the average monthly retail price (AMRP) and the imposed MRP values were used in this research. The AMRP of the main four rice types; Long grain white (LGW), Short grain white (SGW), White raw (WR), and Red raw (RR) used in this study. One sample t-test through SPSS software was used to analyze the significance. The deviation (Deviation = AMRP - MRP) between the AMRP and the MRP was calculated from the year 2015 to 2021. Results of the one-sample t-test showed that the AMRP from 2015 to 2021 is significantly higher than imposed MRP in all four rice types. In the analysis of deviation out of the considered 84 months, AMRP showed a positive deviation in SGW and LGW except for March, April, and May 2020. WR showed a positive deviation except for May 2016 and August 2015 and RR showed a positive deviation except in May 2016. Accordingly, the present study proved that the imposed MRP has not regulated the market price. However, the AMRP in the market may vary with the availability of rice and the marketing strategies used by key players. The increase in the AMRP of rice than the MRP indicated that the appropriate actions such as regulatory mechanisms and legal actions have not been implemented by the respective parties. Therefore, the policymakers should identify the limitation in imposing MRP and need prompt action to successfully enforce MRP to regulate market prices in Sri Lanka.

Keywords: Excessive profit, Maximum retail price, Mean monthly retail price, rice scarcity

***Corresponding Author*:** samanpb@yahoo.com

ID 34

Analysis the growth potential of coir substrate industry in Sri Lanka using SWOT

M.A.K.D. Mallikarachchi [1*], R.A.P.I.S. Dharmadasa [1] A.M.C. Amarakoon [1], S.C. Wickramarathna [2]

[1] Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2] Marketing Development and Research Division, Coconut Development Authority, Colombo

Abstract

Sri Lankan coir substrate industry is a significant source of foreign exchange earnings and employment. Since 2013, the substrates industry has grown annually by over 15% because of the impetus of value addition. That allowed the sector to record 135 million USD in export revenue in 2019, which represents 22% of the total export revenue of coconut-based products. The volume of substrates exported has doubled since 2009. Nevertheless, the percentage rise between 2015 and 2019 is just 20%, and between 2018 and 2019, it was only 1%. There is a significant gap between demand and supply for these products in the world market. This SWOT study was conducted to identify barriers to improve coir substrate production and develop and prioritize strategies to overcome them. To develop a questionnaire, a list of strengths, weaknesses, opportunities, and threats were identified through library studies and personal interviews with industry familiars (directors of the Coconut Development Authority, company managers, and the secretary of the Exporters Association of Coir Based Substrates). The reliability of the Likert scale questionnaire was tested through the Cronbach alpha reliability test. Data were collected by holding in-depth telephone interviews with managers and owners of 30 companies out of 138 Coconut Development Authority registered coir substrate manufacturing companies using the questionnaire. The main three phases included in the research framework were the input phase, the comparison and correspondence phase, and the decision-making phase. Both descriptive and matrix analysis were used for the analysis of the data. Required strategies were determined based on the observed results of the IFE-EFE matrix, and developed strategies were prioritized using the QSPM matrix. Through this qualitative research, Prioritized SWOT Factors were; Strengths - Large market share for Sri Lankan Substrate Products in the world market, Weaknesses - Labor intensive industry, Opportunities - Growing world demand for washed and buffered products and Threats - Few low-quality products damage the well reputation of all the other high-quality products. The internal factor evaluation matrix scored 3.112, and external factor evaluation matrix scored 2.464. According to the results of the Internal and external factor analysis matrix (IFE - EFE matrix), the Sri Lankan coir substrate industry belongs to the competitive strategy quadrant, which is major in strengths over weaknesses internally and major in threats over opportunities externally. That means it needs more competitive strategies to achieve success in the industry. In decision- making phase, among seventeen strategies Understanding the gaps in the Sri Lankan coir substrate industry and developing strategic plan with the collaboration of Coconut Development Authority and related industry association was the mostly prioritized strategy in QSPM. The findings of this research will be useful to improve production capacities in an industrial scale and to investors, Coconut Development Authority, related industry associations and policymakers for further developments of the industry.

Keywords: Coir Substrate, Matrix, QSPM, Strategies, SWOT

Corresponding Author: kalanimallikarachchi1997@gmail.com

Acknowledgement: This work was funded by the Uva Wellassa University of Sri Lanka

ID 41

Potentials to implementation of Agro-Tourism Businesses as a new concept of Sri Lankan Economy

D.A.M Hapuarachchchi*

Department of Economics, Faculty of Humanities and Social Sciences, University of Ruhuna, Matara, Sri Lanka.

Abstract
Sri Lanka's economy has long been anchored by its agrarian sector, which serves as a key driver of growth. Additionally, the country's tourism industry has emerged as a significant contributor to its GDP. The convergence of these two distinct yet quintessentially Sri Lankan industries presents an opportunity to launch a new venture known as "Agro-tourism businesses". The primary objective of this study is to assess the feasibility of agro-tourism as a viable business in Sri Lanka, with a particular emphasis on three key factors: the age distribution of farmers, their level of education, and the size of their farms. Five districts were chosen based on secondary data from the Department of Census and Statistics, which indicated that they would be suitable for promoting tourism while also sustaining high levels of agricultural activity. The study's findings clearly demonstrate that all five of the selected districts exhibit the key criteria necessary for the successful implementation of an agro-tourism business project. Given Sri Lanka's unique context, as highlighted by the five major districts under consideration, implementing the concept of agro-tourism is not only appropriate but could also yield significant benefits in terms of sustainable economic growth. The selected districts demonstrate high potential for introducing agro-tourism industries, which could have a positive impact on the development of the sector. Given Sri Lanka's unique agrarian and tourism background, there is a significant number of farmers across various age groups and a considerable amount of arable land. In addition, involving degree holders from the agricultural sector in agro-tourism implementation could unlock significant potential for the sector. Overall, these factors suggest that Sri Lanka is well-positioned to successfully launch agro-tourism business projects.

Key words: Agro tourism, Businesses, Economic growth, Sri Lanka

Corresponding Author: madarauorhss17435@gmail.com

ID 79

Impact of the current crisis in Sri Lanka towards paddy cultivation: Perspective of farmers

R B P M Rathnayake[1], R P C K Jayasinghe[2]

[1]Kensley Graduate School, Colombo, Sri Lanka
[2] Department of Public Administration, University of Sri Jayewardenepura, Sri Lanka

Abstract

Rice is not only a staple food in Sri Lanka but a part of the main livelihood of the majority in rural areas in the country. Agriculture plays a pivotal role in contributing to the national Gross Domestic Production in Sri Lanka like many other developing nations. Despite the fact that Sri Lanka's paddy industry has long served as the backbone of the economy, the country's present economic crisis has resulted in severe shortages and price hikes for essential goods, such as food, agricultural inputs, fuel, and medicine, which has severely disrupted agricultural production. Further, Sri Lankan government has enacted an immediate ban on chemical fertilizer imports to address the foreign exchange crisis. Nevertheless, switching to organic farming is not an overnight process, it takes at least two years to rebuild the soil and reach a point where it can produce comparable crop yields. Since the snowballing economic and political crisis deepened by the bungled agricultural transition, the study aims to examine severely undermined causes toward paddy farmers and to their harvest. A qualitative approach included 20 paddy farmers interested in participating in the study. In-depth interviews and observations revealed the several impacts on the paddy farmers by the prevailing economic status of Sri Lanka. The collected data were analysed using the thematic analysis method. The study has identified several pressing issues confronting paddy farmers in Sri Lanka, stemming from the prevailing economic and political crises. These include a decline in rice production, limited access to fertilizer and fuel, which hinder harvesting and paddy cultivation, mounting pressure and uncertainty among farmers about their next crop season, and the exacerbation of economic challenges and dwindling currency reserves. The government's ban on the import of inorganic fertilizer and agrochemicals has had a significant impact on the agricultural supply chain, resulting in limited access to essential agricultural inputs. Although the ban was eventually lifted, the damage had already been done due to the impact of the global pandemic on agricultural productivity. As a result, there has been a decline in paddy productivity, leading to increased food insecurity and income losses for small farmers who are already living on the brink of poverty. As recommendations, the study suggests implying macro-economic policies rather than organic-only policies, and as a long-term intervention strategy, the government needs to plan a holistic approach that improves food security, through economic development and agriculture. Further, appropriate revisions for the current agricultural policies should be executed to be more effective and efficient to support the livelihood of paddy farmers, achieving self-sufficiency in rice, and curtailing transaction costs and inefficiencies associated with distribution by the proper intervention of government in the paddy market.

Keywords: Agriculture, Economic crisis, Food insecurity, Paddy farmers

Corresponding Author: prabodharathnayake71@gmail.com

ID 85

Socio Economic Status of Smallholder Farmers Market Participation Decision in Anuradhapura District, dry zone of Sri Lanka

C.M Udesha Thisari Chandrasekara[1*], K. Umashankar[2] and T.P. Munaweera[3]

[1] Department of Agricultural Economic, Faculty of Agriculture, University of Jaffna, Sri Lanka
[2] Department of Water Resource and Management, HectorKobbakaduwa Reasearch and AgarianTechnologyInstitute, Sri Lanka

Abstract
The emergence of supermarkets and rural development has had a significant economic impact on agriculture, particularly for smallholders. However, supplying high-quality fruits and vegetables to supermarkets presents several challenges, including timing, quality, safety, and quantity. These issues need to be addressed in order to effectively meet the demands of supermarkets. Additional variables such as affection and dichotomous choice for market involvement were taken into account. The objective of the research was to determine the elements that influence market involvement, draw comparisons between Supermarket and Traditional Farmers, and examine the income generation of farmers who supply to supermarkets. The study focuses on smallholder farmers supplying to both supermarkets and traditional markets within the Anuradhapura district. The samples were obtained from five regions of the Anuradhapura district, namely Nochchiyagama, Galnawa, Anuradhapura, Madawachchiya, and Thambuthegama, using the stratified random sampling technique. A questionnaire was created and administered through face-to-face interviews with 100 farmers from the Anuradhapura district. The factors are analyzed with Probit regression by using stat13 software. The Probit model was utilized to analyze dichotomous or binary outcome variables, while descriptive analysis was employed to examine income generation. Factors that have a positive impact increase interest in market participation, while negative factors reduce it. In addition, technical motivation, collective action, and farmers' production capacity are factors that increase market participation

Keywords: Anuradhapura district, Agri-foods, Market participation, Smallholder Farmers, Socio-Economic and other factors.

****Corresponding author:*** udeshaagriecon@gmail.com

Acknowledgement: This work was guided by Hector Kobbakaduwa Reasearch and Agarian Technology Institute of Sri Lanka

ID 132

Influence of entrepreneur traits of owner-manager on the growth of plant nursery agribusiness: A case study in Ampara, Sri Lanka

T. Wakkumburage, M. Edirisinghe, U. Wanigasinghe, S. Wijesooriya, T. Suraweera and C. Wickramaarachchi

Sri Lanka Institute of Information Technology, Malabe, Sri Lanka

Abstract

The entrepreneurial success is influenced by diverse factors which are equally important to investigate. Previous studies confirmed that entrepreneur characteristics (personal traits) are vital for becoming a successful entrepreneur. This study investigates how entrepreneur traits namely, innovativeness, futuristic mindset, and commitment impact on the growth of a plant nursery agribusiness in Sri Lanka. This study uses a case study approach in the largest and most sophisticated private plant nursery in Sri Lanka, called Sevana Plant Nursery (SPN), based in *Ampara* District. This nursery initiated in 1993 as a family business in a 0.5 acres of land and it has been grown substantially over the last 29 years while expanding its business to 40 acres of land producing 10 million plants in 400+ varieties, annually. This study is qualitative in nature, and it used in-depth interview method as the main data collection method. Observation method and other reports/documents were used as validation sources of the findings. Pre-tested interview protocol was employed for in-depth interviews which were carried out with the owner-manager, and two other directors. Data analysis was guided by thematic analysis. The study found many entrepreneur traits in owner-manager, however, this study limits to three traits which substantially contribute to the growth of SPN over its 29-years of journey. Innovativeness, futuristic mindset, and commitment were derived from thematic analysis. In each trait, the owner-manager revealed his unique entrepreneurship skills which have been evidently doable and sustainable. These were supported by the elaboration of two other directors, observation being done by the research team, and other secondary sources. This study can be used as a role model for entrepreneurs in general, and practitioners in the plant nursery sector in particular. Further, this study helps to understand the importance of entrepreneurship traits which drive the growth of Agribusiness in general.

Keywords: Agribusiness, Entrepreneurial traits, Plant nursery

***Corresponding Author*:** colinie.w@sliit.lk

ID 137

Youth involvement in agriculture employment in Sri Lanka

K.D.C.M. Swarnamali[1*], M. Thibbotuwawa[2], and R.A.P.I.S. Dharmadasa[1]

[1] Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2] Institute of Policy Studies, Colombo 07, Sri Lanka

Abstract

Though the youth is an important resource for economic development, yet their participation in agriculture is very low in globally. Sri Lankan youths are stepping down from agriculture. As a developing country, Sri Lanka must motivate youth involvement in agriculture to establish a proper food security. Therefore, this study aimed to identify major determinants of participation decision, major motivations and incentives for youth involvement in agriculture. This scoping study was a mixed methodology that employs both secondary and primary information. The data for the major study are coming from Household Income and Expenditure Survey conducted by Department of Census and Statistics of Sri Lanka. The data were analyzed using multinomial porbit regression. The polychotomous dependent variable contained unemployed, non-agriculture employed, and agriculture employed categories. Results suggested that participation decision depends on individual's marital status, education level, location (urban, rural, estate), household size, annual income generate from employment, household debt, ownership of an agriculture land and distance to the agrarian service center. Around 30% of rural youths stay unemployed while 5% engage in agriculture. The study found that 92.03% of rural youth who received more than ten years of education are open to adopting modern technologies in agriculture. Although this did not impact their decision to participate, the average land area cultivated per individual was 0.9513 acres. Civil status had positive influence on participation decision; married, divorced, separated, and widowed individuals tend to being employed compared to the never married individuals. The mean distance to nearest extension service center was 6.8302km. Reside in rural or estate increase the participation. Increasing household debts had negative influence while gender, ethnicity, cultivation area and individual's age had no influence on participation decision. The primary survey aimed perception of youth about agriculture. This parallel study also resulted that the youth tend to adopt new technologies for farming. 76.27% of youth state it as 'Very important action' to be taken. 72.03% and 66.95% states that introducing agribusiness and entrepreneurial studies to school curricula, provide vocational training on agriculture entrepreneurship is a 'very important action'. Further, the study recommends to promote advanced agriculture techniques, improve accessibility to practical knowledge, and develop market-oriented production system that will also be effective to address the challenges rural youths face.

Keywords: Agriculture, Occupation choice, Participation decision, Youth

[*]***Corresponding Author:*** swarnamalikeeragala@gmail.com

Innovative Agricultural Technologies

ISAE - 2023

Keynote Speech

Agriculture 5.0: Smart Agriculture, AI, Iot, Society 5.0, Big Data Analytics, Blockchain, Digital Twins, Robotics, Drones and Immersive Reality

Prof. PhD. DrSc. A. Kaklauskas
Vilnius Gediminas Technical University, Lithuania

***Email -** arturas.kaklauskas@vilniustech.lt

Abstract
Agriculture is transforming due to Agriculture 5.0, including smart agriculture, AI, IoT, Society 5.0, big data analytics, blockchain, digital twins, robotics, drones and immersive reality, and digitally delivered services and apps. There are numerous examples at various points in the agriculture value chain: traceability technologies and digital logistics services have the potential to streamline agri-food supply chains while also offering consumers reliable data, information, knowledge; remote satellite data and in-situ sensors increase accuracy and lower the cost of crop growth and water or land quality monitoring; automated farm equipment allows for fine-tuning of inputs and decreases the need for manual labour. The development and application of mobile technology, distributed computing, and remote sensing services are now enhancing smallholders' admittance to data, information, knowledge, financing, markets, and education in the agriculture. Digital technologies are creating new opportunities to include smallholders in a digitally driven agriculture. The entire agriculture chain will shift as a result of digitalization. It is possible to achieve highly optimal, customized, intelligent, and anticipatory resource management throughout the real-time and hyperconnected system. Traceable and coordinated value chains will be more precisely, allowing for managing various farms, crops, and animals according to their unique ideal prescriptions. Digital agriculture will result in highly productive, proactive, and responsive systems to changes like those caused by climate change. This could result in improved sustainability, profitability, and food security. The technologies employed frequently draw on the ideas of the Internet of Things and include sensors, communication networks, unmanned aerial systems (UAS), artificial intelligence (AI), robotics, and other cutting-edge gear. Digital agriculture can increase productivity, consistency, and resource and time usage. This has significant advantages for farmers as well as global social gains. Creating new, disruptive opportunities allows organizations to share data, information, knowledge, across conventional industry borders. According to our research, the following development in Agriculture 5.0 research, recent developments, policy, and practice need to be reflected: smart agriculture, AI, IoT, Society 5.0, big data analytics, blockchain, digital twins, robotics, drones and AR/VR/immersive reality.

Keywords: Smart agriculture, Artificial Intelligence (AI), Internet of Things (IoT), Society 5.0, Big data analytics, Blockchain, Digital twins, Robotics, Drones, Immersive reality

Introduction

Agriculture is the backbone of many economies worldwide. In recent years, the application of technology in agriculture has become increasingly prevalent, leading to the emergence of Agriculture 5.0. Agriculture 5.0 refers to the use of smart agriculture, Artificial Intelligence (AI), Internet of Things (IoT), Society 5.0, big data analytics, blockchain, digital twins, robotics, drones, and immersive reality in agriculture. These technologies have the potential to revolutionize the agriculture industry,

making it more efficient and sustainable. In this paper, we will explore the various technologies that make up Agriculture 5.0 and their potential impact on agriculture.

Smart Agriculture

Smart agriculture is an emerging concept that involves the use of various technologies such as AI, IoT, big data analytics, and drones to optimize agricultural production. The goal of smart agriculture is to enable farmers to make more informed decisions by providing them with real-time data on crop health, soil moisture, and weather conditions. Smart agriculture can also help farmers reduce water usage, fertilizer and pesticide application, and increase crop yields. One example of smart agriculture is precision agriculture, which involves the use of sensors and GPS technology to map fields, track crop growth, and monitor soil health. Another example is smart irrigation systems, which use real-time weather data and soil moisture sensors to optimize irrigation scheduling. Smart agriculture has the potential to revolutionize the agricultural industry by making it more efficient, productive, and sustainable. According to a report by the Food and Agriculture Organization of the United Nations, smart agriculture has the potential to increase crop yields by up to 70%, reduce water usage by up to 50%, and reduce fertilizer usage by up to 30%. However, the widespread adoption of smart agriculture will require significant investments in technology and infrastructure, as well as education and training for farmers to effectively use these tools (FAO, 2019).

Artificial Intelligence (AI)

Artificial intelligence (AI) is a key technology that is increasingly being used in agriculture to improve crop yields, reduce costs, and increase efficiency. AI can be used in a variety of ways in agriculture, including crop monitoring, disease detection, and yield prediction. AI algorithms can analyze large amounts of data from sensors, satellite imagery, and weather stations to provide farmers with real-time information on crop health, soil moisture, and weather conditions. This information can help farmers make more informed decisions about irrigation scheduling, fertilizer application, and crop management. One example of AI in agriculture is the use of computer vision algorithms to identify plant diseases. Researchers have developed AI algorithms that can analyze images of crops to identify signs of disease, allowing farmers to take action before the disease spreads. Another example is the use of machine learning algorithms to predict crop yields based on weather patterns and soil moisture levels. AI has the potential to revolutionize agriculture by enabling farmers to make more informed decisions and optimize their operations. According to a report by the International Data Corporation, the market for AI in agriculture is expected to grow from $214 million in 2019 to $816 million in 2024 (IDC, 2020).

Internet of Things (IoT)

The Internet of Things (IoT) is a technology that enables the connectivity and exchange of data between physical devices and systems over the internet. In agriculture, IoT can be used to improve crop monitoring, precision farming, and resource management. IoT sensors can be deployed throughout fields to collect data on soil moisture, temperature, and other environmental factors. This data can be analyzed in real-time to inform decisions on irrigation scheduling, fertilization, and crop management. IoT can also be used to optimize equipment and machinery, reducing downtime and increasing productivity. For example, IoT sensors can be used to monitor the health and performance of tractors and other farm machinery, allowing farmers to schedule maintenance and repairs before they break down. The use of IoT in agriculture is growing rapidly. According to a report by MarketsandMarkets, the global market for IoT in agriculture is expected to grow from $9.06 billion

in 2018 to $26.76 billion by 2023 (MarketsandMarkets, 2018). However, the widespread adoption of IoT in agriculture will require significant investments in technology and infrastructure, as well as education and training for farmers to effectively use these tools.

Society 5.0

Society 5.0 is a concept introduced by the Japanese government that envisions a society where technology, including AI, IoT, and other advanced technologies, is used to solve social problems and create a more sustainable future. In the context of agriculture, Society 5.0 envisions the use of technology to improve food security, reduce waste, and promote sustainable agriculture practices. Society 5.0 emphasizes the importance of collaboration and partnerships between different sectors of society, including government, academia, and industry. In agriculture, this means bringing together farmers, researchers, and technology companies to develop and implement innovative solutions that address the challenges facing the industry. One example of Society 5.0 in agriculture is the development of precision agriculture technologies, such as smart irrigation systems and crop monitoring tools, that use data and analytics to optimize crop yields while minimizing environmental impact. Another example is the use of blockchain technology to improve transparency and traceability in the food supply chain, ensuring that consumers have access to safe, high-quality food. The Society 5.0 concept is gaining traction around the world, with governments and organizations recognizing the importance of using technology to address social and environmental challenges. In 2019, the United Nations launched the Society 5.0 Global Initiative to promote the use of technology for sustainable development (United Nations,2019).

Big Data Analytics

Big data analytics refers to the process of analyzing large and complex data sets to uncover patterns, trends, and insights. In agriculture, big data analytics can be used to inform decisions on crop management, resource allocation, and risk management. One example of big data analytics in agriculture is the use of satellite imagery and weather data to predict crop yields and identify areas that are vulnerable to drought or other environmental risks. This information can be used to inform decisions on irrigation, fertilization, and other crop management practices. Big data analytics can also be used to optimize supply chain management and reduce waste in the food system. By tracking data on crop yields, transportation, and storage, farmers and food companies can identify inefficiencies in the system and develop more efficient and sustainable practices. The use of big data analytics in agriculture is expected to grow significantly in the coming years. According to a report by ResearchAndMarkets, the global market for big data analytics in agriculture is expected to grow from $864.4 million in 2018 to $2.3 billion by 2023 (ResearchAndMarkets, 2018). However, the widespread adoption of big data analytics in agriculture will require investments in technology and infrastructure, as well as education and training for farmers to effectively use these tools.

Blockchain

Blockchain is a distributed ledger technology that allows for secure and transparent transactions without the need for intermediaries. In agriculture, blockchain technology can be used to improve supply chain transparency and traceability, as well as reduce food fraud and increase food safety. By using blockchain technology, farmers and food companies can track the movement of food products from farm to table, allowing for greater transparency and accountability in the supply chain. This can help to build trust between consumers and food producers, and ensure that consumers have access to safe and high-quality food. In addition, blockchain technology can be used to reduce food waste by providing real-time information on food products, including their origin, quality, and freshness. This can help to reduce waste in the supply chain and ensure that food products are delivered to

consumers in a timely and efficient manner. The use of blockchain technology in agriculture is still in its early stages, but there are several initiatives underway to explore its potential. For example, IBM has partnered with Walmart and other companies to develop a blockchain-based system for tracking the movement of food products through the supply chain (IBM, 2019).

Digital Twins

Digital twins are virtual models that replicate the physical characteristics and behavior of a real-world object or system. In agriculture, digital twins can be used to create a virtual representation of a crop or livestock system, allowing farmers to monitor and optimize their production processes in real-time. By using digital twins, farmers can simulate different scenarios and test the effects of different management practices on crop yields, water usage, and soil health. This can help to improve crop productivity and reduce the use of resources, such as water and fertilizers. In addition, digital twins can be used to monitor and optimize livestock production systems, such as animal health, feed efficiency, and waste management. This can help to improve the overall efficiency and sustainability of the livestock industry. The use of digital twins in agriculture is still in its early stages, but there are several initiatives underway to explore its potential. For example, Microsoft has partnered with the European Space Agency to develop a digital twin of a wheat farm, which can be used to optimize irrigation and fertilizer use (Microsoft, 2020).

Robotics

Robotics has been increasingly used in agriculture to automate labor-intensive tasks such as planting, harvesting, and weeding. Agricultural robots are equipped with sensors and cameras that can detect and analyze data on soil moisture, crop health, and yield, allowing farmers to make data-driven decisions to optimize their production processes. In addition, robots can be used to reduce the use of chemicals and pesticides in agriculture, as they can accurately apply chemicals only to areas where they are needed, minimizing waste and environmental impact. They can also work around the clock, which can help to increase crop yields and reduce labor costs. Some examples of agricultural robots include the LettuceBot, which can thin and weed lettuce crops, and the Agrobot, which can pick strawberries. The use of robotics in agriculture is expected to grow in the coming years, as farmers seek to increase productivity, reduce labor costs, and improve sustainability (Doraiswamy et al., 2019).

Drones and immersive reality technologies

Drones and immersive reality technologies are being increasingly used in agriculture to enhance crop monitoring and management. Drones equipped with sensors and cameras can collect high-resolution images of crops and fields, providing farmers with data on crop health, yield, and soil moisture levels. This data can then be analyzed using big data analytics to optimize crop management strategies and increase yields. Immersive reality technologies, such as virtual and augmented reality, can be used to create immersive experiences for farmers, allowing them to visualize and manipulate data in new and interactive ways. For example, virtual reality can be used to simulate different growing scenarios and test the impact of different management strategies on crop yield. The use of drones and immersive reality technologies in agriculture is expected to continue to grow as farmers seek to improve crop yields, reduce costs, and increase sustainability (Garcia-Santillan et al., 2020).

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Oral Presentations

ID 05

Impact of gamma irradiation on microbiological and physical properties of butterfly pea tea (*Clitoria ternatea*)

S.H.P.K. Maneesha[1*], R.D.R. Ranasinghe[2], A.A.G. Madurakanthi[2] and W.A.J.P. Wijesinghe[3]

[1]Department of Export Agriculture, Faculty of Animal Science & Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2]Sri Lanka Gamma Centre, Sri Lanka Atomic Energy Board, Biyagama, Sri Lanka
[3]Department of Food Science & Technology, Uva Wellassa University, Badulla, Sri Lanka

Abstract
Butterfly pea flower tea is a caffeine-free herbal fusion made from flowers of the *Clitoria ternatea* plant and is rich in antioxidants. It is difficult to clean large quantities before processing as butterfly pea tea is made from small flowers. In consequence, microorganisms can be present in the final product. This product has a good demand in the foreign market and is expected to increase in the future. Large-scale production is more profitable and efficient if contamination is reduced. Gamma irradiation can be used as an effective treatment to destroy microorganisms. Samples collected from an exporter were irradiated 3 days after processing at different target doses of 3kGy, 5 kGy and 7 kGy and non-irradiated sample was used as the control. Co-60 gamma irradiator was used with the rate of 0.15Gys^{-1}. Total Plate count, total coliform and fecal count and yeast and mold count of butterfly pea were determined according to modified ISO standard methods. Water activity, moisture content %, powder color and infusion color (ΔE value based on L, a, b in Hunter color scale) were measured for each treatment under physical parameters. All treatments were done within a week after irradiation and replicated three times. The highest microbial contamination was observed in the non-irradiated sample. The total plate count dramatically decreased with increasing irradiation doses. *Escherichia coli* were identified in the control sample. There were no yeast and mold count, total coliform and total fecal count observed in all the treated samples. The average water activity and moisture % of control samples were 0.263±0.00 and 7.860±0.18% whereas irradiated butterfly pea tea samples were 0.31±0.01 and 7.37±0.20% respectively. The mean ΔE values of powder and infusion of the irradiated samples were not significantly different (P>0.05) from the control sample. The study shows that 3kGy is the possible dose to eliminate microbial contamination and has no considerable effect on the physical parameters of butterfly pea.

Keywords: Butterfly pea, Irradiation, dose, Microbial safety, Physical parameters

Corresponding Author: kaumadeemaneesha96@gmail.com

ID 08

Improvement of nutritional quality of *Basella alba* (spinach) by altering circadian rhythms during post-harvest storage

W.D.N. Perera and R. Wimalasekera*

Department of Botany, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda

Abstract

Leafy vegetables, highly perishable and prone to rapid senescence after harvest, experience a decline in both their longevity and nutritional quality during postharvest storage, as they remain biologically active and undergo metabolic and biological processes that are influenced by entraining internal circadian clocks with external environmental stimuli. The present study was aimed to investigate the effect of circadian rhythms on the nutritional quality of *Basella alba* (spinach) during postharvest storage. The effect of light and dark treatments on the nutritional quality of spinach leaves was studied by determining chlorophyll, carotenoid, vitamin C and Fe contents during the storage of 1-6 days under different light / dark regimes, i.e., 24h light (LL), 16h light/8h dark (16L/8D), 12h light/12h dark (12L/12D), 10h light/14h dark (10L/14D), constant 24h dark (DD) at 20 ◦C and constant 24h dark at 4 ◦C (RDD). Results showed that there was a considerable change in the nutrient contents of spinach leaves at the end of the storage period compared to the initial nutrient content. Initial chlorophyll, carotenoid, vitamin C and Fe contents of the spinach leaves were enhanced at the end of the storage period under 16L/8D treatment by 7.0%, 6.2%, 5.6%, and 14.8%, respectively. In LL and DD treatments, nutrient content decreased significantly at the end of the storage period. Declining of nutrient content was greatest in spinach leaves stored under DD. In 12L/12D treatment, initial nutrient content was relatively maintained 6-day storage period. During the storage period under 16L/8D, 12L/12D, 10L/14D treatments nutrient contents were increased compared to DD and LL treatments. The storage temperature had significant contribution to the preservation of nutrients in spinach leaves. The nutrient contents of spinach leaves were maintained under low temperature storage. Chlorophyll, carotenoid, vitamin C and Fe contents were increased by 29.6%, 12.4% 6.5%, 9.5%, respectively under constant dark at 4 ◦C (RDD) compared to constant dark at 20 ◦C (DD). The results exhibited that altering circadian rhythms during the postharvest storage under light/dark cycles and low temperature contributes to maintain nutritional value of spinach after harvest.

Key Words: Circadian rhythms, Leafy vegetables, Light/dark cycles, Nutritional value, Senescence

***Corresponding Author*:** rinukshi@sci.sjp.ac.lk

ID 21

Characterization of activated charcoal produced from palmyrah (*Borassus flabellifer)* seed shell for the formulation of handwash

T. Keasavi[1], M.P.M. Arachchige[1*], E.A.L. Lochana[1], N.A. Kaushalya[2] and A. Kirushanthi[2]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2]Palmyrah Research Institute, Jaffna, Sri Lanka

Abstract

The ability of activated charcoal to cleanse and absorb impurities from the skin is well known. However, the high cost and non-renewable nature of commercially available activated charcoal have hindered its widespread use in large-scale industrial settings. In Sri Lanka, the hard and lignified shells of palmyrah seeds are currently underutilized despite their potential for producing activated charcoal.The aim of this study was to characterize the activated charcoal derived from the shell of palmyrah seeds (*Borassus flabellifer*) for use in handwash formulations. Initially, the dried seed shells underwent carbonization using the traditional barrel method for a duration of 1.5 hours. The resulting material was then subjected to both chemical activation using a mixture of lemon juice, potassium hydroxide (KOH), and calcium chloride (CaCl2) at a 25% concentration in a 1:2 impregnation ratio, and physical activation through thermal treatment at temperatures of 600 ˚C and 800 ˚C for 45 minutes. Measurements of physiochemical, proximate, and Fourier Transform Infrared Spectroscopy of produced activated charcoal were conducted using commercial activated charcoal as a reference. The best-activated charcoal was selected based on the comparison, for the formulation of handwash at the rate of 0.5 % and 1 %. The foamability, pH, density, antimicrobial activity, and sensory analysis of formulated handwash were compared with a commercial handwash. It was found that chemical activation provided a higher yield compared to physical activation. The physicochemical, proximate, and surface chemical properties of the activated charcoal were significantly influenced (p value < 0.05) by the methods of activation, which included acid, base, neutral, and thermal methods. Additionally, the activation temperature had a significant effect (p value < 0.05) on these properties, except for the moisture content. Surface chemistry analysis of produced activated charcoal revealed the presence of hydroxyl, carbonyl, carboxyl, alkyne, and aromatic groups, which were similar to that of commercial activated charcoal. Among all the produced activated charcoal, treatment with KOH 800 ˚C was selected for the formulation of handwash due to its high percentage similarity to commercial activated charcoal properties. Formulated handwash showed similar density, formability (*p value* > 0.05), and antimicrobial activity of commercial handwash except pH. Aesthetic attraction to color on the sensory analysis resulted in selecting formula 1, which contained 0.5 % activated charcoal, as the best formulation. It can be concluded that palmyrah (*Borassus flabellifer*) seed shell activated charcoal can be successfully used to produce commercial-scale handwash.

Keywords: Activated charcoal, Characterization, Handwash, Palmyrah seed shell

***Corresponding Author**:* melani@uwu.ac.lk

Acknowledgement: This work was done with the contribution of Uva Wellassa University of Sri Lanka and Palmyrah Research Institute, Sri Lanka

ID 39

Study on growth and yield performances of coated seeds of finger millet (*Eleusine coracana* L.) under mechanical planting

I.C.S. Edirimanna, K.D.C.D. Priyadarshani and N.G.S. Koshila

Division of Agronomy, Grain Legume Oil Crop Research and Development Centre, Angunukolapalessa, Sri Lanka

Abstract

Finger millet (Eleusine coracana L.) is a highly productive and nutrient-rich crop in Sri Lanka, where it is mainly cultivated using rain-fed methods and the broadcasting technique. However, this method results in significant seed wastage due to the small size of the seeds, and thinning requires additional labor. To address this issue, mechanical planting is recommended, which requires larger seed sizes to be compatible with machinery. During the 2021-2022 *Maha* season, the experiment was carried out at the Division of Agronomy, Grain Legume Oil Crop Research and Development Centre, Angunukolapalessa (GLORDC) to standardize seed size for mechanical planting and analyze coated seeds in the field. The finger millet cultivar Rawana seeds were utilized, and seed size was standardized through the addition of talc powder as a filler and gum arabic as an adhesive. Diatomaceous earth (DME), Carboxy Methyl Cellulose sodium salt (CMC), Manioc starch, Maize cob based biochar powder, and Triple Super Phosphate (TSP) powder were also added to the coating media to optimize binding and moisture absorption while also increasing nutrient content, which is important during the early growth stage. The coated and naked seeds were tested using Randomized Complete Block Design (RCBD) with three replicates in three distinct planting methods: (a) broadcasting, (b) row planting, and (c) machine planting. As a result, the coated seed size was increased from 1.2mm (average diameter of naked seed) to 3.94mm (average diameter of coated seed) with two average numbers of seeds in one coated seed. Although the 359 naked seeds were recorded in 1g, only 72 coated seeds were included in 1g of seeds. The naked seeds broadcasting method produced the lowest growth and yield parameters (days to first and 50% flowering, number of tillers, number of ears, and average yield per plant). The average seed rate could be reduced by half (from 6kg/ha to 3.06kg/ha) compared to the naked seeds broadcasting method. Substantial quantity of seed rate was necessary in naked seed row planting (7kg/ha) and more manpower also required for thinning out and application of other agronomic practices to the seedlings. The highest average yield per plant (39.12g/plant) was recorded in mechanical planting of coated seed. Therefore, seed coating and mechanical planting technique can be used to improve the productivity of finger millet production in Sri Lanka. Further identification and modification of mechanical planters are most important to improve the efficiency of the process.

Key words: Broadcasting, Finger millet, Machinery Planting, Row planting, Seed coating

Corresponding Author: edirimannaics@gmail.com

ID 42

Application of brown seaweed (*Sargassum Cristaefolium*) as natural eco-colourant on cotton fabrics with natural mordants

W.P. Deshanjalee[1*], U.G.S. Wijayapala[2], K.G.R. Samarawickrama[2], D.P.N. De Silva[1] and **B.V.A.S.M Bambaranda[1]**

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka.
[2] Department of Textile and Apparel Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka.

Abstract

Dyeing is a technique that provides a wide range of color shades and gives textiles a distinct attractiveness. In the textile industry, natural dyes are regarded as sustainable eco-colorants. Seaweeds are types of marine macro algae, and *Sargassum* contains natural colorants and several bioactive compounds. The textile industry uses a lot of toxic substances that contain synthetic colors and are harmful to the environment. The purpose of this research was to assess the dyeability of seaweed (*Sargassum cristaefolium*) extract as a textile eco-colourant on cotton fabric using various natural mordants. To obtain the seaweed (*S. cristaefolium*) dye, the ethanolic extraction method was used, and the exhaustion dyeing was performed at 70°C for 3-4 hours. Mango (*Mangifera indica*) bark, dried Night-Flowering Jasmine (*Nyctanthes arbor-tristis*) flowers, Lotus (*Nelumbo nucifera*) petals, and waste tea (*Camellia sinensis*) were utilized as natural mordants, and two mordanting procedures were employed: pre-mordanting and post-mordanting. The properties of the coloured textiles' washing, light, and rubbing fastness were measured. To evaluate the colour strength of the dyed textiles, K/S and CIE L*, a*, b* values were evaluated for each mordant. All the experiments were conducted in triplicates. The maximum washing fastness was revealed in the sample pre-mordanted with Lotus petals and the highest light fastness was demonstrated in the sample pre-mordanted with Mango bark. The dry rubbing fastness shows the best fastness properties than the wet conditions. According to the K/S values the highest colour depth of the dyed fabrics indicated in the sample mordanted with Mango bark in both pre-mordanting and post-mordanting methods. The lightest colour represented in the sample pre-mordanted with dried Night-Flowering Jasmine flowers and the darkest colour represented in the sample post-mordanted with lotus petals. The sample pre-mordanted with dried Night-Flowering Jasmine flowers was indicated as the most reddish coloured sample and the sample post-mordanted with dried Night-Flowering Jasmine flowers gave the most yellowish colour on the cotton fabric.

Keywords: Fastness properties, Mordanting methods, Natural dye, Natural mordants, Seaweed

[*]***Corresponding Author:*** poorniwitharana@gmail.com

ID 73

Comparative assessment of clay pot cooler storage for maintaining postharvest quality of leafy vegetables

W.A.B.H. Hettiarachchi[1], K.M.S.D. Sandarenu[1], S.N.W. Gamage[1], R.M.T.D. Attanayake[1], Y.M.H.M.H. Dasanayaka[1], D.D.K. Galahitiyawa[2] and H.M.P.C. Kumarihami[1*]

[1] Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka
[2]Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

Abstract

Leafy vegetables are a highly perishable, cheap, and readily available source of micronutrients. As they are highly perishable, leafy vegetables should be consumed immediately after harvesting. Proper storage methods preserve the quality of leafy vegetables after harvesting. Storage temperature and relative humidity greatly affect the postharvest quality of fresh produce. Low-cost evaporative cooling systems were developed to maintain the quality and extend the shelf-life of fresh produce. The zero-energy clay pot coolers are an eco-friendly system with low construction costs. This technology is based on the principles of a passive evaporative cooling mechanism. Clay pot coolers have been shown to effectively prolong the shelf-life of many fresh produces. The present study was conducted to evaluate the effectiveness of the evaporative clay pot coolers in preserving the postharvest quality of four selected leafy vegetables, including kankun (*Ipomoea aquatica*), gotukola (*Centella asiatica*), lettuce (*Lactuca sativa)* and thampala (*Amaranthus spp.)*. Leafy vegetables that were freshly harvested were sorted into 200 g bundles and subjected to storage under three different conditions: room temperature, refrigeration, and clay pot cooler storage, for a period of seven days. The average temperatures recorded were 27.7 ºC, 7.1 ºC, and 25.6 ºC, respectively, with relative humidity values of 76.1%, 58.2%, and 93.6% observed in each storage condition. The average cooling efficiency of clay pot coolers was 66.7%. The physiological weight losses of leafy vegetables were significantly reduced during the clay pot cooler storage. At the end of the storage period, chlorophyll content, soluble solids content (SSC), color changes, and the visual quality of leafy vegetables were significantly maintained in clay pot cooler storage compared to room temperature storage. The results of this study suggest that the clay pot cooler is a better alternative low-cost storage method to preserve the quality of leafy vegetables during their storage.

Keywords: Clay pot cooler, Leafy vegetables, Quality, Shelf-life

****Corresponding Author:*** prathibhani@agri.pdn.ac.lk

Acknowledgement: The research assistance provided by the Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya. Further, the financial assistance received from the AHEAD/ELTA/ELSE Department Proposal to purchase the required laboratory and field equipment is greatly appreciated.

ID 75

Design, development and performance evaluation of Pneumatic Type Semi-Automated Agarwood Inoculum Injector (PSAII)

H.M.W.A.I. Herath[1*] and B.M.S. Jinendra[1]

[1]Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna, Sri Lanka.

Abstract

The "Agarwood" is a resinous bio-chemical fragrant produced by certain tree species of family *Thymalaeaceae* as a defense response to environmental stress. In commercial scale plantations, the causal stress is induced by artificial fungal inoculation. The effectiveness of the inoculation process is critically important to increase the productive harvest. The inoculum paste is made up with a high viscous agar medium to stick to the plant tissues inside drilled holes in the tree trunk and the branches. However, so far, no effective tool has been developed to deliver such a thick semisolid paste into the drill holes in Agarwood trees. At present, common silicon adhesive applicators (caulking guns) are used, which are inefficient, time-consuming, and ergonomically poor tools. To overcome these limitations, a Pneumatic type Semi-automated Agarwood Inoculum Injector (PSAII) was developed. A cast iron chamber of 6 L capacity was used as the pressure vessel. Standard HCFE 3/8″ non-return valve was fixed into the tank as an air inlet. The inoculum delivery out was sent through 1mm stainless steel strainer to avoid nozzle blocking. A pressure relief valve was incorporated to the pressure vessel and adjusted to 15 bars. The ambient air was used to compress the inoculum inside the tank once it is filled up to 5 L loading capacity. Comparison of performance between the new device with the existing caulking gun was done for the inoculum filling rate, labour efficiency and the inoculum wastage. With the new device, the average filling volume of inoculum inside the drill holes was increased up to 85.35% and reduced the inoculum wastage from 1.325mL to 0.47mL per drill hole and both improvements were significantly different at the 5% probability level ($p<0.05$). The results showed that the developed PSAII device is capable of delivering a smooth flow of inoculum paste to the target when the impending pressure thrust range within 5 to 15 bars. Moreover, within this pressure range, the total volume of 5L was delivered at a consistent rate. The new device PSAII was found to be highly successful in assisting the critical process of inoculation in the commercial level agarwood industry.

Keywords: Agarwood, Fungal Inoculum Paste, Semi-automated, Pneumatic Injector

***Corresponding Author:** akilaherath2@gmail.com

ID 76

Evaluation of the dimensional effect and relationship between density and shrinkage of Sri Lankan grown timber species

C.K. Muthumala[1*], Sudhira De Silva[2], P.L.A.G. Alwis [3] and K.K.I.U. Aruna Kumara [4]

[1]Research, Development and Training Division, State Timber Corporation
[2]Department of Civil and Environmental Engineering, Faculty of Engineering, University of Ruhuna
[3]Department of Agricultural Engineering and Environmental Technology, Faculty of Agriculture, University of Ruhuna
[4]Department of Crop Science, Faculty of Agriculture, University of Ruhuna

Abstract
Wood shrinkage mainly occurs along two main directions: radial (R) and tangential (T). Volumetric shrinkage measures the magnitude of the shrinkage. But T/R ratio measures the uniformity of the shrinkage. This is very good indicator of wood's stability. To be a good stable wood it must have both low volumetric shrinkage and low T/R ratio. This study was attempted to identify the variations of T/R ratio of 32 timber species in Sri Lanka in year 2019. The T/R ratios of 32 different timber species were analyzed and classified into three classes based on the results. These classes are: T/R ratios below 1, T/R ratios ranging from 1 to 2, and T/R ratios above 2. It was observed that a T/R ratio of 1 indicates uniform shrinkage. Timber species with T/R values ranging from 1 to 1.50 were found to have stable dimensional effects and are thus recommended as good timber species. However, no significant correlation was observed between the density of timber species and their radial shrinkage, tangential shrinkage, or T/R ratio. To minimize defects when combining different timber species in furniture manufacturing, it is recommended to use three timber groups that have been prepared based on T/R values. This approach helps in selecting the best matching timber pieces for the furniture making process.

Key words: Density, Shrinkage, T/R ratio, Wood stability

***Corresponding Author*:** ck_muthumala@yahoo.com

ID 80

Far Infrared drying effects on drying kinetics, energy consumption and antioxidant properties of *Gymnema sylvestre* R.Br. leaves

Abhiram Briyangari[1, 2] and Gunaratnam Abhiram[1, 3, 4, *]

[1]Postgradaute Institute of Science, University of Peradeniya, Peradeniya 20400, Sri Lanka.
[2]Veterinary Surgeon's Office, Nallur, Jaffna 40000, Sri Lanka.
[3]Environmental Sciences, School of Agriculture & Environment, Massey University, Palmerston North 4442, New Zealand.
[4]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla 90000, Sri Lanka.

Abstract
Gymnema sylvestre R.Br. is a medicinal plant widely used to treat diabetes mellitus and used as a natural antioxidant. The dried powder of this plant is used in the Ayurvedic system of medicine as an alternative to fresh leaves. Far infrared (FIR) can be a potential source to dry herbs as it rapidly transfers the heat and provides uniform heating without heating the air. Although the antioxidant properties of dried leaf extract of *G. sylvestre* are studied, applicability of FIR for drying this plant has not been tested. Therefore, this study was undertaken to investigate the impact of FIR (ceramic type) on drying characteristics, colour and antioxidant activity of leaves of *G. sylvestre*. Fresh leaves were dried under four temperatures (125, 150, 175 and 200 °C) and drying times (5, 10, 15 and 20 mins) and weight changes, energy consumption and colour changes were measured for five replicates. The water-ethanol extract was prepared and total phenolic compounds (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity and ferric-reducing power (FRAP assay) were investigated. The results revealed that significant ($P<0.05$) effect of temperature and drying time on drying kinetics, specific energy consumption (SEC) and antioxidant activity. With temperature and time, drying rate and total colour change increased whilst SEC decreased. The Leaves dried under FIR showed significantly ($P<0.05$) higher TPC than fresh leaves. The TPC continuously increased with drying time at low temperatures (125 & 150 °C). However, under high temperatures (175 & 200 °C), TPC increased up to 15 minutes and significantly ($P<0.05$) decreased at 20 minutes. A similar trend for DPPH and FRAP values with time was observed under low and high temperatures. The strong correlation of TPC with DPPH and FRAP ($r = 0.93$ and 0.86, respectively) revealed that TPC mainly involves with antioxidant activity of the leaves. The highest TPC, DPPH and FRAP values were reported for leaves dried under 200 °C for 15 minutes. The results showed that FIR drying is conducive for drying of *G. sylvestre* as it increased the antioxidant properties. Further research is needed to investigate the potential of intermittent FIR drying for reducing the specific energy consumption (SEC) during the drying of G. sylvestre.

Keywords: Colour changes, DPPH, Energy consumption, Far infrared, Total phenolic compound

Corresponding Author: abhiram@uwu.ac.lk

ID 86

Effects of storage period on physicochemical properties of selected improved and traditional rice (*Oryza sativa* L.) varieties in Sri Lanka

H.M.L.P. Herath[1*], R.P.N.P. Rajapakse[1], D.M.J.B. Senanayake[2] and B.M.K. Senarathna[2]

[1] Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Sri Lanka
[2] Rice Research and Development Institute, Bathalagoda, Sri Lanka

Abstract

Rice (*Oryza sativa* L.) is the dietary staple food in Sri Lanka and the major livelihood of farmers since ancient times. After harvesting rice, storage is done as a postharvest operation to prolong the shelf-life and commercial value. Gelatinization temperature and amylose content are the most important physicochemical properties that influence the cooking and eating characteristics of rice. Knowing those properties is important in the processing, handling, and storage of rice. This study was carried out to evaluate the several physicochemical properties of rice grains of selected improved and traditional rice varieties harvested in three seasons (2021 *Yala*, 2021/22 *Maha*, and 2022 *Yala*). Twelve rice varieties, including traditional (*Pachchaperumal*, *Herathbanda*, *Madathawalu*, *Suduheenati*) and improved (Bg 352, Bg 360, Bg 366, Bg 374, Bg 450, At 362, At 311, Ld 253) were cultivated and harvested at the Rice Research and Development Institute, Bathalagoda, Sri Lanka. The gelatinization temperature was determined based on the alkali spreading score, and the amylose content was determined according to the iodine binding procedure. All the tested parameters had significant ($p<0.05$) variations among rice varieties within and among seasons. The most rice varieties harvested in all three seasons, except for *suduheenati* in 2021 *Yala* and 2021/22 *Maha* showed an intermediate gelatinization temperature (70–74 ℃). At 362, rice variety in all three seasons showed low gelatinization temperature of 55-69 ℃. No variety was found with a high gelatinization temperature (>74 ℃). High amylose content was observed in most varieties except for At 311 in the 2021/22 *Maha* and 2022 *Yala* seasons. The traditional rice variety *Herathbanda* showed high amylose content within the 31-35% range for three seasons. Grain elongation varied significantly ($p<0.05$) in the 2021/22 *Maha* season, and there was no significant ($p>0.05$) difference between the 2021 and 2022 *Yala seasons*. Bg 450 rice variety showed a higher grain elongation ratio (71.25%) in the 2021/22 *Maha* season compared to the 2021 *Yala* and 2022 *Yala* seasons. The lowest grain elongation ratio was observed in Bg 374 in 2021 *Yala* and 2021/22 *Maha* (31.27% and 30.54% respectively). *Herathbanda* showed a lower grain elongation ratio (21.79%) in 2022 *Yala*. The resulting information can be utilized in planning postharvest practices and selecting suitable rice varieties for commercial cultivation in Sri Lanka.

Keywords: Cooking quality, Physicochemical properties, Storage time, Traditional rice varieties

Corresponding Author: priyankalakshi@gmail.com

ID 92

Development of jackfruit (*Artocarpus heterophyllus*) based noodles incorporated with kohila (*Lasia spinosa*)

R.S.Rajapaksha[1*] and T.A.K.A.Thennakoon[1]

[1] Department of Food Science and Technology, Faculty of Applied Sciences, Sabaragamuwa University, Sri Lanka

Abstract

Jackfruit is gluten-free and rich in starch, proteins, vitamins, minerals, and many classes of phytochemicals. Commercial noodles were found to have a very small amount of fiber. A diet low in fiber may contribute to a number of gastrointestinal and cardiovascular problems. Objective of this research was to make a gluten-free, fiber rich noodles using jackfruit bulb flour incorporated with *kohila* (*Lasia spinosa*) rhizome flour. Three different flour composites were prepared by blending jackfruit and *kohila* flour (C1-95:5%, C2-90:10% and C3-85:15% w/w) and 100% (w/w) jackfruit flour was considered as control (C0). Water and oil absorption capacities, bulk and tapped densities, and swelling capacity were determined as functional properties of different flour samples while colorimetric values, textural properties, cooking properties of all noodles samples and proximate composition, and microbial counts of control and best sample were determined. Water and oil absorption capacities of *kohila* (304.00±0.02% and 210.33±1.52%) were higher than jackfruit flour (277.20±0.00% and 158.66±0.57%). Noodles prepared using treatment C1 (95:5% jackfruit to *kohila*) obtained the highest consumer preference from five point hedonic test. Color values were not significantly changed among different noodle samples ($p>0.05$). Due to 5% incorporation of *kohila* flour, the fiber content was increased from 13.25±0.12% to 14.76±0.19%. Moisture, protein, fat, ash and carbohydrate content of best sample (C1) were 7.51±0.04%, 9.3±0.06%, 0.59±0.01%, 3.52±0.01% and 63.59±0.65%, respectively. Hardness of cooked, best sample (C1) was 39.67±1.53 g. Cooking loss of noodles made with 100:0, 95:5, 90:10 and 85:15 flour blend were 2.51±0.02%, 5.53±0.01%, 7.82±0.08%, and 8.53±0.10%, respectively. When increasing the particle size of treatment C1 from 0.4 mm to 0.5 mm, cooking loss was increased from 5.53±0.01% to 20.5±0.50%. It can be concluded that composite flour using jackfruit and *kohila* can be effectively used to make gluten free, fiber rich consumer acceptable noodles.

Keywords: Composite flour, Gluten free, Jackfruit, *Kohila,* Noodles

Corresponding Author: ruwanirajapaksha96@gmail.com

Acknowledgement: This work was funded by the Department of Food Science and Technology, Faculty of Applied Sciences, Sabaragamuwa University, Sri Lanka.

ID 93

Potential use of *Moringa olifera* Lam. and *Azadiracta indica* L. leaf powder on the growth and development of Anthurium *in vitro* cultures

R.M.C.U. Rathnayaka[1], H.M.I. Herath[2], A.N.M.Mubarak[1*] and M.N.F. Nashath[1]

[1] Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka, Oluvil, Sri Lanka
[2] Floriculture Research and Development Unit, Royal Botanical Garden, Peradeniya, Sri Lanka

Abstract

Supplementing culture media with organic additives is a simple and cost-effective way of improving the growth and development of *Anthurium andraeanum* Lind. *in vitro* cultures. The present study was conducted in the Floriculture Research and Development Unit at the Royal Botanical Gardens, Peradeniya to identify the potentials of *Moringa olifera* Lam. (Moringa) and *Azadiracta indica* L. (Neem) organic supplements in promoting *in vitro* cultures. Initially, the Murashige and Skoog (MS) medium was prepared in three strengths (full, ½ and ¼), then additionally supplemented with %,, 10 and 15g/L of moringa and neem leaf powder separately. Altogether, seven treatments (media) including one control (MS only) were made with introducing explants (1 cm height plantlets) from *Anthurium* Lj21 Lalani variety. The experiment was laid out in completely randomized design with seven treatments having 10 replicates. One month after explant inoculation the number of leaves, shoots and roots per plantlet and shoot length (cm) were recorded. Data analysis was done using SPSS software and analysis of variance (ANOVA) was performed to check the significant differences between treatments. According to the results, different treatments had significantly (p<0.05) affected the tested parameters. The ¼ MS+15 g/L of neem leaf powder increased the number of leaves per plantlet (7.25) whereas, Full MS+5 g/L of neem leaf powder resulted the production of increased number of roots per plantlet (2.88). The ½ MS+10 g/L of moringa leaf powder (1.56), ¼ MS+15 g/L of moringa leaf powder (1.69) and ½ MS+10 g/L of neem leaf powder (1.69) resulted significantly higher number of shoots per plantlet than the control treatment (1.06). On the other hand, all three concentration of neem leaf powder increased the shoot length of Anthurium explants than other treatments. Conversely, Full MS+5 g/L of moringa leaf powder did not give improved results in the tested parameters. According to this study, moringa and neem leaf powder can be introduced to develop a simple and cost-effective culture media for promoting Anthurium tissue culture. However, further studies are needed to discover the chemical composition of the above additives and to understand their interaction effects.

Keywords: *Anthurium andraeanum* Lind., *Azadiracta indica, Moringa olifera* Lam., Organic additives

Corresponding Author: anmubarak@seu.ac.lk

ID 97

Value-added coconut skim milk beverage from defatted desiccated coconut kernel

L.L.W.C. Yalegama[1], H.P.D.T. Hewa Pathirana[1*], B.G.R.R. Bandara[1], K.M. Fernando[1] and R.M.S.I. Rathnayake[2]

[1]Coconut Processing Research Division, Coconut Research Institute, Bandirippuwa Estate, Lunuwila, Sri Lanka
[2]Department of Food Science& Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka

Abstract
Defatted Desiccated Coconut Kernel (DDCK), a by-product generated during virgin coconut oil production with proven health benefits. The present study was designed to develop a low-fat beverage using coconut skim milk obtained from DDCK to increase consumer demand for non-dairy milk alternatives. By product of DDCK was obtained from virgin oil processing plant at Coconut Research Institute Sri Lanka and it was used to milk extraction with water addition. According to preliminary sensory tests, cold water extraction with a 1:4 ratios after 1-hour soaking was favored. Three types of beverages were formulated namely, Strawberry Flavored (SBF), Wood Apple Flavored (WAF)) and Non-Flavored (NF) with three brix levels (11^{o}bx, 13^{o}bx, and 15^{o}bx). NF samples were made with 3%, 5%, and 7% sugar levels, whereas flavored samples were made with 2.5% sugar with fruit pulp. Each sample comprised 0.01% added salt. Three sensory tests were conducted using 30 untrained panelists. To the selected beverages, three levels (0%, 0.1%, and 0.15% w/v) of carboxymethyl cellulose (CMC) were added followed by pasteurization (TEM) at 63^{o}C for/30 minutes and 85^{o}C for 7 minutes which were stored at bottles and stored in refrigerated temperature 4±2 ^{o}C. Beverages were tested for physicochemical and rheological properties, nutritional composition, and microbial quality (One-month period). For the NF beverage, a significantly ($p<0.05$) higher sum of the rank of overall acceptability was recorded at 13^{o}bx. Strawberry Flavored beverages resulted in a significantly higher sum of ranks for mouth feel, aroma, and overall acceptability at the 15^{o}bx level. All sensory attributes of WAF samples changed significantly ($p<0.05$) with brix level, while the highest sum of rank values for all sensory attributes was at 15^{o}bx level. The interaction of CMC concentration and TEM had a significant effect on the pH, lightness, viscosity, and sedimentation index. According to the nutritional studies, significantly higher ash, and crude fat contents resulted in the NF, while the total sugar and protein contents were significantly higher in the WAF and SBF beverages, respectively. The treatments of 0% of CMC at 85^{o}C/ 7 min, 0.15% CMC at 63^{o}C/30 min, and 0% CMC at 85^{o}C/ 7 min were selected as the most suitable preservation treatments for NF, SBF, and WAF, respectively. The highest microbial quality was observed in WAF with 0% CMC at 85^{o}C/ 7 min treatment. The beverages can be safely stored for one month under refrigerated conditions.

Key words: Beverage, Carboxymethyl cellulose, Defatted desiccated coconut flour, Skim coconut milk

***Corresponding author*:** dilthihewa@gmail.com

ID 109

Growth and yield performances of salad cucumber as affected by artificial light and rate of fertilizer under controlled environmental conditions

V.K.U. Muthuwan*, U.D.T. Perera, S. Subasinghe, H.K.M.S. Kumarasinghe

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

Abstract

An experiment was accomplished at the Faculty of Agriculture, University of Ruhuna from August to October 2022 in two protected houses to study the effect of artificial light and the rate of Albert fertilizer on the growth and yield performances of Salad cucumber (*Cucumis sativus* L. var Efdal F1). The experiment was carried out in a Two Factor Factorial Completely Randomized Design (CRD) with five replicates. The tested two factors were light; L_1 (with artificial light), L_2 (without artificial light), and rate of fertilizer; R_1 (1.5g/plant/day), R_2 (2g/plant/day). These two fertilizer rates were the best-performed treatments of previous research. Thus, the present study was conducted to evaluate the effect of artificial lights on the best-performed fertilizer rates of the previous study. Light was provided from 6.00 a.m. to 6.00 p.m. When lux level is less than 3000, lights were automatically on. Treatments were applied daily. As growth parameters, vine length, leaf area, and number of leaves per plant were measured once a week. As yield parameters, the number of days taken to first flowering, number of fruits per plant, total fruit yield, and length of fruit were measured at harvesting. Data were analyzed using ANOVA and means were separated by Duncan's Multiple Range Test (DMRT) at a 5% probability level. According to the results, there was an interaction effect between artificial light and the rate of Albert fertilizer on the number of leaves. The significantly highest number of leaves was recorded in 1.5g Albert fertilizer solution/plant/day with artificial lights. There was no interaction effect on vine length, leaf area, fruit length, and total yield. However, 1.5g Albert fertilizer solution/plant/day reported significantly higher vine length and leaf area. Also providing artificial lights recorded significantly higher fruit length and total yield. he number of days taken for first flowering and the number of fruits per plant were not significantly affected by either the main factor or any interactions between factors. Among all the treatments, 1.5g/plant/day Albert fertilizer solution (R_1) under the artificial lights (L_1) is the best treatment for receiving higher growth and yield performances of Salad cucumber.

Keywords: Artificial light, Fertilizer rate, Protected house, Salad cucumber

Corresponding Author: uththaramuthuwan@gmail.com

ID 138

Identification and characterization of mutations in genes involved in GA_3 biosynthesis and signaling pathways of a black seeded dwarf rice variety

I.L. Jayasekara[1*], D.S. de Z Abeysiriwardena[2] and M.P.C.S. Dhanapala[1]

[1] Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka
[2] CIC Agri Businesses, Pelwehera, Dambulla, Sri Lanka

Abstract
Gibberellic acids (GA) are a family of tetracyclic diterpenoid phytohormones, whose regulation of biosynthesis and signal transduction are crucial for key characteristics in plant growth and development. Plants that lack these elements exhibit unique phenotypes, including delayed germination, dwarfism, small and dark green leaves, and retarded root development. Dwarfism, in particular, is a desirable trait in crop breeding, as it enhances the plant's ability to withstand lodging damage caused by heavy rain and wind, resulting in increased yields. Rice is a major crop plant grown worldwide including in Sri Lanka. Similar to all the other plant types, gibberellic acids play a prominent role in dwarfism in rice. Hence, this research was carried out to study the involvement of a few genes in GA biosynthesis and signaling pathways on the dwarfism of black seeded dwarf rice variety. Therefore, this study was conducted to identify and characterize mutations responsible for the dwarf phenotype of a novel black seeded dwarf rice variety which is a spontaneous breeding outcome of a locally available rice variety CIC *Tikiri.* A genetic analysis was performed through DNA extraction and Polymerase Chain Reaction using two selected molecular markers, *OsSLR1* and *OsGA3ox2*. They are accountable for amplifying segments of *SLR1* and *GA3ox2* genes in the rice genome, which encode for the production of DELLA protein and GIBBERELLIN 3BETA-HYDROXYLASE 2, which are critical in the conductance of gibberellic acid signaling and biosynthesis pathways, respectively. This process was followed by a sequence alignment with the associated mother plant variety, CIC *Tikiri*. The results revealed some variations of a few base pairs in the amplified regions of the genes. The differences that appeared to be nonsense mutations and INDELs could be concluded as possible causes of dwarfism of the considered mutant rice variety. However, a phenotypic analysis through a gibberellic acid hormonal treatment assay is recommended to further clarify the involvement of the identified mutations for the respective phenotype.

Keywords: DELLA, Dwarfism, Gibberellic acid biosynthesis, Gibberellic acid signaling, *Oryza sativa*

Corresponding Author: il.jayasekara97@gmail.com

ID 142

Assessment of the effect of freeze-dried *Lactobacillus* inoculants on ensiling fodder Sorghum and Guinea grass

K.M. Devindi[1], R. Priyantha[2], N. Liyanagunawardena[2], W.M.P.B Weerasinghe[2] and M.B.P. Kumara Mahipala[1*]

[1] Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka.
[2] Veterinary Research Institute (VRI), Peradeniya, Sri Lanka

Abstract
The quality of ensiled forage can be protected by using appropriate lactic acid bacteria (LAB) inoculants. The present study assessed the influence of freeze-dried *Lactobacillus plantarum, L. rhamnosus* and *L. oris* which were isolated from maize, sorghum and guinea grass silage, respectively on ensiling fodder sorghum and guinea grass. Two experiments were conducted each as a complete randomized design which included 2 factors (LAB species, inoculation rate). Each treatment combination had 3 replicates. Fodder sorghum (28.88 % DM) and guinea grass (19.29 % DM) were harvested and chopped (10 – 15 mm) and ensiled under laboratory conditions in 1L Weck glass jars. At ensiling, chopped fodder were inoculated with each LAB species at 3 inoculation rates (0, 10^4 and 10^6 CFU/g fresh fodder). The jars were opened on 14 days post-ensiling and assessed for dry matter, soluble carbohydrate, lactic acid and ammonia nitrogen contents and pH value. Fodder sorghum inoculated with *L rhamnosus* and *L. oris* at 10^6 CFU/g fresh fodder recorded low ($P<0.05$) pH values (3.48 and 3.45, respectively). However, fodder sorghum inoculated with *L. rhamnosus* at 10^6 CFU/g fresh fodder had higher ($P<0.05$) lactic acid content compared to *L. oris* (9.77 % vs. 2.95 %). Guinea grass inoculated with *L. oris* at 10^4 CFU/g fresh fodder recorded higher ($P<0.05$) lactic acid content (17.66 %) and the lowest ($P<0.05$) pH value (4.87). The study confirmed that the inoculation of fodder sorghum and guinea grass with freeze-dried *L. rhamnosus* and *L. oris* inoculants (10^6 CFU/g fresh fodder and 10^4 CFU/g fresh fodder, respectively) ensures rapid drop of pH value during ensiling, resulting in high quality of fodder silage.

Keywords: Lactic acid, *Lactobacillus oris, L. plantarum, L. rhamnosus*, pH

Corresponding Author: pmahi@agri.pdn.ac.lk

Livestock, Poultry and Aquaculture

ISAE - 2023

Keynote Speech

The Remarkable Potential of Fungi

Samantha Chandranath Karunarathna

Center for Yunnan Plateau Biological Resources Protection and Utilization, College of Biological Resource and Food Engineering, Qujing Normal University, Qujing, Yunnan 655011, P.R. China

***Email -** samanthakarunarathna@gmail.com

Abstract

Fungi are a relatively understudied group yet an essential, charming, and valuable group of organisms with an implausible biotechnological potential for industrial applications. Because of fungi's cosmopolitan habitats and the need to compete against various other fungi, bacteria, and animals, various survival mechanisms have been developed in fungi. Fungi have various potential uses, but their potential application research is poorly supported overall. On the other hand, many of the studies carried out in academic fields are fundamental, even in biotechnology and applied mycology. Despite the obvious benefits to ecosystems, it has been found to be one of the reasonable answers to alleviate the world's food hunger by providing various nutritional and medicinal benefits. Today, secondary metabolites extracted from fungi are used as vital drugs, however, there is a huge gap in the research field. The fungi have significant potential to give countless medicinal values, and could be the place to find answers to many incurable diseases. Nevertheless, fungi are at great risk all over the world, due to human colonization and other interconnected effects, thus efforts should also be made to protect this gifted kingdom.

Keywords: Anticancer agents; Antimycotic drugs; Endophytic fungi; IUCN red list; Mushrooms; Nutrient cycling

Tremendous diversity

Fungi are known to be among the most diverse group of organisms, including microscopic, single-celled yeasts, and aquatic chytrids to macroscopic multicellular mushrooms and lichenized fungi (Devkota *et al*., 2023). The presence of fungi is universal; even they can be habited in harsh environments such as in Antarctic glaciers, deserts, the bottom of the deep ocean, and inside the gut of animals (Naranjo-Ortiz, & Gabaldón, 2019). The diversity of fungi is unbelievable, and their presence in an ecosystem is closely linked to the levels of animal and plant diversity (Buckley, 2008). Signifying more, in a forest often fungal diversity far exceeds that of tree diversity (Tedersoo *et al*., 2016). Recent molecular-based understanding revealed much more on fungi diversity, helping to resolve taxonomic confusion, thus it is now expected that the distribution of 11.7–13.2 million species of fungi worldwide, which is up to fivefold from the previously predicted number of 2.2–3.8 million (Antonelli *et al*., 2020; Hawksworth & Lücking, 2017). Nevertheless, the findings of those magnificent organisms are far behind; as of 2023, around 155,000 species only have been recorded (Index Fungorum 2020, 2023) and described by taxonomists (Antonelli *et al*., 2020).

Fungi as service providers

Why we should pay attention to those organisms is a worthy question to ask. Fungi, particularly those that affect soil-based processes, have the ability to affect almost every aspect of ecosystem function. The decomposition of organic matter is one of the foremost services that they do, on the one hand, it

helps to remove the waste dumped from the earth's surface, on the other hand, it helps with nutrient cycling (e.g., Nitrogen, Phosphorous) in terrestrial ecosystems (Hemkemeyer *et al*., 2021). Of this, saprophytic fungi are the role players, and also the primary agents of plant litter decomposition. Moreover, they support nutrient distribution throughout the ecosystem. Through the enzymes, they degrade the organic matter, grow all over the soil-litter interface, through the mycelia, and carry nutrients as they grow (Crowther *et al*., 2012). The action of endophytic fungi is worthwhile; they interact with the plant root system, penetrate inside the root tissues and supply nutrients to the plant, thus enhancing the nutrient availability to the plant, which promotes the growth of the plant (Sun *et al*., 2022; Wen *et al*., 2022). Fungal mediated nutrients at various placements could happen when the Arthropods, Oligochaetae, and Nematoda consume hyphae and distribute spores. In addition, the synthesis of hydrolytic enzymes and increased respiration rates are two examples of the physiological reactions of fungi to grazing, which have a direct impact on the mineralization of nutrients and the movement of carbon dioxide between terrestrial and atmospheric pools. It is also consumable that invertebrates feed on fungi, which means that fungi serve as a food provider for such macro and micro fauna (Crowther *et al*., 2012). Further, fungi help to improve the soil composition and structure, which affect colonization and the dynamic of the floral communities. The effect of fungi could be plus or minus depending on their nature, as mutualistic fungi benefit the plants by fixing the nitrogen, synthesis of plant hormones, biological control phytopathogens, and protecting against hazardous environmental conditions such as drought, flooding, and nutrient deprivation, while pathogenic fungi effects on the plants by altering their normal physiological and biochemical functions, thus leads to decline their productivity, even killing them (Frąc *et al*., 2018).

Fungi as a valuable source for humans

Despite the fact that their ecosystem services, fungi have been considered a source of human food and not surprisingly as an income generator. In addition to the ecosystem services fungi provide, wild edible fungi provide two main benefits to people: they are a source of food and income (Li *et al*., 2021). The past two decades have seen an almost exponential increase in the global consumption and trade of edible fungi, and a significant part of this comes from the harvest of wild species (Royse *et al*., 2017). However, the consumption of wild edible fungi has resulted in a parallel increase in mushroom-related poisonings and fatalities, for example, according to the Chinese Center for Disease Control and Prevention (CCDC) in 2022, 1,332 patients and 28 deaths occurred from 482 incidents (Li *et al*., 2023). This brings us to think either they are friends or foes, nevertheless, consideration is with the poor classifying and understanding of their effects, thus, in the context of food safety and human health, more information regarding edible and toxic species of mushrooms needs to be made available to the broader public also with continues exploration on the subject (Jo *et al*., 2014; Wennig *et al*., 2020). Now, coming back to the point, owing to their unique characteristics and the revealing of their greater medicinal properties, undeniable to use them in biotechnological studies and industries.

It is unforgettable that fungi have gifted human beings with cyclosporin, lovastatin, penicillin, and other globally important drugs (Keller, 2019). Furthermore, fungi can be cultivated with comparative easiness, making production practicable. The exploration of novel fungi and maintaining a living fungi collection both have implausible economic potential in finding fungi with industrial uses that lead to novel products (Sánchez *et al*., 2010; Assemie and Abaya, 2022). Considering the enormous benefits fungi provide, they can be classified into several major categories such as strategies against human disease; strategies against plant disease; enhancing crops and forestry; food and beverages; saving the planet; and commodities (Sakiyama *et al*., 2001; Zhang *et al*., 2016; Hyde *et al*., 2019; Alem *et al*., 2022; Baron and Rigobelo, 2022; Chugh *et al*., 2022; Elkhateeb *et al.,* 2022). The discovery of the first antibiotic "penicillin" in 1928 started the golden age of natural product discovery that peaked in the mid-1950s (Adedeji, 2016). Among the many antibiotics that were discovered over the

last 50 years, a few were derived from fungi such as including aforesaid Penicillin, Cephalosporin C, Fusidic acid, Pleuromutilin, and Retapamulin (Stennett *et al*., 2022; Conrado *et al*., 2022).

Antimycotic drugs have also been developed from fungi such as Griseofulvin; Pneumocandin B0, Enfumafungin, Favolon, and Sporohrioide (Aqueveque *et al*., 2005; Chen *et al*., 2015; Tian *et al*., 2020; Aris *et al*., 2022). Scientists over the decades finding ways to combat infectious diseases and biofilm inhibitors are one of the several promising methods. Fungal metabolites have been developed as effective biofilm inhibitors such as Coprinuslactone, Microporenic acid A and Roussoellenic acid (Chepkirui *et al*., 2018; Phukhamsakda *et al*., 2018). Several promising natural products have been derived from fungi that are effective as anticancer agents and are currently in the clinical and preclinical developmental stage such as Irofulven, Illudin S, Aphidicolin, Leptosin F, and Leptosin C. Many fungi, such as *Agaricus bisporus, A. campestris, A. subrufescens, Cyclocybe aegerita, C. cylindracea, Hericium erinaceus, Ophiocordyceps sinensis* and *Tremella fuciformis* are used as medicine for the treatment of diabetes. In addition, mushrooms such as *Antrodia camphorata*, *Ganoderma* spp., *Hericium erinaceus*, *Lignosus rhinocerotis*, and *Pleurotus giganteus* are well known for improving the peripheral nervous system (Hyde *et al*., 2019). Mushrooms have been used in traditional Chinese medicine for thousands of years, and this has been gradually distributed to Japan and other Asian countries (Lee *et al*., 2012). Some well-known medicinal mushrooms used in traditional Chinese medicine are *Agaricus subrufescens, Cordyceps militaris, Ganoderma lingzhi, G. sinense, Grifola frondose, Hericium erinaceus, Lentinula edodes, Lycoperdon pyriforme, Ophiocordyceps sinensis, Trametes versicolor, Wolfiporia cocos,* and *Xylaria nigripes*. The genera *Auricularia*, *Ganoderma*, *Grifola*, *Ophiocordyceps, Pleurotus*, and *Tremella* have been reported to contain cholesterol-lowering compounds (Hyde *et al*., 2019). Several fungal metabolites Hinnuliquinone, Stachybosin D, Integrastatin A, Stachyflin, Vanitaracin A, 4-hydroxypleurogrisein, Cytosporaquinone B, and Rhodatin have been reported to possess antiviral activities for human immunodeficiency virus (HIV), influenza virus, herpes simplex virus (HSV), hepatitis virus and other viruses such as enterovirus-71, and respiratory syncytial virus (RSV). Statins that are derived from fungal natural products are used to reduce plasma cholesterol levels. Compactin, Mevinolin, and Lovastatin are the three main statins with cholesterol-lowering properties. The immunosuppressive drugs have been derived from fungal fermentation such as Mycophenolate mofetil, Mycophenolic acid, and Cyclosporin A (Hyde *et al*., 2019).

Fungi have also been used to control plant diseases, pests, and nematodes, and some fungi can be utilized as herbicides. Endophytic fungi isolated from various host plants such as *Alternaria, Chaetomium, Cladosporium,* and *Trichoderma* have shown successful biocontrol abilities against pathogens (Grabka *et al*., 2022). Entomopathogenic fungi such as *Beauveria bassiana, Beauveria tenella, Lecanicillium lecanii, Isaria* spp., and *Metarhizium anisopliae* are known to produce insecticidal compounds, and products developed from those fungi are used as biocontrol agents against various insect pests (Bamisile *et al*., 2021). Several nematode parasitic fungi with nematode trapping abilities such as *Stylopage*, and *Cystopage* belonging to Zoophagomycota; *Arthrobotrys/Orbilia, Dactylellina/Orbilia, Drechslerella/Orbilia*, and *Gamsylella/Orbilia* belonging to Ascomycota and *Hohenbuehelia* belonging to Basidiomycota have been reported (Hyde *et al*., 2019). In addition to the above-mentioned applications, fungi have many other biotechnological applications such as biocontrol of weeds and herbicides from fungi (*Colletotrichum*, *Phoma*, and *Sclerotinia*) (Harding and Raizada, 2015); fungal antagonists in post-harvest disease control (Liu *et al*., 2013); biocontrol of rusts and smuts by antagonistic fungi (Thambugala *et al*., 2020); enhancing crops and forestry by fungi (Karunarathna *et al*., 2021); fungal biofertilizers (Odoh *et al*., 2020); arbuscular mycorrhizae as biofertilizers (Berruti *et al*., 2016); application of ectomycorrhizal fungi in forestry; use of orchid mycorrhizae and endophytes in biotechnology; growth promoting hormones from fungi; mushroom cultivation; using fungi to enhance food value (Mold-ripened cheese, Fermented products such as Soy sauce and Miso, Indonesian tempeh, Quorn, and Rennet); food coloring from filamentous fungi (Red mold rice, β-Carotene, and Lycopene); food flavoring;

mushroom stock, fungi in making tea; wine, beer and spirits; functional foods and nutraceuticals; untapped probiotic potential of fungi; agricultural waste disposal; mycoremediation; mycofumigation; biomass to biofuel; mycomaterial production; fungal degradation of plastics; polycyclic aromatic hydrocarbon degradation; fungi towards modifying the sustainable soil enhancer biochar, fungi and cosmetics; agarwood; fungal enzymes; preservatives; organic acids and textile dyes (Hyde *et al*., 2019).

Threats on fungi and what we could do?

The sad news is that fungi everywhere are declining in both quantity and diversity, and some species are under threat or are likely to go extinct (Nic Lughadha *et al*., 2020). No wonder how they can only survive global warming and other anthropogenic activities, as it said the sixth mass extinction will be purely occurred by ill practices of humans (Cowie *et al*., 2022). Highlighting the scenario of human interferences, where they found niches such as old-growth forests, grasslands, or deserts, their habitats are being impacted by rapid development, logging, fires, climate change, and pollution, and this affects not only for the fungi but also for the trees and other plants, insects and other animals that directly or indirectly depend on the fungi in the ecosystem in which they occur (Nic Lughadha *et al*., 2020). Lack of understanding of which plant/fungi are most at risk, of what factors threaten them, and of how the latter is changing over time, limit our capacity to develop effective conservation policies and activities designed to protect those areas and species mostly not in the agenda, and eventually to support plant- and fungal-based solutions are at immensely at pressure consequence also need to face by the humans. Fungi and their habitats need to be protected the same as so many other organisms since habitat health and fungal health are inseparably interwoven (Buckley, 2008). Unlike animals or plants, fungi are rarely considered in conservation plans, for which priority is invariably placed on macroscopic organisms (Heilmann-Clausen *et al*., 2015). For example, of the 120,000 species that were assessed for the IUCN Red List of threatened species, only 371 are recorded as fungi while the rest are other fauna and flora (Antonelli *et al*., 2020). Unlike animals or plants, many species of fungi often fruit for only a few days a year; their fruiting bodies appear and then disappear rapidly (Marren, 2019). At first glimpse, fungi diversity is not readily apparent since they are often inconspicuous, with relatively few people searching for and recording these organisms (Perini *et al*., 2014). Most importantly, without a proper record of their presence, they remain ignored, understudied, misunderstood, and unprotected (Nic Lughadha *et al*., 2020). In order to save the fungi, also for their sustainable usage, it needs to find a solution to avert climate catastrophe, explore more about their diversity and recognize their potential usage, public participation and giving knowledge of all the aspects would be ideal. In summary, though fungi are a diverse group of microorganisms, not enough attention is given to recognize their in-depth potential usage in both ecology and human perception. More studies need to be done to explore to reveal new species and how they are used for the well-being of the human.

Acknowledgement

Samantha C. Karunarathna is grateful to the Center for Yunnan Plateau Biological Resources Protection and Utilization, College of Biological Resource and Food Engineering, Qujing Normal University, and National Natural Science Foundation of China grant number 32260004 and A. K. Hasith Priyashantha.

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Oral Presentations

ID 06

Effect of rice-fish (Tilapia) integration on nutrient dynamics and biodiversity of rice (*Oryza sativa*) field

R.M.L. Madhawa[1], D.I.P. Kumara[1], W.H.U. Kaushalya [1], H.K.R.S. Kumara[1*], K.S.S Atapaththu[2], and S.S Herath[3]

[1] Institute for Agro Technology and Rural Sciences, University of Colombo, Hambanthota, Sri Lanka
[2] Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka
[3] Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka

Abstract
This experiment aimed to examine the impact of rice-fish integration on the nutrient dynamics and biodiversity of rice fields, using *Oriza sativa* (rice) and *Oreochromis niloticus* (Tilapia). The study included four fish stocking densities as treatments (T1-T4). Stocking density of fish in T1, T2 and T3 were 30, 60 and 90 respectively while T4 was the control treatment where fish was absent. Each treatment, with three replications, was randomly allocated into twelve experimental plots ($4\times4m^2$) using a complete randomized block design. Two-week-old paddy seedlings were planted in the space of 25cm × 25cm. The initial mean weight and length of the fish were 10.87g and 8.65cm, respectively. Fish were fed using a commercial diet at 2% of body weight per day, and the experiment was lasted for 105 days. The early stage of rice field was covered with mesh to protect fish from predators. Soil and water quality parameters in the rice field were measured monthly. The Shannon diversity index was applied to assess biodiversity. The results showed that fish integration significantly impacted soil pH ($p<0.05$), which was within the accepted range (pH 6.0-7.2) for rice in all treatments. Electrical conductivity, organic matter content, soil phosphate, and potassium were significantly improved in fish integrated plots ($p<0.05$) compared to the control, while the density of earthworms was reduced ($p<0.05$) by the integration. However, the density of snails was significantly increased ($p<0.05$) in all treatment groups compared to the control. Water pH, dissolved oxygen content, and alkalinity were statistically similar among all treatments. Paddy yield was improved ($p<0.05$) in all treatments compared to the control, with the highest yield (6.58 tons) was recorded in T3. The biodiversity of the experimental plots T1 (3.06), T2 (3.07), and T3 (3.09) were significantly higher than control treatment (2.14). In conclusion, findings revealed that the integration of Tilapia with rice improves soil quality, rice yield, and biodiversity in rice fields.

Keywords: Biodiversity, Rice-fish integration, Soil quality, Tilapia

***Corresponding Author**:* rasika@uciars.cmb.ac.lk

ID 18

Macro debris pollution of sea turtle nesting beaches along the southern coast of Sri Lanka

B.G.D.O. Perera[1*], E.P.D.N. Thilakarathne[1], A.P. Abeygunawardana[1], G.A.J. Sandamali[1], K.U.D.N. Hansani[1], W.M.P.U. Weerasingha[1], W.G.I.T. Gunathilaka[1]

[1]Department of Animal Science, Faculty of Animal Science & Export Agriculture, Uva Wellassa University of Sri Lanka, Badulla, Sri Lanka

Abstract

The southern coastal area of Sri Lanka provides ideal habitats for nesting of Green sea turtle (*Chelonia mydas*), Olive ridley (*Lepidochelys olivacea*), Hawksbill (*Eretmochelys imbricate*), Loggerhead (*Caretta caretta*) and Leatherback (*Dermochelys coriacea*) sea turtles. The increase of coastal macro debris is negatively affecting a wide range of marine organisms including sea turtles. Any type of natural or synthesized solid waste materials that remain in the coastal area are referred to as coastal debris. Entanglement, ingestion, reduction of crawling speed and release of chemical contaminants are some of the negative effects of coastal macro debris on the health of sea turtles. Therefore, this study was carried out to investigate the presence of coastal macro debris at selected turtle nesting beaches along the Southern coast of Sri Lanka during the period from February to May 2022. Random plot sampling method was employed at Palatupana, Godawaya, Ussangoda, Kalametiya, Rekawa, Mirissa, Habaraduwa and Kosgoda and the macro debris were classified under the categories, wood, glass, macro plastic, styrofoam, metal, rubber, fishing material and cloth. Five plots (100m×30m) were surveyed for each selected beach and macro-debris densities (g/m^2) were calculated. Habaraduwa was identified as the highest polluted beach ($9.05g/m^2$) among the beaches studied and the least polluted beach was Mirissa ($0.43g/m^2$). The Friedman test recorded no significant difference ($P<0.05$) between the types of debris found and the debris density of the nesting sites. The questionnaire survey indicated that the beach cleaning programmes could be the prominent reason for non-significant difference of the debris densities between the nesting sites. According to the survey, the lack of significant difference between debris types of various nesting sites was due to common anthropogenic activities, prominently garbage dumping.

Keywords: Anthropogenic activities, Macro debris, Pollution, Turtle nesting

Corresponding Author: ojithmad@gmail.com

ID 19

Effects of liquid extract of fish waste on growth performance of micro-propagated Water Trumpet (*Cryptocoryne wendtii*)

M.H.R. Subhanu[1*], K.K.T. Nuwansi[2], S.S. Herath[1]

[1]Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka
[2] National Aquatic Research and Development Agency, Crow Island, Colombo 15, Sri Lanka

Abstract

Biological waste from fish processing and post-harvest handling is an environmental issue and the conversion of fish waste into organic fertilizer has been identified as an eco-friendly approach to address it. Therefore, this study was done to evaluate the effectiveness of liquid extract from fish waste as a liquid fertilizer (LFE) and its effects on the growth performance of the micro-propagated ornamental aquatic plant *Cryptocoryne wendtii*. Three levels of LFE, 0.25 gL^{-1}, 0.50 gL^{-1}, and 0.75 gL^{-1} were compared with the recommended level of inorganic fertilizer (0.5 gL^{-1} Albert solution) as the control for six weeks. Twenty-four micro-propagated plants were potted in individual plastic cups and plants were randomly allocated to 12 glass tanks (two pots per tank) with the respective level of fertilizer (40 L). Complete water exchange with the relevant level of fertilizer was done at two weeks intervals and, $NO_3^-$and PO_4^{3-}concentrations of water were measured before water was renewed. In this study, measurements of initial and final plant wet weight, total plant height, stem height, rhizome height, root length, leaf length and width, leaf area, and the number of leaves and shoots were taken. Additionally, Relative Growth Rate (RGR), Leaf Area Ratio (LAR), and Net Assimilation Ratio (NAR) were calculated for plants in each treatment. These parameters were compared using one-way ANOVA. Plant wet weight, total plant height, rhizome height, leaf width, and leaf area of plants treated with 0.75gL^{-1} LFE showed significantly higher growth performance compared to the control. Significantly higher RGR, LAR, and NAR were reported for 0.75gL^{-1} LFE treatment followed by 0.5gL^{-1} and 0.25gL^{-1} LFE treatments. The results of this study revealed that liquid fish waste extracts at the concentration of 0.75gL^{-1} can be used as a liquid fertilizer for *Cryptocoryne wendtii* without compromising the growth performances when compared to the recommended level of inorganic fertilizer.

Keywords: Aquatic plant, Fertilizer, Fish waste, Growth performance, Micro-propagated

***Corresponding Author*:** rimasuba123@gmail.com

ID 27

Identification and classification of the different types of agrochemicals used in the Sri Lankan livestock sector: A Review

M.V.U.M. Sugathadasa[1*], Y.A.K. Hasara[1], W.M.A.U.K.M. Wijesekara [1]

[1] Crop Improvement and Plant Protection Module, Department of Export Agricultural, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya

Abstract

The Sri Lankan livestock sector plays a vital role in sustainable food production, rural livelihood development, human health, and animal welfare. Based on this review, four major sub-sections were identified based on agrochemical usage, with the livestock veterinary section having the highest usage, followed by animal feed production, livestock food processing, and farm biosecurity management. Tetracycline, ß-lactams, and Macrolides are the major classes of antibiotics used in the livestock veterinary sector. The most popular endoparasitic drug is Albendazole followed by Fenbendazole. The commonly used drugs for treating ectoparasites are typically classified into one of the following chemical categories: Pyrethroid, Organophosphate, Carbamate, or Organochlorine. Top examples for those classes are Permethrin, Malathion, Propoxur, and DDT. respectively. In poultry farming, Avilamycin, Flavophospholipol, Virginiamycin, and Bacitracin are commonly used as antimicrobial growth promoters. Under the sub-section of the livestock animal feed industry, many types of nutritive and non-nutritive feed additives could be identified such as vitamins, buffers, antioxidants, preservatives, acidifiers, amino acids, and minerals. Highly used chemicals under the above categories are vitamin E, Sodium Bicarbonate, Butylated Hydroxy Anisole, Calcium Sorbate, Fumaric acid, Methionine, and Calcium Carbonate, respectively. Different agrochemicals used in livestock food processing could be categorized as preservatives, stabilizers, water retention agents, flavoring substances, thickeners, antioxidants, and acidity regulators. Preservatives are the most frequently used chemical category. The top listed meat preservatives are Sodium Chloride, Citric acid, Sodium Dihydrogen Citrate, Potassium Dihydrogen Citrate, and Lactic acid. Sodium Benzoate, Potassium Sorbate, and Natamycin are the common preservatives in dairy food processing. For farm biosecurity management prominent use of Chlorine or Formaldehyde based disinfectants could be observed. Production of agrochemicals in the country is extremely low, only the importation and processing occur. Sri Lankan government-issued acts such as the Food Act (No. 26 of 1980) and Import-Export Control Act (No 1 of 1996) are currently in power for the control of agrochemical flow in the livestock sector. The major health hazard generated by the misuse of agrochemicals is antibiotic resistance. Workers engaged in livestock farming should be aware of agrochemical usage. Majorly usage of veterinary products by livestock farmers needs to be regulated to minimize health hazards.

Keywords: Agrochemical, Antibiotics, Chemical, Livestock, Veterinary

Corresponding Author: udaraminsara15@gmail.com

ID 69

Production of freeze-dried *Lactobacillus* inoculants and evaluation of the effect of inoculation rate on ensiling of forage maize

K.M. Devindi[1], R. Priyantha[2], N. Liyanagunawardena[2], W.M.P.B Weerasinghe[2] and M.B.P. Kumara Mahipala[1*]

[1] Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka.
[2] Veterinary Research Institute (VRI), Peradeniya, Sri Lanka

Abstract
Favorable lactic acid bacteria (LAB) inoculants are used to enhance forage ensiling. The study aimed to produce freeze-dried inoculants from *Lactobacillus plantarum, L. rhamnosus* and *L. oris* which were isolated from silage of maize, sorghum and guinea grass, respectively and asses the influence of the inoculation rate on ensiling of forage maize. The *Lactobacillus* isolates were inoculated separately into MRS broth and incubated at 37° C for 18 hours (MRS mother culture). The mother cultures were inoculated into skim milk broth (10 %) and incubated at 37° C for 72 hours. Their growth kinetics were studied. All LAB species exceeded 10^9 CFU/mL by 24 h and reduced the pH value to 3.92 – 4.11 by 72 h. Therefore, skim milk (10 %) broth was chosen as lyophilization media for making freeze-dried LAB inoculants. Pelleted MRS mother cultures (10 mL) were dissolved in 10 % skim milk broth (30 mL) and the suspensions (0.5 mL) were freeze-dried in vials (LAB inoculant). The effect of inoculation rate on forage maize ensiling was assessed at 3 inoculation rates (0, 10^4 and 10^6 CFU/g fresh forage). The experiment was conducted as a complete randomized design which included 2 factors (LAB species, inoculation rate). Chopped (10-15 mm) fodder maize was treated with respective LAB inoculant and inoculation rate. They were ensiled in I L Weck glass jars. Each treatment combination had 3 replicates. Laboratory silos were opened at 14 days post-ensiling and dry matter, pH value, lactic acid content and ammonia nitrogen contents were measured. The species of LAB inoculant and inoculation rate had significant ($P<0.05$) effect on the pH value of maize silage. An increasing trend of lactic acid content was evident with increasing inoculation rate of *L. plantarum*. The pH value was low ($P<0.05$) when forage maize was inoculated with *L. rhamnosus and L. oris* at 10^6 CFU/g rate (3.43 and 3.41), respectively. The study confirmed the potential of production of freeze-dried LAB inoculants from *L. plantarum, L. rhamnosus* and *L. oris* that isolated from maize, sorghum and guinea grass, respectively. Ensiling forage maize with freeze-dried *L. rhamnosus L. oris* inoculants at 10^6 CFU/g fresh matter ensures rapid drop of pH value during ensiling forage maize.

Keywords: Lactic acid, *Lactobacillus oris, L. plantarum, L. rhamnosus*, pH

Corresponding Author: pmahi@agri.pdn.ac.lk

ID 87

Occurrence of Microplastics in Sardinella gibbosa and Decapterus macarellus collected from Southern coast in Sri Lanka

A.R.M.P.M. Rathnayaka[1*], K. Radampola [1], P.B.T.P. Kumara [2]

[1]Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Science Technology, University of Ruhuna, Sri Lanka
[2]Department of Oceanography and Geography, Faculty of Fisheries and Marine Science Technology, University of Ruhuna, Sri Lanka

Abstract
Microplastics (MPs<5mm) are transferred through food chains to higher trophic levels and accumulated in food fish which becomes a major health concern worldwide. Two planktivorous pelagic fish species, *Sardinella gibbosa* (SG, 21.95 ± 3.94g) inhabiting coastal waters, and *Decapterus macarellus* (DM, 239.56 ± 47.63g) inhabiting offshore waters, were examined for the presence of MPs in gastrointestinal tract (GIT) and gills. MPs were extracted using acid digestion method, identified using the photomicroscope and categorized according to type, size and color. Occurrence of MP in fish was 100% for both species. Mean (+SD) MP particles/g tissue of GIT and gills in SG (74.20 ± 8.01 and 72.87 ± 16.72) were significantly higher than that of DM (47.26 ± 5.06 and 46.14 ± 7.46), while mean MP (± SD) particles/organ of GIT and gills in SG (64.70 ± 17.59 and 38.20 ± 10.80) were significantly lower than that of DM (350.17 ± 85.47and 333.68 ± 54.54). Mean (± SD) MP particles/individual in DM (683.85 ± 137.10) was significantly higher than SG (102.90 ± 24.98). MP fragments was the most abundant, followed by fibers and beads in both tissues of both species. The prevalence of large MP fibers/individual was significantly higher in SG, while small MP fibers/individual was significantly higher abundance in DM. Red and black color MPs were occurred predominantly than blue, purple, green and pink MPs in both species. Results suggested that there is a risk for the consumers and advanced technologies and further studies are needed to evaluate sources, pathways, contaminants and ultimate effects of MPs on human health.

Keywords: Coastal, Microplastics, Planktivorous, Offshore

***Corresponding Author*:** piumimdhu@gmail.com

ID 108

Evidence of microplastics in *Sargassum sp.* in South coast of Sri Lanka

K.A.T.N. Thilakarathna[1*], K. Radampola[1], P.B. Terney Pradeep Kumara[2]

[1] Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka.
[2] Department of Oceanography and Marine Geology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka.

Abstract
The deposition of microplastic (MP) particles on marine macrophytes, such as macroalgae, is a possible entry point for MP into marine food webs. The present study was conducted to identify the MP associated with the most common seaweed species; *Sargassum sp.* grown on different tidal zones, i.e.: low-tidal zone (LTZ), mid-tidal zone (MTZ), and high-tidal zone (HTZ) on rocky shores in the Southern coast of Sri Lanka. The *Sargassum* samples (18/site) and water samples (3/site) were collected from all three tidal zones in Batheegama reef and Koggala reef. *Sargassum* blades were treated with 30% H_2O_2 solution, filtered and examined microscopically to identify MPs. The occurrence of MP was 100% for all seaweed and water samples. MP abundance in *Sargassum* in Koggala reef (2.72$\pm$1.45 particles/cm^2) was significantly higher than that of Batheegama reef (1.94$\pm$0.60 particles/cm^2). However, the MP abundance of water samples was not significantly different between Koggala (144.67 ± 48.95 particles/L) and Batheegama (147.60 ± 99.01 particles/L). In Koggala, MP abundance in *Sargassum* of MTZ was significantly lower than that at HTZ and LTZ. In Batheegama, the highest MP abundance in *Sargassum* was seen at the MTZ while that at the LTZ was the lowest. Significant variations were seen in the abundance of various MP types that were examined from the three tidal zones in Koggala and Batheegama. However, MP fibers were the most predominant type in water samples. In both *Sargassum* samples and water samples, black was the most abundant colour of MP, and small (<0.25cm) fibers were the most prominent type. Additional investigation is required to pinpoint the precise source, type of polymer, and the true impact of the microplastics on the ecosystem of the rocky shore.

Keywords: Microplastic, Rocky shore. *Sargassum sp.*, Tidal zone

Corresponding Author: tharuka96nadeeshani@gmail.com

Food Technology and Nutritional Sciences

ISAE - 2023

Keynote Speech

Strategies to Combat Micronutrient Deficiencies in Low- and Middle-Income Countries: Role of Agriculture and Food Technology

Faruk Ahmed

Public Health, School of Medicine and Dentistry, Griffith University, Gold Coast, QLD 4222, Australia

***Email -** f.ahmed@griffith.edu.au

Micronutrient deficiency or hidden hunger is a significant global health issue affecting approximately one-third of the world's population. Low- and middle-income countries (LMICs) are particularly affected, where poor-quality diets, poor bioavailability, infections, and poor hygiene contribute to the occurrence of multiple micronutrient deficiencies. Deficiencies in micronutrients such as iron, vitamin A, iodine, folate, and zinc can lead to severe and even life-threatening conditions. This presentation aims to provide a comprehensive overview of the extent of micronutrient deficiencies in LMICs, including the various risk factors and potential public health impacts.

Several strategies and intervention options will also be discussed, including food fortification and biofortification. Food fortification involves adding micronutrients to commonly consumed foods to increase their nutritional value, while biofortification is the process of breeding crops to increase their nutrient content naturally. These interventions have shown promising results in addressing micronutrient deficiencies in LMICs. However, it is crucial to consider cultural and social factors when implementing these interventions to ensure their effectiveness and sustainability.
Overall, this presentation highlights the urgent need to address the issue of micronutrient deficiencies in LMICs and provides valuable insights into various intervention options that can help prevent and control these deficiencies.

Keywords: Dietary diversification, Food security, Low- and middle-income countries, Malnutrition, Micronutrient deficiencies, Nutrient biofortification

Oral Presentations

ID 07

Liposomal encapsulation for enhancing the retention of antioxidant activity of curcumin incorporated in cookies during baking

H.P.M. Prasadani* and K.M.G.K. Pamunuwa

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), 60170, Sri Lanka

Abstract

Functional foods comprise fortified, enhanced, or enriched foods that give health benefits beyond the provision of essential nutrients. Although curcumin possesses numerous beneficial bioactivities, formulation of functional cookies incorporating curcumin is challenging due to its poor solubility, low bioavailability, and instability under different environmental conditions. This study was carried out to investigate the effectiveness of liposomal encapsulation on the retention of the antioxidant activity of curcumin during the baking of fortified cookies. The curcumin-encapsulated liposomes showed a very high encapsulation efficiency, which amounted to 90.58 %. Three types of cookies were prepared using a standard cookie recipe with slight modifications. Those were regular cookies (T1), cookies fortified with 1g/kg free curcumin (T2), and cookies fortified with 1g/kg liposomal curcumin (T3). Sensory and physicochemical properties of the cookies revealed that liposomal curcumin can be incorporated into cookies without any negative effects on the properties of the cookies except color. As expected, the color of the liposomal curcumin incorporated cookies showed, higher yellowness than the regular cookie. The extracts of the cookies were analyzed for antioxidant activity using 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging assay and ferric-reducing antioxidant power (FRAP) assay. Similarly, liposomal curcumin incorporated cookies (T3) exhibited higher antioxidant potential than free curcumin incorporated cookies (T2). In fact, the DPPH radical scavenging activity of T3 and T2 were 92.70 ±3.34%, and 84.73 ±3.37%, respectively, and the FRAP values of T3 and T2, were 683.46 ±91.00 µg/mL and 645.46 ±18.00µg/mL with the reference of ascorbic acid standard respectively. Thus, fortification of cookies with liposomal curcumin may be carried out successfully to retain the antioxidant activity of curcumin during baking.

Keywords: Antioxidant activity, Curcumin, Encapsulation, Functional food, Liposome

Corresponding Author: mprasadani1@gmail.com

ID 33

Potential of minor fruits as a good alternative for mainstream fruits in Sri Lanka in terms of antioxidant properties and vitamin C content

A.P.H.I. Abeysuriya[1], V.P. Bulugahapitiya[2*], L.P. Jayatissa[3]

[1]Department of Food Science and Technology, Faculty of Agriculture, University of Ruhuna, Sri Lanka
[2]Department of Chemistry, Faculty of Science, University of Ruhuna, Sri Lanka
[3]Department of Botany, Faculty of Science, University of Ruhuna, Sri Lanka

Abstract

Sri Lanka is rich in wide diversity of fruits, categorized into two main categories based on their utilization, as mainstream and minor fruits. In Sri Lanka most of the edible fruits (95%) are underutilized (minor) while fruit consumption among people is far below the recommended levels. Therefore, this study was conducted with the objective of determining the potential of minor fruits to be good alternatives for mainstream fruits consumed in Sri Lanka, in terms of antioxidant properties and contents of vitamin C. Sixty six species of locally grown fruits including 15 species of mainstream and 51 species of minor fruits were studied for contents of L-ascorbic acid (AA), total vitamin C (TVC), total phenolic (TPC), total flavonoid (TFC) and *in-vitro* antioxidant capacities using DPPH and FRAP assays. Principal component analysis (PCA) was done to find the best fruit among those, in terms of measured parameters. According to the PCA, *Phyllanthus emblica* (Nelli) found to be the best fruit in Sri Lanka which is a minor fruit, with the highest contents of TVC (529.6 ± 57.5 mg/100 g of fresh weight (FW)), TPC (2701.7 ± 2.9 mg Gallic acid equivalent/100 g FW) and FRAP value (2070.0 ± 61.4 µmol $FeSO_4$/g FW). The highest AA and TFC contents were found in *Anacardium occidentale* (Cashew apple) (185.0 ± 10.0 mg/100 g FW) and *Melastoma malabathricum* (Maha bovitiya) (228.0 ± 27.1 mg Quercetin equivalent/100 g FW), respectively. The highest DPPH radical scavenging activity (lowest IC_{50}) was observed in *Elaeocarpus serratus* (Veralu) (0.8 ± 0.1 mg/mL). In the PCA, 7 fruit species (*P. emblica*, *Aegal marmelos*, *M. malabathricum*, *A. occidentale*, *Clidemia hirata*, *Ardisia willisii* and *Muntingia calabura*) were extracted from the main cluster, due to their high antioxidant properties and vitamin C contents. The present study emphasizes that the minor fruits grown in Sri Lanka are good alternative sources for mainstream fruits in terms of antioxidant properties and vitamin C. Therefore minor fruits should be popularized among Sri Lankans as alternative sources to mainstream fruits.

Keywords: Antioxidant properties, Fruits in Sri Lanka, Mainstream fruits, Underutilized fruits

Corresponding Author: vajira@chem.ruh.ac.lk

Acknowledgement: This work was funded by the UGC Block Grant (RU/PG-R/16/13)

ID 43

Heat-induced changes in physiochemical properties of coconut proteins in skimmed coconut milk

Pasindu W. Jayasooriya[1], M.A. Elangasinghe[1], Charitha J. Gamlath[1*]

[1] Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya, Sri Lanka

Abstract

Coconut milk is a source of plant-based proteins, increasingly processed to form vegan-products. Heat treatments used during processing are likely to denature coconut proteins, leading to changes in their physiochemical properties that, in turn, affect the processing of coconut milk. A better understanding of heat-impacted changes in coconut milk proteins is crucial. Past research is largely restricted to studies of heat-induced behaviour of whole coconut milk that reflect the collective behaviour of proteins and fat during heating. Limited studies available on coconut protein denaturation have also been conducted using chemically extracted coconut proteins, which may have changed their conformation during extraction. Therefore, in this study, fat-depleted skimmed coconut milk (SCM) with 4.49% protein, 0.10% fat and 96.92% water was first produced using centrifugation to maintain the native protein structure. Then SCM was heat-treated in the range of 85 - 115^{o}C for 15 min using an oil bath. Visual observations revealed an increase in turbidity from 85^{o}C to 93^{o}C and from 100^{o}C to 105^{o}C, followed by aggregate formation at 95^{o}C and 110^{o}C, suggesting protein unfolding and aggregation. Bradford assay results showed a significant ($p<0.05$) reduction in protein solubility at elevated temperatures with two minima observed at 95^{o}C (46.65% solubility) and 110^{o}C (78.67% solubility) where aggregates formed. All thermal treatments significantly ($p<0.05$) increased the viscosity of SCM compared to that at room temperature (1.338 ± 0.003 mPa.s), with a maximum (1.622 ± 0.002 mPa.s) reported at 85^{o}C and two minima reported at 95^{o}C (1.369 ± 0.003 mPa.s) and 110^{o}C (1.347 ± 0.008 mPa.s). This study suggests that heat denaturation of coconut proteins indeed imparts physiochemical changes in SCM. The insights gained from this study will help manipulate operating conditions during coconut milk processing to obtain milk streams with desirable physiochemical attributes.

Keywords: Centrifugation, Coconut Protein, Heat treatment, Solubility, Viscosity

Corresponding Author: charithag@eng.pdn.ac.lk

Acknowledgement: This research was facilitated by the Department of Molecular Biology and Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka and China-Sri Lanka Joint Research and Development Centre, Kandy, Sri Lanka

ID 74

Phytochemical screening, quantification of tannin, flavonoid and *in vitro* antimicrobial activity of different forms and varieties of coconut water

S. Shayayanthavi[1, 2*], R. Kapilan[2] and I. Wickramasinghe[1]

[1] Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2] Department of Botany, Faculty of Science, University of Jaffna, Sri Lanka

Abstract

Tender coconut water (*Cocos nucifera*) is a natural beverage and sports drink in tropical countries due to the presence of high mineral content and other nutritional properties. The aim of this study was to investigate the nutritional and phytochemical analysis and *in vitro* antimicrobial activity for eight different forms and varieties of tender coconut water with a maturity stage of 5-7 months. Tender coconut water of *Nawasi, Ran thembili*, Green dwarf, Brown dwarf, Yellow dwarf, King coconut, CRIC 60, and CRIC 65 were collected in sterile bottles and liquid-liquid extraction was carried out in different separating funnels using the nonpolar solvent n-hexane for qualitative analysis. Nutritional and phytochemical screening was carried out for n-hexane extract and fresh coconut water. The findings from the nutritional and phytochemical screening show the presence of carbohydrates, reducing sugars, amino acids, phenols, tannins, flavonoids, terpenoids, alkaloids and glycosides. Quantification of tannin was determined using Folin ciocalteu assay and flavonoid was determined using Aluminium chloride assay. *Ran thembili* (Tall variety) shows significantly higher total tannin content (22.32 ±0.909 µg TAE/ mL) and *Nawasi* (Tall variety) shows significantly higher total flavonoid content (1.229 ± 0.114 µg QUE/ mL). When agar well diffusion assay was used to determine the antibacterial and antifungal activity of fresh coconut water, *Pseudomonas aeroginosa* showed an inhibition zone for *Nawasi* (2.5±0.109 cm)*, Ran thembili* (2.783± 0.223 cm), Green dwarf (2.45±0.152 cm), Brown dwarf (2.45±0.188 cm), Yellow dwarf (2.383 ± 0.24 cm), King coconut (2.567±0.294 cm), CRIC 60 (2.33± 0.234 cm), and CRIC 65 (2.417± 0.214 cm) while Streptomycin (positive control) shows an inhibition zone of (5.03±0.34 cm) and the diameter of the well was 0.9 cm. Microorganisms such as *Staphylococcus, E.coli, Enterococcus, Klebsiella, Proteus, Bacillus*, *Mucor, Aspergillus, Penicillium,* and *Fusarium* were not inhibited by coconut water. The components in the coconut water of all the varieties inhibit the growth of *Pseudomonas aeroginosa* while not inhibiting the growth of other microorganisms tested. Preliminary nutritional and phytochemical analysis of coconut water shows the existence of biologically active compounds.

Keywords: Antimicrobial, *Cocos nucifera*, Nutritional, Phytochemicals, Tender coconut water

Corresponding author: shayanthavi@sci.sjp.ac.lk

Acknowledgment: This work was funded by the National Research Council of Sri Lanka (Grant no. NRC-19-075)

ID 105

Study on the effectiveness of selected aspects of Food (Hygiene) Regulations, 2011 of Sri Lanka: A case study from Horana MOH Division

D.P. Lihinikadugamage[1*], C.A. Hettiarachchi[2], M.J.M. Fari[1] and M.R.A. Rifath[1]

[1]Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka
[2] Regional Director of Health Services Office, Kalutara, Sri Lanka

Abstract

The degree to which food handlers adhere to hygienic practices has a substantial impact on the effectiveness of food hygiene regulations. The objective of this study was to assess the effectiveness of the Food Hygiene Regulation 2011 of Sri Lanka and the factors affecting the hygienic practices among the food handlers in Horana Medical Officers of Health (MOH) Division. This study employed a structured questionnaire survey to assess the knowledge and attitude of food handlers, and an observational checklist to assess practices of selected aspects of Food hygiene regulation 2011. The descriptive analysis was used to interpret the knowledge, attitude, and practice-related information. Furthermore, an independent sample t-test and ANOVA test were performed to compare the knowledge, attitude, and practice related attributed to different socio-demographic variables. According to the results of protective clothes-related practices, 5.19% wear an apron without pockets, 5.19% wear hand gloves, 39.26% of wear a facemask, 2.96% wear suitable footwear, and 4.07% wear hair nets while handling food and beverages. While dealing with food, 44.81% of food handlers were not handling money and food simultaneously, and 39.26% of handlers were not talking without a mask. Regarding the food handler's knowledge of food regulations, it was obvious that the correct answers provided by the respondents were in the range of 56.87 to 98.51%. The mean values for food handlers' attitudes towards food regulations were 2.19 to 4.49. The findings of ANOVA revealed that the attitude and practices of the respondents had no significant difference with respect to gender. But only the knowledge related to personal hygiene attributes had a significant difference with respect to gender. Personal hygiene and medical certificate-related attributes were significantly different between the different ranges of age groups. Furthermore, there were no significant differences observed in the food handlers' knowledge compared to the education levels except for storage-related knowledge. However, there was a significant difference observed in the practice of food handlers with respect to the different education levels. Conclusively, even if food handlers have good knowledge of Food hygiene regulations, they do not practice accurate procedures properly depending on the socio- demographic variables.

Keywords: Attitude, Food handlers, Food hygienic regulation, Knowledge, Practices

Corresponding Author: lgdishanipiumini@gmail.com

ID 121

Screening of anti-inflammatory potential of three selected Sri Lankan medicinal plant extracts

N.D. De Silva[1*] and A.P. Attanayake[1]

[1]Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Sri Lanka

Abstract

Medicinal plants represent a notable source in the treatment of various chronic diseases. They possess a variety of phytoconstituents, particularly polyphenols with promising biological activities. The anti-inflammatory activity of dietary polyphenols can suppress chronic inflammation in many chronic diseases. The present study was conducted to determine total polyphenol content (TPC), total flavonoid content (TFC) and anti-inflammatory activity of *Garcinia zeylanica* L. (Family: Clusiaciae, common name: Garcinia), *Hibiscus rosa-sinensis* L. (Family: Malvaceae, common name: R*ose mallow*) and *Trianthema portulacastrum* L. (Family: Aizoaceae, common name: B**l**ack pigweed). The aqueous extracts of (0.125 mg/mL) dried fruits of *G. zeylanica*, flowers of *H. rosa-sinensis* and leaves of *T. portulacastrum* were prepared by refluxing for 4h. The resulting aqueous extracts were filtered and lyophilized (-55 °C). The percentage yield was calculated in freeze-dried plant materials. The TPC and TFC were determined using Folin Ciocalteu method and aluminum chloride method respectively. The results of TPC and TFC were expressed as gallic acid equivalents (GAE) and quercetin equivalents (QE) respectively. The anti-inflammatory activities of plant extracts were determined by the xanthine oxidase (XO) inhibitory assay (reference compound–allopurinol) and nitric oxide (NO) scavenging assay (reference compound–ascorbic acid). The percentage yield of aqueous extracts of *G. zeylanica*, *H. rosa-sinensis,* and *T. portulacastrum* were 14.55%, 16.55%, and 11.75%, respectively. *H. rosa-sinensis* achieved the highest content of polyphenols (63.05±0.24 GAE/g) and the highest content of flavonoids (14.25 ± 0.13 QE/g) followed by *T. portulacastrum* (24.26±0.18 GAE/g and 5.21 ± 0.02 QE/g) and *G. zeylanica* (7.22±0.08 GAE/g and 0.67±0.01 QE/g). *G. zeyalanica* and *H. rosa-sinensis* exhibited the highest significant anti-inflammatory activity representing the lowest IC_{50} values for the XO inhibitory assay (2.41±0.03 mg/mL) inhibitory and the NO scavenging assay (0.36±0.04 mg/mL) when compared to the reference compounds ($p<0.05$) respectively. In conclusion, of the three selected medicinal plants, *H. rosa-sinensis* was found to be a potent anti-inflammatory agent with comparatively high TPC, TFC content and NO scavenging activity. However, the amounts of bioactive compounds could vary based on geographic location where the plants/parts were collected, season of the year and extraction protocol.

Key words: Anti-inflammatory activity, Aqueous extracts, Polyphenols

***Corresponding Author*:** nayomi@med.ruh.ac.lk

***Acknowledgement*:** Financial assistance – Faculty Research Grant 2022 (Grant No – FOM/RG2022/01), Faculty of Medicine, University of Ruhuna

ID 124

Factors influencing the diet of preschool children in rural areas, Sri Lanka: Parents' perceptions

S.F. Sashna[1*] and M.S.F. Sirasa[1]

[1]Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka

Abstract

Childhood malnutrition is a public health threat in the developing countries like Sri Lanka. Preschoolers under the age of five are in a vulnerable stage of development, and the diet they consume during early period affects their development and growth, and their future health. Dietary behaviours practice during the young ages tend to continue throughout the whole life. Parents are the "gatekeepers" of young children's food consumption pattern and understanding parents' perception on children's diet is necessary to modify children's dietary behaviours. Exploration of parents' perception on factors influencing children's diet were reported in urban locations of Sri Lanka, but not in rural areas. Therefore, current study was conducted with seven focus groups adopting partial nominal technique, including 47 participants who are the parents of preschool children in rural communities in Anuradhapura District, Sri Lanka. Parents were given a list of 25 potential factors and asked to rank the six most influential and select the six least influential for their children's dietary behaviour. Factors selected by majority within the group were further discussed and the discussions were audio recorded. Based on verbatim written transcription of the focus groups, qualitative data were extracted by content analysis. Factors selected by participants were categorized into three levels: individual, family and peer, and community. Individual level of child preferences, family and peer level of family food budget, maternal control, peers eating behaviours, and community level factors of food price and accessibility of the shops were ranked as most influential factors. Based on selection, child's gender, nutrition knowledge of the child, family size, availability of foods in shops and community cultural beliefs were identified as least influential factors. Additionally, lengthy mealtime and television advertising were also suggested as the influential factors by the participants. Since the influence of factors differ based on the context, exploration is necessary to design tailor made healthy dietary interventions for children in other locations.

Key words: Child diet, Malnutrition, Parental perception, Rural population, Sri Lanka

***Corresponding Author*:** fathimashazna982@gmail.com

Poster Presentations

ID 11

Identification of the relationship among the keeping quality, alcohol test results, and total colony count in raw milk used for dairy processing

N. S. Ranathunga[1], K. N. Wijayasekara[2*] and D. N. Kannangara[3]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka
[2] Department of Food Science and Technology, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka
[3] Department of Bio systems Technology, Faculty of Technology, University of Ruhuna, Sri Lanka

Abstract
As the main ingredient in dairy industry, raw milk has to be handled with superior quality because, it is critical not just for food safety, but for the product quality. Quality checking procedures are essential for a long term supplies of higher quality dairy products. Therefore, dairy companies allocate a higher capital for daily quality assurance process of raw milk. At the point of factory receiving, alcohol test, keeping quality test (KQ), and total colony count (TCC) are three basic quality tests which are carried out to each raw milk sample. The aim of this research was to identify the relationships among the keeping quality, alcohol test results, and total colony count in raw milk used for dairy processing. For that, collected milk samples were subjected to alcohol, keeping quality and TCC tests. One way ANOVA, two sample t-test and chi-square test data analysis revealed that, KQ = 6 raw milk samples were negatively identified for alcohol test and its TCC is less than 120×10^5 CFU/mL. KQ = 4 milk samples were positively identified for alcohol test and its TCC is more than 300×10^5 CFU/mL. KQ = 5 milk samples with total colony count less than 200×10^5 CFU/mL give negative results for the alcohol test whereas, KQ = 5 milk samples with total colony counts greater than 200×10^5 CFU/mL provide positive alcohol test results. These all testing procedures relate to the available microorganisms and their metabolic activities in raw milk. It will enable the prediction of the outcome of one test based on the results of another, without the need to conduct each test separately. This approach will reduce the number of tests required to ensure the quality of raw milk, resulting in minimized cost allocations for quality assurance procedures.

Keywords: Alcohol test, Keeping quality (KQ), Quality, Raw milk, Total colony count

Corresponding Author: kaushalya@uwu.ac.lk

Acknowledgement: The authors gracefully appreciate the support of Milco (Pvt.) Ltd. Digana for providing samples, other resources and laboratory facilities for this research.

ID 22

Use of pretreatments to enhance the quality attributes and drying characteristics of dehydrated tender jackfruit

T. A. Bandara[1], C. Jayakody[2] and C. J. Gamlath[1*]

[1]Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya, 20400, Sri Lanka
[2]Siam City Cement (Lanka) Ltd, Puttlam, 61300, Sri Lanka

Abstract
Tender jackfruit is a perishable tropical food crop with high nutrition. If preserved appropriately, it could be consumed off-season or exported to foreign markets. Convective drying is a simple and economical food preservation technique, which, however, is associated with quality defects such as browning, shrinkage etc. Therefore, this study investigated the possibility of using osmotic dehydration (OD) at 40^0C , followed by two different treatments using, Sodium metabisulfite (SMB-OD) and Citric acid (CA-OD), as pretreatments to improve drying characteristics and quality attributes of dehydrated tender jackfruit. First, convective drying kinetics (at 60℃) of pretreated samples and untreated control (C) were modelled using five thin layer drying kinetic equations (Newton, Logarithmic, Henderson and Pabis, Modified Page, and Page) to predict the time required to reach a standard moisture content of 6% (wb). Page model best fitted the kinetic data of all samples. OD removed nearly 10% moisture from tender jackfruit prior to convective drying, resulting in a significantly ($p<0.05$) lower drying time (9.08 h) in OD, SMB-OD and CA-OD samples compared to the drying time of control (9.57 h). All treatments with OD reduced sample deformation during drying and resulted in a significantly low ($p<0.05$) shrinkage (60.33 - 74.89%) compared to shrinkage of control (86.61%). Browning index (BI) measurements showed a marginal yet statistically significant ($p<0.05$) reduction in enzymatic browning with OD alone (BI=0.66), compared to control (BI=0.80). Greater reductions in browning were observed with SMB-OD (BI=0.07) and CA-OD (BI=0.09). All pretreatments led to insignificant ($p>0.05$) changes in rehydration ratios. This study demonstrates that OD could reduce convective drying times and shrinkage while coupling it with chemical treatments could preserve the colour of dried tender jackfruit. The developed Page model could be used to predict the drying time of tender jackfruit during industrial processing.

Keywords: Chemical treatments, Convective drying, Food preservation, Osmotic dehydration, Thin film drying kinetics

Corresponding Author: charithag@eng.pdn.ac.lk

ID 26

Effect of selected pre-treatments with freeze drying on final quality of dehydrated banana (*Musa spp.)* and mango (*Mangifera indica*)

W.B.W.M.R.C.P. Aluwihare[1*], D.M.S.M. Dissanayake[2], T.M.A.N. Weerasinghe[1], R.M.N.A. Wijewardena[1], G.E.D.A.M Jayarathne[1], H.R.M.G.C. Thilekarathna[3]

[1]National Institute of Postharvest Management, Jayanthi Mawatha, Anuradhapura
[2] Faculty of Technology, University of Jaffna, Jaffna
[3]Faculty of Agriculture, Rajarata University of Sri Lanka, Puliyankulama, Anuradhapura

Abstract

Fruits are perishable commodities which are short lived. Bananas and mango are fruits which are very popular among Sri Lankans. These two fruits abundantly cultivated in Sri Lanka and huge postharvest losses can be seen due to poor handling. Freeze-drying is an advanced technique which can be used for fruit drying and it preserves their quality while extending shelf-life. With a view of identifying the most appropriate pretreatment for freeze drying of fruits, a study was conducted using two fruit samples, namely, banana (var. Sugar) and mango (var. Villard), which were treated with four different pretreatments, T1: hot water blanching (fruit slices were dipped in 60℃ boiled water for 3 min), T2: steam blanching for 2 min, T3: dipped in Citric acid solution (2 g/L) for 2 min and T4: dipped in Sodium metabisulphite (SMS) solution (2 g/L) for 2 min and then freeze dried. An untreated fruit sample (T5) was used as a control. Quality evaluation of freeze-dried samples was done by taking below mentioned parameters; total colour difference, total soluble solid content (TSS), moisture percentage, beta carotene value (mg/100g), Antioxidant value (mg/100g), ascorbic acid content (AA) (mg/100g), total phenolic compound (TPC) (mg GAE/100 g). The experimental design was a complete randomized design (CRD) with three replicates. The results indicated that the significantly lowest ($p<0.05$) color difference (3.19±2.08) and moisture content (8.51±0.21) were observed in citric acid-treated freeze-dried banana fruit samples. However, Antioxidant value, beta carotene and AA content were significantly higher ($p<0.05$) in the T3 banana fruit sample (9.27±0.03; 1.02±0.01; 5.98±0.04), as well it has significantly high ($p<0.05$) values for TSS and TPC compared with the control. According to the data, the lowest color difference (8.60±0.12) and moisture content (8.92±0.08) were observed in T2 mango samples. AA (63.25±0.13) and TPC (119.4±0.76) showed significantly high ($p<0.05$) values in SMS added mangoes and Beta carotene (23.12±0.28) and anti-oxidants (4.96±0.06) were highest in steam-blanched samples, however there was no significant difference among T2 and T4 mango samples. Citric acid treatment (T3) is very suitable for bananas, as SMS treatment (T4) is much more suitable for mango. Pretreatments play important role in dehydration while preventing loss of color, valuable bioactive compounds and improving rehydration characteristics. Although freeze-drying is costly it produce high-quality final product with extended shelf life, resulting increases demand for freeze-dried products.

Key words: Banana, Freeze drying, Mango, Pretreatments, Shelf-life

****Corresponding Author**:* wmrcpalu@gmail.com

ID 30

Development of concentrated herbal tea based on three different tea grades incorporated with *Pimenta dioica* L. (Allspice), *Mentha spicata* L. (Mint), and *Zingiber officinale* Rosc. (Ginger)

W.A.J.P. Wijesinghe [1*], B.P.A. Imesha[2], V. P. Ellepola [2] and R.M. Dharmadasa[3]

[1] Department of Food Science and Technology, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka
[2] Department of Food Science and Technology, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka
[3] Industrial Technology Institute, Colombo 07, Sri Lanka

Abstract

This study was aimed at the development of a concentrated herbal tea incorporating Allspice (*Pimenta dioica* L.), Mint (Mentha *spicata* L.), and Ginger (Zingiber *officinale* Rosc.) which cater not only to the multi-aroma and flavor but also to the therapeutic benefits for consumers. Refuse tea (T1), Broken Orange Pekoe Fanning's (BOPF) (T2) and Dust (T3) grades were used as the tea bases for the concentrated herbal tea. The different concentrations of ingredients were optimized based on the results of the preliminary sensory evaluation. The aqueous extractions of tea grade, and herbal materials (Dried Allspice leaves (4-5%), fresh ginger (30-35%) and mint (20-25%)) were carried out using boiling hot water. Sugar was added and macerated until it reached a final concentration of 30-40 °Bx. Then the concentrated herbal tea was filtered and bottled following refrigeration at 4℃. The procedure was followed for each of the three grades separately and developed three concentrated herbal teas based on the tea grades (T1, T2, T3) and organoleptic, physicochemical characteristics and shelf life of three concentrated herbal teas were evaluated based on the tea grades by using Friedman test and one way ANOVA at 5 % significance level using Minitab software. The results revealed that sensory attributes such as mouth feel (P = 0.002), overall taste (P =0.002), aftertaste (P=0.002), and overall acceptability(P = 0.004) have significant differences among the three tea grades, while there is no any significant difference in appearance (P =0.247) , color (P = 0.165), or aroma (P =0.368). The concentrated herbal tea based on BOPF grade was shown the best performance in sensory evaluation. Proximate parameters such as moisture (P =0.000), carbohydrate content (P =0.000), and energy (P =0.000) were significantly differ among the three grades. The high carbohydrate (33.5%) and energy (135 kcal/100 mL) levels as well as high viscosity (16.7 centipoise), Total Flavonoid Content (TFC) values (1.81 ± 0.09 mg Quecertine equivalent/ mL serving per cup) and high caffeine content (2085 ppm/ 1 mL) were comprised of the concentered herbal tea based on BOPF grade. The Dust grade based on concentrated herbal tea indicated the highest color (L*/ Lightness: 15.8 ± 0.01, a* / Hue between Red and Green: 2.07 ± 0.01, b* / Hue between Yellow and Blue: 1.31 ± 0.01), Ferric Reducing Antioxidant Power (FRAP) (634 ± 30 mg trolox/ mL serving per cup), Total Polyphenol Content (TPC) (45.5 ± 17 mg/ mL serving per cup), Oxygen Radical Absorbance Capacity (ORAC) (0.22 ± 0.01 mg / mL serving per cup) values while BOPF based concentrated herbal ranking second highest. In conclusion, unique flavor combinations provided a pleasant sensorial experience to concentrated teas while the tea grade used directly impacted on the end quality of the product.

Keywords: BOPF, Concentrated tea, Dust, Refuse tea, spice

Corresponding Author: jnkwijesinghe@yahoo.com

Acknowledgement: This work was funded by the Industrial Technology Institute, Colombo 07, Sri Lanka

ID 104

Development of pasta using composite flour of sweet potato (*Ipomoea batatas*), soy (*Glycine max*) and rice (*Oryza sativa*) flours

J.M.J.M. Jayawardhana[1], M.J.M. Fari[1] and Rumesh Liyanage[2]

[1]Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka
[2]Department of Biosystems Technology, Faculty of Technology, University of Sri Jayewardenepura

Abstract

Pasta made out of wheat flour is one of the most populist ready-to-cook food products worldwide. The usage of composite flour in the preparation of pasta products is a viable option to reduce the consumption of wheat flour in Sri Lanka. The objective of this study was to develop a composite flour mixture using locally available crops such as sweet potato (*Ipomoea batatas)* accession *'Carrot Bathala'* characterized with yellow tuber flesh, soy (*Glycine max*), and rice (*Oryza sativa*) while developing pasta products. Flour formulations from nine treatments were developed using Taguchi orthogonal experimental design. Four samples (T_2, T_3, T_4 and T_8) were selected for the final evaluation through a preliminary sensory evaluation. The sweet potato, soy, and rice were composite in the ratio of T_2-50:30:20, T_3-41.6:33.3:25, T_4-60:20:20, and T_8-63.6:27.2:9. A pasta with 100% wheat flour was prepared and used as a positive control. Sensory evaluation was conducted by 30 un-trained panelists using a 9-point Hedonic scale and the results were analyzed by One-way Friedman test at a 0.05 significant level. All the treatments obtained significantly higher ranks for the sensory attributes compared with control. T_2 sample was scored significantly higher values for all the sensory attributes (appearance, taste, hardness, stickiness) including the overall acceptability. Accordingly, T_2 sample had significantly higher values for fat (2.19±0.37%), fiber (2.54±0.17%), energy (510.3±2.55 Kcal/100g), ash (3.35±0.03%), and protein (14.57±0.05%) than the control. However, the proximate and cooking behaviors such as moisture (10.90±0.083%), carbohydrate (74.31±0.33%) and acid insoluble ash (0.05±0.02%) were significantly high in control than T_2 sample. The cooking time of T_2 sample was significantly lower (7 minutes) than the control (13 minutes) and there were no significant differences among other treatments. Moreover, significantly lower water absorption (91.35±2.89%) and higher cooking loss (11.25±0.185%) were obtained for T_2 sample. Overall, the results of the composite flour pasta met the standards set by SLS 420:2019 for pasta product specification, except for cooking loss. Therefore, the composite flour pasta could be commercialized in Sri Lanka as a gluten-free alternative to wheat flour pasta.

Keywords: Pasta, Rice, Soy, Sweet potato, Wheat

Corresponding author: jitharijayawardhana@gmail.com

ID 113

Development of a desiccated coconut-incorporated gluten-free, vegan coconut cookie

W.N.N. Tissera[1], Buddika Malaweera[1] and Niluni M. Wijesundara[1*]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka

Abstract

Cookies are consumed as a snack, ready-to-eat and convenient food. Making cookies with alternatives to wheat flour, whether entirely or in part, may enhance the product's sensory and nutritional qualities. Demand from specific customer segments interested in non-dairy, vegan, or gluten-free snacks is also growing. The present study aimed to develop gluten-free, coconut-based vegan cookies using desiccated coconut and rice flour as the main ingredients. Three treatments were prepared by incorporating desiccated coconut and rice flour in different percentage combinations of 75:25, 50:50, and 25:75 (w/w) and fixed quantities of sugar, vegetable shortening, sodium bicarbonate, water, and salt. The sensory properties of the cookies were evaluated using 34 untrained sensory panelists using a 7-point hedonic scale. These samples were evaluated for appearance, texture, colour, taste, aroma, and overall acceptability. Based on sensory attributes, cookies prepared with 50% desiccated coconut and 50% rice flour combination were the best treatment compared to other combinations. The developed coconut-incorporated cookies were then assessed for proximate composition and found that they contained 26.26 ± 1.36 % of fat, 4.537 ± 0.006 % of protein, 2.163 ± 0.18 % of fiber, and 1.676 ± 0.006 5 of moisture. Physical parameter values such as average weight, thickness, diameter, and spread ratio of cookies were 4.3 g, 6.55 mm, 38.9 mm, and 5.9, respectively. Then, cookies were freshly prepared from the selected best treatment for the shelf-life evaluation, packed in low-density polyethylene packages, and stored under 30 ± 2 °C temperature and 75 ± 5% RH condition. Storage quality evaluation (sensory attributes, shelf-life stability, and microbial safety) was done weekly for four weeks of storage. The total plate count and yeast and mold count of the coconut-incorporated cookies were within the acceptable limits in the SLS standards. Coliforms were never reported throughout the storage period. The rancidity level of the cookies during storage concerning the free fatty acid content was observed. The free fatty acid percentage was increased from 0.12% to 0.19% in the 4th week of storage. However, according to the sensory analysis during the storage period, there were no significant differences ($p<0.05$) over the weeks regarding colour, taste, texture, aroma, and overall acceptability. Therefore, based on the nutritional, sensory, and microbial attributes, cookies prepared with 50% desiccated coconut and 50% rice flour remain within the acceptable range throughout the end of 4 weeks storage period. Further quality assessment can be recommended before commercializing the coconut-incorporated, gluten-free, vegan rice cookies.

Keywords: Cookie, Desiccated coconut, Gluten-free; Keeping quality, Rice flour

***Corresponding Author:** niluni@uwu.ac.lk

ID 116

Development of a low-alcoholic wine using pineapple waste materials, core and peel

T.G.P. Kumari [1], G.A.A.R. Perea[1], A.M.G.N. Rathnayke[1*], S. Geethanjali [1]

[1]Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka

Abstract

Belonging to the Bromeliaceae family and originating from South America, pineapple (Ananas comosus) is a widely consumed fruit that is used both as a raw fruit and extensively processed in various food products such as jam, juice, jellies, fruit pulps, wine, and vinegar. However, commercial food production that uses pineapple generates a considerable amount of waste, including the core and peel, which are often discarded. Despite being discarded, the core and peel of the pineapple are known to be rich in essential nutrients such as potassium, calcium, vitamin C, manganese, and fiber, highlighting their potential as a valuable resource that could be utilized in numerous applications. This study has been carried out to develop low-alcoholic wine using pine apple peel and core considered waste materials. Five wine samples were prepared using different combinations of pineapple peel and core: 100% peel, 100% core, 50% peel with 50% core, 75% peel with 25% core and 25% peel with 75% core. All the samples were kept for 21 days in room temperature for fermentation and evaluated for alcohol concentration, Brix value, pH, titratable acidity and sensory characteristics. According to the sensory evaluation, the best sensory attributes for aroma, taste, sweetness, color, clarity, mouth feel, alcohol strength and overall acceptability were shown in wine which was prepared using 100% pineapple core. In all wine samples, the alcohol concentration was between 3.0 - 4.5% (v/v), and there was no significant difference ($p>0.05$) in the alcohol percentage of all five wine samples. Further, there were no significant differences in pH (3.7 - 3.9), titratable acidity (0.2 - 1.3%) and Brix value (2.0 - 2.5) across all wine samples. This study demonstrates that low-alcoholic wine can be prepared using pineapple core and peel as waste material, but the wine prepared using pineapple core exhibited good sensory properties.

Keywords: low alcoholic wine, pineapple core, pineapple peel, pineapple waste

Corresponding Author: grathnayake8@gmail.com

ID 120

Development of novel functional foods from guava (*Psidium guajava*) and veralu (*Elaeocarpus serratus*) fruits

H. K. I. D. Jayampathi[1], Vajira P. Bulugahapitiya[1*], Hashini I. Abeysuriya[2]

[1] Department of Chemistry, Faculty of Science, University of Ruhuna, Sri Lanka
[2] Department of Food Science & Technology, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Abstract

Guava (*Psidium guajava*) and veralu (*Elaeocarpus serratus*) are highly perishable fruits and are known to be rich sources of vitamins and show several important pharmacological activities. Specially veralu is an underutilized fruit, therefore consumption in the community is less. Moreover, there is post-harvest loss from guava fruits due to their highly perishability. Transforming them into functional foods with keeping their original properties will make them easily accessible throughout the year and provide nutritional and health benefits. Therefore, this study was focused on developing novel functional foods such as fruit-incorporated cereal bars from guava and veralu fruits and wine from veralu. Four formulations for cereal bars were formulated incorporating, dehydrated guava with dehydrated veralu in the ratio of 1:1 and 3:1 (C1 and C2), osmotically dehydrated guava (C3) and control (C4). The functional properties, such as proximate, antioxidant activity and physiochemical properties, were tested for those prepared products. The quality evaluation of the prepared fruit-incorporated cereal bars showed 12% of protein content, 8 % of fat, a range of 8-13% of ash and 5% of moisture content. The highest vitamin C (545.07 ± 3.46 mg/100 g) content was noted in the C3 formulation than the others. The acidity index was about 0.7%. Total phenolic and flavonoid content were recorded in the range of (60-100) mg /100g gallic acid equivalents and (10-20) mg/100 g quercetin equivalents, respectively. The sensory evaluation of C2 formulation was recorded as the highest mean score. The quality evaluation of the prepared wine showed (2.95± 0.02) of pH, (7.11 ± 0.03) g/L in tartaric acid equivalents of titratable-acidity, (2.49 ± 0.01) mg/mL of vitamin C and 11.44% ethanol content. Antioxidant properties of the wine were evaluated using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay and the IC_{50} in DPPH assay was 0.707 mg/mL. In conclusion, fruit-incorporated cereal bars and veralu wine can be served as functional foods providing health benefits and good nutritional value to the consumers, thus suitable for commercialization.

Keywords: Cereal bar, *E. serratus*, Functional food, *P. guajava*, Wine

Corresponding Author: vajira@chem.ruh.ac.lk

ID 129

Use of diet-related coping strategies by households with preschoolers in western province during the current financial crisis in Sri Lanka

C. R. Abayasinghe* and M. S. F. Sirasa

Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila NWP, Sri Lanka

Abstract

Due to the current financial crisis in Sri Lanka, the dietary behaviours of households have been drastically changed, which has badly impacted the nutritional status of preschoolers too. A cross-sectional study was conducted among households with at least one preschooler residing in Western Province, Sri Lanka. A convenient sample of parents or primary caretakers of preschoolers (n=255) was recruited from randomly selected 9 preschools from Kaduwela area. A self-administered questionnaire and a single 24-hour recall were used to collect data. The majority of the participants were females (98.9%), middle-aged adults (63.5%), belonging to Sinhalese ethnicity (97.7%) and housewives (65.7%) who have completed 13 years of school education (41%). Most households had a monthly income of less than 30000 LKR (40.7%). The percentage of households with food security was 19.66% whereas; mild food insecurity, moderate food insecurity and severe food insecurity were 33.06%, 37.65% and 9.63%, respectively. The mean Coping Strategy Index (CSI) was 13.9±22.9. Children scored a mean Dietary Diversity Score (DDS) of 4.4±1.2. Diet-related coping strategies mostly followed were; relying on less preferred and less expensive food (70%), reducing the portion size of meals (43%) and restricting the consumption of adults for small children to eat (33%). Primary caretakers' age, education level and household income showed a significant effect on household food insecurity ($p < 0.05$). Compared to the households with younger parents (≤30 years), households with middle-aged parents (>30 years) were 0.3 times less likely to be food insecure. The households that had a monthly income of below 30,000 LKR were 2.5 times more likely to experience food insecurity than the households that had a monthly income between 30,000 LKR and 60,000 LKR. In conclusion, the majority of households is food insecure and follows various diet-related coping strategies but provide a moderately diverse diet to their young members in the household. Further studies are required to examine the situation in other rural and estate areas in Sri Lanka to understand the complete situation.

Keywords: Child, Coping Strategy, Dietary Diversity Score, Food Insecurity Experience Scale, Household

***Corresponding author*:** chandanaruwanthini@gmail.com

ID 130

Validity & reproducibility of a food frequency questionnaire to assess nutritional intake among preschool children in Kegalle district, Sri Lanka

E.P.M.Subhashani* and M. S. F. Sirasa

Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila NWP, Sri Lanka

Abstract

Sri Lankan preschool children do not consume a varied and balanced diet, which has resulted in the prevalence of malnutrition among preschool age groups for several decades. An accurate assessment of children's diets is necessary to identify the current diet and evaluate the effectiveness of dietary behavior interventions. Currently, no validated food frequency questionnaire (FFQ) exists to measure the habitual dietary intake of Sri Lankan preschool-aged children. Therefore, a validated dietary assessment method is necessary to evaluate the validity and reliability of an adapted food frequency questionnaire (FFQ) to assess energy and nutrient intake in preschool-aged children. A cross-sectional study was conducted among the preschoolers in Ruwanwella division, Kegalle district, Sri Lanka. A total of 52 preschoolers aged 2–5 years participated in the validation study, while a subsample of 15 participants joined the reliability study. The FFQ is modified from the validated FFQ for adults in Sri Lanka and comprises 114 food items from 8 food groups. A three-day estimated dietary record (3DR) was used as a reference, and reliability was assessed through a second administration of the FFQ (FFQ2), four weeks after the first administration (FFQ1). Spearman's correlations showed a lower correlation between FFQ and 3DR for the validation study ($r = -0.029$ to 0.192) except for vitamin D ($r = 0.215$), energy ($r = 0.217$), calcium ($r = 0.234$) and vitamin C ($r = 0.339$). The results indicated that FFQ overestimated the intakes of 3DR for energy (2572.1±1 vs 1025.9±289.5 kcal) and all nutrients, including protein (72.6 ± 3.4 vs. 31.3 ± 1.0 g/day). The portion sizes of FFQ need to be reconsidered and the food list has to be modified to improve the validity of FFQ in future studies.

Keywords: Food frequency questionnaire (FFQ), Preschoolers, Reproducibility, Sri Lanka, Validation

***Corresponding author*:** maheshasubashani@gmail.com

ID 131

Assessment of Raw Milk Quality Collected from Suburban Sale Centres in Jaffna District, Sri Lanka

T. Prabakaran[1*], A. Briyangari[1] and P. Amutha[2]

[1]Department of Animal Production and Health, Jaffna, Northern Province, Sri Lanka
[2]Veterinary Investigation Centre, Jaffna, Sri Lanka

Abstract

The annual milk production of Sri Lanka is significantly bolstered by the Northern Province, with the Jaffna District playing a particularly vital role in this regard. However, the dairy sector is faced with a major concern in the form of the quality of freshly drawn milk, which has far-reaching implications for both direct domestic consumption and the production of various dairy products. Against this backdrop, the primary objective of this study is to comprehensively evaluate the quality of raw milk and effectively identify instances of adulteration across the suburban areas of Jaffna, Sri Lanka. The study was carried out on 1723 milk samples collected from 25 milk sale centres from 2018 to 2022 and milk composition, microbial quality and adulterants were tested. The data were analysed using one way ANOVA procedure in Minitab. The results revealed that water was the common adulterant (64%) found in milk ranging from 13.8 to 55.38% and it was pronounced in the dry season ($p<0.05$) than wet season. The mean specific gravity (SG) was 1.025±0.0039. Only half of the total samples had normal values (1.025 –1.35) of SG which further validates the water adulteration. Sugar, salt, starch and urea were the other extraneous substances found in insignificant quantity (3, 2, 2 and 1%, respectively). The average values obtained for milk fat, Solid Non-Fat and Total Solid contents were 2.63±0.87%, 7.416±0.909% and 9.888±1.464%, respectively. The mean values of the milk components were not statistically significant between years. The organoleptic evaluation confirmed that the majority (86%) of the milk samples met the standards for physical properties. Microbial analysis with alcohol and clot on boiling tests ensured the absence of mastitis-causing microbes and the heat stability of the samples. The resazurin test showed promising results (62%) on the hygienic and keeping quality of milk, whereas 38% of the samples were rejected due to high microbial load. This study found water was the primary adulterant and only few samples were detected with other substances. Microbiological and compositional quality of milk was in required standards.

Keywords: Adulterants, Contamination, Compositional quality, Public health

Corresponding author: tprabavs@gmail.com

ID 134

Comparative study for a potential usage of underutilized or wasted fruits for sanitizer production

M.D. Priyamali[1], S.P. Rebeira[2*], M.P.M. Arachchige[1] , M.H.M.D.M.L. Medagoda[2], H.B. Sasiprabha[2]

[1]Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka
[2]Food Research Unit, Department of Agriculture,Gannoruwa Road, Peradeniya, Sri Lanka

Abstract

The Covid-19 pandemic situation was a recent issue that drew global concern about the use of hand sanitizer to control the spread of pathogens through personal contact. This study aimed at bioethanol production using abundant wasted fruits or underutilized fruits as a cheaper raw material source. Six species of overripe fruits: banana, mango, papaya, star fruit, sapodilla, and jackfruit were tested at three different fermentation periods. Pulps were extracted from surface sterilized fruits using $KMnO_4$ (5% w/w) and fermentation was facilitated by inoculating *Saccharomyces cerevisiae* as inoculum with a calculated amount of sucrose and urea. The pulps were analyzed for proximate composition (moisture, ash, fiber analysis) and physicochemical parameters (pH, brix, acidity) and the concentration of ethanol and methanol fermented pulps were measured in three-week intervals. The highest ethanol concentration was resulted by jack fruit at the ninth week (17.3±0.416%) followed by banana at the sixth and ninth weeks (16.4±0.586% and 16.27±0.902% respectively). Jack fruit and banana showed a significantly high ethanol production even at the third week (16.1±0.265% and 15.73±0.416 respectively). During fermentation, all the fermented samples contain high amount of methanol (>15%). Therefore, the methanol production was controlled by adjusting pH (2.5-3.0) using citric acid. pH adjusted samples have recorded ethanol 14.8±0.28%, methanol 6.7±0.14%, Brix 6.15±0.07 and pH 3.65±0.01, respectively. The steam distillation method was carried out to purify the alcohol from fermented samples. The highest mean ethanol concentration was observed in jackfruit (71.33%). The methanol percentage of the samples decreased with time and the final product consisted of a negligible amount of methanol (0.002%). The highest ethanol percentage was observed in fruits that had the highest brix values. Total plate count study after sanitizing hands with 75% ethanol produced by jackfruit revealed that the produced sanitizer can be successfully used to produce hand sanitizer.

Keywords: Bioethanol, Distillation, Fermentation, Inoculum, Sanitizer

Corresponding Author: srikanthi.rebeira@yahoo.com

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C.M. Nawaratne	champa@agricc.ruh.ac.lk	University of Ruhuna, Sri Lanka
C.P. Rupasinghe	chintha@ageng.ruh.ac.lk	University of Ruhuna, Sri Lanka
C.J. Gajaweera	gajaweera@ansci.ruh.ac.lk	University of Ruhuna, Sri Lanka
D.A.L. Leelamanie	leelamanie@soil.ruh.ac.lk	University of Ruhuna, Sri Lanka
Dananjali Gamage	dananjali@agbio.ruh.ac.lk	University of Ruhuna, Sri Lanka
Dammini Premachandra	dammini@zoo.ruh.ac.lk	University of Ruhuna, Sri Lanka
Deepthi Lakmini	wgdlakmini@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
Dilanthi Koralagama	dilanthi@agecon.ruh.ac.lk	University of Ruhuna, Sri Lanka
Dimuthu Piyaratne	dimuthu@agricc.ruh.ac.lk	University of Ruhuna, Sri Lanka
D.L.C.K. Fonseka	dlckumari@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
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Dushan Kumarathunge	dushank@agri.ruh.ac.lk	University of Ruhuna, Sri Lanka
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K.K.I.U. Aruna Kumara	kkiuaruna@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
K.N.N. Silva	nadee@agecon.ruh.ac.lk	University of Ruhuna, Sri Lanka
M.K.Thulani Amarasinghe	thulani@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
Mangala De Zoysa	mangala@agecon.ruh.ac.lk	University of Ruhuna, Sri Lanka
Menaka Fernando	menaka@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
N.S.B.M. Atapattu	nsbm@ansci.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nalika Ranathunge	nalika@agbio.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nalini Hirimuthugoda	yasho@ansci.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nanditha Hettiarachchi	nandita@mme.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nilantha de Silva	nilanthade@agecon.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nilantha Lakshman	nilantharafta@gmail.com	University of Ruhuna, Sri Lanka
Nilanthi Dahanayake	nilanthi@agbio.ruh.ac.lk	University of Ruhuna, Sri Lanka
Nayana Narayana	nayana@ansci.ruh.ac.lk	University of Ruhuna, Sri Lanka
Niluka Nakandalage Dona	niluka@crop.ruh.ac.lk	University of Ruhuna, Sri Lanka
Niluni Wijesundara	niluni@uwu.ac.lk	Uva Wellassa University, Sri Lanka
Prabhath Priyankara	prabath@agricc.ruh.ac.lk	University of Ruhuna, Sri Lanka
P.W.A. Perera	anton@ansci.ruh.ac.lk	University of Ruhuna, Sri Lanka
Rajika Amarasinghe	rajika@soil.ruh.ac.lk	University of Ruhuna, Sri Lanka
S. Wijetunga	swije@ageng.ruh.ac.lk	University of Ruhuna, Sri Lanka
Sandun Piyaruwan	sandunp@agri.ruh.ac.lk	University of Ruhuna, Sri Lanka
Seneviratne Nawaratne	sbnava1234@yahoo.com	The University of Sri Jayewardenepura, Sri Lanka
Sudarshanee Geekiyanage	sudarshanee@agbio.ruh.ac.lk	University of Ruhuna, Sri Lanka
Sumali Fernando	gsnfernando@fst.ruh.ac.lk	University of Ruhuna, Sri Lanka
Thanuja Liyanage	liyanage@soil.ruh.ac.lk	University of Ruhuna, Sri Lanka
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Dr. Jinendra Balasooriya
Dr. Aruni Wickramaratne
Dr. Nadeeshani De Silva
Dr. Niluka Nakandala

Invited members
Dr. L. Nugaliadda
Dr. R.W. Punchihewa
Prof. M. Liyanage

(07) Online Registration of Participants and Inaugural Session

Dr. Menaka Fernando (Chairperson)
Dr. M.D.P. Kumaratunga (Co-Secretary)
Ms. W.M.A.M Karunarathne (Co-Secretary)

Snr. Prof. D.A.L. Leelamanie
Prof. Yashodha Hirimutugoda
Prof. Nilanthi Dahanayaka
Prof. Sudarshani Geekiyanage
Prof. Anton Perera
Prof. Nayana Narayana
Mrs. Chintha Rupasinghe
Mrs. Thulani Amarasinghe
Dr. Dilanthi Koralagama
Dr. Nadeeshani De Silva
Mr. H.I.G.S. Piyaruwan
Mr. Arawinda Bellanthudawa
Ms. Hashini Abeysuriya
Mr. Udaranga Samarawickrama
Ms. H.L.C. Himanda

(08) Scientific Sessions (Presentations)

Prof. Deepthi Lakmini (Chairperson)
Dr. Aruni Wickramaratne (Co-Secretary)

Prof. Indunil Pathirana
Prof. Sudarshani Geekiyanage
Prof. Nilantha Lakshman
Prof. Buddi Walpola
Prof. Nilanthi Dahanayaka
Prof. G.C. Samaraweera
Dr. Jinendra Balasooriya
Dr. Amani Mannakkara
Dr. Chamila Wijekone
Dr. Niluka Nakandala
Mrs. Nimal Shanthi Gunarathna
Mrs. Thulani Amarasinghe
Mr. Daminda Thushara
Mr. Charith Jayawickrama
Mr. Hemantha Dissanayake
Mr. Kapila Premakumara
Mr. Dilshan Chamara
Mr. P.K. Lal
Mr. Upali Wanithunga
Mr. Harsha Bandara
Ms. A. Rathnayake
Ms.Sumithra Abeysekara
Mr. Harsha Dhanasekara
Mr. Gayan Chinthaka
Mr.Nuwan Chameera
Ms. H.L.C. Himanda

(09) Students Session Coordination - Young Graduates' Forum

Prof. Kumari Fonseka (Chairperson)
Dr. Aruni Wickramarathna (Secretary)

Prof. Sudarshanee Geekiyanage
Prof. Nilantha Lakshman
Prof. Nayana Narayana
Mrs. Nimal Shanthi Gunarathna
Dr. Amani Mannakkara
Dr. Buddhika Perumpuli
Dr. Prabath Priyankara
Dr. Rajika Amarasinghe
Mr. H.K.M.S. Kumarasinghe
Dr. Anupa Koswatta

(10) Catering and Home Affairs

Prof. Nilanthi Dahanayake (Chairperson)
Prof. Buddi Walpola (Secretary)

Dr. Buddhika Perumpuli
Dr. Aruni Wickramarathna
Dr. Niluka Nakalanda
Dr. Nadeeshanee De Silva
Dr. Niyomi Pethiyagoda
Mr. H.I.G.S. Piyaruwan
Mr. Arawinda Bellanthudawa
Ms. Hashini Abeysuriya
Mr. Daminda Thushara
Ms. Champika Dolamulla (Sub Warden)
Mr. Charith Jayawickrama
Mr. A. Rathnayake
Mr. Hemantha Dissanayake
Mr. M.M.K. Premakumara

(11) Symposium Night & the Excursion

Prof. A.L. Sandika
(Co-Chairperson)
Prof. Nilantha Lakshman
(Co-Chairperson)
Dr. Chandima Gajaweera
(Secretary)

Snr. Prof. G.Y. Jayasinghe
Prof. Indunil Pathirana
Prof. Nilanthi Dahanayaka
Prof. G.C. Samaraweera

Mr. H.K.M.S. Kumarasinghe
Dr. Anuga Liyanage
Dr. Jinendra Siriwijaya
Mr. Daminda Thushara
Mr. H.I.G.S. Piyaruwan

International Symposium on Agriculture and Environment (ISAE) – 2023

Lighting of the traditional oil lamp by the distinguish guests of ISAE 2023

Welcome address by Dr. I.R. Palihakkara – Coordinator ISAE 2023

Presenting the token of appreciation for the Chief Guest of ISAE 2023 - Her Excellency Mrs. Dewi Gustina Tobing, the Ambassador of Indonesia to Sri Lanka by the Deputy Vice Chancellor - University of Ruhuna

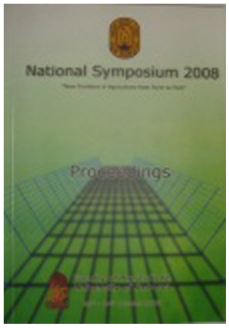
His Excellency Mr. Hideaki MIZUKOSHI, the Ambassador of Japan to Sri Lanka at the Special Session- 'Japan at Ruhuna' of ISAE 2023

Speech by Japan International Cooperation Agency (JICA) delegates in Sri Lanka at the 'Japan at Ruhuna' special session at ISAE 2023

Q&A session of 'Japan at Ruhuna' special session at ISAE 2023

Group photo with the participants of the ISAE 2023 Inaugural Session

Group photo with the sponsors of ISAE 2023


National Symposium 2008
Proceedings


ISAE
2013
International Symposium on Agriculture & Environment
Agriculture and Ecosystem Health: Balancing the Issues
Proceedings
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ISAE
2019
International Symposium on Agriculture & Environment
Networking for smart agriculture and sustainability of bioresources
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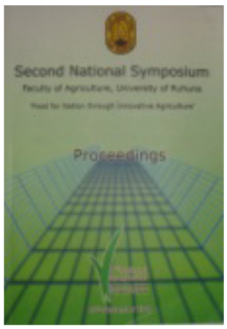
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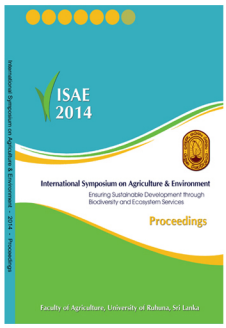
ISAE
2014
International Symposium on Agriculture & Environment
Ensuring Sustainable Development through Biodiversity and Ecosystem Services
Proceedings
Faculty of Agriculture, University of Ruhuna, Sri Lanka


ISAE
2020
International Symposium on Agriculture & Environment
Redefining agricultural & environmental policies: Emerging challenges and new horizons
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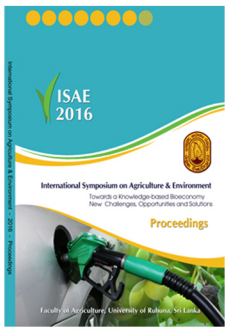
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New Challenges, Opportunities and Solutions
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Challenges in Agriculture:
Impact, resilience and adaptation for sustainability
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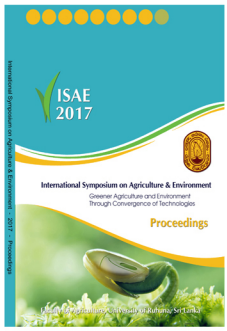
ISAE 2011
International Symposium on Agriculture and Environment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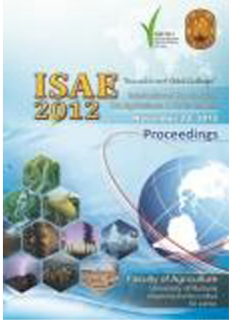
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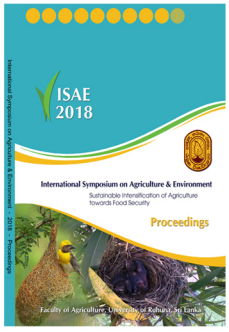
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