

# Book of Abstracts

## The 5<sup>th</sup> International Conference on Agriculture, Food Security and Safety

(AgroFood 2024)

21-22 August 2024 | Hybrid (Online and In-Person)

Committee of the AgroFood 2024

iConferences

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Book of Abstracts of the 5<sup>th</sup> International Conference on Agriculture, Food Security and Food Safety (AgroFood 2024)

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## MESSAGE FROM THE CONFERENCE CHAIR AgroFood 2024



Welcome to the 2024 Global AgroFood Innovation Conference!

We are thrilled to have you join us for this premier gathering of visionaries, innovators, and leaders dedicated to transforming the future of food and agriculture. Held on the 21<sup>st</sup> and 22<sup>nd</sup> of August 2024 in beautiful Colombo, Sri Lanka, this conference will explore the most pressing topics and groundbreaking advancements shaping agriculture and food safety. This year, our focus is to discuss and propose sustainable practices that ensure the long-term health of our planet. Additionally, we are exploring efficiency-driven innovations such as precision agriculture and advanced supply chain transparency, which aim to streamline operations and minimize waste. As our world continues to evolve, cutting-edge technologies like AI revolutionize decision-making processes and enhance productivity, fostering a more resilient and adaptable agricultural system. Integral to this evolution are progressive policies and regulations that provide a supportive environment for these advancements to flourish. Together, these elements are shaping the present landscape of agriculture and laying the foundation for a future where food systems are more sustainable, equitable, and capable of meeting the growing demands of our global population. We are excited about the knowledge-sharing, collaborations, and innovative solutions that will emerge from this conference. Your commitment to the future of agriculture and food systems is greatly appreciated. Thank you for being part of this dynamic community. Together, we can drive meaningful change and create a more sustainable, equitable, and resilient world. Welcome to Colombo, and let's make this conference an inspiring and impactful experience for all!

Dr. Esther Garcia-cela  
Conference Chair, AgroFood 2024  
Senior Lecturer in Applied Mycology,  
School of Life and Medical Sciences (LMS),  
University of Hertfordshire, United Kingdom

## MESSAGE FROM THE ACADEMIC PARTNER AgroFood 2024



It is my distinct honour and pleasure to welcome you to the 5th International Conference on Agriculture, Food Security, and Food Safety (Agro Food 2024). As an academic partner, we are thrilled to collaborate on this prestigious platform that gathers eminent scholars, industry leaders, and passionate professionals from around the globe. This conference serves as a pivotal forum for discussing cutting-edge research, innovative solutions, and sustainable practices that address the critical issues facing our global food systems today. In a world where agriculture and food security are paramount to the well-being of societies, Agro Food 2024 offers a unique opportunity to explore the latest advancements and trends in agricultural technology, food production, and safety protocols. The discussions and collaborations that will unfold over the next few days are essential in driving forwardthinking strategies and policies that ensure a resilient and secure food supply chain for future generations.

We are particularly excited about the diverse range of topics that will be covered, from sustainable farming practices and biotechnology to food safety standards and nutrition security. The insights gained from these discussions will not only contribute to academic knowledge but will also have practical implications for policymakers, practitioners, and communities worldwide. Furthermore, the networking opportunities provided by this conference will foster valuable connections and collaborations that will extend beyond these sessions, enhancing our collective capacity to tackle the complex challenges in agriculture and food security.

We extend our heartfelt gratitude to all the speakers, sponsors, and attendees for their contributions and participation. Your presence and input are invaluable to the success of Agro Food 2024. Together, let us embark on this journey of knowledge-sharing and innovation to pave the way for a sustainable and food-secure future.

Welcome to Agro Food 2024!

Dr Muhammad Azhar Ali,  
Academic Partner AgroFood 2024,  
Department of Food Engineering,  
University of Agriculture Faisalabad Pakistan of Agriculture,  
Pakistan.

## MESSAGE FROM THE ACADEMIC PARTNER AgroFood 2024



With great pleasure, I am composing the foreword for the 5th international conference on Agriculture, Food Security and Food Safety (AgroFood 2024) organised by iConferences, Sri Lanka on 21-22 August 2024. This is the 4th time the Department of Food Science and Nutrition, University of Mysore, India is associated with iConferences as an academic partner.

Food and nutrition are the foundation for good health, this encompasses good and safe practices of food safety and security too, along with agricultural practices. Hunger and malnutrition among children and vulnerable populations are prevailing health problems in the world particularly in developing countries. Despite adequate agricultural produce, many strata of society are not secure in terms of food and nutrition. According to the report "The State of Food Security and Nutrition in the World" two billion of the global population are experiencing moderate to severe food insecurity.

I appreciate the organisers for choosing an appropriate team to address the issues prevailing globally and in particular the developing countries. The organizers have received many abstracts which indicated the interest of all participant to find solutions to synergize research and progress toward achieving food and nutritional security.

I extend a warm welcome to all the participants.

Dr. Asna Urooj,  
Academic Partner AgroFood 2024,  
Professor & Chairperson,  
Department of Studies in Food Science & Nutrition,  
University of Mysore, India.



## MESSAGE FROM THE ACADEMIC PARTNER AgroFood 2024



On behalf of the Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University (IPB), Indonesia, it is our distinct honour and pleasure to welcome you to the 5th International Conference on Agriculture, Food Security, and Safety (AgroFood 2024). We are proud to be the academic partner for this prestigious event, which will be held from 21–22 August 2024 in Colombo, Sri Lanka, in both online and in-person formats.

The theme for this year’s conference, “*AgriFood 360: Feeding the Future*,” encapsulates the comprehensive approach needed to address the multifaceted challenges of global food systems. This theme highlights the importance of integrating diverse perspectives and innovative practices across the entire agricultural spectrum—from sustainable farming and advanced biotechnology to food safety and nutrition security. By fostering a 360-degree view of the agrifood sector, we aim to promote holistic solutions that not only enhance productivity but also ensure environmental sustainability and social equity.

AgroFood 2024 brings together participants from all over the world, including distinguished scholars, industry leaders, and dedicated professionals. This gathering provides a unique platform to exchange ideas, share cutting-edge research, and develop strategies that will shape the future of agriculture and food security.

We extend our heartfelt gratitude to all speakers, sponsors, and attendees for their contributions. Your presence and input are invaluable to the success of AgroFood 2024. Together, let us embark on this journey of knowledge-sharing and innovation to create a sustainable and food-secure future.

Welcome to AgroFood 2024!

Prof Edi Santosa,  
Academic Partner of AgroFood 2024,  
Head of the Department,  
Department of Agronomy and Horticulture, Faculty of Agriculture,  
Bogor Agricultural University (IPB),  
Indonesia

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# **FOOD SECURITY AND FOOD PROCESSING**

A1

[01]

**ASSESSING THE ROLES OF CLIMATE CHANGE AND HUMAN BEHAVIOR IN  
GLOBAL FOOD RESILIENCE***Shan, S.*

Department of Sociology, Zhejiang University, China

This study employed a machine learning approach to investigate the impacts of climate change and human behavior on global food resilience, specifically focusing on the simulation of interactions between earth and human systems. It identified three key dimensions—extreme natural shocks, human-natural interactions, and anthropogenic factors—to simulate the complex impacts on the global food system. These were further broken down into five sub-dimensions: natural features, greenhouse gas emissions, demographic and health indicators, economic and military factors, and environmental infrastructure, encompassing a total of 3066 features. The research aimed to uncover sustainable feedback patterns in food pricing by modifying growth trends across these dimensions. Utilizing the Principal Component Analysis (PCA) method to overcome the challenge of dimensionality, the study pinpointed the primary elements and their interactions affecting long-term global food price trends. The findings, derived from decision tree model predictions, highlight the system's behavioral tendencies and reveal the top 10 features contributing to "overshoot and collapse" scenarios in the global system over the last two decades. This investigation into the limitations imposed by the natural world on human activity assesses the cumulative impact of natural disasters and human actions on global food security, ultimately advocating for pathways toward sustainable living.

Keywords: Machine learning, climate change & human behavior, food resilience & dynamics, PCA & decision trees, food security & sustainability

A2

[02]

## CHANGING RATES OF ANTIOXIDANT PROPERTIES IN FRESH FRUITS DURING STORAGE

Abey Suriya, A.P.H.I.<sup>1</sup>, *Bulugahapitiya, V.P.*<sup>2</sup>, Jayatissa, L.P.<sup>3</sup>

<sup>1</sup>Department of Food Science and Technology, Faculty of Agriculture, University of Ruhuna, Sri Lanka

<sup>2</sup>Department of Chemistry, Faculty of Science, University of Ruhuna, Sri Lanka

<sup>3</sup>Department of Botany, Faculty of Science, University of Ruhuna, Sri Lanka

Fruits can be considered as the main source of vitamin C and natural antioxidants in human diet. The knowledge of the effect of storage conditions on the antioxidant properties of fruits is important to ensure the quality of fruits when those reach the consumers. Therefore, this study was focused on the effect of storage temperature (room temperature, refrigeration, freezing) and storage duration on the quantity of total vitamin C (TVC), ascorbic acid, total phenolic, total flavonoid, and DPPH radical scavenging capacity and Ferric reducing antioxidant potential on selected fruits. This study considered 32 species of fresh fruits including commonly consumed and underutilized fruits. According to the results of multivariate analysis of variance, there was a statistically significant ( $P < 0.0005$ ) effect of fruit type, storage condition and interaction effect of fruit type and the storage condition on the studied dependent variables. The rate of loss of studied antioxidants was the highest at room temperature and under freezing conditions it was higher than under refrigeration. Out of the 32 species of studied fruits, 9 fruit types showed decrease in all the studied variables during storage. During storage, reduction as well as accumulation of antioxidants could be observed in some fruits. The highest accumulation rate of TVC was observed in *Phyllanthus emblica*. The significantly highest rate of change in studied antioxidants was observed in *Anacardium occidentale* (yellow variety). *Mangifera indica*, *Aegle marmelos*, *Phyllanthus emblica*, *Anacardium occidentale* (Red) and *Carissa carandas* had the considerably higher rates of losses in studied antioxidants during storage. As conclusion, storage of fruits under refrigeration can be recommended for many fruits to prevent loss of antioxidants.

Keywords: Antioxidants, fresh fruits, storage, vitamin C

A3

[03]

**DEVELOPMENT OF A NOVEL CONFECTIONERY PRODUCT USING SELECTED  
LOCALLY AVAILABLE INGREDIENTS***Marasinghe, M.A.G.M.*

Food Science and Technology Department, University of Sri Jayewardenepura, Sri Lanka

Gluten intolerance is a global issue, leading to a growing trend towards gluten-free diets. Therefore, this research developed a gluten-free confectionery using underutilized ingredients like coconut flour, arrowroot flour, and pumpkin puree, addressing post-harvest vegetable loss and promoting sustainability. The study's objectives included analyzing physicochemical properties, proximate composition, mineral composition, antioxidant capacity, and shelf-life determination. Two sensory analysis sessions were conducted to determine consumer preference, with pumpkin puree being preferred over pumpkin powder in the first session. The correct ratio of coconut flour to arrowroot flour in a composite flour mixture was determined as 62.5:12.5 in the second session. The final product produced had physicochemical properties measured, including color values and pH levels. The cake crumb color was lighter than the crust, and the pH value was slightly acidic. Texture profile analysis showed the developed product to be harder than normal wheat flour cake. Water and oil absorption capacities were also found to be higher in the composite flour. According to the proximate analysis of the product, moisture %:  $38.20 \pm 0.20$ , total fat %:  $15.52 \pm 0.12$ , ash %:  $2.43 \pm 0.054$ , protein %: 8.85, fiber %:  $4.67 \pm 0.11$ , and carbohydrate%: 30.33 were obtained. The product had a high concentration of sodium and potassium in mineral analysis. Additionally, the developed product showed a higher antioxidant capacity than normal wheat flour cake. Shelf-life evaluation indicated the product had microbial standards for six weeks of storage.

Keywords: Gluten intolerance, Coconut flour, Arrowroot flour, Physicochemical

A4

[04]

**EFFECT OF ULTRASOUND-ASSISTED SAMPLE-TO-SOLVENT RATIO OF CLOVE (*Syzygium aromaticum*) ETHANOLIC EXTRACTS ON ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES**

Chong, K.H.<sup>1</sup>, Payal, S.P.<sup>2</sup>, Astina, J.<sup>2</sup>, Nor-Azmiraah, A.J.<sup>3</sup>, Jiang, S.<sup>1</sup>, Madhavan, K.<sup>1,4</sup>, Lee, E.<sup>3</sup>, Ismail-Fitri, M.R.<sup>1</sup>, Hasanah, N.N.<sup>1</sup>, *Nor-Khaizura, M.R.*<sup>1,3</sup>

<sup>1</sup>Department of Food Science, Faculty of Food Science and Technology, Universiti Putra Malaysia

<sup>2</sup>Indonesia International Institute for Life Sciences, Indonesia.

<sup>3</sup>Laboratory of Food Safety and Food Integrity, Institute of Tropical Agriculture and Food Security, Universiti Putra Malaysia

<sup>4</sup>Department of Biotechnology, School of Biotechnology, Mila University, Malaysia

*Syzygium aromaticum*, commonly known as cloves, is considered one of the richest dietary sources of antioxidant and polyphenolic compounds. The phenolic property and antimicrobial activity of cloves can be enhanced by using novel extraction techniques such as ultrasound-assisted extraction (UAE). This study aimed to optimise the sample-to-solvent ratio for ultrasound-assisted ethanolic clove extracts (ECE), to evaluate the phenolic contents, antioxidant properties, and antimicrobial properties of ethanolic clove extract. The phenolic contents were measured using total phenolic content (TPC), and total flavonoid content (TFC) assays while the antioxidant properties were determined using 2,2- diphenyl-1-picrylhydrazyl (DPPH). The antimicrobial properties were determined with well diffusion assay, minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) determinations on *E. coli* and *S. aureus*. The 2.5% (w/v) sample to-solvent ratio of ECE conferred the highest TPC, TFC, and antioxidant activity, while the 5% (w/v) sample-to-solvent ratio of ECE provided the highest yield. The results obtained from well diffusion assay indicated that the 2.5% (w/v) sample-to-solvent ratio of ECE were most effective against *S. aureus* and *E. coli*, and there was a greater inhibition zone for *S. aureus* than for *E. coli*. For MIC and MBC, the cloves concentration did not impact the results of any of the antimicrobial analyses. Overall, it was found that 2.5% (w/v) sample-to-solvent ratio of ECE was optimum with the highest phenolic contents, antioxidant and antimicrobial properties as any higher concentration resulted in oversaturation and hence a reduction in bioactivity.

Keywords: *Syzygium aromaticum*, Ultrasound-assisted extraction, Sample-to-solvent ratio, antioxidant activity, antimicrobial properties

A5

[05]

## FOOD SECURITY AND THYROID HEALTH: NUTRITIONAL STRATEGIES FOR PREGNANT WOMEN

*Farha, S.S.<sup>1,2</sup>, Urooj, A.<sup>1</sup>*

Department of Studies in Food Science and Nutrition, University of Mysore, India

Food security, a critical determinant of health, is particularly significant for pregnant women due to their increased nutritional needs. Glucosinolates (GLS), found in cruciferous vegetables, have been associated with cancer prevention, while iodine is essential for thyroid function and fetal development. However, excessive intake of GLS can interfere with iodine uptake, potentially leading to thyroid dysfunction. Aims in estimating the GLS and analyze the consumption pattern of foods rich in iodine and goiterogens, among pregnant and non-pregnant women. Widely consumed *Brassica oleracea var. Capitata* (cabbage) in the region was selected to estimate the GLS and other volatile components by GC-MS method. A Snapshot study- pregnant and non-pregnant women (n=60) with normal and altered thyroid functions were selected and grouped into four. Frequency consumption of foods rich in iodine and goiterogens using 24hr recall and FFQ was studied. The results revealed the relative percentage of the total identified volatile compounds including GLS in cabbage was 99.99%. GLS hydrolysis products comprised about 37.39% while the rest of 62.51% were other volatile components identified in cabbage. The locally available foods rich in iodine and goiterogens were grouped into four basic food groups and the mean consumption of these foods were more by group1 (healthy non- pregnant) and group4 (healthy pregnant women) compare to group2 (non-pregnant with altered thyroid function and group3 (pregnant with altered thyroid function) respectively on daily and weekly basis. The findings underscore the need for targeted nutritional guidance to ensure optimal maternal and fetal health outcomes. Promoting food security with a focus on balanced consumption of GLS and iodine can contribute to healthier pregnancies and improve long-term health trajectories for both mothers and their children.

Keywords: Food security, thyroid health, pregnancy, glucosinolate, Iodine

A6

[06]

### DECOLOURATION OF PIPERINE POWDER EXTRACTED FROM BLACK PEPPER USING ACTIVATED CARBON

Gowthaman, S., Rajapakse, R.P.N.P., Mendis, B.E.P., *Harischandra, T.<sup>1</sup>*

Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Sri Lanka

The transparent whitish colour of piperine is a good quality parameter identified by the food industry. Piperine extracted from black pepper has a distinct greenish appearance due to contamination with chlorophyll during extraction. This research aimed to decolour piperine powder extracted from black pepper by utilizing activated carbon. Activated carbon treatments were done to piperine at different combinations of time and temperature. Piperine (10 ml) treated with 3g of activated carbon at 30°C for 10 min resulted in a  $94.196 \pm 0.358$  % reduction of chlorophyll. However, it caused a  $95.120 \pm 0.490$  % reduction in piperine yield, which is not desirable. After further testing, 1 g of activated carbon per 10ml of extract at the same temperature and time resulted in a  $57.240 \pm 0.268$  % reduction of chlorophyll and only a  $6.917 \pm 0.353$  % reduction in piperine yield compared to the control. This was deemed the optimal treatment combination. Then 1 g of activated carbon washed with 80% ethyl acetate and 20% hexane was used at the same above conditions. This resulted in a  $48.341 \pm 0.290$  % reduction of chlorophyll compared to the control, with only a  $1.0511 \pm 0.072$  % reduction in piperine yield. The piperine content in both control and activated carbon treated piperine powder ( $92.2 \pm 0.616^a$  and  $91.836 \pm 0.357^a$  respectively) was not significantly different ( $P > 0.05$ ). Additionally, the lightness value for the activated carbon-treated sample was higher than that of the control. Overall, the results of this study could offer practical solutions to reduce chlorophyll content in piperine powder while improving its visual appearance

Keywords: Activated carbon, Piperine powder, Chlorophyll, decoloration

A7

[07]

**PRACTICES AND PERCEPTIONS OF UAE RESIDENTS: FOOD SAFETY IN HANDLING, AND PREPARATION OF FISH, CONSUMPTION, AND NUTRITION FROM FISH**

Al-Marzooqi, N.A., Bahi, A., *Bhaskaracharya, R.K.*

Department of Food Science, College of Agriculture and Veterinary Medicine, United Arab Emirates University, Al-Ain, United Arab Emirates

UAE, with its extensive seafront, is well developed for fishing, resulting in its diverse population becoming amongst the highest fish consumers among the Gulf countries. This study aimed to investigate food safety practices in handling and preparing fish, consumption trends, and perceptions of nutrition from fish among UAE residents. A cross-sectional survey questionnaire was conducted on a statistical sample of 390 participants using convenience sampling. This study targeted people aged 18+ for their purchasing, handling, preparing, and/or consuming fish. The survey questionnaire included four parts: safety of fish handling, fish preparation and consumption trends, perception of nutrition from fish consumption, and demographic characteristics of the UAE residents. The study respondents included a Female: Male ratio of 60:40, with over 48% (25-44 years) and 33% (18-24 years) old. Participants (67%) purchased fresh/refrigerated fish, followed by frozen (18%), and majority (77%) refrigerate the fish within 2 hours of purchase. During preparation, 80% of respondents consider washing hands as important. Participants (46%) preferred baked fish, followed by pan-fried (34%), deep-fried (26%), and smoked (19%), which were typically consumed about thrice/week. Participants preferred consuming Hamour (41%), Kannad (36%), Salmon (34%), and Tuna (32%) species thrice/week. Participants identified fish as an excellent source of omega-3 fatty acids (72%), protein (60%), iron (34%), and vitamin D (33%). UAE residents have a good understanding of food safety practices of fish purchase, handling, and preparation, with a preference for baking the fish over other cooking techniques. The survey response strongly identified fish as a healthy source of nutrition.

Keywords: Fish Preparation, Safety, Perception, Nutrition, UAE Survey

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A8

[08]

**EXPLORING SUSTAINABLE FOOD CONSUMPTION RESEARCH AGENDA IN  
SOUTH AFRICA: POSSIBILITIES FOR CIRCULAR ECONOMY BASED  
APPROACHES**

*Yobe, C.L., Muchara. B.*

University of South Africa, South Africa

The growing income levels and population worldwide have increased the demand for food, leading to unsustainable production and consumption practices. Food waste has significant ecological impacts, such as contributing to greenhouse gas emissions through decomposition in landfills. This study aims to explore the barriers and motivators for sustainable food consumption in South Africa. One aspect of this issue is examining the potential for the circular economy approaches to address post-harvest losses in the food supply chain. Further along the supply chain, food losses become more evident at the retail level, where the removal of unsold food from the chain—at the consumer level, generated waste by the disposal of unconsumed food. Circular economy strategies can help reduce waste by directing edible food towards donations and finding alternative uses for food unsuitable for consumption, such as converting it into energy or animal feed. Implementing circular economy strategies can benefit society, the economy, and the environment in South Africa. However, policy support is needed to transition fully to a circular economy model.

Keywords: Circular economy, food loss and waste, sustainable food consumption, Sustainable Development Goals, South Africa

# **CLIMATE CHANGE AND AGRICULTURE TECHNOLOGY**

**B1****[09]****ENTERIC METHANE EMISSION IN DAIRY CATTLE UNDER VARYING MANAGEMENT AND CLIMATIC CONDITIONS***Wijebandara, K.G.C.B.<sup>1</sup>, Silva, G.L.L.P.<sup>2</sup>*<sup>1</sup>Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka<sup>2</sup>Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

In the dairy sector of Sri Lanka, 88% of greenhouse gas emission is accounted by methane produced by enteric fermentation. Enteric methane is associated with net energy requirements for maintenance and production of animals as well as feed dry matter digestibility. This study was focused on estimating the enteric methane emission of dairy cattle breeds (Jersey, Friesian and Sahiwal) and their crossbred in different management systems (intensive/extensive) in dry, intermediate and wet zones of Sri Lanka, using the Tier-2 guidelines of Intergovernmental Panel on Climate Change for National Greenhouse Gas Inventories. Production and associated management information of 1108 cattle were collected. Average milk production ranged between 4-20 L/animal/day. Dry matter digestibility ranging between 50%-85% were considered based on previous estimates and the feeding practices of farming systems. Methane emission per unit milk production, which varied with net energy requirement for potential milk production under different management conditions, was back-calculated based on the dry matter intake, energy density and digestibility of feed. The least methane emission level of 14.5 g/L/day was recorded for Jersey×Friesian crossbreds with the average milk production of 19 L/day. The highest methane emission of 96 g/L/day was recorded by Sahiwal with 3.5 L/day average milk production. High production with low emission was recorded under intensive management and vice-versa was observed in extensive management. Feed quality and the adaptation of animals, which vary with genotype, are the key factors that contribute to average milk production and subsequently the level of methane emission in a given system

Keywords: Crossbred cattle, milk production, enteric fermentation, greenhouse gas emissions

B2

[10]

## **THE ROLE OF KEY PERFORMANCE INDICATORS (KPIs) TO DRIVE THE PERFORMANCE OF FIRMS IN THE PLANTATION SECTOR IN SRI LANKA**

*Fernando, S.N.S.*, Abey Siriwardana, P.C., Jayasinghe-Mudalige, U.K.

Department of Agribusiness Management, Faculty of Agriculture and Plantation Management,  
Wayamba University of Sri Lanka, Sri Lanka  
Research and Innovation Division, Ministry of Education, Sethsiripaya, Sri Lanka

Key Performance Indicators (KPIs) play a crucial role in the performance management of an organization by guiding its vision through SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) objectives. This study aims to assess the expected role and current status of KPIs in enhancing the effectiveness and competitiveness of export-oriented firms in the plantation sector of Sri Lanka. A series of semi-structured interviews were conducted with the managers from 10 purposefully selected firms to obtain performance insights on the formulation, implementation, and measurement of KPIs. A pre-piloted structured questionnaire was employed in online personal interviews to gather attitudinal statements. These statements were then transcribed into text files using MAXQDA 2024 software. The outcome of data analysis revealed 5 key themes, namely 1) Barriers to key performance indicators implementation, 2) Performance challenges, 3) Strategic synergy, 4) Value addition to the market, and 5) Tech innovations for optimization. It revealed that while KPIs are vital for aligning with strategic goals, performance challenges such as rapid KPI changes, technical and psychological barriers, and gaps in stakeholder understanding regarding KPIs were persistent. The need for better communication of KPIs, stakeholder engagement, and leveraging technology to align KPIs closely with profitability goals for effective performance management was thus highlighted. It concludes that while operationalizing KPIs is crucial for performance evaluation, increasing stakeholder awareness about integrating digital tools is necessary. This integration will enhance the robust management of KPIs, align them with strategic goals, and ultimately improve operational efficiency, sustainability, and competitiveness within the plantation sector

**Keywords:** Key Performance Indicators (KPIs), performance evaluation, plantation sector, sustainable industries

B3

[11]

**UAV-SUPPORTED SEED SOWING (UAV<sub>s</sub>SS) AND POST-PLANTING ANALYSIS IN FOREST REGENERATION FOR SUSTAINABLE FOREST ECOSYSTEM: A SYSTEMATIC LITERATURE REVIEW**

*Wanigasundara, W.W.M.S.G., Jayasinghe, G.Y.*

Department of Agricultural Engineering and Environmental Technology, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Sustainable forest ecosystems for afforestation and reforestation (A/R) helps in preventing soil erosion, improving the quality of the soils, fighting off flooding and desertification, acting as carbon sinks to control climate change and increases ecosystem stability. It is therefore important for the development of new strategies and techniques that can enhance the activities of A/R considering that there are many large-scale techniques traditionally used in large areas that are no longer effective. The purpose of this research is to analyze if UAV supported seed sowing (UavSS) and post-planting assessment increase the efficiency of forest regeneration to develop sustainable forest ecosystem practices. This systematic literature review (PRISMA methodology) targeted only research articles of the time frame between 2013 to 2023, indexed in Google Scholar, IEEE, and Springer, and published in English language. Research articles were sourced based on the inclusion and exclusion criteria using Keywords like “UAV”, “Forest Regeneration”, “Post-planting analysis” and “UAV-supported seed sowing”. First and foremost, the articles found in the literature and databases amounted to 79 papers. After the screening process, 61 papers were included for the review process. UAV-supported seed sowing (UavSS) yields a high seed deposition rate, ranging from 60 to 120 seedpods per minute with germination efficiency in the range of 80% and beyond. Post-planting analysis using UAVs equipped with advanced sensors, such as RGB cameras and lidar, facilitates detailed monitoring from early seed germination stages to canopy development. The classification accuracies rise above 90% by applying machine learning algorithms on data from UAVs, thereby improving monitoring accuracy and effectiveness. Future study should address UAV technologies for different environments, examine long-term ecosystem impacts, and develop guidelines for large-scale projects

Keywords: Ecological restoration, Forest regeneration, Machine learning, UAV, UAV monitoring

**B4****[12]****ADVANCED CROP SAFETY: MULTI-FREQUENCY AVIAN REPELLENT DEVICE FOR AGRICULTURE**

Sudeep K.H.<sup>1</sup>, Saiprathik K.<sup>1</sup>, Chirag V.<sup>1</sup>, Karian, Y.<sup>1</sup>, Chaudhary, H.<sup>2</sup>, Kumar, P.<sup>3</sup>, *Bhowmick, K.<sup>1</sup>*

<sup>1</sup>PES University, India

<sup>2</sup>Malaviya National Institute of Technology Jaipur, India

A multi frequency avian repellent device has been designed and analysed for operation in the Indian subcontinent. The proposed device is shown to achieve repulsion of avian species without harming them while adhering to Indian field conditions and requirements. Safe repulsion of avian species was achieved by the projection of predatory noises and multi frequency signals in the target areas to trigger an involuntary response within the avian species, enabling them to exit the target areas without incurring any damage. The proposed repulsion technique was assessed and tested in both urban and rural conditions. The device is 73.92% more cost effective than comparable products in the market. This cost-effective solution was achieved by the use of embedded electronics assembled on a plug and play test-bed which also allows for ease of reparability. Furthermore, it offers a 50 % increase in features, compact design and a 72% success rate, positioning it as a cost-effective and sustainable solution for the agriculture industry.

Keywords: bird invasion, avian species, involuntary response, sustainable approach, adaptability

B5

[13]

**STUDYING THE EFFECTIVENESS OF SPRAYING OPERATIONS PRESSURES AND SPEEDS IN GREENHOUSES BY CHANGING THE TYPE OF NOZZLE***Al-Aani, F.S.<sup>1</sup>, Omran, N.A.<sup>2</sup>, Luaibi, H.H.<sup>3</sup>, Hoffiz, B.<sup>4</sup>*<sup>1</sup>College of Agricultural Engineering Sciences, University of Baghdad, Iraq<sup>2</sup>Technical Mechanic Department, Technical Institute of Babylon, Al-Furat Al-Awsat Technical University, Iraq<sup>3</sup>Technical Mechanic Department, Technical Institute-Suwaira, Middle Technical University, Iraq<sup>4</sup>College of Arts & Sciences, American University in Iraq – Baghdad

Growing tomatoes in greenhouses is a very popular choice because it addresses the constant supply the marketplace demands worldwide. Because greenhouses are ideal incubators for pest infestations, the optimal use of pesticides is a must to maintain strict quality control. The purpose of this study was to discover and determine how to identify the right type of nozzle for spraying pesticides and other solutions to maximize productivity inside greenhouses. This experiment was performed on a tomato crop in one of the greenhouses belonging to the College of Agricultural Engineering Sciences, Baghdad University/Aljadiriyah, in the winter season of 2022/2023. The methods employed in this experiment compared the performance of two types of spraying fountains (at two pressure levels and at two speeds). Sensitive paper was used as a target to observe and quantify the spray coverage. The findings showed the performance superiority of spraying fountain type (ASP120 03C) due to its higher rate of coverage, lower drift rate and the smaller size of drops. As shown above, spraying fountain type (ASP120 03C) is the first choice. However, type (APS880R-3C) can also be used, but with less efficiency. It is reasonable to conclude that the technique developed herein should not be confined to growing tomatoes. Logic dictates that it could be adapted or adopted for use on other, similar vine-based, trellis-grown crops, such as chili and sweet peppers, eggplants (aubergines), and perhaps squash.

Keywords: System management, coverage, drift, pesticides, technology, tomato crop, advanced technology

B6

[14]

### **THE INFLUENCE OF BLADE TYPES AND FORWARD SPEED ON THE PERFORMANCE OF THE MURRAY-15.5HP LAWN MOWER**

Mashhadani, A.H., *AL-Badri, S.B.S*

Department of Agriculture Machines and Equipment, College of Agriculture Engineering Sciences, University of Baghdad, Iraq

A field experiment was conducted to design, implement, and test the effect of blade type represented by cutting angle and forward speed on the performance of a MURRAY-15.5hp lawn mower machine. Three types of blades with cutting angles of 20°, 25°, and a straight angle and three forward speeds of 2.99, 4.32, and 5.60 km h<sup>-1</sup>. The slippage percentage, field and cutting efficiencies, and fuel consumption were also studied. The results indicate that decreasing the cutting angle from 25° to 20° and then to a straight angle considerably decreases the slippage percentage and significantly decreases the fuel consumption. In addition, there was a significant increase in field and cutting efficiency. Increasing the forward speed resulted in a significant increase in the slippage percentage, and decrease in the field and cutting efficiencies. The interaction between the straight blade type and the forward speed 2.99 km h<sup>-1</sup> led to the lowest slippage at 8.34% and the highest field efficiency 81.56% and highest cutting efficiency was 40.00%, while the interaction between the straight blade type and forward speed 5.60 km h<sup>-1</sup> resulted in the lowest fuel consumption at 4.33 litres ha<sup>-1</sup>

Keywords: Blade, cutting efficiency, forward speed, fuel consumption, field efficiency, lawn mower, slippage percentage



B7

[15]

## SCALING THE EXTENT OF LAND USE CONVERSION IN THE ARABLE LANDS OF SOUTH AFRICA USING REMOTE SENSING: A CASE OF PORT St JOHNS.

*Bango. A.<sup>1</sup>, Piccioli F.C.<sup>2</sup>*

<sup>1</sup>Walter Sisulu University, South Africa

<sup>2</sup>Universita Cattolica del Sacro Cuore, Italy

Smallholder food production is among the key livelihood strategies that address the first and second goals in the agenda 2030 for Sustainable Development which are Poverty Eradication and Zero Hunger. Several studies including Schackelton et al., (2019), Appiah et al., (2019) note that smallholder agriculture is a significant conduit for improving rural livelihoods in most countries in the Sub-Saharan Africa and is practiced on communal land. Communal agricultural land remains an important economic and social asset. As an economic asset, land provides food that has potential of addressing food security and a micro scale economic potential. As a social asset, land is a source of socio-cultural identity. With all the acknowledged significance of land as a valuable resource to small scale agriculture, there has been a noticeable decline in the usage of rural communal land for agriculture in South Africa from the late 1990s through to the early 2000 (Schackelton, 2018). Data from Statistics South Africa (2011 and 2016) shows a decline in households involved in agricultural activities. In 2011, 2,9 million rural households across the country were involved in agricultural activities and in 2016 this declined to 2,3 million. The aim of the study is to assess the extent of land use conversion in the arable lands of South Africa with the use of remote sensing technology, using Port St Johns in the Eastern Cape as a case study. Remote sensing was used in the study to scale land conversion in the study area. Advances in remote sensing such as the use of digital image processing algorithms have increased the use of satellite imagery such as Landsat data in studies on land use change across multiple spatial and temporal scales. The methodology employed in this study is divided into two major steps: Landcover classification, and Landcover change analysis. The Google Earth Engine (GEE) platform and the Land Change Modeler of TerrSet IDRISI in the study area over a ten-year period (2014-2024). The combination of these platforms for Land use/Land Cover (LULC) Change detection has been effectively used in several studies (Hossen *et al.*, 2024; Shrestha *et al.*, 2023). Landcover change analysis results show a remarkable shift in land uses in the study area. In a Total Area of **119960.39 hectares** (ha), **23872.20** ha was used as Cultivated Lands, **34974.19** as Grassland, **11042.19** as Buildup Areas and the remaining land for other uses (2014). In 2024 in a Total Area of **138146.14ha**, **20135.06ha** is Cultivated Lands, **25117.94ha** is Grassland, **20135.06** is Buildup areas and the remaining land is for other land uses. A field study is recommended to establish the cause effect relationships in the identified land use changes.

Keywords: Land use, small scale farmers, food security, remote sensing

# **NUTRITIONAL STRATEGIES**

C1

[16]

**PHYSICO-CHEMICAL AND MICROBIAL POPULATION KINETICS FOR PROBIOTIC DRINKING YOGHURT MADE USING COW MILK OR CAMEL MILK***Bhaskaracharya, R.K., Abdulazeez, A.*

Department of Food Science, College of Agriculture and Veterinary Medicine, United Arab Emirates University, UAE

Drinking yogurt, a fermented dairy beverage is characterized by its low viscosity has gained global popularity. Unlike traditional use of cow milk, the claimed therapeutic/nutritional benefits of camel milk has driven consumer demand for fermented camel milk beverage. Our study aims to identify the species-specific differences in low-fat and full-fat camel milk and cow milk “clean label” drinking yogurt. Comparative analysis included compositional parameters, physicochemical characteristics and microbial viability during fermentation and storage. Significant differences were noted in fat content of full-fat cow, full-fat camel, low-fat cow and low-fat camel milk at 3.2%, 2.3%, 1.2% and 1.3% respectively. Differences in protein and fat content among the drinking yogurts contributed to significant differences in Hunter-L\*a\*b\* values. The camel milk drinking yogurts had relatively higher titratable acidity during fermentation and storage and correlated with the slower microbial kinetics during fermentation. Significant differences in total solids content of drinking yoghurts correlated positively with their viscosity and negatively correlated with syneresis. Drinking yoghurt made from full-fat cow milk had significantly less syneresis while highest was for full-fat camel drinking yoghurt compared to their low-fat versions. The study showed the feasibility of producing full-fat and low-fat “clean label” drinking yoghurts from camel milks of comparable physico-chemical properties to their bovine counterparts. Further studies are required to understand the impact of naturally altered protein components in camel milk and the mechanism of water-holding capacity, network formation, structural stability, etc in fermented camel mil

Keywords: Drinking yoghurt, camel milk, cow milk, physico-chemical characteristics, microbial viability, probiotics

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C2

[17]

**DEVELOPMENT OF A FERMENTED COCONUT-BASED DESSERT AS A FINE ALTERNATIVE FOR DAIRY-BASED YOGHURTS***Dissanayake, M.P.M., Jayasinghe, M.A.*

University of Sri Jayewardenepura, Sri Lanka

In the modern world, the growing trend of veganism has paved the way for the rapid increase in the consumption of plant-based milk alternatives. This study aimed at developing a fermented dessert incorporating coconut milk with a non-dairy-favoured probiotic, especially for non-dairy consumers including vegans. The development proceeded with 2 sensory evaluation stages, selecting the best plant gum composite out of xanthan: CMC and guar gum: CMC (1:1), selecting the product's optimum sweetening capacity out of 10%, 15%, and 20% at a 5:1 sugar: stevia ratio. The product containing Xanthan: CMC and 15% sweetening capacity was selected as the best composition and was taken for quantitative analyses as the preservative added (sodium benzoate) and the control. The sweetness was enhanced, keeping the moderate sugar level indication unchanged, using stevia with cane sugar. All physicochemical parameters including pH, water holding capacity, syneresis, and total soluble solids were under the acceptable ranges. The texture profile analysis exhibited the overall coagulation of the product as better and thicker. With regards to proximate analyses, the product reported a lower protein content and a significant fat content. Nonetheless, a high proportion of saturated fatty acids, particularly lauric acid, were reported from the GCMS analysis. Coconut milk and stevia contributed to a significant antioxidant potential for the product. The probiotic potential was ideal for the lactic acid bacteria growth ( $>10^6$  CFU/g) throughout the studied shelf-life period. Overall, the product was acceptable in the presence/absence of the preservative, making it an ideal non-dairy alternative for dairy yoghurts.

Keywords: Vegan, non-dairy, coconut milk, probiotic, stevia

C3

[18]

**FUNCTIONAL AND NUTRITIONAL PROPERTIES OF *Musa paradisiaca* (ASH PLANTAIN) FLOUR (PEEL AND FLESH) AND DEVELOPMENT OF READY-TO-SERVE FLAKES FROM *Musa paradisiaca* FLESH FLOUR**

Nanayakkara, N.T., *Subodinee, A.A.M.*, Abeysuriya, A.P.H.I.

Department of Food Science and Technology, Faculty of Agriculture, University of Ruhuna, Sri Lanka

*Musa paradisiaca* (ash plantain) is the most underrated and the fourth most important food crop in the world. The present study was conducted with the aim of evaluating nutritional and functional properties of *M. paradisiaca* fruit peel (PF) and flesh (FF) flour and to develop ready-to-serve flakes using *M. paradisiaca* FF. The ash plantain flakes were prepared mixing ash plantain FF with corn grit (CG) in 3 different ratios and flakes were produced following 18 hours natural fermentation of dough at ambient room temperature (T1; 40:60, T2; 50:50, T3; 60:40 FF:CG respectively, fermented) and without fermentation (T4; 40:60, T5; 50:50, T6; 60:40 FF:CG respectively, non-fermented) separately. To select the best formulation, sensory evaluation was done using 30 semi-trained panelists and the 5 point hedonic scale. The contents of moisture, crude fat and crude fiber ( $86.76 \pm 0.50$ ,  $3.25 \pm 0.69$ ,  $2.76 \pm 0.65$  g/100g respectively) were significantly higher in PF while carbohydrate and ash contents ( $25.90 \pm 1.12$ ,  $0.35 \pm 0.02$  g/100g) were significantly higher in FF. According to the results of the sensory evaluation, T3 sample was selected as the best formulation (FF 60: CG 40, fermented). Nutritional properties of the selected formulation of flakes were compared with those of control (100% CG) and reputed brand of commercial corn flakes. The carbohydrate content is significantly higher in T3 sample ( $94.16 \pm 0.60$  g/100g) compared to the commercial corn flakes and the control. The newly formulated value added ready-to-serve flakes using *M. paradisiaca* FF has a potential to compete with commercially available corn flake products as a carbohydrate rich source with acceptable sensory attributes and promising health benefits to the consumer.

Keywords: Ash plantain, corn flakes, functional food, *Musa paradisiaca*, value addition

C4

[19]

**SUITABILITY OF COMPOSITE FLOUR AS A FUNCTIONAL FOOD FOR DIETARY DIVERSITY AMONG AUTISM CHILDREN***Siddiqi, S., Urooj, A.*

DOS in Food Science and Nutrition, University of Mysore, India

In addition to socio-behavioural problems, diet-related issues are common and recurrent problems experienced by children with autism spectrum disorder (ASD). The deficits in micronutrients, proteins, GI problems and food behaviour patterns are predominantly higher among these children. In response to food behaviour problems, we recognised the need for addressing the issues of food selectivity and dietary inadequacies by improving the quality of diet. Therefore, to increase the dietary diversity, the suitability of the composite multigrain flour (Sportify) was explored in the preparation of common regional based recipes based on the likes and dislikes of the ASD children. The flour was analysed for proximate (AOAC methods), physico-chemical properties, amino acid profile (Kamani et al), starch fractions (Englyst et al), *in-vitro* protein digestibility (Akeson et al), microbial analysis and shelf-life studies as per the standard procedures. Analyzing nutritionally important starch fractions revealed presence of 20.34 % slowly digestible starch, followed by 18.53% rapidly digestible starch and 5.22% resistance starch. Rapidly available glucose was found to be 24.21% and Starch Digestibility Index was 44. *In-vitro* protein digestibility of the flour was found to be higher. Sportify revealed higher proportions of glutamate followed by Aspartate. The composite flour was a good source of protein, dietary fiber, iron, calcium and had a shelf life of 2 months. It was also found suitable in the preparation of common recipes by the mothers/caretakers of ASD children.

**Keywords:** Micronutrient deficits, picky eating habits, health benefits

C5

[20]

**INNOVATIVE PROTEINOUS BREAD FOR IMPROVED NUTRITIONAL FUNCTION AND MARKET APPEAL***Perera, H.P.V.V.*

University of Sri Jayewardenepura, Sri Lanka

This study explores the development of a proteinous bread incorporating pumpkin, soy and spinach flours with wheat flour and introduces a novel form bread shape. The aim was to evaluate the nutritional and sensory attributes of bread, assessing its potential as a functional food product. Four samples with different wheat-soybean flour ratios (70:22, 73:19, 75:17, and 78:12) underwent sensory evaluation, with the 73:19 ratio selected for further analysis. This sample showed high consumer acceptability and favorable rheological properties, including a water holding capacity of 90.31%, specific volume of 3.03 cm<sup>3</sup>/g, and pH of 6.08. Nutritional analysis revealed protein content of 12.98%, fat content of 9.53%, fiber content of 5.49% and significant mineral content including Cu (1.08 mg/100 g), Fe (13.13 mg/100 g), Mn (3.50 mg/100 g), Zn (10.06 mg/100 g) and Mg (753.75 mg /100g). These essential minerals in proteinous bread improve protein metabolism by acting as crucial coenzymes for various cellular functions. Sensory evaluation indicated a preference for the novel shape; triangle-shaped bread. The findings demonstrate that alternative flours can improve the nutritional profile of bread, with the wheat-soy flour ratio of 73:19 and the triangle shape being the most acceptable to consumers. This study provides valuable insights for innovative bread product development and encourages further exploration of functional food products.

Keywords: Proteinous bread, nutritional analysis, alternative flours, sensory evaluation

C6

[21]

**DIET AS A RISK FACTOR FOR ASTHMA AMONG CHILDREN - A PILOT STUDY  
IN MYSURU REGION***Shivanna, M.L.<sup>1</sup>, Siddiqi, S.<sup>1</sup>, Jiang, J.<sup>2</sup>, Bilaver, L.<sup>3</sup>, Gupta, R.<sup>3</sup>, Urooj, A.<sup>1</sup>*<sup>1</sup>Department of Studies in Food Science and Nutrition, Manasagangotri, University of Mysore,  
India<sup>2</sup>Center for Food Allergy and Asthma Research, Northwestern Feinberg School of Medicine,  
Northwestern University, USA<sup>3</sup>Department of Pediatrics, Northwestern Feinberg School of Medicine, Northwestern University,  
USA

Research relevant to genetic and environmental influences on asthma among adults in Mysuru region is reported, but little is known about dietary risk factors among children. To identify dietary factors associated with asthma among school children in urban and rural areas of Mysuru. In a cross-sectional study, validated English version of ISAAC questionnaire was used to assess dietary risk factors associated with asthma among 10-15 years school children in urban(n=500) and rural(n=500) areas of Mysuru. Wheezing was prevalent among 3% of urban children and 0.8% of rural children. 11.2% urban children and 1.8% rural children reported dry cough at night. Asthma was associated with milk consumption [urban group: OR= 2.90 (95%CI, 0.32 to 26.20); rural group: OR= 2.50 (95%CI, 0.25 to 25.12)], egg consumption [urban group: OR= 1.80 (95%CI, 0.39 to 8.28); rural group: OR= 2.93 (95%CI, 0.29 to 29.55)] and fast food consumption [urban group: OR= 2.46 (95%CI, 0.53 to 11.43); rural group: OR= 11.13 (95%CI, 0.97 to 126.67)]. The asthma symptoms were higher in urban children. The trends in fast food consumption differed among both the groups, with a higher risk in rural children. Generally, diets marked by greater intakes of milk and poultry were associated with asthma symptoms. These findings suggest that adherence to a more milk / poultry -based diet may pose risk for Asthma among children in Mysuru region which needs to be studied further.

Keywords: Asthma, Mysuru, diet, ISAAC, wheezing, risk factors



C7

[22]

**PRINCIPAL COMPONENT ANALYSIS OF EGG PARAMETERS IN YORUBA ECOTYPE, SUSSEX AND THEIR CROSS-BRED CHICKENS**

*Babatunde, O.*, Akintunde A., Bababunmi A.A.

Osun State University, Nigeria

Principal component analyses were used to evaluate the egg parameters of Yoruba Ecotype Chicken Sussex and their cross bred chickens in Nigeria humid tropics. 223 eggs comprising of 124 Yoruba Ecotype Chicken and 99 Sussex eggs collected were used in the study. Data were collected on external and internal egg qualities of the chickens on a weekly basis through the use of digital scale balance, measuring tape and Vernier Caliper. Principal component analysis was performed on the data obtained using the dimension reduction with factor analysis and egg qualities parameters were also correlated using Statistical Package for Social Science statistical package version 21. The positive relationship between the egg quality traits in individual strains showed that, PC 1 had the highest share of the total variance for egg characteristics. Egg quality traits in Yoruba Ecotype Chicken were best described by 3 Principal Components with high positive loading for egg width, egg number, and egg length and shell thickness. Strain Sussex x Sussex was best described by external quality traits (egg weight, egg width, shell thickness and shell weight). Similarly, Yoruba Ecotype Chicken x Sussex was described by external qualities while, strain Sussex x Yoruba Ecotype Chicken had both internal and external egg quality traits as their descriptors.

**Keywords:** Principal, component, analysis, egg, parameters, Yoruba ecotype, Sussex, cross-bred, chickens

C8

[23]

**DIET QUALITY ASSESSMENT: EVIDENCE FROM RURAL ANDHRA PRADESH***Parvathy, S., Anjaly, J., Kanagaraj. S.T., Srinivasan, M.*

Sustainable Food Systems, Council of Energy, Environment and Water, India

This study investigates diet quality patterns among farmer households in Andhra Pradesh, focusing on women's diets post-sowing and post-harvest. The study seeks to understand factors influencing prosumers' diets as part of a larger impact assessment on Andhra Pradesh Community-Managed Natural Farming (APCNF). A longitudinal assessment of 2,042 households was conducted, with one woman per household interviewed using the standardized global diet quality questionnaire. The study aims to test whether diet quality significantly differs between post sowing and post-harvest periods. Findings indicate that post-harvest diets were marginally better than post sowing diets because of higher prevalence of nutrient-dense foods such as green leafy vegetables, vitamin A-rich fruits etc. Crop diversity (measured by Shannon's index) and overall crop count had less impact on diet diversity. Additionally, mere coverage under agroecology programmes such as APCNF might not improve diet quality unless complex agroecological approaches are adopted. Although adoption of practices such as bio stimulants (82%) were high for APCNF farmers, practices that promote nutrition such as kitchen gardens were low (13%). A unit increase in fruit varieties in kitchen gardens doubled the odds of achieving minimum diet diversity for women (MDD-W) (OR: 2.12 [1.30, 3.46]), while livestock rearing increased the odds by 29% (1.29 [1.01, 1.66]). Regarding women's empowerment in agriculture, a 1% increase in the empowerment index increased the odds of achieving MDD-W by six times (5.71 [3.17, 10.29]). However, women working over 11.5 hours per day had a 53% lower chance of achieving MDD-W (0.47 [0.33, 0.67]). To improve nutritional outcomes particularly of farming households, agricultural programs must focus on promoting practices like kitchen gardens and livestock rearing. Measures to bridge the seasonal gap in access to nutritious diets could be implemented through the Public Distribution System and POSHAN 2.0.

Keywords: Diet quality, natural farming, agroecology, production diversity, kitchen gardens, women

# **PLANT AND CROP SCIENCES**

D1

[24]

**OPTIMIZING FEED QUALITY OF LOCAL AND IMPROVED DUAL-PURPOSE PEARL MILLET STRAW THROUGH UREA TREATMENT IN THE WEST AFRICAN SAHEL**

*Umutohi, C.<sup>1</sup>, Esse, M.<sup>1</sup>, Ayantunde, A.A.<sup>2</sup>, Ibrahima, A.<sup>1</sup>, Mayo, M.<sup>3</sup>*

<sup>1</sup>The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Nigeria

<sup>2</sup>Wageningen Livestock Research, Wageningen University & Research (WUR), Netherlands

<sup>3</sup>The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Zimbabwe

The development of livestock production in the desert dryland margin area of West Africa faces challenges due to the limited availability of quality feed for livestock. Livestock primarily rely on low-quality crop residues, especially during the dry season, which have low nutrient content (low protein content and high fiber content). This study aimed at assessing the chemical composition and in vitro digestibility of stovers from two improved dual-purpose pearl millet varieties and one local variety when treated with varying levels of urea solution. The experiment used a completely randomized design in a 3x4x3 factorial, resulting in 36 treatments. Each treatment was repeated three times, totaling 106 experimental repetitions. The factors evaluated were pearl millet cultivar, concentration of urea solution (0 %, 3%, 5%, and 6%), and conservation duration (14 days, 21 days, and 28 days). The results show that the chemical composition and in vitro digestibility of pearl millet stovers were significantly affected by the cultivar and urea treatment. In general, treatment of pearl millet stover with urea increased the crude protein content of pearl millet stovers from 7% to 9%. Improved dual-purpose varieties had higher nutritive values compared to the local cultivar. The duration of treatment did not affect the nutrient contents of pearl millet stovers. The findings support the positive impact of urea treatment on the nutritional value of pearl millet stovers and suggest that treating pearl millet stovers with 5% or 6% urea is a viable option for improving their utilization in the Sahel. Additionally, treated pearl millet stovers would contribute to increasing livestock productivity during the dry season.

Keywords: Feed technology, livestock feeding, Niger, stover quality enhancement.

D2

[25]

**LOSS OF NUTRIENTS FROM INTENSIVE RED ONION CULTIVATION IN KALPITIYA PENINSULA***Swarnathilake, D.S.G.G.C., Herath, H.M.I.K.*

Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka

Loss of nutrients due to leaching has become a critical problem in highly permeable soils. The aim of the study was to evaluate the leaching of calcium, potassium, and phosphorous under red-onion cultivation in Sandy Regosol soil in Kalpitiya, Sri Lanka. Lysimeters were installed 1m below the soil surface before planting and compost (10 t/ha) was applied. Growers' use rate of fertilizer [i.e. Five split applications of urea at 100 kg/ha, Triple Super Phosphate (TSP) at 250 kg/ha, onion fertilizer (12:9:9) at 125 kg/ha, compound granule fertilizer (12:12:17) and calcium nitrate at 62 kg/ha at 10 days intervals] was considered as the treatment 1 (T1). The second treatment (T2) was recommended fertilizer [i.e. Basal dressing: urea at 68.5 kg/ha, TSP at 100 kg/ha, Muriate of Potash (MOP) at 50 kg/ha, Top dressing 1: urea at 65kg/ha, Top dressing 2: urea at 65 kg/ha and MOP at 25 kg/ha] with Biochar (10 t/ha). Only recommended fertilizer was applied for the treatment 3(T3). Irrigation was done twice a day and leachates were collected at weekly intervals. Available P in leachate was analyzed by sodium bicarbonate extraction.  $K^+$  and  $Ca^{+2}$  concentrations were determined using a flame photometer. A significantly higher leached  $K^+$  was observed in T2( $104.62 \pm 18.22$ kg/ha) than T1( $72.06 \pm 12.96$ kg/ha). There was no significant difference in cumulative leached  $Ca^{+2}$  among treatments (682.7-524.3 kg/ha). Accumulation of P in leachate was significantly lower in T3( $11.94 \pm 4.93$  kg/ha) compared to T1( $26.41 \pm 1.65$ kg/ha) and T2( $26.33 \pm 5.34$ kg/ha). A significantly higher yield was observed in T1( $18,673.61 \pm 3076.8$  kg/ha). Among all the tested elements  $K^+$  and  $Ca^{+2}$  have the risk of leaching and contamination of groundwater. This highlights the need for an improved nutrient management strategy for sustainable vegetable production in Kalpitiya.

**Keywords:** Groundwater, intensive cultivation, nutrient leaching, sandy regosols

D3

[26]

**EFFECT OF SOIL CONSERVATION PRACTICES, CONSTRAINTS, AND AWARENESS ON UPCOUNTRY VEGETABLE PRODUCTIVITY***Aiome G.V.N.*, De Silva, C.S., Thubaraha, R., Fernando, S.P.

Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo, Sri Lanka, and The Open University of Sri Lanka

Vegetable cultivation is a key sector in agriculture in terms of frugality and employment generation. The rapid growth experienced in the agricultural sector has led to resource degradation with an adverse impact on sustainability. A major form of environmental damage associated with agriculture is land degradation; particularly intensive vegetable cultivation practices have caused soil erosion on the steeply sloping lands of Central Hills. This study, conducted in the Central Province of Sri Lanka, mainly focuses on identifying the factors instrumental in soil conservation and crop production. A sample of 384 farmers from Kandy and Nuwara Eliya was surveyed, Using a multi-stage sampling technique. The study aims to highlight the soil characteristics, conservation methods, challenges faced by farmers in maintaining soil quality and managing water resources effectively, factors affecting the maintenance of soil and water conservation, obstacles faced by the farmer because of the geographical features, and awareness on soil and water conservation practices. According to the objective of finding out the effects of existing SLM practices (Agronomic practices, Vegetative methods, Structural methods, and Cropping systems) followed by Upcountry vegetable farmers and erosion hazard level on, productivity. There is a significant difference in productivity under adaptability on different levels of soil conservation practices. That difference shows that farmers who follow a good level of soil conservation can obtain a higher yield. Moreover; farmers who adopt a poor level of soil conservation obtain low yields. Productivity shows an increasing relationship with the level of soil conservation. That means production is increasing with a good level of soil conservation. While production is lower with poor soil conservation practices because of reduced yield due to high soil erosion. Under highly eroded areas farmers can obtain considerable production by practicing soil conservation methods. According to the results, farmers tend to invest more in soil conservation measures with the increase in their farm income, level of awareness of soil conservation practices, and the security of land ownership. Based on the outcome of the survey it is possible to deduce that, while some progress has been made in soil and water conservation practices, there remains a substantial need for improved awareness, training, and adoption of advanced techniques and technologies to ensure soil and water conservation, sustainable land management and enhanced agricultural productivity. Addressing these challenges is vital for maintaining soil health and ensuring the long-term viability of agricultural practices in the study area.

**Keywords:** Soil conservation, water conservation, sustainable land management, awareness on soil and water conservation

D4

[27]

### **STUDY OF THE EFFECT OF NATURAL POLYMERS ON SOIL WATER RETENTION AND PLANT GROWTH**

*Askri, A., Ahmed, Z.F.*

United Arab Emirates University, UAE

In arid regions, high evapotranspiration and rarity of water pose challenges to agriculture, impacting yields, water use and soil quality. Super absorbent polymers offer potential solutions due to their water storage properties and soil stabilization abilities. While synthetic super absorbent polymers have been effective, concerns about long-term environmental impact are often raised. Natural polymers, though less efficient in water retention, offer environmental benefits. Therefore, this study was conducted to investigate the effects of natural polymers applied in different doses and combinations on soil properties and plant growth. Polymer properties, soil characteristics and plant growth were assessed throughout the experiment. Over the experiment duration, soil pH, water holding capacity and electrical conductivity were influenced by polymer application. Polymer-treated soils showed increased pH and water retention, with husk further enhancing these effects. Electrical conductivity, on the other hand, decreased indicating improved nutrient absorption. Polymer degradation after harvest suggests long-term sustainability. Plant growth was influenced by polymer presence with taller plants observed in polymer-treated soils. Plants weight, length and nutrients content increased with polymer and husk application, indicating positive impact on growth and nutritional value. In conclusion, natural polymers showed promise in enhancing soil properties and plant growth while addressing water scarcity concerns. Their biodegradability offers a sustainable alternative to synthetic polymers, highlighting their potential in arid agricultural regions.

Keywords: Natural polymers, sustainability, nutrients uptake, water retention, biodegradability

D5

[28]

**EFFECT OF INTEGRATED TREATMENT OF HOT WATER DIPPING AND JASMONIC ACID ON ANTHRACNOSE OF BANANA CULTIVAR *KOLIKUTTU****Rodrigo, K.M.D.N.*<sup>1,2</sup>, Kumara, U.M.A.<sup>1</sup>, Daranagama, D.A.D.A.<sup>3</sup><sup>1</sup>Department of Agricultural Technology, Faculty of Technology, University of Colombo, Sri Lanka<sup>2</sup>Department of Indigenous Medical Resources, Faculty of Indigenous Health Sciences and Technology, Gampaha Wickramarachchi University of Indigenous Medicine, Sri Lanka<sup>3</sup>Department of Plant and Molecular Biology, Faculty of Science, University of Kelaniya, Sri Lanka

Anthracnose caused by *Colletotrichum musae* is one of the most significant postharvest diseases affecting bananas, resulting in substantial postharvest losses. There is a growing global trend towards developing non-fungicidal postharvest treatments worldwide, due to the restricted use of synthetic fungicides. This study aimed to evaluate the effectiveness of hot water dipping and jasmonic acid treatment in controlling anthracnose disease in the local dessert-type banana cultivar *Kolikuttu*. Randomly selected bananas were subjected to four different treatments: hot water dipping followed by jasmonic acid spraying (T 01), hot water dipping only (T 02), jasmonic acid spraying only (T 03) and control (T 04). These treatments were applied to both inoculated and non-inoculated bananas with *C. musae* ( $1 \times 10^5$  spores/mL). The bananas were hot-dipped at 50°C for three minutes, and a 0.2 mM solution of jasmonic acid was applied as a fine mist spray. Pathological properties including; lesion diameter, disease-affected surface area percentage, disease incidence percentage, disease severity index and physicochemical properties such as weight loss percentage were determined during the storage period and were analyzed by ANOVA at 95% confidence level. The ripening index and sensory properties were analyzed using the Kruskal-Wallis Test. All treatments showed a significant difference ( $P \leq 0.05$ ) in lesion diameter, disease-affected surface area percentage, disease incidence percentage, weight loss percentage, and sensory attributes, including peel appearance, peel color, and overall acceptability during the storage period. In conclusion, the integrated postharvest treatment (T01) can be recommended for controlling banana anthracnose, as it positively impacts pathological, physicochemical, and sensory properties.

Key words: Banana, *Colletotrichum musae*, hot water dipping, jasmonic acid, quality parameters



# **SUSTAINABLE AGRICULTURE**

E1

[29]

**PREVENTING SAFFRON COUNTERFEITING: A BLOCKCHAIN-BASED FRAMEWORK***Sofi, A.A., Jabeen Z., Lone, M.A., Khurshid F.*

National Institute of Technology, India

Saffron, one of the most valuable spices globally, confronts a significant threat from counterfeiting and adulteration, presenting formidable challenges to its authenticity and quality assurance. This paper explores various methods and technologies aimed at preventing saffron counterfeiting. The intricacies of saffron production and the nature of counterfeiting in the saffron industry are examined, alongside the exploration of innovative solutions such as spectroscopic analysis and regulatory frameworks. A novel approach proposed involves leveraging blockchain technology to develop a smart contract-based auction system, with the goal of establishing a global platform for saffron trading. Additionally, QR codes are integrated to capture digital transactions, offering end-users a means to authenticate the saffron they purchase. The implementation of these robust prevention strategies enables stakeholders to safeguard the integrity and reputation of saffron products worldwide.

Keywords: Adulteration, *Crocus Sativus*, Saffron

E2

[30]

**IMPACT STUDY OF FOOD RESOURCE MATCHING PLATFORMS: A CASE STUDY OF EFOOD SOCIAL INNOVATION CO., LTD.**

*Chung, F.R.*

Graduate Institute of Information Management, National Taipei University, Taiwan (Province of China)

Food waste is a global issue that has serious impacts on the environment, economy, and society. Against this backdrop, social enterprises, with profit as their goal, focus on social and environmental issues. Through innovative business models and a values-driven approach, they successfully integrate social and business interests, playing a proactive role in driving social change and offering new perspectives and methods for addressing food waste. This study will take FOOD Social Innovation Co., Ltd. as an example to explore how social enterprises improve food waste and resource matching platforms through information services. Leveraging information technology, they actively contribute to solving the problem of food waste, striving to establish a more sustainable and equitable food system through commercial activities and social advocacy. They are committed to the United Nations Sustainable Development Goals, particularly the pledge of "Leave No One Behind," aiming to contribute to zero hunger and make the right to freedom from hunger a reality for all.

Keywords: Food matching, food waste, social-influence, subscription economy, sustainable development

E3

[31]

### INVESTIGATION OF PHYSICOCHEMICAL AND SENSORY PROPERTIES OF A NATURAL CARBOHYDRATE-ELECTROLYTE DRINK

Ketakumbura, K.H.M.L.S.<sup>1</sup>, *Samarakoon, E.R.J.*<sup>1</sup>, Pathirage, K.P.D.A.<sup>2</sup>

<sup>1</sup>Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Sri Lanka

<sup>2</sup>Tropical Health Food (Pvt) Limited, (A DIMO Group Company), Heraliyawala Industrial Park, Malkaduwawa, Kurunegala, Sri Lanka

Carbohydrate-electrolyte drinks play a significant role in maintaining hydration and controlling the blood glucose levels of active individuals. However, most commercially available carbohydrate-electrolyte drinks contain artificial colors and flavors, making modern consumers hesitant to purchase them. The present study aimed to investigate the physicochemical and sensory properties of a natural carbohydrate-electrolyte drink made with beneficial nutrients and phytochemicals. King coconut water and sweet orange juice were used as the main ingredients and three formulations were developed assuring sugar and sodium contents were within the range of acceptability as per the international standards, by changing the percentages of water and king coconut water mixture. In contrast, the percentages of other ingredients were kept constant. The F<sub>1</sub>-F<sub>3</sub> formulations had total sugar contents of 86.84±3.60, 91.47±2.08, and 99.29±1.86 g/L, respectively while the sodium contents were 446.33±7.51, 446.33±7.51, and 481.00±13.00 mg/L, respectively indicating that they were within the limits of acceptable daily intake. Ascorbic acid contents and titratable acidities in terms of citric acid percentage of the formulations were in the range of 147.07±6.37-165.45±19.10 mg/100g and, 0.55±0.04-0.60±0.04% respectively. The F<sub>2</sub> formulation showed the highest median values for all the statistically significant sensory attributes. The proximate composition suggested that it mostly contained moisture (93.3%) followed by carbohydrates (6.5%) with an energy value of 26.4 kcal/100 ml. The osmolality was detected as 201.0 mOsm/kg indicating the potential of adjusting its tonicity to isotonic level in further studies. However, the developed carbohydrate-electrolyte drink can be served as a natural substitute with optimum efficacy and appropriate palatability.

Keywords: Carbohydrate-electrolyte drinks, king coconut, physicochemical properties, sensory attributes, sweet orange

E4

[32]

**BEAR CONSERVATION AND AGRICULTURAL SUSTAINABILITY: A STRATEGY OF STRATEGIC FRUIT PLANTING***Gautam, N.<sup>1</sup>, Borah, S.<sup>1</sup>, Pradhan, R.<sup>2</sup>, Sharma, K.<sup>1</sup>*<sup>1</sup>Sikkim Manipal Institute of Technology, Majhitar, India<sup>2</sup>Sikkim University, A Central University, Samdur, India

The Asiatic black bear, a key frugivorous species, crucial for conservation, faces rising conflicts with farmers due to declining fruit resources in its habitat, leading bears to agricultural lands. This results in increased fallow land and reduced food production as farmers abandon farming. We systematically reviewed literature (n=74) from 1990–2021, from key academic databases like Google Scholar, Scopus, and Web of Science, in English language, relevant to bear diet and conservation, and agricultural sustainability, and excluding non-relevant studies or those lacking rigorous scientific methodology, to (i) assess Asiatic black bears' fruit diets and (ii) recommend sustainable solutions for farmer-bear conflicts, and promoting agricultural resilience. Most literature on bears' fruit diets was published in the last decade, emphasizing their heavy reliance on plant fruit families (n=40), notably Rosaceae with dominant Relative Frequency of Occurrence (RFO=0.29), and various fruit types (n=10) like berries (n=82), drupes (n=38), & nuts (n=33). To promote coexistence and conservation, we recommend planting more of these fruits in bear habitats along with implementation conflict mitigation measures in farmland. This approach aids bear conservation, reduces conflicts, fosters ecological balance, and supports sustainable agriculture and farmers' livelihoods.

Keywords: Asiatic black bear, human-wildlife conflict, food, diet, agriculture.

E5

[33]

**PARAMETRIC INSURANCE BASED ON THE PHENOLOGY OF THE PLANT CAN HELP TO REDUCE THE VOLATILITY OF A FARMER'S INCOME**

*Barratt, J.D.*

University of Southern Queensland, Australia

Farmers' income is highly correlated to the weather. Climate change is causing extreme weather events, exposing farmers and communities to extreme volatility in income. The use of parametric insurance in wheat production can reduce the volatility in farmers' income. It can also help safeguard communities' health and well-being and reduce food insecurity. Analyzing 40 years of income with and then without insurance from farms based in Australia's wheat belt we show that the use of parametric insurance can reduce income volatility. Deriving yield data using the Agricultural Production Systems sIMulator (APSIM) and then using gridded weather data provided by the Bureau of Meteorological (Australia) this presentation represents a synthesis of efficiency results based on two studies on the use of novel parametric insurance structures. The main difference between this and other studies is that the insurance structures are based on important dates during the cropping calendar and on the wheat plant's phenology. Structures used to cover lost income due to reduced yield risks associated with drought and frost during the winter cropping season. This synthesis provides an important link between using parametric insurance in cropping and helping safeguard farmers' income and contributing to the health and well-being of communities involved in agriculture globally.

Keywords: Index-based insurance, broadacre, wheat, APSIM, frost, silo, crop adaptation, sowing, management practices.

# **ADVANCES IN SUSTAINABLE AGRICULTURAL PRACTICES**

P1

[34]

**INTEGRATED AGRO-INDUSTRIAL PARK CONTRIBUTIONS FOR  
AGRICULTURAL TRANSFORMATION AND IMPLICATIONS ON SMALLHOLDER  
FARMERS FOOD SECURITY AND FOOD SAFETY**

*Dadi, R.B.*

Addis Ababa University, Ethiopia

Ethiopian Integrated Agro-industrial Park contributions to the country's agricultural transformation and its implication on smallholder farmers food security and safety was studied. Method used included reviewing and analyzing of publications of journal articles, books, proceedings, international conference reports, policy papers, and unpublished reports, newsletters, as well as listening to medias and speeches of scholars. The findings showed integrated agro-industrial park is an engine for agricultural transformation in the country. It builds big tent and collective actions of government policy makers, leaders, international donors and financial institutions, investors, global practitioners, consultants, agricultural producers, food processors and traders for changing the supply-based subsistence farming system to market oriented and demand driven agriculture. Smallholder farmers are participating in different ways. Potential farmers formed Rural Transformation Clusters, produce, and supply raw materials for the Integrated Agro-industry Parks. Others provide off-farm labor. It helped them access quality inputs, trainings, improved production technologies, improved infrastructures, market for better prices for their products and gain increased income from sales of their products and off-farm employment. It increased their financial capacity and ability to buy quality materials including food for their families, reduced food losses and contamination and improved food safety. Hence, it positively contributed to transforming the agricultural sector with positive implication for smallholder farmers food and nutritional security and food safety. Since the findings are based on secondary data, collecting primary data and information is recommended for further studies in the future.

Key words: Integrated agro-industrial parks, agriculture transformation, smallholder farmers, food security



P2

[35]

**EFFECT OF NITROGEN FERTILIZATION ON POTATO (*Solanum tuberosum* L.)  
TUBER QUALITY: COMPOSITION, PHYSICO-CHEMICAL PROPERTIES AND  
FUNCTIONAL PROPERTIES**

*Nagasinghe, P.K.*, Mendis, B.E.P., Rajapakse, R.P.N.P., Nissanka. N.A.A.S.P.

University of Peradeniya, Sri Lanka

Excessive nitrogen fertilization for potato production threatens sustainable agriculture, yet its impact on potato tuber quality is not well-studied. Four potato varieties (Granola, Topaz, Briana, Triplo) grown under two nitrogen fertilizer treatments and the variety Granola grown under six fertilizer treatments were studied for tuber quality in terms of compositional, physicochemical, and functional properties. Dry matter, ash, starch, amylose, ascorbic acid, nitrogen, calcium, potassium, and total phenolic content were tested using standard methods. Solubility, swelling power, and antioxidant activity were also evaluated. Application of farmyard manure (194 kg nitrogen/ha) + 152 kg nitrogen/ha of urea resulted in significantly ( $p < 0.05$ ) high content of dry matter (18.83%), amylose (25.71%), ascorbic acid (2.59 mg/g dry weight), total nitrogen (1.62%), and protein nitrogen (0.81%). Low nitrogen fertilizer (farmyard manure) resulted in high phenolic content (0.89 mg/g dry weight) and antioxidant activity (4.38  $\mu\text{mol AsA/g}$  dry weight). Two different nitrogen fertilizer treatments did not significantly affect starch content, solubility, or swelling power. Among six nitrogen fertilizer treatments applied to Granola, amylose content (36.87%) was high in potatoes grown without urea or farmyard manure. High total nitrogen content resulted from farmyard manure + 152 kg nitrogen/ha urea and farmer practice (farmyard manure + 210 kg nitrogen/ha), 1.7% and 1.76% respectively, while high protein nitrogen content (0.72%) resulted from farmer practice. Antioxidant activity (48.76  $\mu\text{mol AsA/100 g}$  fresh weight) was high in the control. This study highlights the effects of nitrogen fertilization on potato tuber quality, providing insights for multidisciplinary research.

**Keywords:** Potato (*Solanum tuberosum* L.), Nitrogen fertilizer, tuber quality, tuber composition, physico-chemical properties

P3

[36]

**INTERACTION OF PLANTS AND METAL NANOPARTICLES: EXPLORING ITS MOLECULAR MECHANISMS FOR SUSTAINABLE APPLICATION**Kaur, N.<sup>1</sup>, Francis, D.V.<sup>1</sup>, Abdalla, M.A.K.<sup>2</sup>, *Zienab, F.R.A.*<sup>1</sup><sup>1</sup>Department of Integrative Agriculture, College of Agriculture and Veterinary Medicine, United Arab Emirates University, United Arab Emirates (UAE)<sup>2</sup>Faculty of Medicine - Assiut University, Egypt

Metal nanoparticles offer promising prospects in agriculture, enhancing plant growth and ensuring food security. Silver, gold, copper, and zinc nanoparticles possess unique properties making them attractive for plant applications. Understanding molecular interactions between metal nanoparticles and plants is crucial for unlocking their potential to boost crop productivity and sustainability. This review explores metal nanoparticles in agriculture, emphasizing the need to understand these interactions. By elucidating mechanisms, it highlights potential for enhancing crop productivity, stress tolerance, and nutrient-use efficiency, contributing to sustainable medical, agriculture and food security. Quantifying benefits and risks reveal significant advantages. Metal nanoparticles enhance crop productivity by 20% on average and reduce disease incidence by up to 50% when used as antimicrobial agents. They also reduce nutrient leaching by 30% and enhance soil carbon sequestration by 15%, but concerns about toxicity, adverse effects on non-target organisms, and nanoparticle accumulation in the food chain must be addressed. Metal nanoparticles influence cellular processes including sensing, signaling, transcription, translation, and post-translational modifications. They act as signaling molecules, activate stress-responsive genes, enhance defense mechanisms, and improve nutrient uptake. The review explores their catalytic role in nutrient management, disease control, precision agriculture, nano-fertilizers, and nano-remediation. A bibliometric analysis offers insights into the current research landscape, highlighting trends, gaps, and future directions. In conclusion, metal nanoparticles hold potential for enhancing productivity, mitigating environmental stressors, and promoting sustainability.

Keywords: Metal nanoparticle, molecular interaction, translocation, crop productivity, sustainability

P4

[37]

### MINIMIZING NITRATE LEACHING LOSSES FROM SANDY REGOSOLS USING DIFFERENT FERTILIZER MANAGEMENT TECHNIQUES

*Herath, H.M.I.K.<sup>1</sup>, Lakshani, M.K.P.A.<sup>1</sup>, Dewage, P.B.<sup>2</sup>, Swarnathilake, D.S.G.G.C.*

<sup>1</sup>Department of Plantation Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka

<sup>2</sup>School of Food Technology and Natural Sciences, Massey University, Palmerston North, New Zealand

Intensive use of nitrogenous fertilizers leads to leaching of nitrates into groundwater. Mitigating losses using synthetic nitrification inhibitors is costly and less environmentally friendly. This study was carried out to assess the effect of different fertilizer management techniques with bio-based amendments on nitrogen leaching losses from red onion grown on sandy regosols. The treatments were grower-used rate of fertilizer without amendments (T1), Neem extract incorporated urea (T2) with recommended fertilizer (RF), Bamboo extract incorporated urea with RF (T3) RF applied to biochar incorporated soil (T4) and only the RF (T5). The experiment was established in lysimeters and arranged in a completely randomized block design with three replicates. Growth and yield of the crop were recorded while the leachate was collected from lysimeters (at 1m below the surface) weekly for nitrate analysis. There was a significant difference ( $P < 0.05$ ) in cumulative leached nitrate (over six weeks) among treatments. T1 (196.18 kg/ha) showed the highest leaching throughout the cropping season while the lowest was by T4 (85.45 kg/ha). There was a significant reduction in nitrate leaching in T3 compared to T1. The application of biochar together with RF has significantly reduced nitrogen leaching losses without compromising the yield of red onion compared to T1. Furthermore, the application of urea with neem and bamboo extracts has also reduced nitrate leaching in sandy regosols.

Keywords: nitrification inhibitors, nitrate leaching, red onion, biochar

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**TAILORED BIOFERTILIZER FOR SUSTAINABLE CROP FARMING**Leong, C.Y.<sup>1</sup>, Ng, W.P.V.<sup>1</sup>, Patrick, B.<sup>1</sup>, *Ng, S.B.<sup>1</sup>*<sup>1</sup>Singapore Institute of Food and Biotechnology Innovation (SIFBI), Agency for Science, Technology and Research (A\*STAR), Singapore

For land scarce urban environment to grow vegetables, hydroponic growth system with multiple levels vertical farming is the most appropriate methods. The basis of hydroponic uses defined chemical nutrient solutions to provide all necessary macro and micro nutrients for crop growth. A long-term crop agriculture industry to be green and sustainable, a move from chemical to a biological bio-based fertilizer is important. Many biofertilisers are already available for soil farms but limited products target the hydroponic growth system. A series of 5 miniaturized functional assays identifying nitrogen fixing, mineral solubilizing, siderophore production were used to screened 400 microbial strains. Several microbes showed desired properties suitable for vegetable growth promotion in hydroponic system. These microbes were able to improve the yield and phytonutrients production of the leafy green vegetables at a chemical nutrient solution at 50% in the hydroponic system. Furthermore, some are able to promote seed germination with quicker and better germination rate.

Keywords: Biofertilizer, miniaturized assays, growth promoting microbes, agriculture