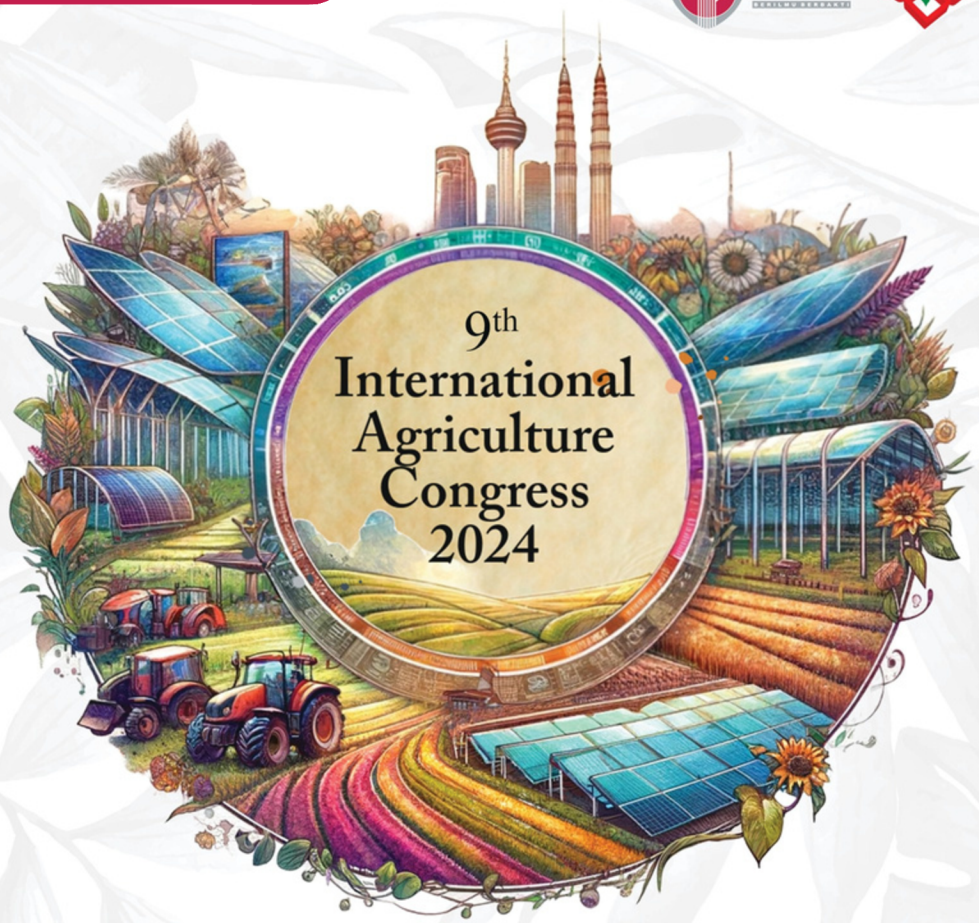
ABSTRACT BOOK



"REVOLUTIONIZING AGRICULTURE FOR A SUSTAINABLE FUTURE"

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List of Oral

*DP = Distinguished Paper
**LP = Lead Paper

List of Poster

Distinguished Paper

Distinguished Paper 1

Inclusivity of UPM to Enrich Agriculture and Food Security Nexus

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Agriculture has long been unfairly perceived as the least important sector in the country, leading to lower budgeting priorities, slower growth, and inadequate productivity in local bio and agricultural-based industries. This perception has also resulted in a relatively low number of interested students and graduates from higher learning institutions in the field. Consequently, the agriculture sector has lagged behind in terms of GDP contribution and other economic indicators. The palm oil industry stands out as the largest contributor, influencing Malaysia's position in terms of food security. Universiti Putra Malaysia (UPM), with agriculture at its core, is committed to playing a more impactful role in addressing these challenges. Under its "true-north" initiative, UPM has developed several strategies to enhance its contribution to the agriculture sector. The PUTRA initiative symbolizes UPM's commitment to agriculture for the people, encapsulated in the acronym "Pertanian Untuk Rakyat." It is essential for the UPM community to embody this ethos and translate it into meaningful initiatives and outcomes. One significant initiative is the launch of the UPM Blueprint for Food Security, a comprehensive document that addresses the entire food security ecosystem, identifies key issues and challenges, and outlines UPM's role in addressing food security concerns. To effectively achieve these goals, it is imperative for UPM's intellectuals and talent to collaborate as a cohesive team. Inclusivity is crucial, requiring active participation from all stakeholders in the agriculture and food security industry to ensure mutual benefits and contributions. Through thoughtful deliberations and showcasing examples of successful approaches at UPM, the university aims to foster a collaborative environment that drives innovation and sustainable solutions in the agriculture and food security sector.

Keywords: Agricultural-based industries, palm oil industry, PUTRA

Distinguished Paper 2

Innovations for Sustainable Agriculture

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The agriculture sector requires transformative changes to be more sustainable in facing climate change. CGIAR research programs explore solutions to pressing global challenges in agriculture that must be overcome for climate-resilient, sustainable farming to be possible for millions of farmers in low- and middle-income countries by 2030. Seven breakthrough areas have been identified spanning from alternative proteins to digital solutions for agriculture. These breakthrough areas hold innovations across five different pathways including reducing unsustainable practices, increasing production without expanding land size, reducing damage to natural resources, reducing emissions and prioritizing needs and interests of smallholder farmers. In this presentation, innovations in two breakthrough areas, crop breeding and digital solutions, will be discussed. Accelerated breeding programs are essential in the production of crops that can withstand the impacts of climate change. Plant breeding has been successful in delivering a host of high-yielding varieties that are in use today; however, the rate of genetic improvement must be doubled to meet future demands. Data-driven approaches in crop breeding combined with digital tools and solutions that cross disciplinary and organizational boundaries can deliver new insights for more efficient and effective crop improvement. Innovations in digital solutions have been developed for the entire chain of crop production from applications in genetics during crop breeding to IoT where universal access to the internet presents a critical pathway to educate smallholders and small businesses on ways to reduce the footprint of agriculture and achieve sustainable, long-term food security.

Keywords: Breakthrough, crop breeding, digital solutions, sustainable

Distinguished Paper 3

Enhancing Agricultural Resilience with Big Data and Climate Informatics: Efforts to Enhance the Agricultural Productivity

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Southeast Asia's agricultural sector is increasingly vulnerable to climate extremes, with recent droughts and floods causing substantial crop losses and disrupted seasonality and monsoons further complicating crop production. The "Thailand Grand Challenge Project" integrates big data analytics, drone technology, and climate informatics to enhance agricultural forecasting for crops like rice and oil palm. Despite challenges in funding and data collaboration, the AgriSpace platform, developed by Kasetsart University, demonstrates significant potential. More recently, integration of advanced climate reanalysis and forecast data, supported by the Kasetsart University Center for Climate Intelligence (KUCCI), is expected to further popularize and add value to these forecasts, ensuring farmers receive timely, actionable insights to adapt to erratic climatic conditions. This keynote will delve into the scientific methodologies underpinning these initiatives, including multi-source evapotranspiration estimates and the integration of socio-economic data from community surveys. By leveraging KUCCI's state-of-the-art climate data access and educational platform, researchers and policymakers can better understand and mitigate the impacts of climate anomalies on crop production. The presentation will highlight how improved agricultural forecasting can bolster resilience against disrupted seasonal patterns and irregular monsoon cycles, driving forward sustainable agricultural practices. Through a comprehensive examination of the project’s achievements and future directions, this presentation aims to inspire a collaborative effort towards revolutionizing agricultural resilience and ensuring food security in the face of climate change.

Keywords: Agricultural forecasting, big data, climate change, climate informatics food security

Distinguished Paper 4

Breeding through Rational Design: The Path to Securing Future Rice Yields

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Rice is one of the world's most important cereal crops and feeds about half of the world's population. Rice yield has made two big leaps in the last century, and then the yield ceiling appears in many rice-growing regions, although local breeders have made some efforts. It is important to find new ways to break the yield limit. In this study, we addressed rational design breeding as a possible route to further increase yield, achieved by searching and exploiting different quantitative trait loci (QTLs) through molecular marker-assisted selection (MAS) and gene editing. We present our successful dissection of several key QTLs from different germplasms, accounting for important agronomic traits such as panicle size, plant architecture and grain size. Clarification of different QTLs makes it possible to better understand the contribution of individual or combined traits in different genetic backgrounds and to select the best combinations for rational design during breeding. We highlight the importance of *ipa1-2D*, *qPL6* and *qWS5* for the rapid development of the plant with large panicles and strong culm, which is crucial for high yield and lodging resistance. After that, other traits such as harvest date, plant height and grain size can be further adjusted by associated QTL, including *Hd1*, *Hd6*, *Ghd7*, *Sd1*, *Dep1*, *GS3* and *GW5*, all of which have been confirmed to contribute greatly to the trait variation through our genetic Analysis. Furthermore, we highlight the gene editing strategy in creating new alleles of different QTLs with similar or better trait performance than the natural type, as illustrated by the example of *ipa1-2D* and *qPL6*. By combining MAS and gene editing, we have developed a rational design breeding model to produce new rice varieties with high yield potential.

Keywords: Breeding, gene editing, QTL, rice, yield

Distinguished Paper 5

How Effective is Our Plant Protection System in an Everchanging Environment?

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The human efforts to guard the safety of their agricultural and farming enterprises against external disturbances both from organisms and natural disasters are as old as the farming itself. The dynamics of these efforts are very divergent and interesting. Better progress on the understanding of the ecosystem, particularly the agroecosystem, in turn brings about the advancement of plant protection (sub)system which gives rise to IPM or Integrated Pest Management concept and practices. As a subsystem which was greatly affected by its surrounding, IPM cannot be firmly established without embracing the changes. New thoughts, paradigms, discoveries, and inventions were always formulated and would provide up to date contributions both to the IPM concept and its implementation. Newer technologies come and go, some stay as they showed better efficiency and practicality, while others may not make it into chosen IPM technologies as they are of lesser qualities. Wisely select these choices are crucial in ascertain the effectiveness of plant protection (sub)system that we need to develop and apply. Which and what requirements are essential in establishing an IPM program that is easy to understand and has excellent efficacy in protecting the farms, these are considerations that will include factors to be considered both for in the short and long time IPM planning and later, its actual applications in field level.

Keywords: Changes, concept, control technology, implementation, IPM

Distinguished Paper 6

Development of Nature-Based Solutions for Sustainable Pest Management in Agroecosystems

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Agroecosystems experience dramatic disturbances such as climate change, biodiversity losses, changing land use patterns, and biological invasions. Unsustainable farming practices, such as irrational use of broad-spectrum synthetic pesticides, can be very destructive to agroecosystem functions and services on which we rely to meet the food and nutrition security for increasing global population. Nature-based solutions not only prevent and control agricultural pests and diseases but also restore core agroecosystem functions and services to be more resilient to biotic and abiotic stresses in the long run. In this talk, I will present several research activities and digital tools being conducted by CABI to enhance the uptake of nature-based solutions in smallholder farming context.

Keywords: Bioprotection products, ecosystem service, integrated pest management, nature-based solutions, pesticides risk reduction

Distinguished Paper 7

Sustaining Blue: Strategies for a Healthier Marine Ecosystem

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Asian fisheries and aquaculture contribute an estimated 70% to global seafood production. In contrast to aquaculture production which has been increasing rapidly, marine capture fisheries have plateaued, and most fisheries are fully exploited, with little potential for increase. Typically, fisheries are assessed based on single species stock assessments, which do not consider interactions between fisheries and other species, the impact of fishing on the marine ecosystems that support them or acknowledge the multi-species nature of fisheries. The multi-species, multi-gear and data-limited nature of fisheries are prominent in Asian waters, which are a hotspot of marine biodiversity. In addition, the livelihoods of coastal communities and millions of people in Asia are dependent on catches from small-scale fisheries, which are notoriously difficult to assess and manage. Incorporating ecosystem approaches and the social dimensions of fisheries provides a means of enhancing the understanding of these fisheries and is fundamental for ecosystem-based fisheries management (EBFM). Ecosystem modelling provides a means of increasing understanding of fisheries and their interactions with marine ecosystems to ensure their future sustainability and contribute to EBFM. Ecosystem models also provide a mechanism for communicating across a wide variety of people from different disciplines and backgrounds to understand ecosystem structure and function. Examples from Australia and Indonesia are provided of how conceptual, qualitative, and quantitative models are developed to understand the functioning of marine systems and identify solutions for impacted systems. To understand the current state of a system and assess its health requires transdisciplinary approaches that consider fisheries and their ecosystems within a management system, including the implementation of management decisions. Asian scientists have the capacity and interest to apply these approaches which would be enhanced by establishing networks of practioners and developing partnerships with a range of organizations across government, universities, NGOs, fishers and the fishing industry.

Keywords: Ecosystem-based fisheries management, ecosystem models, fisheries and aquaculture, partnership approaches, stock assessment

Distinguished Paper 8

Harnessing Climate Resilient Circular Economy Protein (CRiPE) for a Greener Future

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Macrobrachium rosenbergii, commonly known as the giant freshwater prawn, is a commercially important and has remarkable traits as a fast grower, low disease risk, fillet palatability, and the option of polyculture with other freshwater fish. However, one of the significant issues in freshwater prawn production is maintaining the feed cost using sustainable protein sources, as it constitutes 40–60% of the operational budgets. In recent years, insect meal (IM) has gained attention as a potential feed protein, specifically a protein derived from omnivore larvae, the black soldier fly (BSF). Sento Biotech has created a novel approach using an underutilized leguminous plant known as the hummingbird leaf (*Sesbania grandiflora*) (Patent Filling No. PI2023001409). The research findings by Sento Biotech demonstrated the accumulation of higher protein, i.e., 50 to 60%, higher essential amino acids (> 60%), and lower deposition of crude fat (8–13%). The IM derived from plant-based promotes green and sustainable technologies that highlight and override crucial issues such as inconsistent nutrients in waste materials, heavy metals, food hygiene, and food security that concern conventionally produced insect meal. A 60-day feeding trial was carried out to assess the effects of Sento IM inclusion replacing the dietary fish meal on growth performance, survival, specific growth rate and feed conversion ratio. Five isoproteic (35%) and isolipidic (9%) diets were formulated to contain a gradient level of insect meal derived on sesbania substrate from 0% of IM, 25%, 50%, 75% and 100%. An average weight of 3–4 g of juvenile prawns was selected, weighed, and stocked in 10 replicate tanks representing a diet group. The prawns were fed with the experimental diets two times daily to apparent satiation. Post-harvest analysis revealed the growth indices of prawn fed the diet 100% IM showed numerically lower weight gain compared to the control diet (100% FM) but significantly higher ($P < 0.05$) than the remaining treatment, indicating that the replacement of 100% FM with the inclusion of Sento IM is possible without compromising the prawn growth and survival.

Keywords: Black solder fly larvae (BSF), *Macrobrachium rosenbergii*, *Sesbania grandiflora*, sustainable protein, underutilized crop

Distinguished Paper 9

Development Strategy of Agro-Edutourism

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In order to develop agro-edutourism development strategies that are appropriate to apply to Moosa Edufarm, the study will analyze internal factors, such as strengths and weaknesses, that affect the development of agro-edutourism in Moosa Edufarm. It will also analyze external factors, such as opportunities and threats, that affect the development of agro-edutourism in Moosa Edufarm. Using a case study methodology, this study was conducted over the course of two months in June and July of 2022 at Moosa Edufarm, specifically in Rawang Lubuk Selasih Jorong Batang Barus, Gunung Talang District, Solok Regency, Sumatera Barat Province, Indonesia. thorough interviews, firsthand observations, and secondary data to supplement the information gathered. This research stage is conducted in three steps: 1) Identifying internal factors that influence Moosa Edufarm's agro-tourism development, 2) Identifying external factors that influence Moosa Edufarm's agro-tourism development, and 3) developing strategies for Moosa Edufarm's agro-tourism development. The study's first phase's findings include internal factors such as Moosa Edufarm's strengths (which received the highest overall score) accessibility to accessible locations, expertise in human resources, and corporate culture and weaknesses (which received the highest total scores) high production costs, feed forage land's carrying capacity, and dairy product marketing. Stage two involves external factors that take the shape of opportunities with the highest scores. These include shifts in how consumers view travel, tourists' interest in returning, unmet needs for meat and dairy, threats to businesses and government regulations, a rise in agro-edutourism competition, taxes, and levies. In the third stage, the company recommends strategies such as developing a more innovative and creative tourism concept, enhancing communication among management, producing efficiently and with a focus on the market, maintaining consistency in the quality and uniqueness of products, improving infrastructure availability and quality, and collaborating with local communities to provide animal feed forage as a multiplier effect.

Keywords: Agro-edutourism, development strategy

Distinguished Paper 10

Linking Weed Knowledge to Improving Crop Resilience

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Weedy plants are the bane in agriculture. Crop producers and agricultural scientists alike deplore the damage that weeds can do to crops but scientists also acknowledge the potential benefit weeds can ascribe to crop improvement and the advancement of weed management technology. Understanding the diverse mechanisms of weed adaptation to crop cultivation; weed management tactics, especially chemical weed control tools; and environmental stresses due to changing climatic conditions. The veritable diversity of weed genomes presents biological facts yet to be discovered and potentially utilized to push the glass ceiling of crop yield, break barriers to crop adaptability, and increase consistency in performance across environments. Weed genomes are also a resource for finding solutions to the current impasse in the effort to mitigate the evolution of herbicide-resistant weeds and preparedness to manage the problem when it arises. In the short period from inception of the International Weed Genomics Consortium, reference genomes of at least 27 species have already been generated. These include the notorious global grass weeds in the genus *Echinochloa* (*E. colona*, *crus-galli*, and *oryzoides*), *Alupecurous myosuroides*, *Lolium rigidum*, and the globally problematic *Cyperus* species (*C. esculentus* and *rotundus*). Already, genomic investigations of weeds and weedy relatives revealed genes controlling seed dormancy, abiotic stress tolerance (drought, heat, low temperature); seed shattering; and resistance to herbicides among others. Advances in gene sequencing technology, computing power, and artificial intelligence applications are paving the way for gene discovery and channeling it toward improving crop resilience.

Keywords: Abiotic stress, crop resilience, herbicide-resistant weeds, weed adaptation, weed genomics

Session IA: Crop Production

Lead Paper 1

Future Ready Crops - Breeding Resilient Plants for Sustainable Agriculture

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Evolution of science brought technological developments in all the aspects of human life. Modernization of agriculture in the last few decades via, breeding of high yielding varieties and intensive crop management practices brought in green revolution for many countries. But in the developing world, climate change has emerged as a big threat to agriculture and thus food security. There is a mega challenge of producing food for alarmingly increasing human population under the most adverse climatic conditions and depleting natural resources – land, soil and water. The effect of climate change is directly visible with the rise in abiotic stress on the crops. The synergistic and additive effects of climatic factors – viz extreme atmospheric temperature – heat and cold waves, flood and drought, high relative humidity coupled with high temperatures and depleting soil health is drastically affecting the crop cultivation in many countries. Climate change is also contributing to the emergence and resurgence of insect pests and diseases in endemic and epidemic nature in all the major crops. The development of climate-resilient crops requires predicting and identifying future agricultural problems from both local and global perspectives. This needs innovation in breeding and crop management science. Breeding has a wider role to play, and it involves viz. conserving and developing pools of domesticated and wild germplasm, characterizing and utilizing the genetic variability, use of advanced methodologies like genomics, and molecular tools viz. CRISPER/Cas systems to create desired combination of plant genetics. Use of artificial intelligence-based tools for precise phenotyping and machine learning software's for data analysis are necessary to speed up breeding. And on the application side, customized crop management practices for protected and open field conditions under current and predicted environments is necessary. Breeding and development of the future ready climate resilient crops can be achieved only through integration of all the right technologies of research, sustainable crop management practices and coordinated efforts of the scientific community.

Keywords: Abiotic stress, biotic stress, climate resilient

Oral Paper IA-1

Genetic Variability and Traits Related to Drought Tolerance in Groundnut (*Arachis hypogaea* L.) under Different Water Regimes

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Investigation and better understanding of the variability that exists in a population base of crops is pivotal to crop improvement so that it can be exploited by plant breeders for crop improvement. This study aimed to estimate variance components, heritability estimates and correlations between some morphological and physiological traits related to drought tolerance in some groundnut genotypes under two water regimes, to speed up the selection and breeding of groundnut genotypes tolerant to drought. The experiment was carried out in a randomized complete block design with three replications each at the Research Farm of the Institute for Agricultural Research, Ahmadu Bello University, Samaru-Zaria Nigeria. Data collected for performance evaluation were the number of days to 50% flowering, plant height, number of pods/plants, seed weight/plant and pod yield/plant. Physiological traits related to drought tolerance measured included, Harvest Index (HI), SPAD chlorophyll meter reading (SCMR) at 40, 60 and 80 days after showing (DAS). Variance components, genetic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and broad-sense heritability were calculated for all the traits recorded. Results showed that PCV were generally higher than GCV in both water regimes, this indicates the influence of environment on the groundnut genotypes. Heritability of the traits ranged from 8.16% - 62.14% with pod yield/plant having the highest value and days to 50% flowering having the lowest values in non-stress while in water-stress condition heritability was low to moderate from 12.14% - 53.33%. SCMR at 60 DAS and HI showed a strong positive and highly significant ($P<0.01$) correlation with pod yield/plant (0.45 and 0.83) in water-stress condition. Due to SCMR at 60 DAS, number of pods/plant and HI having moderate heritability and significant correlation with pod yield/plant under water stress condition, these traits could be useful criteria in drought tolerance selection.

Keywords: Correlation, groundnut, heritability, SPAD Chlorophyll meter reading (SCMR)

Oral Paper IA-2

Growth Response of Lettuce (*Lactuca sativa* L.) to Auxin and Cytokinin Hormones in the Deep Flow Technique Hydroponic System

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Lettuce (*Lactuca sativa* L.) has a relatively high nutritional content. Hydroponic cultivation with a deep flow technique system is a form of land intensification to maximize plant production. In cultivating plants using a hydroponic system, administering hormones is one of the critical factors that can influence plant growth rate. However, the optimal type and concentration of hormones in the deep flow technique hydroponic system, especially for lettuce plants, is still not widely known. This study aimed to determine the concentration of auxin, indole butyric acid (IBA) and cytokinin, benzyl amino purine (BAP) in the hydroponic cultivation of lettuce. This research was carried out in the greenhouse of the Pusat Pelatihan Pertanian Dan Pedesaan Swadaya (P4S) Hikmah Farm, Kediri. The study was carried out in May-July 2022. The experiment was arranged factorially using a randomized block design. Factor I was the IBA concentration (0, 1, 2, and 3 ml/L), and factor II was the BAP concentration (0, 1, 2, and 3 ml/L). The results showed that adding 3 ml/L BAP at various IBA concentrations increased the length of plant roots. By administering 2 and 3 ml/L IBA, the number of leaves was 12 and 11, respectively. Furthermore, the application of 2 ml/L IBA with 0 ml/L BAP resulted in stem diameter (3.86 cm), total fresh weight (889.78 g), shoot fresh weight (725.78 g), and root fresh weight (209.27 g) was higher compared to other treatments.

Keywords: Hormone, hydroponic, plant growth regulator

Oral Paper IA-3

Effect of Superabsorbent Polymers (SAP) and MYKOVAM® on the Growth of *In Vitro* Regenerated Plantlets of Banana (*Musa acuminata* Colla (AA) 'Lakatan')

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The study aimed to alleviate water stress in 'Lakatan' banana plants using superabsorbent polymers (SAP) and MYKOVAM®. *In vitro* grown 'Lakatan' banana plantlets were subjected to different levels of SAP and MYKOVAM® during pre-drought, drought, and recovery conditions. The treatment with 100 ppm benzylaminopurine (BAP) effectively induced the proliferation of 'Lakatan' banana plantlets *in vitro*. In drought simulation, incorporation of SAP in the soil improved soil moisture retention up to 30 days without watering. During drought, plants treated with 0 SAP had the highest height, leaf area, pseudostem biomass, catalase (CAT) activity, and mycorrhizal root colonization. One percent SAP treatment promoted the highest relative growth rate (RGR) in terms of plant height, percent open stomata, and leaf number. Treatment with 3% SAP had higher stomatal density and chlorophyll content compared with 0, 1 and 2% SAP. Plants treated with MYKOVAM® had higher average root length, chlorophyll content, root colonization, and percent open stomata compared with untreated plants. In addition, plants treated with 10 g MYKOVAM® had reduced CAT activity as indication that 'Lakatan' plants were not encountering drought stress. The treatment combination of 3% SAP and 10 g MYKOVAM® resulted in plants having the highest stomatal density and percent open stomata. Moreover, plants treated with the combination of 0 SAP and 10 g MYKOVAM® exhibited higher CAT activity and percentage root colonization than plants treated with 1% SAP and 0 MYKOVAM®. The findings suggest that 10 g MYKOVAM® with no SAP promotes a high percentage of root colonization on 'Lakatan' plants. A useful treatment could be 1% SAP and 10 g MYKOVAM®, implying that this level of SAP can supply appropriate amount of water while this sufficient amount of MYKOVAM® promotes colonization of the roots, and serving as root extension, thus promoting a mutualistic symbiotic relationship by enhancing the root system to obtain this water to support the growth of 'Lakatan' plants under drought condition.

Keywords: *In vitro*, Lakatan' MYKOVAM®, superabsorbent polymers (SAP), water stress

Oral Paper IA-4

Herbicide Resistance and Management Options of *Papaver rhoeas* L. and *Centaurea cyanus* L. in Europe: A Review

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Corn poppy (*Papaver rhoeas* L.) and cornflower (*Centaurea cyanus* L.) are two overwintering weed species found in crop fields in Europe. They are characterized by a similar life cycle, similar competitive efforts, and a spectrum of herbicides recommended for their control. This review summarizes the biology and herbicide resistance phenomena of corn poppy and cornflower in Europe. Corn poppy is one of the most dangerous dicotyledonous weeds, having developed herbicide resistance to acetolactate synthase inhibitors and growth regulators, especially in Mediterranean countries and Great Britain. Target site resistance to acetolactate synthase inhibitors dominates among herbicide-resistant poppy biotypes. The importance of non-target site resistance to acetolactate synthase inhibitors in this species may be underestimated because non-target site resistance is very often associated with target site resistance. Cornflower, meanwhile, is increasingly rare in European agricultural landscapes, with acetolactate synthase inhibitor-resistant biotypes only listed in Poland. However, the mechanisms of cornflower herbicide resistance are not well recognized. Currently, herbicides mainly from acetolactate synthase and photosystem II inhibitors as well as from synthetic auxins groups are recommended for the control of both weeds. Integrated methods of management of both weeds, especially herbicide-resistant biotypes, continue to be underrepresented.

Keywords: ALS-resistance, fitness, herbicides, integrated weed management, mechanisms of resistance

Oral Paper IA-5

Productivity Assessment of Soybean (*Glycine max* L.) and Maize (*Zea mays* L.) Relay Cropping System in Laguna, Philippines

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Relay cropping can increase internal utilization efficiency (IE), land use efficiency (LER) and net income per unit area of land. The relay cropping was performed at Laguna with five cropping systems: monocrop maize (M), monocrop soybean (S), soybean relayed with maize (S/M), soybean with *Rhizobium* inoculant (SwR), and soybean with *Rhizobium* inoculant relayed with maize (SwR/M), and two tillage systems: conventional tillage and reduce tillage. This study assesses its influence on the test species agronomic performance and economic profitability. In maize, a significant increase was observed in the plant height, biomass partitioning for ear, 1000-seed weight, and grain yield of maize in monocropping. In soybean, S and SwR had increased 1000-seed weight than relay cropping. However, soybean with *Rhizobium* inoculant relayed with maize had the highest IE, gross income and net income, and cost benefit ratio with LER of 1.58. Relay cropping conducted in Laguna maximized total productivity per unit area and with the dual purpose of ensuring food and nutritional security from two crops harvested at the same plot. The identified advantages in the crop removal efficiency, land use efficiency and net income are essential, however, obtaining such yield benefits in actual agriculture in the Philippine agriculture will require site-specific technology and training for the farmers. Further studies on cropping systems to explore the best combination of crops to improve the mutualism between crops for increasing yield of the main crop and additional crop for the benefit of the farmers.

Keywords: Monocropping, productivity, relay cropping, *Rhizobium* inoculant, tillage system

Oral Paper IA-6

Sanitization of Rat-Tailed Radish Seeds using Chlorination Treatment for Microgreen Herb Production

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Microgreens are preferred as functional food owing to their high nutrients and health promoting phytochemicals as compared to their mature-leaf counterparts. *Raphantus sativus* L. var. *caudatus* Alef or rat-tailed radish (RTR) possess antioxidant and cancer preventive properties with high potential to be mass produced as microgreen herbs. Microgreens are commonly eaten fresh; thus, contaminated seeds represent a microbiological risk. Therefore, this study aimed to evaluate the effect of different chlorine concentrations on total bacterial and fungal counts of RTR seeds. The seeds were rinsed and rehydrated with tap water for 5 hr. Subsequently, the seeds rinsed with tap water and sanitized with tap water (control) (control), 200, 500, and 1000 mg/L NaOCl for 1 hr. Then, total bacterial and fungal count of the treated and untreated seeds were determined. The result showed that the initial total bacterial count of the dried seed before washing was 5.25 log CFU. The total bacterial count decreased significantly after washing in which sanitization of the seeds with 200 mg/L NaOCl showed 26% and 18% reduction in total bacteria count as compared to no wash and washed with tap water only. For total fungal count, washing with tap water did not reduce the fungal population. However, 200 mg/L NaOCl treatment significantly reduced fungal population count by 34.75% as compared to washing with tap water only. There were no differences in total bacterial and fungal count for all chlorine concentrations. The findings also found that 200 mg/L NaOCl had the highest reduction (before and after treatment) in total chlorine (64.46%) and free chlorine (76.91%) as compared to 500 and 1000 mg/L NaOCl, indicating the effectiveness in germ-killing caused by available chlorine. In conclusion, 200 mg/L NaOCl is the best seed sanitization treatment to be used for RTR microgreen herb production.

Keywords: Microbial contamination, microgreen, seed sanitization

Oral Paper IA-7

Fiber Yield and Quality of Red Spanish Pineapple (*Ananas comosus* L.) through Fertilizer Application and Planting Distance

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Red Spanish pineapple (*Ananas comosus* L.) is a source of excellent fibers for handloom weaving used in textile industry to produce fabric, which is prized for its unique beauty and elegance when sewn into formal wear and fashion accessories. The study was conducted to determine the fiber yield and quality of RSP through fertilizer application and planting distance. Split-plot design was used wherein the main plot is the planting distance consist of 30 x 30 cm (Aklan farmers' practice) 20 x 20 cm (Recommended for RSP), 60 x 30 cm (farmers' practice for Queen Pineapple), and 80 x 50 x 30 cm (Mindanao practice adapted in Cam. Norte) while the sub plots are made up of fertilizer treatments such as control, 10 g NPK + 10 g Urea, 7.5 g NPK + 7.25 g Urea, 6 g NPK + 5 g Urea, 4.5 g NPK + 3.75 g Urea, 5 g NPK, 4 g NPK, and 3 g NPK with three replications. Results showed that application of 4.5 g NPK + 3.75 g Urea, 3 g NPK and 6 g NPK + 5 g Urea had improved the *liniuan* fiber length, *bastos* fiber length and *bastos* fiber tensile strength, respectively. Planting distance of 20 x 20 cm favored both the *liniuan* fiber length and *bastos* fiber tensile strength, while 30 x 30 cm for the longest *bastos* fiber length. For longest *liniuan* fiber and highest *bastos* fiber tensile strength value 20 x 20 cm planting distance is recommended and 30 x 30 cm for longest *bastos* fiber. To enhance the length of *liniuan* fiber, length and tensile strength of *bastos* fiber, the suggested rates of fertilizers are 4.5 g NPK + 3.75 g Urea, 3 g NPK, and 6 g NPK + 5 g Urea.

Keywords: Fertilizer application, fiber quality, fiber yield, planting distance, red Spanish pineapple

Oral Paper IA-8

The Effects of Planting Time and Type of Intercrops on the Growth and Yield of Tomatoes with the Intercropping System

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Boosting tomato plant productivity presents numerous challenges. Traditionally, increasing vegetable productivity has relied heavily on monoculture systems with intensive inputs, which can compromise environmental sustainability. This research aimed to investigate the effects of intercropping systems on the productivity of tomato plants. The study was conducted from June to November 2022 in Poncokusumo District, Malang Regency. The study used a split-plot design. The main plot was the intercropping period, including W1 = at the same time as tomatoes were planted, W2 = 1 week after tomato planting, W3 = 2 weeks after tomato planting, and W4 = 3 weeks after planting tomatoes. The subplot is a type of intercropping, namely T1 = curly lettuce, T2 = pakchoy, T3 = flowering cabbage, T4 = cabbage. The results indicated that there was no interaction between the timing of planting intercrops and the type of intercrop in influencing the growth and yield of tomato plants. Individually, intercropping periods and types significantly affect the height, number of leaves, stem diameter, fruit weight per plant and per hectare, and fruit number/plant. The treatments of W0 and W1 showed the best result in increasing fruit weight by 1.81 and 1.69 kg/plant or 43.01 and 38.73 t/ha. Delaying planting of intercrops for 2-3 weeks (W2 and W3) results in lower growth and yield of tomato. Moreover, our results showed that tomatoes that intercropped with pakchoy (T2) and curly lettuce (T1) resulted in a better fruit weight by 1.93 and 1.76 kg/plant or 45.15 and 40.72 t/ha compared to T3 and T4. Our results suggest that tomato plants have better growth and fruit yields when intercropped with plants with a short canopy, fast crown spread, shallow roots, and a short harvest time.

Keywords: Intercropping, intercropping types, planting time, tomato

Oral Paper IA-9

Growth and Yield Performance of Lettuce (*Lactuca sativa* var. Lalique) using Different Organic Growing Media Under Hydroponic System

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This study assessed the growth and yield of lettuce, nutrient solution consumption of the plant, and its quality using different growing media (foam, coco peat, raw rice hull, coconut sawdust, antipolo sawdust, composted rice straw, composted rice hull) in a Kratky hydroponic system at the Institute of Agriculture, Camiguin Polytechnic State College-Catarman Campus, Tangaro, Catarman, Camiguin during wet season (August 9 – October 12, 2022) and dry season (February 18 – April 7, 2022). The study was laid in a randomized complete block design with seven treatments and three replications. Tukey's honest significant difference test was used to compare the significant differences between treatment means. Results showed that the type of growing media significantly affected the lettuce growth performance and horticultural root development except for root volume, root fresh weight, and percentage root per plant, insect pests and disease incidence and survival rate for both seasons. A highly significant difference was also observed in terms of yield, nutrient solution consumption, and final quality of the hydroponic nutrient solution for both wet and dry seasons. Our results showed that the use of organic growing media (composted rice hull, raw rice hull, composted rice straw, antipolo sawdust, and coco peat) could be used effectively to increase production performance of lettuce under a hydroponic system. It can be concluded that the growing media affects the growth and yield of lettuce in a hydroponic production system; however, the potential use of these various growing media should be further tested for verification.

Keywords: Growth, hydroponics, lettuce, organic growing media, yield

Session IB: Sustainable Soil & Water Management

Lead Paper 2

Biostimulants Produced from Agricultural Waste Materials Improve Soil Quality and Plant Growth

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About 80% of agricultural waste is organic and these wastes can potentially be used to produce valuable products (i.e., biostimulants, compost, plant extract, etc.) to improve crop productivity and soil quality. Developing biostimulants from agricultural waste is classified as one of the eco-friendly methods to promote recycling activities and this approach is known to be economic, especially in promoting plant growth in Tropical areas. Few techniques can be used to produce biostimulants from agricultural waste materials and most of these techniques are simple and cost-effective. A small amount of biostimulants (i.e., 0.2% for protein hydrolysate and 2 g for humic acids) is generally needed to promote crop growth and soil fertility, and this approach will be effective in reducing input costs in agricultural fields. In conclusion, the use of biostimulant products in the local environment may help farmers reduce their dependency on chemical input sources.

Keywords: Agricultural waste, chicken feather, humic acid, plant extract, protein hydrolysate

Oral Paper IB-1

Influence of Organic Manure and PGPR Application Timing on Growth and Yield of Eggplant in Intercropping Systems

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The use of chemical fertilizers to increase crop production has resulted in various problems. This causes soil degradation through decreased physical, chemical, and biological properties. Manure and PGPR can help improve plant growth and create sustainable agricultural systems. This study aimed to determine the optimal application time for manure and PGPR to increase the growth and yield of an eggplant intercropping system. The research was conducted from June to November 2021 in the Poncokusumo District, Malang Regency. A split plot design was used in this study. The main plot was the manure application time (10 t/ha), which included M1=4, M2=3, and M3=2 weeks before planting. The subplots were the application time of PGPR (20 ml/L) including P1 = at manure application (MA), planting (PL), 14 and 28 days after planting (DAP), P2 = MA, 14, 28, and 42 DAP, P3 = PL, 14, 28, and 42 DAP, and P4 = 14, 28, 42, 56 DAP. Observations included plant height, leaf number, and yield. The benefits of the intercropping system were calculated using the Land Equivalent Ratio (LER). The application of manure in treatments M1 and M2 significantly increased eggplant growth and yield. At 70 DAP, the height was 95.95 and 92.23 cm, respectively. The best PGPR application was in P1, with a height gain of 94.73 cm. Similar results were observed for the growth of pakchoy. The leaf number was 95.95 and 94.73 t/ha in M1 and P1, respectively. Furthermore, treatments M1, M2, P1, and P2 significantly increased the yield of eggplant by 46.69, 43.44, 45.03, and 43.00 t/ha, respectively. The results showed that intercropping eggplant with pakchoi with the M1P1 and M2P1 treatments obtained NKL values of 1.84 and 1.90, respectively. These results suggest that an intercropping system of eggplant and pakchoy can help to increase land productivity.

Keywords: Eggplant, intercropping system, organic manure, PGPR, pakchoy

Oral Paper IB-2

Effect of Organic Fertilizer (Fermented Plant Juice) on the Growth and Flowering of Rohelia (*Ruellia Brittoniana* L.) 'Katie Pink' Dwarf Variety

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In recent years, several efforts have been made to reduce the impacts of climate change on the environment and shift to more sustainable practices, especially in agriculture. The ornamental plant industry has been gaining popularity since the pandemic, but there has been limited research on suitable sustainable practices. In this study, the effects of fermented plant juice (FPJ) on the growth and flowering of *Ruellia brittoniana* L. were investigated. FPJ, an organic soil enhancer derived from plant extracts and molasses, has been reported to improve growth and induce early flowering in several horticultural crops. The effects of different concentrations and frequencies of FPJ application were compared to those of inorganic fertilizer (ammonium sulfate) and humic acid. The results showed that increasing the FPJ concentration also increased growth; however, the soil became highly acidic, which limited growth when compared to the control. The growth of plants treated with ammonium sulfate was found to be significantly different from all treatments, except for plants treated with 2 tbsp FPJ per L applied once a week. Early flowering and an increased number of flowers were also observed under the ammonium sulfate treatment when compared with the control and all organic treatments. Since the application of 2 tbsp FPJ per L once a week showed promising results, its potential as an alternative to inorganic fertilization may be further explored with the use of leguminous plant extracts or in combination with other organic fertilizers.

Keywords: Fermented plant juice, frequency, organic

Oral Paper IB-3

Preliminary Assessment of Universal Extractants and Colorimetry/Turbidity Reagents Compatibility for Rapid Soil NPK Test Kit Development

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Rapid soil test kits are being developed that use universal soil extractants to simultaneously extract multiple nutrients from the soil. These kits also include colorimetry or turbidity reagents that determine nutrient concentrations. By providing quick, on-site soil testing and results that can be visually observed, these kits offer a cost-effective solution for soil nutrient analysis. But assessing compatibility is crucial to ensure accurate and reliable results. In this study, we investigated the compatibility of various universal extractants with colorimetry and turbidity reagents and compared the results with those of wet chemistry analysis. Forty-two soil samples, varying in texture, pH, and nutrient composition, were subjected to 90 agitations by hand using universal extractants. Universal extractants, including Morgans, $SrCl_2$, $BaCl_2$, and Kelowna, were assessed for compatibility with colorimetry/turbidity reagents such as Zn-Griess (for nitrate), salicylic acid Berthelot (for ammonium), molybdenum yellow (for P), and sodium tetraphenyl boron turbidity (for K). Each universal extractant demonstrated incompatibility with more than one colorimetry/turbidity reagent, which was attributed to factors such as neutralization between acidic and alkaline solutions and interference with other elements. However, H3A-4 has emerged as the most promising universal extractant, demonstrating its compatibility with colorimetry/turbidity reagents. This resulted in strong correlations with the wet chemistry analysis for nitrate and P (r>0.7). Despite these promising results, challenges remain, particularly in achieving consistent color/turbidity formation for ammonium and K determination, and future studies will focus on improving color/turbidity consistency formation for more accurate results. Additionally, efforts will be made to establish a standardized color chart to identify soil NPK ranges as low, medium, or high, followed by validation to ensure a precise soil nutrient assessment. This standardized color/turbidity chart developed for identifying soil NPK ranges enables farmers to make informed fertilization decisions. These kits aim to provide economical soil nutrient analysis, optimize fertilizer use, and reduce environmental impacts, thereby promoting their widespread adoption and fostering sustainable agriculture.

Keywords: Colorimetry, soil nutrient analysis, rapid soil test kit, turbidity, universal extractant

Oral Paper IB-4

Dry Matter and Protein Yields of Selected Adlai (*Coix Lacryma-Jobi* L.) Varieties under Varying Nutrient Applications

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Coix lacryma-jobi L., locally known as adlai, is a potential alternative to rice, but there is limited local information about its growth and yield, dry matter (DM) partitioning, protein content, and nitrogen (N) use efficiency as affected by N, phosphorus (P) and potassium (K) application levels. The research was conducted from December 2022 to July 2023 in Bongabon, Nueva Ecija, Philippines, where the production of adlai has not yet been documented. In this study, different levels of NPK were applied to the 'Ginampay' and 'Kiboa' adlai varieties. The highest DM (8.38 t/ha) was obtained in plants fertilized with NPK (B5-151-28-28 kg/ha). Medium (113 kg/ha) and high N (151 kg/ha) applications resulted in 50% greater leaf partitioning. The recommended NPK levels (B2-113-21-21 kg/ha) enhanced early flowering and percent filled grains, whereas the application of B5 resulted in delayed flowering and significantly increased the plant height, number of productive tillers, partitioning to the leaves, grain yield (580 kg higher than B2), chlorophyll content, crude protein content, and other yield components of adlai varieties. 'Kiboa' applied with B5 had a higher grain yield (2.13 t/ha) and harvest index (0.25) than 'Ginampay,' due to its higher number of productive tillers, heavier and bigger grain size, and greater total DM. The application of 151-28-28 kg NPK/ha to 'Kiboa' is recommended for higher grain yield. However, the timing of fertilizer application, particularly the third application before or after flowering, and the use of short stature varieties can be tried in the area (Type 1 condition). The use of higher levels of N greater than (151 kg N/ha) be evaluated in future studies to attain maximum yields of adlai in the area, although optimum levels of nutrient application would be evaluated based on the optimum economic use of nutrient application.

Keywords: Adlai, crude protein, dry matter partitioning,

Oral Paper IB-5

The Effect of Bokashi Fertilizer Doses on the Growth and Yield of Two Varieties of Red Beet (*Beta vulgaris* L.)

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Red beet plants (*Beta vulgaris* L.) are widely cultivated in Indonesia, especially in highlands. The demand for red beets is increasing along with public awareness of the benefits of red beets from a health perspective. However, production is still not optimal because of a lack of cultivation knowledge. One of the efforts made to enhance production is through intensification using superior varieties and adding organic materials. The objective of this study was to investigate the interaction between bokashi dosage and variety in two varieties of red beet. The research was conducted from April to July 2020 at the Agro Technopark, Brawijaya University, Cangar. The study used a split-plot design with three replicates. The main plot was the red beet plant variety Crimson Globe and Boro. The subplot was the dose of bokashi waste taken from the cities, which consisted of five levels (0, 6, 12, 18, and 24 t/ha). The results showed that there was an interaction between the treatment of red beet varieties and the bokashi dose on plant height, leaf area, total fresh and dry weights of the plant, fresh and dry weights of the tubers, and tuber harvest per hectare. In the Crimson Globe variety, treatment with a bokashi dose of 18 t/ha increased productivity by 45.05% compared to the treatment without bokashi. In the Boro variety, a bokashi dose of 24 t/ha increased productivity by 163.8% compared to the treatment without bokashi. At an equivalent dose of bokashi, the Crimson Globe variety can elevate productivity by 66.87–113% compared to the Boro variety. In the treatment with a bokashi dose of 18 t/ha, there was an increase in tuber diameter by 43.16% and tuber length by 38.52% compared with the treatment without bokashi.

Keywords: Bokashi, growth, red beet, tubers, varieties

Oral Paper IB-6

Impact of Black Soldier Fly (*Hermetia illucens*) Biowaste on Lettuce (*Lactuca sativa*) Growth and Yield in a Screenhouse Environment: A Sustainable Approach to Waste Management

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The study focused on investigating the influence of integrating black soldier fly (BSF) biowaste on lettuce growth and yield in a screenhouse environment, aiming to enhance lettuce production through sustainable waste management practices. Various treatments, including pure garden soil, different ratios of biowaste and garden soil, and a control with synthetic fertilizer, were applied. Leaf length, leaf width, plant height, leaf number, and plant weight were evaluated. The experiment followed a randomized complete block design, with one-way ANOVA used for data analysis. The results showed significant differences among treatments. All biowaste treatments significantly improved lettuce leaf length compared with the synthetic fertilizer control. Notably, treatment with 75% biowaste and 25% garden soil demonstrated the most promising results across growth and yield parameters, closely resembling the performance of the synthetic fertilizer control. This research underscores the potential of BSF biowaste integration as a sustainable practice to enhance lettuce production while effectively managing organic waste. The findings contribute to advancing environmentally friendly approaches to agriculture and waste management and offer insights for practitioners and policymakers seeking to promote sustainable agricultural practices.

Keywords: Biowaste integration, screenhouse study, sustainable waste management

Oral Paper IB-7

Microbial Dynamics Supporting Pine Coffee Agroforestry with Allelopathic Stress

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Agroforestry (AF) is a combination of trees and annual crops in one area, producing beneficial ecological interactions between the components of the ecosystem. An interesting scientific phenomenon of a specific agroecosystem is the dynamics of microbes that only occur in coffee and pine AF. In coffee pine AF systems with less intensive management, the presence of fresh or rotting AF litter becomes a medium for soil microbial growth and the addition of inorganic chemicals is minimal, resulting in more soil microbial colonies. The biodiversity of soil microbes plays a role in providing ecosystem services, so that AF can be useful in providing food, fibre, and non-timber forest products. Ecosystem services provided by soil microbes include determining factors for soil health. Soil microbes that are important in AF include nitrifying bacteria, fungi, and cellulolytic bacteria. At the research location, pine (*Pinus merkusii*) has the potential to secrete secondary metabolites that act as allelochemicals. This study examined the effects of pine allelochemicals on the abundance of soil microbes in a pine coffee AF system. The method used: A survey was conducted on four pine coffee AF systems managed at different levels of cultivation management intensity (low, medium, high, and business management of coffee cultivation). The results of this study showed that the abundance of soil microbes is lower in pine coffee AF systems that are managed more intensively. The results show that more intensive cultivation of the AF system will reduce the number of soil microbes.

Keywords: Allelochemical, bacteria, fungi, microbial

Oral Paper IB-8

Influence of Drought Stress on Crop Growth and Development: A Review

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Studies have reported that crops face different abiotic stresses under field conditions, which are either lethal or retard crop growth and development; one prominent among them is drought. Drought has been observed to alter molecular, physical, physiological, and biochemical processes, resulting in effects on growth and development. Drought adversely affects crop production more than other stress conditions do. Crops have developed unique adaptive stress measures to tolerate drought stress. In the present review, drought was defined as a period of time without appreciable precipitation, during which the water content of the soil is reduced to the extent that plants suffer from a lack of water. The relationship between plants and water stress varies in different habitats. Water deficits have been reported to have major effects on plant photosynthetic capacity and inhibit the enzyme nitrate reductase. Water-use efficiency (WUE), a physiological trait associated with drought tolerance, refers to the amount of biomass accumulated per unit of water. Crop water use and WUE varied among different crops. Quantifying the effects of drought on crop production was difficult because other factors, such as poor irrigation practices and over-exploitation of land, combined with drought, affect crops. Drought resistance mechanisms were reported to have been divided into drought avoidance and drought resistance. The former refers to the adoption of reducing abilities of plants, while the latter relates to physiological traits developed for moderating water use, etc. Various novel approaches have been tested to minimize the negative effects of drought stress. Despite the main improvements, there is still a challenge in improving drought tolerance. Thus, future research should employ biotechnological and molecular approaches to develop genetically engineered crops with enhanced tolerance to drought stress. Crop physiology is inevitable in plant breeding programs that are designed to improve drought resistance.

Keywords: Crop-water stress, effects of drought, management strategies, protective approaches

Oral Paper IB-9

Green Hydrogen

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The technique of producing green hydrogen by utilizing green and renewable energy sources is called green hydrogen production. Therefore, by implementing this technique, hydrogen will become a sustainable and clean energy source by lowering greenhouse gas emissions and reducing our reliance on fossil fuels. Green hydrogen has several aims including decarbonization, technological innovation, and employment. Research on green hydrogen production focuses on developing technologies to produce hydrogen from water using renewable electricity, as well as chemical and physical storage systems. Results of green hydrogen include 100% sustainable where green hydrogen does not emit polluting gases either during combustion or during production. Hydrogen is easy to store, which allows it to be used subsequently for other purposes and at times other than immediately after its production. In conclusion, green hydrogen emerges as a critical player in the global effort to combat climate change. Its versatility and sustainability make it a promising solution for replacing carbon-intensive energy sources.

Keywords: Decarbonization, green hydrogen production, renewable energy

Session IC: Agricultural Extension & Education

Oral Paper IC-1

Modeling the Factors of Implementation and Adoption of Rice Technology Among 4-H Club Youth

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The study aimed to pave an argument that exposes the causal factors of rice technology implementation and adoption among the members of 4-H club youth in Southern Leyte, Philippines. Primary data were gathered from 118 4-H club youth members selected at complete enumeration. Descriptive statistical measures were used to summarize the collected data and ordered regression models were constructed to determine the predictors of implementation and adoption of rice technology. Results portrayed that there are still more members who do not implement and adopt the rice technologies introduced by the 4-H club in their respective places. And very few of them have fully implemented and adopted the rice technologies. The first regression model revealed that the significant causal factors of implementation of rice technologies are attended training (at a 5% level), economically viable characteristics of rice innovative and new technology (at a 10% level), and minimal risk characteristics of rice technology (at a 10% level). Plus, the second-ordered logistic model represented that the only significant causal determinant of the adoption of rice innovative and new technologies among 4-H club youth is the training attended (at a 5% level). In conclusion, the youth members of the 4-H club must be trained and educated concerning the different functions, features, and benefits of adopting innovative rice technology. Furthermore, proper training will give them sufficient knowledge and information in implementing and adopting rice technology to improve their productivity as well as increase their economic profitability.

Keywords: Implementation and adoption, regression analysis, rice technology, youth members of the 4-H club

Oral Paper IC-2

Efficiency and Productivity of NERICA Rice Varieties in Northern Nigeria

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Nigeria has a huge demand-supply gap and self-insufficiency for rice due to low productivity. The New Rice for Africa (NERICA) variety has been developed to enhance farmers' productivity and reduce the demand-supply gap. However, there is little documentation of the efficiency and productivity of NERICA in Nigeria; hence, the level of efficiency and productivity of NERICA was investigated. This study aims at investigating the determinants of NERICA rice production, determining the managerial, resource-transformation, and cost efficiencies of the adopters of NERICA rice. A multistage sampling technique was used for the study which comprised selection of two states from which four Local Government Areas were selected, out of which 243 rice farmers that adopted NERICA technology were selected. The study revealed that labour, seeds, fertilizer and herbicides had direct and significant influence on output. The rice farming in the study area witnessed increasing returns to scale, as well as technical and managerial efficiencies. The average output was 2244.55 kg while the optimal output was 5503.97 kg, showing a huge cost inefficiency. It was concluded that expansion in NERICA production to the point of optimum output should be encouraged to make rice production more cost-efficient. Also, the study suggested relatively easy access to NERICA seeds as well as large-scale production of the seeds and an efficient distribution network for enhancement of farmers' scale efficiencies. Moreover, timeliness in input delivery to the farmers was recommended.

Keywords: Efficiency, NERICA, productivity, rice farmers

Oral Paper IC-3

Determining the Productivity and Poverty Level of Queen Pineapple Farmers in Camarines Norte, Philippines

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Pineapple cultivation provides sustainable livelihood to many smallholder farmers in the Philippines. Despite its production potential, pineapple farmers complain of low productivity as the price of input increases and the net income decreases. This paper compares the productivity level relative to the poverty threshold of Queen pineapple farmers who use traditional and innovative production practices. Data was gathered from January to March 2022 in Camarines Norte, where Queen pineapple production is highly concentrated. A total of 96 farmers were interviewed using a semi-structured questionnaire. Productivity was measured based on the cost and revenue analysis of traditional practices, the use of innovative production, and the input and output ratio in terms of land labour and capital. Further, Fisher's exact test was used to determine the association of socioeconomic variables to the poverty threshold. Results revealed that innovative production increased land, labour, and capital productivity. The poverty threshold is influenced by educational status, household size, and pineapple cultivation area. Thus, 56% of the farmers live with less than the basic food requirements, 17% live below the poverty threshold, and only 27% live above the poverty threshold. To earn more than the poverty threshold, a Queen pineapple farmer must utilize 1.6 ha using traditional practices but only 0.68 ha if they apply innovative production.

Keywords: Poverty threshold, production cost, traditional farming

Oral Paper IC-4

The Relationship Between Deforestation and Food Security in 47 Sub-Saharan African Countries: A New Insight using GMM

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This study investigates the linkages between deforestation and food security in sub-Saharan Africa from 2011-2019, utilising data from the World Bank's World Development Indicators, FAO, and the EIU's Global Food Security Index 2020. While previous research has separately examined deforestation and food security, this study seeks to bridge the gap. The challenge of feeding over 1 billion people in sub- Saharan Africa, including 240 million living in poverty, is formidable. Over the past decade, Africa has witnessed a substantial net loss of forest cover, totalling up to 420 million hectares, depriving inhabitants of their livelihoods. Deforestation, primarily attributed to agriculture, population growth, and urbanisation, adversely affects biodiversity and agriculture, leading to water scarcity, climate change, and agricultural risks like soil erosion and reduced fertility. Additionally, removing forests contributes to higher CO2 levels, exacerbating climate change and threatening food security. The study, employing the robust system GMM estimator, establishes that deforestation and rising food prices undermine food security, while increased food production and fertiliser application enhance it. Interestingly, the region's growing youth demographic in farming momentarily boosts food security. The findings advocate for technology-driven farming due to its superior yields and emphasise the role of fertilisers in balancing food production and forest conservation.

Keywords: Deforestation, food prices, food security, sub-Saharan Africa, population growth

Oral Paper IC-5

Adopt a School Program of the College of Agriculture in Pangantucan Community High School in Pangantucan, Bukidnon, Philippines

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Central Mindanao University is committed and active in achieving SDG number four on quality education for all. The project is aimed at developing the capability of the faculty of PCHS in advancing agriculture and development in the country. Specifically, this study aimed to identify the current state of Pangantucan Community High School; determine technical services needed by the faculty members of Pangantucan Community High School and enumerate problems met by the faculty members and the school teaching agriculture subjects. Data were gathered through a survey questionnaire personally administered to the 15 respondents who were agriculture faculty members of PCHS and were interviewed in their School at their most convenient time. Descriptive statistics and PRA tools were employed. Results revealed that Faculty members were young, had experiences in farming, College graduates, and landowners. Technical services needed were on Goat and Sheep production, Poultry Production and Management, Swine Production and Management, Cattle Production and Management. Materials and other extension techniques were employed in the project. The extension project strengthened the public and private partnership between Central Mindanao University and Pangantucan Community College. CMU-College of Agriculture provided technical knowledge to PCHS faculty members. Sheep, Instruction Materials, Cacao Seedlings, Coffee and assorted fruit trees were provided to PCHS for School purposes. Problems met include insufficient linkages, funding and other technical services to improve the competency and skill sets of the teachers were identified. The active participation of school administration and faculty members can contribute to the economic and holistic social development of faculty members, students and their respective communities. The Public and Private partnership would lead to the empowerment of the teachers and students to become globally competitive through the provision of appropriate technologies and relevant information.

Keywords: Extension, public private partnership

Oral Paper IC-6

Overview on Knowledge and Perceptions of Potential Ecosystem Services at the Bukit Kuantan Rubber Forest Plantation

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The RRIM Bukit Kuantan Research Station was established as a rubber forest plantation with a focus on biodiversity and conservation concepts. The concept was portrayed by several initiatives, such as preserving natural forest fragments within the plantation landscape. This effort recognizes the potential of rubber forest plantations in Malaysia as well as the increasing awareness of biodiversity. Over the years, rubber-dominated landscapes have continuously provided provisioning services in terms of natural latex and rubber wood, however, this landscape may provide additional benefits that are essential for human well-being and environmental sustainability. By using the concept of ecosystem services, this exploratory study aims to understand how these services, which consist of provisioning services, regulating services, supporting services, and cultural services, are perceived and valued by the stakeholders. This study uses a questionnaire-based approach (N = 259) to gain insights into stakeholders' knowledge, awareness, and preferences for potential ecosystem services that could be provided by the Bukit Kuantan rubber forest plantation. Overall, this exploratory study emphasizes the need for better communication and education to improve the recognition and valuation of all ecosystem services and suitable management strategies to support the environmental and economic sustainability of rubber forest plantations.

Keywords: Potential ecosystem services, perceptions, rubber forest plantation, sustainability.

Oral Paper IC-7

The Productivity of Forest Areas through Social Forestry Programs (Case Study of KPH Probolinggo, Indonesia)

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The production forest has the potential to improve the development and productivity of farmers in a forest area. 63.7% of Indonesia's land is forest, and 28-31% included is Social Forestry which contributes to the economy of farmers. This study aims to: 1) Identify agricultural commodities in the forest area cultivated by farmers and 2) Analyze the contribution of the productivity of forest land to the welfare level of farmers in the forest area. This research used a quantitative method with a descriptive research type. Data collection techniques were interview, observation, and documentation. Respondents were determined using simple random sampling techniques of 35 farmers of BKPH Sukapura, Probolinggo, Indonesia. The data were analyzed descriptively on the identification of agricultural commodities and analysis of the welfare level of farmers involved in agricultural activities on forest land. The results showed that farmers planting coffee, tobacco, and vegetable commodities were utilized by forest communities to fulfill household needs. The income of farming in the forest area is Rp. 29,829,476.00/year and farmers' expenditures are Rp. 18,368,000.00/year. The level of farmers' welfare is categorized as moderate; farmers' expenditures amounted to 61.58% of income. Forest area in the Social Forestry program contributes to the productivity and welfare of forest area farmers.

Keywords: Farmers' welfare, productivity, social forestry

Oral Paper IC-8

Shoreline Perspectives: Community Views on Ecotourism in Laguna de Bay

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Laguna de Bay stands as a linchpin in the Philippines, catering to the multifaceted needs of its adjoining communities. However, its ecosystem faces continuous degradation due to escalating demands, threatening community welfare. This study presents preliminary data analysis from a survey conducted as part of the "Policy Advocacy for the Adoption of Ecotourism as a Local Sustainable Development Solution for Laguna de Bay's Resource Use and Management" project by researchers from the University of the Philippines – Los Baños. The research focuses on implementing a science and technology-based model for lake-based ecotourism management to enhance Laguna de Bay while safeguarding local communities. Incorporating the Theory of Planned Behaviour into the survey design, the study explores community attitudes, subjective norms, and perceived behavioural control towards ecotourism engagement. The survey findings highlight the importance of tailored communication strategies and community ownership, emphasizing the need for initiatives to align with local values and priorities. Moreover, the study identifies key attributes such as waste management and biodiversity protection that are crucial for ecotourism initiatives to resonate with the community and ensure sustainability. The analysis underscores the community's proactive stance towards collaboration, empowerment, and continuous monitoring, positioning lake-based ecotourism as a feasible and adaptive solution for sustainable development in the Laguna de Bay region. Overall, the study provides valuable insights into the local perspective on ecotourism and lays the groundwork for robust management frameworks that integrate community needs and environmental conservation.

Keywords: Alternative livelihood, community engagement, environmental science, resource conservation and management, Theory of Planned Behaviour

Oral Paper IC-9

Assessing Supply Chain Performance among Coconut Farmers in Peninsular Malaysia

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Coconut industry in Malaysia was once considered as a dim industry and has now gained more attention due to the high demand locally. The main effect of this newly garnered attention on coconut industry is because of the indifference between local coconut prices with international coconut prices. Apart from that, traditional cultivation practice is one of the major causes for the decline in coconut productivity. The old traditional variety produces fewer nuts and thus, unable to generate more revenue for the farmers by using traditional breed due to the high price of new breed such as Matag. Therefore, the objective of this study is to measure supply chain performance (SCP) of coconut farmers. This study was conducted in quantitative method and primary data was collected via face to face in Selangor, Perak, Johor and Kelantan. There were 150 coconut farmers involved in this study. The methods used for this study were chi-square, confirmatory factor analysis (CFA) and multiple regression. The result of chi-square analysis shows significant relationship between selected socio-demographic profile (farm experience) with overall supply chain performance indicators (OSCPI). Five extracted factors were identified as influencing OSCPI: *plan, source, make, deliver, and return*. The most influencing factor that influencing OSCPI was the *plan*. The finding of this study can possibly help coconut farmers to improve the efficiency and productivity of coconut farms in Peninsular Malaysia.

Keywords: CFA, coconut farmers**,** multiple regression, SCOR model

Session ID: Aquaculture & Fishery

Lead Paper 3

Role of Microalgae with Quorum Sensing Inhibition Properties as Disease Control in Aquaculture

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The interaction between microalgae and bacteria in aquaculture is closely interconnected, with both acting as agonists and antagonists through the release of a wide range of chemicals that play crucial roles in numerous metabolic functions. One process involves the disruption of bacterial cell-to-cell communication also known as quorum sensing (QS) activities. Quorum sensing has been shown to be an important mechanism for aquaculture pathogens to control various virulence factors production. In this study, various microalgal strains that are commonly used in aquaculture were screened for its QS inhibition activities using two types of QS biosensors, *Chromobacterium violaceum* CV026 and *Vibrio campbellii* BB120. The results show that both freshwater and marine microalgal groups showed QSI activities through the inhibition of CV026 purple violacein pigmentation that is regulated by QS. Similar results were also observed using the second QS biosensor BB120. Besides, probiotic bacteria that are isolated from different microalgae also showed QSI activities. Growth studies indicated that both microalgae and its associated probiotic bacteria mutually support the growth of each other in culture systems. This reflects the potential of using microalgae and bacteria consortium as disease control agents in aquaculture.

Keywords: Bacteria, disease control, microalgae, mutualism

Oral Paper ID-1

Immunoprophylactic Effects of *Isochrysis galbana* on Red Hybrid Tilapia (*Oreochromis* sp.) Elucidated by Spleen NMR metabolomics

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Malaysia's National Agrofood Policy 2021-2030 (DAN 2.0) has made a goal to raise aquaculture production by 123% to fulfill the high demand for fish as one of the necessary protein sources for mankind, despite significant obstacles related to aquacultural disease outbreaks. Therefore, this study aimed to determine the potential of an indigenous species of Malaysian microalgae, *Isochrysis galbana* (IG), in improving tilapia (*Oreochromis* sp.) health through utilization as an immunoprophylaxis agent. Tilapia was fed with an IG-supplementation diet for 14 days and the metabolic changes of the spleen was examined using NMR metabolomics in identifying the responsible potential biomarkers. The results showed that IG-supplementation at 2.5% had enhanced the immune response of innate immunity in spleen cell suspension. The OPLS analysis demonstrated that three significant metabolites, namely isoleucine, glutamate and tyrosine were substantially upregulated in the 2.5% IG-supplemented fish compared to the control group. The metabolic pathways of the tilapia spleen implicated by *Streptococcus agalactiae* infection in contrast to the immunoprophylactic efficacy of IG dietary were explored through NMR metabolomics. The results suggested that the survival rate of fish fed with IG supplemented diets was higher than the commercial diet supported by the histological observation on several organs. Hence, this work revealed the potential of IG as immunoprophylactic agent through application of metabolomics tools in improving tilapia health in meeting the aquaculture's future target.

Keywords: *Isochrysis galbana*, immunostimulant, multivariate data analysis, NMR, tilapia

Oral Paper ID-2

Management, Culture, and Financial Performance of Whiteleg Shrimp in Grow-Out Farm, Peninsular Malaysia

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In Malaysia, the largest portion of aquaculture production from brackish water ponds comes from whiteleg shrimp (*Litopenaeus vannamei*) at RM779 million. Despite being one of the main shrimp species cultured in Malaysia, whiteleg shrimp culture still requires improvements in production performance. The production performance can be measured through economic profitability (gross profit = revenue – variable costs) by considering the farm management parameters including days of cycle (DOC, days), stocking number (SN, pieces), survival rate (SR, %), harvest weight (HW, kg), harvest number (HN, pieces) and feed conversion ratio (FCR). These measures can be used as a yardstick for comparison of whiteleg shrimp farming in Malaysia. Therefore, the purpose of this study is to determine the management, culture performance and economic profitability of whiteleg shrimp in grow-out farm. Using operational farm data obtained from a farm in central region of Peninsular Malaysia, these parameters are calculated. Unit of observation in the data set is pond cycle during the production period of 2019 and 2020. For 2019, the DOC is 88 ± 31 days, SN 479,538 ± 56,196 pieces, SR 74.74 ± 13.48%, HW 3,759.48 ± 909.08 kg, HN 350,758 ± 91,453 pieces and FCR 1.51± 0.17. For 2020, the DOC is 74 ± 14 days, SN 474,000 ± 70,576 pieces, SR 59.29 ± 11.09%, HW 3,710.53 ± 1,545.01 kg, HN 279,081 ± 75,634 pieces and FCR 1.49 ± 0.24. The calculated gross profit in 2019 and 2020 are RM 23,098.94 ± 22,297.18 and RM 22,728.94 ± 32,679.11, respectively.

Keywords: Farm management, survival rate, whiteleg shrimp

Oral Paper ID-3

Length-Weight Relationship and Condition Factor of Nile Tilapia (*Oreochromis niloticus* Linnaeus, 1758) Fed with Different Inclusion Levels of Microplastics

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Microplastics might be incorporated into feeds through manufacturing processes or contaminated materials utilized for processing, thus, this study aims to evaluate the effects of different inclusion levels of microplastics in commercial feed given to the Nile tilapia *Oreochromis niloticus* for a culture period of 15 days. The inclusion levels of microplastics are 0 g/kg (T1), 0.2 g/kg (T2), 0.4 g/kg (T3), 0.6 g/kg (T4), and 0.8 g/kg (T5). Condition factors of Nile tilapia show no significant difference in all the treatments ($p>0.05$) with mean k-value of $p>1$ indicating that fish are in good condition. The length-weight relationship values for T1, T2, T3, T4 and T5 are 3.06, 2.18, 1.72, 1.60, and 1.65, respectively, indicating negative allometric growth pattern in all the treatments, but the b value is lower in T3, T4, and T5 (with high inclusion levels of microplastics) as compared to T1. In conclusion, this study demonstrates that diets containing high inclusion of microplastic somehow affects the growth pattern of Nile tilapia *Oreochromis niloticus*.

Keywords: Condition factor, inclusion level, length-weight relationship, microplastics

Oral Paper ID-4

Physiological Responses of Hybrid Grouper (*Epinephelus fuscoguttatus* X *Epinephelus lanceolatus*) to Temperature Fluctuation Revealed by LCMS/MS-based Mucus and Sera Metabolomics

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Aquaculture, which involves the cultivation of aquatic animals and plants, is recognized to be an effective and vital resource-efficient food production system for supplying affordable protein to humans. Hybrid grouper (*Epinephelus fuscoguttatus* x *Epinephelus lanceolatus*) is a marine carnivorous teleost that has a high economic importance in marine aquaculture industry particularly in the Asian countries. However, the vulnerability of juvenile hybrid grouper to temperature fluctuations stemming from the acceleration of climate change is regarded as one of significant threats to their market supply and a major concern for the aquaculture industry. In the present study, LCMS/MS–based mucus and sera metabolomics were used to investigate the physiological responses of juvenile hybrid grouper via their behavioral response towards temperature fluctuation stress that could be translated as indicators for either resilience or susceptibility to the stressors. A total of 36 important mucus metabolites and 59 sera metabolites (VIP > 1) were profiled in the juvenile hybrid grouper exposed to temperature fluctuation. Mucus metabolites did not show separation between the resilient and susceptible fish in the OPLSDA analysis but a minor difference could be detected from the Student T-test of the profiled metabolites. Meanwhile, obvious separation was observed in the OPLSDA sera metabolites and resulted in the nomination of potential markers namely, hypoxanthine, guanosine, guanine, methionine, DL-malic acid and glucose in the identification of susceptible juvenile hybrid grouper. Pathway analysis of these metabolite markers revealed that temperature stress mainly affected purine metabolism, TCA cycle, cysteine and methionine metabolism, and pyruvate metabolism. Overall, the findings of this study provide insights into the physiological regulation of juvenile hybrid grouper that are susceptible to temperature changes though their behavioral response, as well as a framework for future research.

Keywords: Biomarker, hybrid grouper, LCMS/MS, mucus, metabolomics

Oral Paper ID-5

Nutritional Profile and Microbial Biota of Raw and Processed Mussel *Mytella strigata* (Hanley, 1843) of Panguil Bay Philippines and Its Potential as Feeds

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Mytella strigata, a prominent non-indigenous mussel species in Southeast Asia, remains underutilized as feed in the Philippines. This study aims to assess the nutritional profile and microbial biota of both raw and processed *M. strigata*, evaluating their suitability as feed. Mussels, ranging from 4 to 8 cm in length, were collected from nearshore and offshore locations in Lala, Lanao del Norte, and Tangub City, Misamis Occidental, Philippines. Proximate and microbial analyses were conducted on raw and processed mussels. Results revealed that raw *M. strigata*, encompassing shell and meat, exhibited a crude protein (CP) content of 21.83%, with high levels of crude ash (85.51%) and calcium (29.97%). Processed mussel products, such as unshucked mussel meal (33.56% CP) and mussel meat meal (77.68% CP), demonstrated significant protein content, while mussel shells contained notable amounts of ash (91.58%). Microbial evaluation identified *Salmonella*, *Vibrio*, *Pseudomonas*, *Proteus*, and *Escherichia* in raw mussels, with higher levels observed in nearshore specimens. However, processed mussel meals showed reduced microbial loads, with undetectable levels of *E. coli* and *Salmonella* post-processing. This study revealed that raw and processed *M. strigata* have the potential to be used as protein and calcium feed sources to poultry and livestock with proper consideration of the microbiological safety to eliminate microbial contamination of the feed product. Hence, the study recommended to include safety protocols when *M. strigata* mussels are used as feed.

Keywords: Feeds, microbial content, mussel, *Mytella strigata*, proximate composition

Oral Paper ID-6

Post-Mortem Surface-Enhanced Raman Spectroscopy of Grouper Epidermal Mucus to Discern the Cause of Mortality

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Fish bacterial diseases such as vibriosis represent a major challenge in the aquaculture industry. On the other hand, due to high-density fish farming practices, a major threat to fish health in the industry is hypoxia. Thus, these two factors combined represent a major impact to the profit margins and sustainability of fish farms. Current methods of determining the cause of fish mortality include histopathological examination, culture-dependent methods, and PCR for biotic causes. However, for abiotic factors, water parameters need to be monitored to identify which factor caused the fish mortality. Thus, at present, there is a need to rapidly determine the cause of death for fish to minimize fish mortality. In this work, surface-enhanced Raman spectroscopy (SERS) using gold nanostars to enhance the Raman signal coupled with principal component analysis and linear discriminant analysis (PCA-LDA) was explored as a method to quickly determine the cause of fish death. The analysis was performed on epidermal mucus collected from hybrid groupers (*Epinephelus fuscoguttatus x Epinephelus lanceolatus*) collected from moribund or deceased fish exposed to hypoxia or *vibrio alginolyticus* infection. PCA analysis showed that fish that succumbed to hypoxia and vibriosis had significant perturbation in the Raman profile in comparison with the control group. Examinations of the PCA loadings revealed that a downregulation of cystine was an indication for both hypoxia and vibriosis and specific to the vibriosis group, downregulation of phenylalanine and tryptophan was observed. This was not observed in the hypoxia group, but an upregulation of methionine was observed. Using the extracted PCs, a predictive model was constructed to determine the cause of death and cross-validation of the mode showed no error. Overall, PCA revealed hypoxia and vibriosis specific responses from the SERS spectra of epidermal mucus and the LDA model is a promising avenue for rapid determination of fish mortality.

Keywords: Hypoxia, LDA, PCA, SERS, vibriosis

Oral Paper ID-7

Skin Transcriptome Reveals the Molecular Response Mechanisms to Temperature Fluctuations in Hybrid Grouper (*Epinephelus fuscoguttatus* X *Epinephelus lanceolatus*)

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Temperature fluctuations possess the capacity to disrupt the physiological processes in fish, exerting notable effects on critical parameters including growth, reproduction, and survival. Fish skin serves as a vital protective barrier, outlining the internal milieu from the external environment, thereby safeguarding against physical harm and preserving bodily integrity. Therefore, it is essential to identify the genes involved in response to temperature fluctuations. This study examines the regulatory mechanisms of stress response in hybrid grouper to identify potential resilient heritable traits when exposed to temperature fluctuations. Transcriptional responses of hybrid grouper are compared between control and temperature treated groups. Hybrid groupers were exposed to temperature fluctuations between 22 to 31°C for five consecutive days. Fishes were euthanized and skin tissues were sampled on the sixth day and processed for transcriptomic profiling using RNA-Seq bioinformatic analysis. Results showed an upregulation of carbon metabolism and oxidative phosphorylation genes, with downregulation of ribosomal genes temperature treated group, indicative of skin tissues undergoing apoptosis resulting from the temperature stress. This finding shows that these genes have the potential to be used as putative targets for the future development of genetic biomarkers to monitor temperature stress in hybrid grouper, as well as for the selection of temperature resilient broodstock for breeding programs.

Keywords: Hybrid grouper, RNA-Seq, skin, transcriptomic, temperature

Oral Paper ID-8

Feeding Capacity and Prey Preferences of *Anabas testudineus* Fry

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Anabas testudineus (Bloch 1792), is a native species of Southeast Asia with a good economic value as food fish. *Anabas* can be hormonally induced to breed in control condition, however, producing high survival of larvae and fry during early life stage is quite a challenge. Early life stage is considered as the most critical period of life. Larvae and fry are very vulnerable. The ability to adapt to surrounding environment with the availability of suitable nutritious food may be of utmost importance to ensure their survival. Therefore, this study focuses on the prey preference and feeding capacity of *Anabas* fry. Experiment on prey preferences used the neonate and adult of *Moina* sp as prey options for *Anabas* fry from 3 day after hatching (DAH) to 11 DAH. As for feeding capacity, numbers of *Moina* consumed per fry were tabulated on daily basis from 3 to 30 DAH. Results showed that *Anabas* fry of 3 to 6 DAH significantly preferred ($P<0.05$) to feed on *Moina* neonates rather than adult. However, between 7 to 9 DAH, fry feed on both neonate and adult without significant preferences ($P>0.05$). At 10 DAH onwards, fry showed significantly higher preferences ($P<0.05$) to adult *Moina*. As for feeding capacity, *Anabas* fry at 3 DAH were able to feed on average 2 *Moina* neonates per day. Feeding increased steadily until 8 DAH, feeding on average 11 of both neonate and adult per day at 8 DAH. A sudden surge at 10 DAH, whereby fry was able to feed on average 54 adult *Moina* per day. By 30 DAH, fry were able to feed on average 192 adult *Moina* per day. Based on the findings of this study, it can be concluded that at early stage of life, *Anabas* can be fed with *Moina* neonates from 3 to 6 DAH, followed by adult *Moina* until 30 DAH.

Keywords: *Anabas testudineus*, feeding capacity, fry, *Moina*, neonate, prey preferences

Oral Paper ID-9

Effect of Temperature and pH on the Growth and Survival of *Macrobrachium lanchesteri*

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Temperature and pH are two critical water parameters known to affect the livelihood of aquatic species. Numerous studies on prawn species have demonstrated that the fluctuation of these parameters may disrupt prawn growth and survival. Thus, this study investigated the effect of temperature and pH on the growth and survival of an economically important species of freshwater prawn, *Macrobrahium lanchesteri*. Four temperature levels tested were 26, 27, 28 and 29°C, while five levels, 5.0, 5.5, 6.0, 6.5 and 7.0 for pH. All treatments were triplicated using 1 day after hatching (DAH) prawn with size between 1.7 to 1.8 cm in total length. Experiments were conducted in glass aquarium for a period of 63 days. Growth and survival were monitored and recorded throughout the experimental period. Results showed that there was no significant difference ($P>0.05$) in both total length increment and survival of prawn for all 4 levels of temperature. However, prawn showed comparatively highest total length increment and survival when cultured at 28°C as compared to other temperature levels. As for pH, no significant difference was observed for total length increment with comparatively highest in pH 7. As for survival, highest record of 99% was at pH 6.5. Based on this study, it is recommended to culture *M. lanchesteri* at temperature of 26 – 28°C and pH of 6.5-7.0 for best growth and survival.

Keywords: Glass prawn, growth, *Macrobrachium lanchesteri*, pH, survival

Session IE: Economics, Agribusiness & Policy

Oral Paper IE-1

Achieving Self-sufficiency in Wheat Production: Challenges and Opportunities for the Subsector

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The wheat sector has played a key role in agricultural income, employment, and food security in Afghanistan, with its significance expected to persist in the foreseeable future. Wheat constitutes a quarter of the agricultural GDP and contributes to 6.3% of the national GDP. Despite this, Afghanistan has struggled to meet its domestic demand for wheat, necessitating reliance on imports from neighbouring countries. This study aimed to explore the opportunities and challenges within the wheat subsector, focusing on pre-and post-harvest activities crucial to achieving self-sufficiency in wheat production. Data collection involved laboratory tests and surveys targeting farmers, bakers, and the milling industry, employing Cochran's formula to ensure a 95% confidence level in the sampling. Laboratory analyses of 22 wheat varieties for protein and gluten content identified only four high-quality varieties – Lilmi 4, Lilmi 17, Mazar 99, and Moqawim 09 – suitable for use as parental germplasm or continued cultivation, while the rest may be used for cookie or cracker production. Survey findings highlighted challenges such as seed unavailability during planting time, poor quality of domestic wheat grain, forged domestic flour under domestic brand names, and the absence of tariff differentiation between imported wheat and wheat flour. To attain self-sufficiency in the wheat subsector, the study proposes the development of high-quality and marketable wheat varieties, the establishment of a market-oriented seed distribution system, the construction of wheat storage facilities to regulate price volatility, increase tariffs on wheat flour and reduce tariffs on wheat grain, prevention of fake domestic flour production, and provision of subsidies to wheat processing plants to enhance their market competitiveness.

Keywords: Food security, gluten, protein, wheat grain, wheat flour

Oral Paper IE-2

A Supplier Selection Model for Agro-Food Supply Chain Network in Banten, Indonesia

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The present study examines the design of mixed-integer linear programming (MILP) within the context of devising an efficient agro-food supply chain in Banten Province, Java, Indonesia. The methodology assumes that the agro-hub connects agro-food supply from farmers and delivers the goods to various distribution channels such as retailers and customers. An approach to defining a workable and sustainable agro-hub involves creating mathematical modelling to determine the optimum types and quantity of agro-food purchased from farmers. This model necessitates predetermining the types of commodities, their quantities received from farmers, and the number sent to each channel. This model's primary objective is to optimize the profit generated by the agro-hub by subtracting all associated costs, which include expenses incurred for purchasing, processing, and transporting agro-food products. It is formulated as a supplier selection multi-period multi-commodity transportation model. The model was tested using data from the agro-hub company in Banten. The computer-based MILP optimization enables the rapid determination of the optimal supplier, the quantity to be supplied, and the delivery date of the product within seconds. The numerical result gains insight to help agro-hub run their business more efficiently.

Keywords: Agro-hub, mixed-integer linear programming, optimization

Oral Paper IE-3

Impacts of Economic Policies on Agricultural Commodity Development in Afghanistan

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Agricultural production and distribution need to be independent of the economy's total demand and supply. Hence, policies should align with these two crucial aspects of the economy. In Afghanistan, the agriculture sector is considered the main pillar of the country's economy, accounting for 28 percent of the gross domestic product. Therefore, fostering the growth of agriculture is of paramount importance in economic development policies. While challenging to predict, achieving this goal is possible through meticulous planning based on robust data. This study assesses the implications of economic policies on the development of agricultural commodities in Afghanistan from 2010-11 to 2019-20. Statistical tools such as CAGR and the Cuddy-Della Valle Index were utilized to analyze the growth rates of area, production, and productivity of major commodities. The results reveal a positive and highly significant CAGR of area (21.65 percent) and production (19.91 percent) of selected crops in Afghanistan. Additionally, productivity showed a growth rate of 1.77 percent. The study underscores the impact of area fluctuations on production instability, emphasizing the importance of fair pricing for farmers and reducing middlemen involvement. Afghanistan holds immense potential to emerge as a major player in the global agricultural market and is poised to become a leading exporter soon. Economic development policies can lay the groundwork for the commercialization and exportation of Afghanistan's agricultural products to international markets.

Keywords: Agricultural Commodities, Afghanistan, compound growth rate, development

Oral Paper IE-4

Assessing the Economic Value of Ecosystem Services on Vegetable Farms in Cameron Highlands, Pahang

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Food availability is crucial for national food security. Malaysia aims for 70-83% self-sufficiency in food commodities like rice, fruits, and vegetables by 2030. However, the domestic food production sector faces significant challenges, particularly the availability of suitable land for food crops. The total land use for food production is decreasing due to competition from more profitable sectors like manufacturing, services, and construction, as well as industrial crops, especially oil palm. This reduction indicates a lower priority for food production land, possibly due to undervaluing the ecosystem benefits provided by food crops. The economic value of the ecosystem services provided by food crops is rarely evaluated. The objective of the study is to assess the economic value of ecosystem services, focusing on vegetable farms in Cameron Highlands. The ecosystem services from food production can be valued based on four components: provisioning services, regulating services, supporting services, and cultural services. Methodologies like the productivity method, Contingent Valuation Method (CVM), and benefits transfer were utilized to calculate the total economic value of ecosystem services. The research used both primary and secondary data. For provisioning and cultural services, primary data were collected from 241 vegetable farmers in Cameron Highlands through face-to-face interviews. Respondents revealed the value they are willing to accept for their land based on ecosystem value. For regulating and supporting services, the benefits transfer method was utilized, with data obtained from secondary sources. This research underscores the substantial economic value of ecosystem services associated with vegetable farms in Cameron Highlands, with a total value of RM952,731.60/ha, far exceeding the average agricultural land market price of RM234,000/ha. Based on the study findings, it is vital to promote and educate various stakeholders on the importance of ecosystem services provided by food crops and the need for balanced land use strategies.

Keywords: Economic value, ecosystem services, land use, vegetable farms

Oral Paper IE-5

Marketing Chain Analysis of Piña Fiber and Textile

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The Red Spanish Pineapple *(Ananas comosus* L.*)* is renowned for producing high-quality fibers, with UNESCO recognizing Aklan's *piña* handloom weaving as an Intangible Cultural Heritage. This study analyzed the marketing chain of *piña* fiber and textile in the province of Aklan. A mixed data collection process was employed, incorporating interview-guide questionnaires and key informant interviews. Respondents were purposely selected, including *piña* growers, processors, middlemen, and customers which are the key players. The System Theory was adopted for conducting market chain analysis, while descriptive statistics were employed to describe and interpret the data. Middlemen contribute significantly to the production and processing of *piña* fiber and textiles. Processors such as farmer-scrapers, knotters, warpers, and weavers benefit from product sales and credit provided by middlemen. The reliable supply of *piña* fiber and fabric by processors benefited both assemblers and traders. The market chain for *piña* fiber and clothing had just two intermediaries: the assembler of knotted fibers and the wholesaler of weaving enterprises. The latter supplied materials to processors and sold knotted fiber and *piña* cloth straight to customers. The key players offered a variety of *piña* products for sale, including fiber, textiles, apparel, and accessories. Products were marketed through social media platforms and trade exhibitions. In terms of product disposal, both pick-up and delivery were done utilizing local transportation if the customer lived in the vicinity and air cargo for overseas buyers. The price of *piña* cloth varies according to material, design, length, and width for barong, dresses, and wedding gowns. During the pandemic outbreak, market actors faced challenges including delayed delivery of *piña* fiber products and increased losses. *Piña* fiber's sustainability and rich texture made it appealing to fashion enthusiasts and customers, there's a gradual shift towards modern design and practices to meet evolving preferences and increasing demand of *piña* textile.

Keywords: Aklan, marketing chain, *piña* fiber, *piña* textile

Oral Paper IE-6

Horizontal and Vertical Integration in Agricultural Co-operatives Development: A Systematic Review

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Agricultural co-operatives emerged as a means for producers to assist one another in addressing market failures or excess supply prices. They may also serve as parastatal organizations to accommodate government programs. During their development, stakeholders may decide to integrate the organization horizontally or vertically with other co-operatives to reduce transaction costs, achieve economies of scale, enhance the value added of agricultural produce, or make coordination for the government agenda more efficient and effective. However, integration among co-operatives may result in a successful or unsuccessful pathway. This systematic review aims to examine literature discussing the longevity of horizontal and vertical integration in agricultural co-operative development. To achieve this, we employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) procedures, beginning with identifying relevant literature by retrieving them from Google Scholar and Scopus, screening the articles, and selecting studies for further investigation. Based on the literature reviewed, factors affecting the longevity of co-operative integration can be divided into two categories: internal and external. Internal factors include asymmetrical information, operational policies, decision-making, efficiency, equity, financing, farmers-led, integration stages, management, membership policy, pricing policy, risk preference, and social capital. External factors include contract, economic conditions, equity, financing, government-led, non-member involvement, market, regulation, socio-political conditions, and technical assistance. Additionally, although the practice of agricultural co-operative integration has been occurring for some time, this study contributes to the initial discussion of the topic.

Keywords: Agricultural co-operatives integration, farmers-led co-operatives, government-led co-operatives

Oral Paper IE-7

Assessing the Adoption Likelihood of Sustainable Cacao Production Practices in Davao Region, Philippines

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Continuously increasing global demand for cacao products, especially chocolate, serves as an opportunity for the emerging cacao industry in the Philippines. However, efforts to catch up with the market demands led to conventional intensification and raised environmental burdens on production systems. Sustainable agricultural practices (SAPs) are few of the strategies identified to address this concern. Hence, this study assessed the drivers for the adoption of SAPs in cacao production in the Davao Region, the country's top producer. Personal interviews with 271 cacao farmers selected through stratified random sampling were performed. The Theory of Planned Behaviour was used to frame the analysis and identify the effects of intrinsic and economic factors towards the adoption of SAPs. The Partial Least Squares - Structural Equation Model was employed to capture the unobservable intrinsic variables and its impacts towards farmers' intention to adopt SAPs. Additionally, post-estimation using Probit Model measured the likelihood of adoption of a particular practice and its interrelatedness with the adoption of the other practices given the socio-demographic and farm characteristics. Results revealed that not all practices were simultaneously adopted. Further, age, sex, predicted intention, education, farm experience, income, training, memberships, irrigation, and land ownership were found to significantly affect adoption.

Keywords: Multivariate probit, partial least squares, structural equation model, sustainable agriculture

Oral Paper IE-8

Evaluation of the Effects of Agricultural Methane Emissions on Sorghum (*Sorghum bicolor*) Production

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Achieving food security requires optimizing agricultural productivity, yet potent greenhouse gasses of farm activities promote climate change, which threatens sustainable production. Using cross-sectional data from the World Bank's World Development Indicators (WDI) and the Food and Agriculture Organization (FAO), this study evaluates how sorghum production is affected by agricultural methane emission, with countries as the unit of analysis. The study assessed the combined and joint effects of selected agricultural input and emission variables on sorghum yield. Data for 54 countries on sorghum yield, methane emissions, land, and fertilizer use were gathered and examined using the Cobb-Douglas regression model. The results indicate that more land and fertilizer use increases sorghum yield, while agricultural methane emission lowers the yield. Sorghum yield is more affected by methane emissions in Africa than in other regions. The results imply that Africa should use better farming methods that reduce emissions. Policymakers and stakeholders should emphasize ways to increase fertilizer use, enlarge farmland, and reduce emissions. The study offers significant implications for the impact of the prevailing agricultural practices on sorghum yields for farmers, policymakers, and scientists who are striving for sustainable and productive agriculture and can inform strategies for mitigating climate change and increasing food security.

Keywords: Agricultural methane, climate change, effects, emissions, sorghum production

Oral Paper IE-9

Producing Quality Eggs: Utilizing Value Chain Approach in Japanese Quail Production in Central Luzon, Philippines

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The utilization of Japanese quail (*Coturnix japonica*) eggs and meat in Southeast Asia underscores their cultural and economic importance. In the Philippines, quail is the third most significant poultry species, offering lucrative opportunities. Despite its development, the quail industry remains fragmented, with marketing inefficiencies, sustainability challenges, and insufficient government support. A comprehensive value chain analysis (VCA) was conducted in Central Luzon, the top quail-raising region in the Philippines, to address these issues. The study aimed to identify key actors and recommend solutions using PESTLE and SWOT frameworks. A sample of 120 quail raisers, 20 wholesalers and retailers, 10 processors, and 30 consumers were interviewed. Findings revealed that most quail raisers operate on a semi-commercial scale, marketing their eggs to wholesalers, retailers, processors, and end consumers, either individually or in combination. The study identified six value chains, highlighting opportunities for profit optimization among quail raisers. However, stakeholders faced several challenges, including rising feed and chick prices, diseases such as bird flu and coryza, declining egg prices during the lean season, and waste management issues. To advance the quail industry, the study recommended formulating national standards for quail, supporting producer groups or associations, and developing quail egg processing technology. The quail industry has the potential to provide an affordable and healthy protein source, contributing to food security. However, it faces significant challenges that can be addressed through a value chain approach. This study aims to enhance the competitiveness of the quail value chain by helping various actors improve their practices and adapt to changing conditions. By implementing these recommendations, the quail industry in the Philippines can achieve greater efficiency and sustainability.

Keywords: Food security**,** Japanese quail, Philippines, poultry production, value chain analysis

Oral Paper IE-10

Analysis of Production Pattern and Export Performance of Saffron in Afghanistan

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Saffron (*Crocus sativus* L.), the red gold, one of the oldest natural plants that have attracted the world by its significant characteristics such as shade, flavour, and aroma. It is a highly priced product in the world. Saffron production in Afghanistan dates back more than 100 years, but it remained marginal until a few decades ago. The crop is being grown widely in the country and is recognized as the best quality saffron globally. The climatic conditions blessed make Afghanistan an ideal location to grow high-quality saffron. Despite outstanding performance during prestigious spice-tasting events, the Afghan saffron continues to show very low visibility in the international market. Afghan-traders cannot utilize the untapped export potential of saffron. To delineate the best and stable market(s), the study aimed to analyse the pattern of production, export potential, export competitiveness, and trade-directions of Afghanistan's saffron based on secondary data obtained from various international databases between 2004 and 2020. The exponential growth function and Cuddy-Della-Valle-Index of instability were applied along with Revealed-Comparative-Advantage (RCA) and Markov-chain analysis. The study revealed that the area, production, and export of saffron had grown positively with a low level of instability. The study indicated that Afghanistan had a huge potential for saffron export, the country had a strong RCA in saffron export to India followed by Saudi-Arabia and the USA with mean RCA Indices of 8.17, 4.76, and 2.1, respectively. Though Afghanistan had managed to retain its original market share, it was likely to lose its market share in many countries. Improvement across the value-chain on scientific lines in pre- and post-harvest techniques requires more attention. Re-orientation commensurate with global market requirements of production and marketing system is needed along with devising progressive export promotion strategies to diversify the geographical concentration of exports and minimizing market risk.

Keywords: Afghanistan, competitiveness, growth, saffron, trade-direction

Session IF: Industrial Crop – Coconut

Lead Paper 4

The Revival of Coconut Industry in Malaysia: Prospects, Opportunities and Challenges

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Coconut is one of the important food crops in Malaysia in term of acreage, after oil palm, rubber and paddy. Total planted area with coconut was recorded at 84,936 hectares, with production about 604 million nuts in 2022. In Malaysia, coconut is not only consumed fresh but also processed into various products such as coconut water, coconut milk, copra, desiccated coconut, virgin coconut oil, activated carbon and also handicraft. The coconut industry is in the process of revival, encouraged by rising local demand and proactive government strategies outlined in the 12th Malaysia Plan (RMK-12). However, the industry is facing challenges, including aging coconut trees and a need for better coordination and modern farming practices. To overcome these hurdles, Malaysia is focusing on enhancing productivity and increasing self-sufficiency. The RMK-12 initiatives emphasize on developing high-yield coconut varieties and expanding plantation areas. There is also a push towards reducing reliance on imports and enhancing the processing of coconut products, such as virgin coconut oil and coconut water, which are in high demand globally. Modern farming techniques, such as precision agriculture and mechanization, are being promoted to optimize yields and reduce labor dependency. These efforts are complemented by investments in research to breed superior coconut varieties and improve pest and disease management together with the private sector. This revival is also expected to enhance local economic growth, provide employment opportunities, and ensure the long-term sustainability of the industry, making it a vital contributor to Malaysia's agricultural economy.

Keywords: Coconut, coconut industry, coconut production

Oral Paper IF-1

Improving Genuine MATAG (MRD/MYD × TAGT) Percentage during Hybridization using Pollination Bags

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The MATAG coconut hybrid, a cross between Malayan Red Dwarf (MRD) or Malayan Yellow Dwarf (MYD) with Tagnanan Tall (TAGT), has shown significant promise in yield and fruit size, leading to high demand for genuine F1 MATAG seedlings in Malaysia. Controlled pollination is essential for producing these hybrids, with pollination bags commonly used to prevent contamination by unintended pollen. However, the high temperature within pollination bags can cause female flowers to shed, prompting some breeders to forgo bags, resulting in only 30% genuine MATAG seedlings in nurseries. Thus, this study aimed to identify the impact of bagging (with and without pollination bags) and to compare the micro-environment within and outside of different pollination bags (DuraWeb and Spun-bond+Melt-blown (SMP)) on successful fruit set using MRD and MYD coconut varieties. Emasculation was carried out on 45 selected inflorescences for MRD and MYD, respectively. The total number of female flowers was recorded, and the inflorescences were bagged with DuraWeb, SMP bags or left unbagged. Hand pollination with TAGT pollen was conducted daily. Results indicated that using pollination bags did not reduce the fruit set percentage (27 – 36% for both MRD and MYD) despite significant differences in the micro-environment created by the different bag types. To evaluate contamination risk, 90 bagged and non-bagged emasculated inflorescences were left undisturbed in an open field, and the percentage of remaining female flowers after three months was recorded. It was found that the use of pollination bags significantly reduced contamination risk from 51.9% to 3.7% in MYD and from 60.5% to 7.9% in MRD, thereby, indirectly increased percentage of genuine MATAG production. Thus, it is recommended to use pollination bags during coconut hybridization. Given the current situation, the DuraWeb bag is suggested due to its durability and specially designed features for pollination.

Keywords: Fruit set, hybridization, MATAG coconut, pollination bag, pollination frequency

Oral Paper IF-2

The Reproductive Phases, Anthesis Stages and Stigma Receptivity of Malayan Red Dwarf (MRD) and Malayan Yellow Dwarf (MYD) Coconut Varieties

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The development of superior coconut hybrids with enhanced productivity and resilience against diseases and environmental stresses is crucial, particularly given the constraints on agricultural land and the high demand for coconuts. Successful hybrid coconut production relies on the precise timing of controlled pollination to maximize hybridization success and seed set. To obtain genuine F1 hybrids, controlled pollination must prevent self-pollination, necessitating emasculation before female flowers on the inflorescence become receptive. This research pinpointed the reproductive phases, anthesis stages, and stigma receptivity of the commonly used female parents, Malayan Red Dwarf (MRD) and Malayan Yellow Dwarf (MYD) coconut varieties in hybrid production. A total of 75 MRD and MYD inflorescences were observed throughout the male and female phases, with stigma receptivity tested using 6% hydrogen peroxide. The female phase of both MRD and MYD extended up to 14 days, averaging 8 days, while the male phase typically lasted 15-17 days. Due to the overlap of male and female phases, emasculation should be conducted soon after spathe opening, ideally within 5 days for MRD and 3 days for MYD. Six anthesis stages were identified for both varieties, with peak stigma receptivity occurring when the stigma was fully opened, appearing white or light brown, and moist. Observation revealed that the female flowers of both MRD and MYD exhibited anthesis on varying days throughout the female phase, displaying no consistent pattern. Thus, predicting the peak female flower receptivity involved identifying the day when the highest percentage of palms exhibited most of their female flowers becoming receptive. The results indicated that the peak flowering time for MRD occurred between 3-7 days after anthesis (DAA), whereas for MYD, it occurred between 4-8 DAA. These findings offer practical guidance and reference for achieving timely emasculation and pollination in hybrid coconut production.

Keywords: Anthesis stages, coconut, male and female phases, stigma receptivity

Oral Paper IF-3

Enhancing Coconut Seedling Emergence through Seednut Orientation and Slicing of the Three Coconut Varieties: Malayan Red Dwarf, Malayan Yellow Dwarf, and Pandan

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Germination, a critical factor in coconut cultivation, is influenced by seednut sowing practices, which directly affect the industry's economic viability. In Malaysia, common practices include using sliced or non-sliced seednuts and sowing them either horizontally or vertically. However, the effects of these practices on coconut seednut germination are not well understood. This 4-month study examined the impacts of seednut sowing orientation and slicing on germination percentage and seedling height in Malayan Yellow Dwarf (MYD), Malayan Red Dwarf (MRD), and Pandan cultivars. The interaction between cultivar, slicing, and horizontal orientation significantly impacted germination during the first two months. In the first month, slicing and placing the seednut horizontally increased germination for Pandan from 6% to 26% and for MRD from 5% to 14.5%, while MYD showed no significant changes. By the third month, horizontal sowing orientation remained advantageous, with 63.50% germination compared to 55.33% for vertical sowing orientation. Slicing did not significantly affect germination overall, with sliced and non-sliced seednuts having 61.67% and 57.17% germination, respectively. Seedling height for MYD, MRD, and Pandan was not significantly affected by slicing and sowing orientation. During the first month, vertically positioned seednuts averaged 0.77 cm in height, compared to 0.72 cm for horizontally sown seednuts, 0.75 cm for sliced seednuts, and 0.74 cm for non-sliced seednuts. By the end of the experiment, average heights were 64 cm for vertically sown, 66 cm for horizontally sown, 65.34 cm for sliced, and 65.72 cm for non-sliced seednuts. Across all cultivars, average height was around 65 cm, indicating no significant variation. These findings suggest that simple techniques, such as slicing seednuts and placing them horizontally, can enhance early coconut germination, offering cost-effective strategies to improve coconut cultivation.

Keywords: Coconut, germination, seed orientation, seedling height, slicing

Oral Paper IF-4

Phenomics and Genomics Approaches in Improving Tagnanan Population towards Increasing MATAG Production Efficiency

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As one of the main coconut hybrid varieties in Malaysia, there is a high demand on MATAG seedlings production. The seedlings are produced by hand pollinating Malayan Dwarf with pollen from Tagnanan, a tall coconut variety. Tagnanan is allogamous in nature, therefore the population possess considerable heterogeneity in yield and performance. Consequently, this condition affects the current hybridization success rate in producing uniform and genuine MATAG. A strategy to improve Tagnanan population by incorporating phenotypic and genomics approaches could expedite the process to increase the efficiency of MATAG seedlings production. A sample of 100 Tagnanan individuals were chosen to acquire phenotypic data regarding growth, yield, and fruit quality. Genomic DNA were extracted from young leaf samples of these individuals to develop genotypic data using polymorphic microsatellite markers. This approach has successfully shown that the current Tagnanan population used as pollen source in MATAG seed production have moderate variation for yield traits, namely meat weight (CV – 26%), water volume (CV – 32%), fruit size (CV – 33%) and husk weight (CV – 53%). The genotypic data was used to estimate population parameters including Shannon's diversity index (I) of 0.699 and Nei's index (h) of 0.4708, indicating moderate allelic variation and heterozygosity in the sample population. Selection of high yielding individuals were also made possible with the identification of 11 putative SSR markers associated with yield and fruit quality traits. These findings increase the precision of selecting high performing Tagnanan individuals for the purpose of developing improved and homogenous Tagnanan population in one selection cycle.

Keywords: Coconut breeding, genotyping, phenotyping, Tagnanan, yield and quality

Oral Paper IF-5

Marker Identification and Validation for Enhanced Hybrid MATAG Cultivation

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MATAG coconut, a hybrid from crossing MYD/MRD with Tagnanan Tall, faces supply constraints due to limited seed production and the variability in the Tagnanan population can lead to variations in getting pure MATAG. Therefore, there is a need to improve the yield and quality of Tagnanan for MATAG hybrid production. This research aims to enhance Tagnanan yield and quality for MATAG hybrid production by screening polymorphic markers, genotyping the homogenous Tagnanan population, and identifying markers of high yield and quality through association mapping analysis. Genomic DNA was extracted from 100 Tagnanan individuals (Green, Gold, and Red), and 200 SSR markers were used to screen the population, with a significant number of markers showing polymorphism. Marker-trait associations analysis was tested using the General Linear Mixed Model in the Tassel software, where significant correlated levels were computed with a simulation configuration of 10,000 burning periods of permutations and 100,000 number of reps after burning, with 20 iterations within a chromosome to identify the putative markers that are linked to the traits of fruit yield and quality. Association analysis showed that few markers had putative association with several traits, where GLM shows significance at log score of ≥3. Genotypic cluster analysis revealed two major clusters with four distinct sub-clusters, with sub-cluster 1 predominantly green. The identified markers from the Tagnanan population are validated on MATAG and MYD/MRD DNAs. Pure MATAG hybrids were selected in the nursery based on their known phenotypes. This study showed morphological and genotypic variations among Tagnanan palms, emphasizing that the selection approach for pollen source should be based on these characteristics and approach, rather than fruit color alone. It could also improve the selection of the Tagnanan population towards producing high-quality MaTAG. Future research should explore multiple approaches to validate these findings.

Keywords: Association mapping, markers, MATAG, Tagnanan, traits

Oral Paper IF-6

Genetic and Phenotypic Variation in Tagnanan Tall Palm: Insights for MATAG Hybrid Production

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The Tagnanan tall palm, a key male parent in MATAG hybrid production, exhibits cross-pollinating behaviour and significant phenotypic variation. This variability can lead to inconsistencies in traits crucial for efficient MATAG hybrid production. Ensuring uniformity among Tagnanan tall individuals is essential to enhance the quality and reliability of MATAG hybrid yields. This study aimed to characterize the diversity of the Tagnanan tall palm through genetic and phenotypic analyses. A detailed quantitative study was conducted on a 10-year-old Tagnanan population at the Department of Agriculture Teluk Bharu, Perak. The research involved assessing growth parameters and coconut yield attributes, alongside collecting young leaf samples for DNA extraction to evaluate genomic quality. Phenotypic assessments focused on color, shape (both polar and equatorial views), and fruit count. Notably, the majority of fruits exhibited a round shape under both views. Principal component analysis (PCA) explained 49% of the variance, with PC1 (35.9%) correlating positively with most parameters except for stem length with 11 leaf scars. PC2 (13.8%) highlighted distributions related to various traits including stem length, shell thickness, fruit and husk weight, and dry matter content, showing positive correlations among stem circumference, meat weight, and the interplay between fruit size and husk weight. Genetic analysis involved amplifying microsatellite regions using 150 SSR primer pairs, with diversity parameters computed using Popgene Software version 1.32. Shannon's information index ranged from 0.3145 to 1.2407 across all loci, averaging 0.699, indicating moderate allelic variation. Nei's genetic diversity index (h) reflected intermediate heterozygosity (mean 0.4708). In conclusion, the phenotypic and genotypic analyses provide a comprehensive understanding of the Tagnanan population structure. These findings underscore the importance of refining Tagnanan tall palm traits to optimize MATAG hybrid production, ensuring higher quality and consistency in yield.

Keywords: Coconut, MATAG hybrid, molecular markers, phenotypic, Tagnanan tall

Oral Paper IF-7

Commercial Production of Elite Aromatic Dwarf Coconut Seedlings in Malaysia

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Aromatic dwarf coconut (ARD) or commonly known as 'pandan' coconut in Malaysia is the most popular coconut variety that has been planted widely for tender nuts production for fresh consumption and coconut water. Currently, pandan coconut seedlings receive high demand from private sector, government agencies and small holders for large scale planting. However, the market is facing a serious shortage of reliable elite pandan coconut seedlings. FGV has taken initiative to develop a pandan coconut seed garden to produce elite true-to-type pandan coconut seedlings to fill the market demand. This seed garden was certified under 'Planting Material Verification Scheme (SPBT)' that was introduced by the Department of Agriculture (DOA). All the pandan coconut mother palms were certified by DOA based on the verification characteristic of their morphology of upright trunk without bole base, green in color for both leaves and fruit, rounded fruit shape, spherical crown shape and presence of "pandan" aroma in the leaves and coconut water. These aromatic dwarfs' seedlings must be subjected for inspection and certification by DOA officer to ensure their legitimacy and quality. For the seedlings, the specification includes the presence of "pandan" aroma in the leaves, green leaf base coloration, upright leaf morphology, achieved minimum seedling height of 45 cm and free of pests and diseases. All these SPBT certified pandan coconut mother palms and seedlings will be issued a SPBT certificate by DOA to ensure their legitimacy and quality to produce elite planting materials to the market. Currently, FGV has successfully certified about 2,484 legitimate pandan coconut mother palms. From 2020 until 2023, about 118,758 SPBT certified legitimate pandan coconut seedlings have successfully been produced by FGV for supply to the local market.

Keywords: Aromatic dwarf coconut, elite pandan coconut seedlings, seed garden

Oral Paper IF-8

The Impact of Market Environment on Comparative Advantage of Coconut: A Review Literature

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The majority of smallholder farmers chose to employ conventional farming methods, which created serious problems and may have decreased the output of coconuts. These fields were not adequately irrigated or fertilized. The market for goods made from coconuts grows annually. Exports of coconut oil would probably gradually decrease due to competition from palm oil exports. Consequently, it is critical to consider how the market environment affects the coconut's comparative advantage. Thus, the purpose of this systematic research was to provide an overview of the difficulties and advantages associated with combining the graduate start-up and academic spin-off models. A cumulative index employing Scopus, the Web of Science, and Emerald was utilized to search three online databases for publications published between 2010 and 2023. The goal was to present an overview of how market environment affects the coconut's comparative advantage. Price fluctuations in the market can affect how profitable it is to produce coconuts, which in turn affects how advantageous they are compared to other crops. Coconut's market share and profitability, however, can be impacted by competition from similar goods and other agricultural commodities, which could reduce its competitive advantage. Policymakers, farmers, and other industry stakeholders can use these effects to guide their decision-making and strengthen the coconut's competitive advantage in the marketplace.

Keywords: Coconut, comparative advantage, Malaysia, market environment

Oral Paper IF-9

Technological Advancements and Sustainable Development in Malaysia's Coconut Industry: A Thematic Review

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This study provides a comprehensive analysis of the technological advancements and value-added product development in Malaysia's coconut industry from 2018 to 2022. With coconuts serving as a crucial agricultural crop, especially in Southeast Asia which accounts for over 55% of global production, the industry is facing challenges like weakening production and poor management. Despite these issues, coconuts remain in high demand globally due to their recognized health benefits, making them a popular superfood. A two-stage literature review methodology was employed to analyze 301 articles from major academic databases, with a particular emphasis on values-added products, coconut waste management, and novel technology. The results emphasize the industry's capacity for expansion by promoting the implementation of sustainable practices and innovative technologies. For instance, hybrid coconut varieties such as MATAG demonstrate potential in enhancing production, while coconut waste products like activated carbon and cocopeat provide new economic prospects. The review highlights the need of addressing challenges such as pest infestations and insufficient infrastructure, which impede the industry's effectiveness. Malaysia can improve the profitability and sustainability of its coconut business by adopting sustainable farming methods and creating new coconut products that can be sold in the market. The aim of this paper is to provide stakeholders, policymakers, and researchers with valuable insights for strategic planning and policy formulation by examining the current status and future prospects of Malaysia's coconut industry.

Keywords: Coconut production, sustainable practices, technological advancement, value-added products

Oral Paper IF-10

Exploring E-commerce Potential for Improved Marketing and Income of Small-Scale Coconut Farmers

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This study investigated the potential of e-commerce to address challenges faced by small-scale coconut farmers in Malaysia. While e-commerce has revolutionized numerous industries, its adoption in agriculture remains limited. We explored this gap by examining the coconut supply chain and marketing landscape. A quantitative survey was conducted among 274 coconut farmers across diverse regions. Descriptive analysis revealed that most farmers (aged 50-65) cultivate 5-10 acres and grow Mataq coconuts. While the average income is RM2250, a significant portion (65%) expressed interest in using e-commerce for selling. The primary obstacles identified were pest control, price volatility, marketing, and labor. Most farmers rely on intermediaries, limiting their market reach. Despite having limited experience with online marketing (86% with no training), a strong majority (71%) expressed a desire to acquire digital marketing knowledge. Our findings suggest that e-commerce presents a promising avenue to boost income for small-scale coconut farmers. The low current income and high interest in e-commerce highlight this potential. We propose a pilot e-commerce platform to assess its feasibility within the coconut industry.

Keywords: Coconut farmers, e-commerce, digital marketing

Oral Paper IF-11

Identification and Characterization of Viruses Infecting Coconut Seedlings through Metagenomic and Molecular Approaches

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The coconut (*Cocos nucifera* L.) is a member of the Arecaceae family and is locally referred to as 'kelapa' or 'nyior' in Malaysia. Despite Malaysia's efforts to revitalise the coconut industry, there remains a lack of comprehensive knowledge about coconut-infecting viruses on a global scale. To address this, the study aims to comprehensively identify and characterize the viruses in coconut seedlings using the metagenomic and molecular approaches. A total of 161 coconut seedlings composed of 'Matag', 'Aromatic green dwarf' (AROD), and 'Malayan yellow dwarf' (MYD) were collected from Perak, Johor, and Negeri Sembilan. RNA was extracted from individual seedlings using the CTAB method and was pooled to prepare RNA libraries using rRNA depletion by Ribo-Zero & Directional Library Preparation on the Illumina NovaSeq X Plus platform to produce 150 bp paired-end reads. These reads were analyzed according to the published bioinformatic analysis pipeline. Initial BLAST analysis of the scaffolds with lengths between 1 kb to 15 kb to the local plant virus database showed the highest number of virus hits in the virome of MYD (0.233%), while the lowest number of virus hits was observed in the virome of AROD (0.165%). However, subsequent BLAST analysis of the putative plant virus scaffolds to the non-redundant GenBank database, followed by validation with RT-PCR, showed that the putative plant virus scaffolds were of plant host origins. The findings obtained from this comprehensive study indicate that all three varieties of coconut seedlings in the country's major propagation areas are free from viruses. The metagenomics approach used and developed in this study can become a standard procedure for screening viruses when exporting and importing coconut seedlings in the future, thereby ensuring the production of certified virus-free crops and increasing confidence in crop trades.

Keywords: Coconut, metagenomics, RT-PCR, viruses

Session IIA: Livestock Production

Lead Paper 5

Black Soldier Fly Larvae Meal Modulates Gut Health and Heat Tolerance in Broiler Chickens

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The Malaysian poultry industry faces the challenge of developing innovative and sustainable methods to address future social, environmental, and economic needs. Insects, particularly black soldier fly larvae (BSFL), have been proposed as a sustainable and efficient alternative protein source for poultry. BSFL can be reared on organic waste, reducing environmental and economic impacts while producing high-protein feeds. While BSFL meal (BSFLM) has been extensively studied as a poultry feed, there is limited information on its implications for broiler chickens in hot and humid environments. The study determined the effects of feeding BSFLM [inclusion levels of 0% (D0), 5% (D5) and 10% (D10)] on stress biomarkers [serum levels of corticosterone (CORT) and heat shock protein (HSP) 70], gut health [serum levels of d-lactic acid (DLA), diamine oxidase (DAO) levels, and cecal counts of *E.coli* and *Clostridium* spp.] in broiler chickens exposed to 32±1°C for 6 h from days 21 to 35. Heat stress elevated CORT in the DO group but not in the D5 and D10 groups. While diet did not affect HSP70 expression, heat stress increased its levels. Unheated D0 birds had higher DLA levels compared to other groups. Heat exposure raised DAO levels regardless of diet and reduced caecal *E. coli* and *Clostridium* spp. in heat-stressed D5 and D10 birds. The D10 group also had higher caecal *Lactobacillus* spp. counts. Heat exposure negatively impacted intestinal morphology, but diet did not. Overall, BSFLM as a feed ingredient may promote optimal growth, gut health, and heat tolerance in broilers.

Keywords: Black soldier fly larvae meal, broiler chickens, gut health, heat stress

Oral Paper IIA-1

Laying Performance of Japanese Quail *(Coturnix coturnix japonica)* Fed with Commercial Ration Supplemented with Powdered Leaves of Jute Mallow *(Corchorus olitorius)* and Siam Weed *(Chromolaena odorata)*

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The study aimed to determine the laying performance of Japanese quail *(Coturnix coturnix japonic*a) fed a commercial ration supplemented with powdered leaves of jute mallow and Siam weed. One hundred thirty-two quails, consisting of 108 ready-to-lay females and 24 males, were arranged in a complete randomized design with 4 treatments replicated 3 times, with nine females and two male birds per replication. The experimental treatments were: T_1 (1000 g commercial ration), T_2 [1000 g commercial ration + 50 g jute mallow leaves powder (JMLP)], T_3 [1000 g commercial ration + 50 g Siam weed leaves powder (SWLP)], and T_4 (1000 g commercial ration + 50 g SWLP + 50 g JMLP). The parameters measured were hen-day/hen-house egg production, average egg weight, average daily feed intake, feed conversion efficiency, body weight gain, feed cost per dozen eggs, and return above feed cost per dozens of eggs produced. All data were analyzed using one-way analysis of variance. The results showed that quails fed with commercial ration supplemented with powdered leaves of jute mallow and Siam weed had no significant effect on the average egg weight. However, parameters such as hen-day/hen-house egg production, feed conversion efficiency, body weight gain, and return above feed cost per dozens of eggs showed highly significant differences. While the parameters of average daily feed intake and feed cost per dozen eggs showed only significant difference. Based on the findings, the combination of jute mallow and Siam weed added to the ration is recommended for laying quails due to its positive effects on laying performance, locally available, low cost, and contains beneficial nutrients for egg production.

Keywords: Feed additives, Japanese quail, jute mallow, laying performance, Siam weed

Oral Paper IIA-2

Clinical and Epidemiology Investigation of Babesiosis in Goats in Khost Province of Afghanistan

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Babesiosis is an economically important haemoparasitic disease that inflicts significant losses on the production potential of small ruminants in tropical and subtropical regions. *Babesia* spp. is a tick-borne parasite that infects a wide range of vertebrate hosts. *Babesia ovis*, the main etiological agent affecting small ruminants in Afghanistan, plays an important role in causing anemia and renal dysfunction in infected goats. Extensive research is needed to understand the incidence and clinical significance in this country. Thus, this study was conducted to investigate the prevalence of babesiosis and its effects on blood parameters in the goats in Khost province. A total of 120 goats were divided into two groups based on age. Approximately 5 ml of blood samples were collected from the jugular vein in EDTA tubes. For prevalence determination, a thin smear of each sample was fixed with methanol, stained with Giemsa, and examined under an oil immersion lens at 100x magnification. Blood parameters such as haemoglobin (Hb), packed cell volume, RBCs and WBCs were analyzed using a haemocytometer and chamber slide under the microscope, respectively. The result indicated that the prevalence of *Babesia ovis* was significantly higher ($P<0.05$) in adult male goats compared to adult females while there was no significant difference ($P>0.05$) between young males and females. Furthermore, the levels of Hb and RBCs were significantly increased in infected goats, while a significant decrease was observed in the level of WBCs compared to healthy animals. These findings are supported by recent investigations. It can be concluded that *Babesia* spp. affects the blood parameters of goats, with prevalence being higher in adult males compared to females.

Keywords: *Babesia ovis*, blood parameter, goats, prevalence

Oral Paper IIA-3

Comparison of Mitochondrial Genetic Variation of *Taenia hydatigena* Cysticerci from China and Mongolia

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Parasitic infection is one of the many challenges facing livestock production globally. Cysticercosis is a common parasitic disease in domestic and wild ruminants (intermediate hosts) caused by the larval stage of *Taenia hydatigena* that primarily infects dogs (definitive hosts). Although genetic studies on this parasite exist, only a few describe the genetic variation of this parasite in Mongolia. Our aim was to identify the mitochondrial differences in ovine isolates of *Cysticercus tenuicollis* entering China from Mongolia and compare them with existing Chinese isolates from sheep and goats, using the recently described PCR–RFLP method and mitochondrial genes of NADH dehydrogenase subunit 4 (*nad*4) and the NADH dehydrogenase subunit 5 (*nad*5). Sixty-nine isolates were collected during routine veterinary meat inspections from sheep originating in Mongolia, at the modern slaughterhouses in Erenhot City, Inner Mongolia. An additional 114 cysticerci were also retrieved from sheep and goats from northern (Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, and Gansu Province), western (Tibet Autonomous Region), and southern (Jiangxi Province and Guangxi Province) China. The PCR–RFLP analysis of the *nad*5 revealed nine mitochondrial subclusters A1, A2, A3, A5, A8, A9, A10, A11, and B of *T. hydatigena* isolates from sheep and goats in Mongolia and China. Notably, haplogroup A1 RFLP profile was more widespread than other variants. These data supplement existing information on the molecular epidemiology of *T. hydatigena* in China and Mongolia, demonstrating the occurrence of similar genetic population structures in both countries.

Keywords: *Cysticercus tenuicollis*, genetic diversity, *Nad*4+*nad*5, PCR–RFLP

Oral Paper IIA-4

Cryobanking of Livestock Species: The Philippines Outlook

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The cryobanking or ex-situ cryoconservation of animal genetic resources (AnGR) supports the genetic improvement in livestock amid the adverse effects of climate change. This necessitates immediate action and a strategic approach to lead national efforts in managing and preserving diverse AnGR of indigenous species and commercial breeds with economic, adaptable, and resilient traits toward environmental factors and diseases. The cryobanking approach includes information dissemination, collection of AnGR for processing of samples (e.g., species identification, cryopreservation, test of infectious diseases), databank, and utilization. Cryobanking efforts and research strengthen the legal policies regarding cryobanking activities through the provision of the Department of Agriculture of the Philippines with the Administrative Order No. 31, Series of 2021, declaring the National Livestock Cryobank (NLC) of Animal Genetic Resources Towards Conservation and Management Program, and the Memorandum Circular No. 04, Series of 2022, implementing guidelines for the NLC. As of March 2024, 400,000 units of semen collected, cryopreserved, and stored covering the years 2012-2024, provide the following accessions: 93.7% buffaloes from swamp and riverine breeds (e.g. Brazillian, Bulgarian, Indian, Italian Murrahs, and Philippine Dairy Breed), 5.4% cattle from Brahman, Girolando, and Indo-Brazil, 0.5% goat Alpine, Boer, Saanen, Anglo-Nubian, Black Boer, Alpine X Saanen, and La Mancha X Saanen, and 0.5% swine Philippine native pigs, Large White, Landrace, Pietrain Yorkshire, White Duroc. The genetic materials support sustainable animal production systems. Moreover, optimized preservation of blood and DNA mainly from buffaloes, swine, goats, and cattle for downstream analysis for breed identification and monitoring the species' genetic diversity with implications for conservation management. Future directions of the Cryobank feature its vital role in utilizing preserved animal genetic materials for breeding programs in institutional herds, private stakeholders, and distribution to smallholder farmers to increase the livestock productivity.

Keywords: Cryobank, cryopreserve, gene bank

Oral Paper IIA-5

Revolutionising Poultry Nutrition: Impacts of Microbial Phytase on Nutrient Digestibility, Calcium and Phosphate Homeostasis Genes Expression, and Bone Geometric Characteristics of Broiler Chicken

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Microbial phytase is an exogenous enzyme commonly used in monogastric animal feeds. It enhances nutrient availability and growth while reducing inorganic phosphorus excretion. Endogenous phytase in non-ruminants is insufficient, limiting phytate breakdown. This study examines phytase's effects on nutrient digestibility, calcium and phosphate homeostasis gene expression, and tibia bone characteristics in broiler chickens. 576 (Cobb 500) day-old chicks were randomly allocated to six diets: T1 (control), T2 (200 FTU/kg phytase), T3 (300 FTU/kg), T4 (400 FTU/kg), T5 (500 FTU/kg), and T6 (600 FTU/kg). Starter and grower diets were fed for two weeks, and finisher for one week. Each group had eight replicates of twelve birds. Results showed significant improvement ($p<0.001$) in crude protein, ash, calcium, and phosphorus digestibility with phytase supplementation. Nutrient digestibility increased linearly with phytase levels. FGF23, TRPV6, SLC34A2, and VDR genes did not differ significantly in starters but FGF23 and VDR differed in finishers ($p<0.05$). Birds fed phytase had higher values compared to control diets. Tibia bone weight, length, and robusticity significantly increased ($p<0.01$) with phytase supplementation. The Seedor index was not significantly affected ($p>0.05$). Phytase improved amino acid digestion and cation bioavailability, enhancing starch, amino acid, and mineral absorption. Higher tibia weight and robusticity indicated better bone mineralization in phytase-fed birds. In conclusion, adding up to 500 FTU/kg of phytase to feed enhances nutrient digestibility, bone mineralization, and reduces phosphorus excretion. Phytase-supplemented diets improved digestibility, bone health, and had favorable environmental impacts compared to control diets.

Keywords: Broiler, digestibility, genes, microbial phytase, tibia bone

Session IIB: Agricultural Biotechnology

Oral Paper IIB-1

Neural Network Model for Estimating Total Chlorophyll Laboratory Measurement Based on Chlorophyll Meter (SPAD) Value in Oil Palm

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Chlorophyll is one component that is often an indicator of plants experiencing environmental stress. Quantitatively, the value of chlorophyll can be measured using a chlorophyll meter and in the laboratory. Chlorophyll meter measurements can be done quickly, but do not produce actual values like chlorophyll measurements in the laboratory. Meanwhile, measurement of chlorophyll in the laboratory requires special treatment and a long time to get results. This study aims to estimate the chlorophyll content of chlorophyll meter and laboratory measurements using a neural network model. The input that will be used in this study is the age group and SPAD value, while the output is the estimated total chlorophyll in laboratory measurements. The number of datasets used in this research is 1,066 data which is divided into 80% training and 20% test data. The neural network model can predict the chlorophyll content in the laboratory with a mean square error (MSE) and a Mean Absolute Error (MAPE) of 0.0330 and 0.1333 respectively.

Keywords: Chlorophyll, oil palm, neural network model

Oral Paper IIB-2

Transcriptome Profiling of Flooding Stress in the Oil Palm

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Climate change is poised to intensify the frequency of heavy precipitation events, alongside other impacts. As arable agricultural land gradually diminishes, marginal lands may be incorporated into production to cope with the rising global food demand. These marginal lands may include those that face periodic droughts and floods. Therefore, breeding of climate-resilient crops is important to mitigate climate change's adverse effects on crop productivity. Understanding how plants survive and respond to combined and sequential abiotic stresses in their natural environment is important, as plants often face multiple stresses simultaneously. Transcriptomic changes in response to an abiotic stress can vary among plant species, underscoring the need for customized approaches. Transcriptomic studies can thus serve as an initial step towards the understanding of molecular stress response in the crop of interest. Mature oil palm trees in a trial that had experienced flooding in nature were sampled for this study. Due to the uneven terrain in this trial, the oil palm trees were grouped into two, low- and high-flooded groups, based on the flood levels experienced. RNA-sequencing using the Illumina platform facilitated transcriptomics analysis, revealing a set of differentially expressed genes. This included several dehydration-responsive elements-binding genes and hydrolase gene members. Further evaluation of gene expression profiles will extend to other unsequenced plants and those subjected to a controlled flooding stress at the nursery stage.

Keywords: *Elaeis guineensis*, productivity, RNA-sequencing, vegetative response

Oral Paper IIB-3

Allium cepa Antimitotic Test and Brine Shrimp (*Artemia salina* (Linnaeus, 1758) Leach (1812) Lethality Assay of Leaf Ethanolic Extracts of *Begonia bangsamoro* subp. *bagasa* (Naïve, 2022)

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Antimitotic and toxicity activities of leaf ethanolic extracts of *Begonia bangsamoro* subp. *bagasa* was evaluated for anticancer activity using *Allium cepa* and brine shrimp (BSLA) assays. The *Allium cepa* root tip assay is the most common method and suitable plant for detecting and testing compounds with potential antimitotic activity while BSLA is a reliable general bioassay that can detect pharmacologic activities in higher plants that are employed by natural products and done at low cost. A total of 150 onion bulbs were exposed to treatments and examined for *Allium cepa* test and findings showed that *B. bangsamoro* subp. *bagasa* leaf ethanolic extracts can reduce mitotic index and block mitosis by causing spindle damage in actively dividing onion root tip cells with an average of 4.14 ± 0.643% mitotic index. The extracts also caused chromosomal and mitotic aberrations, however, these effects were not concentration-dependent. With 225 brine shrimp nauplii exposed to extracts per trial, it has been found that the extracts cause lethality in brine shrimp and its mortality is time-dependent. The calculated LC_{50} values showed toxicity with the value of 1.7118 ± 2.96 ppm after the 6-hour mark and 31.557 ± 44.61 ppm after the 12-hour exposure. Results of the study showed that the extracts have promising cytostatic (inhibition of growth, division, and differentiation of cells) and cytocidal (lethal) effects which are two important fates of an anticancer drug. Hence, *B. begonia bangsamoro* subp. *bagasa* can be a potential source of a nature-based chemotherapeutic compound. Isolation, purification, and identification of specific bioactive compounds that are responsible for these optimal cytotoxic and genotoxic activities are recommended to be explored alongside with investigation of the effect of the *B. begonia bangsamoro* subp. *bagasa* extracts on human cancer cell lines and other mammalian test systems.

Keywords: Antimitotic test, *Begonia bangsamoro*, brine shrimp lethality assay (BSLA), medicinal plants

Oral Paper IIB-4

Molecular Regulation Mechanism of Rice Panicle Germination-related Gene OsHXK6 on Seed Germination and Dormancy

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Rice spike germination is ubiquitous in the grain production process and can be alleviated by improving the dormancy of seeds, of which the specific regulation expression of endogenous signals in seeds is particularly important. Our study found that the rice hexokinase gene OsHXK6 can resist pre-harvest, which is meaningful for improving rice yield. The decrease of starch content and α-amylase activity in seeds after Oshxk6 mutation leads to a decrease in the kinetic energy of starch conversion into seed germination, which may be one of the important reasons for the slow-germination. In addition, we used plant hormone gibberellic acid and abscisic acid (ABA) inhibitors to treat germinated seeds and found that ABA inhibitors have a more significant effect on the germination recovery and growth of Oshxk6 mutants. Through RT-PCR analysis we found ABA can significantly induce the expression of OsHXK and ABA synthesis genes OsNCED1 and OsNCED2 may be the reason for Oshxk6 mutants' slow germination. In order to further study the molecular mechanism of seed germination and dormancy involved in OsHXK6, we found there are potential binding sites of OsBZR1 on this sequence during the analysis of OsHXK6 promoters, and through double fluorescence transcriptional activity analysis, we learned that OsBZR1 can promote the expression of OsHXK6 promoters. We also investigated the agronomic traits of Oshxk6 in the field and found that OsHXK6 mutations have no significant effect on plant shape and other traits except for a slight decrease in seed setting rate and blade width. In conclusion, our study shows OsHXK6 plays an important role in the molecular network that responds to the co-regulation of seed dormancy and germination by sugar and poly hormones. Our research results not only enrich the high-quality resource pool of anti-ear germination genes, but also lay an important foundation for the cultivation of new varieties of anti-ear germination rice.

Keywords: Abscisic acid, glucose metabolism, pre-harvest, rice, seed germination

Oral Paper IIB-5

Induced chromosome doubling: a tool for enhancement of ornamental traits and secondary metabolites production in plants – case studies on gerbera (*Gerbera jamesonii*) and Thai ginseng (*Kaempheria parviflora*)

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Artificially induced chromosome doubling is an efficient approach to unlocking the genetic potential of cells. Changes resulting from synthetic autotetraploidy due to chromosome doubling substantially increase genome size without alterations to the basic genetic material. When compared to their diploid counterparts, autotetraploid medicinal and ornamental plants have more distinguishing traits, such as higher phytochemicals, higher concentrations of desired metabolites, plant form, and floral traits. When it comes to genetically improving plant species, induced auto-tetraploidization has been used in various decorative and therapeutic plants. In this context, 0.1-0.5% (w/v) solutions of colchicine were applied to 14-day-old *in vitro*-regenerated *Gerbera jamesonii* shoots for 4-12 h. The metaphase chromosome count and flow cytometry (FCM) analysis validated the auto-tetraploidy levels of the plantlets, which were exposed to 0.1% colchicine for 4 or 8 h. Auto-tetraploids showed fewer but longer shoots, fewer but wider leaves, higher number of chloroplasts and less frequent but larger stomata, greater levels of chlorophyll, carotenoid, and anthocyanin, larger flower, longer stalk and extended vase life than their diploid counterparts. The aesthetic qualities of the tetraploids obtained will be crucial for genetic advancements in the plant. It is also evident that increased synthesis of secondary metabolites is a benefit of genome multiplication. Medicinal plants such as *Kaempferia parviflora* may benefit more due to increased secondary metabolite. K. parviflora's transverse thin cell layers submerged in colchicine solutions of 0.1-0.5% for 6-24 h resulted in autotetraploids. Maximum frequency was recovered from 0.4% colchicine exposure for 12 h, confirmed by FCM analysis. Larger stem thickness, leaf length, and leaf breadth were seen in autotetraploid. While tetraploid roots had higher (63-90%) concentrations of flavonoids and phenolics than diploid roots, tetraploid leaves had higher levels of chlorophyll. The current *in vitro* tetraploid induction study results indicate the potential for developing a better variety of Thai ginseng.

Keywords: Antimitotic agents, autotetraploid, colchicine, flow cytometry, secondary metabolites

Oral Paper IIB-6

Resolving Interspecific and Intergeneric Relationships of Selected Peninsular Malaysia *Amomum* Species (Zingiberaceae) through Plastid Phylogenomics Analysis

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The genus *Amomum* Roxb. belonging to the Alpinioidae subfamily, Zingiberaceae family and Alpiniae tribe includes perennial, tropical herbaceous plants. This is the second largest genus, after *Alpinia* Roxb. with about 150-180 species and found throughout Southeast Asia. Species of this genus are known as spices, condiments, traditional medicinal components and possess ornamental properties. There are 28 *Amomum* species reported in Peninsular Malaysia, however, the genetic information for clear identification and relationship between species are limited for this genus. This study aimed to elucidate the relationship among seven native *Amomum* species, both interspecific and intergeneric relationship using a comprehensive plastid phylogenomic analysis. To achieve this, transcriptome datasets were generated for the selected seven species - *A. uliginosum, A. testaceum, A. aculeatum, A. smithiae, A. elan, A. curtisii,* and *A. trilobum*. Plastid datasets were constructed by extracting the translated peptide sequences for all genes in the chloroplast region, and multiple sequence alignment was performed. A total of 85 chloroplast sequences belonging to *Zingiber, Kaempferia, Wurfbainia* and *Amomum* genera were also downloaded from National Center for Biotechnology Information (NCBI) and included in this study. The phylogenetic analyses using maximum likelihood (ML) and Bayesian inference (BI) using the super matrix were then generated. There were 43 chloroplast genes identified and this study confirms the paraphyllia of the *Amomum*, consistent with previous research studies. Three genera, namely *Amomum, Alpinia*, and *Wurfbainia* were found to be nested within one major clade, providing valuable insights into the relationship among these taxa. Based on the maximum likelihood tree, the Peninsular Malaysian species *A. elan, A. smithiae, A. curtisii* are resolved as sister to *Alpinia nigra and Alpinia galanga* species whereas *A. uliginosum* resolved as a sister species to *Wurfbainia* species. *Amomum aculeatum, A. testaceum* and *A. trilobum* are resolved as sister clade to *A. krervanh* and *A. compactum* species. This study contributes to the understanding of species relationship within the *Amomum* genus from Peninsular Malaysia. Further research with increased sampling from Peninsular Malaysia will aid in better understanding of species relationships.

Keywords: *Amomum,* Peninsular Malaysia, phylogenomics, transcriptomic sequencing

Session IIC: Plant Protection

Lead Paper 6

Bio-Management of Soil-Borne Plant Parasitic Nematodes for Sustainable Agriculture

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Nematodes are the most numerous eukaryotic multicellular invertebrates on Earth, exhibiting great diversity in their food habits and habitats. They play a vital role in soil ecosystems, where microbivorous species regulate microbial populations and contribute to decomposition and nutrient cycling. However, some nematodes are significant parasites of humans, animals, and plants, affecting agricultural productivity. In agriculture, nematodes can be harmful plant parasites, while certain species, known as entomopathogenic nematodes, are beneficial insect parasites. Various biological organisms, including bacteria, fungi, protozoa, and plants, regulate nematode populations through complex interactions that can either promote or suppress their numbers. Understanding these interactions is essential for developing sustainable agricultural practices that utilize or enhance biological controls for nematode management. Some beneficial microbes act as predators or parasites of nematodes, producing toxins that are nematostatic or nematicidal. Predatory microfauna such as certain nematodes, enchytraeids, tardigrades, collembola, and mites consume nematodes, while nematophagous fungi (e.g., *Dactylaria* and *Arthrobotrys*) and bacteria (e.g., *Pasteuria penetrans*) are employed as biological control agents. Some fungi, like *Trichoderma harzianum* and *T. viride*, along with *Pseudomonas fluorescens*, have shown effectiveness in controlling nematodes in trials across India. Commercially, the focus is often on developing sellable products for frequent application, which may overlook the potential of native or introduced nematode-suppressive microflora and microfauna. Integrating these suppression methods with other pest management techniques is essential for achieving sustainable solutions. This overview will discuss observations and experiences in nematode management from the past few decades.

Keywords: Biological control, integrated pest management, microbes, nematodes, sustainable agriculture

Oral Paper IIC-1

Exploring the Potential of a *Trichoderma*-Biochar Combination as a Plant Growth Promoter in Young Oil Palms Infected with *Ganoderma boninense*

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Oil palm (*Elaeis guineensis*) is an essential economic crop in Malaysia, contributing up to 3% of gross domestic product (GDP). Long term monoculture in palm oil production has reduced natural biodiversity, leading to emerging biotic threats, notably *Ganoderma boninense*, the causal agent of basal stem rot (BSR) disease. *Trichoderma* spp., a soil-borne fungus, has emerged as a potential solution to combating *G. boninense*. The efficacy in combining *Trichoderma* spp. isolate 4A and palm kernel shell (PKS) biochar (T-mix) to improve oil palm root architecture was investigated. Three-month-old healthy and BSR-infected seedlings, with or without biofertilizer were observed in control, *Trichoderma* inoculum and T-mix. Root development parameters such as root length, diameter, and total root surface area were observed bi-monthly for six months. *Trichoderma*-inoculated healthy plants, T5 (3.3 m) and T9 (4.4 m), had the highest root length, suggesting a role for *Trichoderma* in improving root health. All diseased oil palms exhibit stunted roots, with *Trichoderma*-treated roots in T7 and T11 having denser root systems versus non-treated diseased roots. The rot diameter showed a similar trend to root length, with T9 having the highest reading at 5.4 mm. Total surface area of *Trichoderma*-inoculated control palms are significantly higher (T5: 1386 cm^2, T9: 1408 cm^2) ($p \leq 0.05$) as compared to non-*Trichoderma* palms (T1: 1282 cm^2) but diseased palm roots treated with *Trichoderma* (T7: 850 cm^2, T11: 856 cm^2) had higher surface root area than non-treated roots (T3: 211 cm^2). This study highlights a new perspective of *Trichoderma* treatment providing protection to young oil palm root health beyond disease control, indicating a beneficial role for early application at seedling stage. This is the first study to highlight the role of a *Trichoderma*-biochar mixture in influencing root architecture of oil palm at seedling stage and presents a potential in using a new *Trichoderma*-biochar solution in the battle against *G. boninense*.

Keywords: Biochar, biocontrol agents, BSR, *Ganoderma boninense*, *Trichoderma*

Oral Paper IIC-2

Evaluating First Generation Anticoagulant Rodenticide via Response Baiting Method for Controlling Rat Infestation in Oil Palm Plantation

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Rats are significant pests to oil palm crops, attacking developing fresh fruit bunches (FFB) and causing substantial losses in palm oil production. To combat rat infestations, plantation operators typically use chemical control methods, applying bait through a replacement round baiting system. This system requires placing one bait per palm and replenishing it weekly until either fresh FFB damaged by rats drops below 5% or bait uptake falls below 20%. However, this replacement round baiting system is labor-intensive and costly. To address this issue, FGV developed a more efficient rat management method known as "response baiting." This method determines the total rat bait per palm, baiting interval, and rounds for each palm block based on a pre-census of fresh rat damages conducted before the baiting campaign. A bio-efficacy study was conducted to validate this method in FGV's plantation in Jengka, Pahang. Common first-generation anticoagulant rodenticides, chlorophacinone and coumatetralyl, were used in the treatment plots, with control plots left untreated for comparison. Each treatment plot was applied with either chlorophacinone- or coumatetralyl-based baiting to a 3-hectare plot, replicated three times. The method of application was based on recorded percentages of FFB damaged by rats from fresh damage censuses conducted before the trial. All plots initially showed 20-25% fresh rat damage. Therefore, the application was set at three baits per palm per round for two rounds, with a baiting interval of three weeks per round. Overall, plots treated with chlorophacinone significantly reduced fresh rat damage below the 5% threshold after two rounds of baiting. In contrast, coumatetralyl treated plots required an additional two rounds of baiting to achieve the same reduction. Thus, despite the modification of the baiting method from standard practices to response baiting, first-generation anticoagulant rodenticides such as chlorophacinone are effectively reducing rat infestations in oil palm plantations.

Keywords: Chlorophacinone, coumatetralyl, fresh rat damage, rat damage, rat management

Oral Paper IIC-3

Mycosynthesis of Antifungal Silica Nanoparticles from Agriculture Waste via *Aspergillus niger*

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Myconanotechnology explores the ecofriendly green synthesis of silica nanoparticles (Si Nps) using silica-rich agricultural waste. Silica, known for its role in enhancing plant defense by accumulating a cell wall and inducing resistance. Investigation was carried out on synthesis of Si Nps using *Aspergilus niger* and its antifungal efficacy was tested against *Colletotrichum gloeosporioides*, causing anthracnose. Tissue isolation of *A. niger* was made from silica rich rice husk and was characterized based on cultural and morphological methods. *A. Niger* was inoculated in rice husk and incubated for 24 and 30 hr. Color change from black to light purple was observed in filtrate, later phenol chloroform isoamyl alcohol (1:1 v/v) was added and centrifuged at 8000 rpm for 10 min. Characterization was made by using a UV-Visible Spectrophotometer which confirmed the synthesis of Si Nps at two different absorbance peaks, 285 nm for 24 hr and 315 nm for 30 hr. However, 235 nm was observed in control with only rice husk and water depicting absence of nano size silica. The fungal metabolites convert the silica in rice husk to nano size. Antifungal activity was assessed following the agar well method, where at 100% inhibition was recorded at 50, 70 and 100 ppm, while it was 54.5% and 68.1% at 10 and 25 ppm, respectively. Mycosynthesis of Si Nps using rice husk is a sustainable and economical method and can be a promising product for developing ecofriendly strategies to combat plant pathogens and reduce reliance on chemical pesticides. The present study underscores the feasibility of utilizing fungal-mediated nanoparticle synthesis from agricultural waste, promoting sustainable and economical agricultural practices.

Keywords: *A. niger*, anthracnose, mycosynthesis, silica nanoparticles, rice husk

Oral Paper IIC-4

Oryzalin Mediated *In Vitro* Tetraploidization for the Augmentation of Wedelolactone in *Sphagneticola calendulacea* (L.) Pruski

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To increase the synthesis of wedelolactone, a workable and trustworthy procedure for in vitro tetraploidization of *Sphagneticola calendulacea* (L.) Pruski [synonym *Wedelia chinensis* (Osbeck) Merrill] has been developed. Oryzalin, an antimitotic drug, was applied to shoot tip and nodal explants from an *in vitro*-grown culture (2n=50) at different concentrations (0, 0.025, 0.05, 0.1, 0.3, and 0.5%; w/v) for 12, 24, 36, 48, and 60 hr. Root induction in 1.0 mg/L indole-3 acetic acid enriched ½ MS medium was done after the treated explants were subsequently incubated and multiplied in Murashige and Skoog (MS) media supplemented with 0.2 mg/L thidiazuron and 0.05 mg/L naphthalene acetic acid. Shoot tips treated with 0.05% oryzalin for 24 hours helped explants reach the highest survival rate of 58.5% and the tetraploid induction rate being around 38.62%. The *in vitro* tetraploids' morphological, stomatal, and cytological traits were then contrasted with the diploids' secondary metabolite content. The tetraploid plants that were recovered showed improvements in plant height, stem diameter, leaf size, number of roots, and stomata length and width but not its frequency. Utilizing spectroscopy, flow cytometry, and cytology, it was shown that the tetraploid plants had twice the number of chromosomes (2n=4x=100) compared to the diploid plants. Through the use of high-performance thin-layer chromatography, the wedelolactone content of tetraploid plants (520.68 µg/g of dried sample) was found to be much higher (1.6x) than that of diploid plants (325.43 µg/g of dried sample), indicating the potential of this approach for improving value of trade.

Keywords: HPTLC, Oryzalin, *Sphagneticola calendulacea*, tetraploid, wedelolactone

Session IID: Precision Agriculture

Lead Paper 7

Gearing from Precision Agriculture to Digital Agriculture: Challenges and Opportunities

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Precision agriculture started out in the mid-1980s to improve fertilizer application by varying rates and blends as needed within fields. This approach was termed as site-specific fertilization. With time, the concept of 'site-specific' (spatial variability) was juxtaposed with that of 'time-specific' (temporal variability) into other domains of production agriculture including seeding, pest and disease control, irrigation, tillage and harvesting. This gave rise to what is commonly known as spatio-temporal analysis of crop, soil and other field attributes. The core narrative of precision agriculture back then through 2015 was to create an efficient farm, where input use and farming practices can be adjusted to maximize benefits from each field location in a sustainable manner. Technological components such as global satellite navigation system, geographical information system, remote sensing, variable rate application, artificial intelligence and decision support systems were used to deliver the promise of an efficient farm. Post 2015, the paradigm of precision agriculture started to shift from an efficient farm to a connected farm. An accelerator to this paradigm shift is the Internet of Things (IoT). New and updated technological components such as sensors, data analytics, telematics, hardware and software systems, and communication systems are being added into the precision agriculture toolbox. Interestingly, the modus operandi of precision agriculture is also beginning to change from 'sustainability' to 'climate-smart.' Sustainable agriculture typically involves strategies where the environment is modified to fit the crop while climate-smart agriculture does the reverse, i.e. changing the crop (or practice) to fit the environment. As a result of this paradigm shift in precision agriculture, research priorities are beginning to change and new opportunities for scientific collaboration are beginning to emerge. This presentation will i) examine some of the key areas for precision agriculture research that are seemingly fueled by the IR 4.0 phenomenon, and ii) discuss further on how IoT is making a difference in production agriculture.

Keywords: Digital agriculture, precision agriculture, smart agriculture

Oral Paper IID-1

Boosting Decision Support in Precision Agriculture in the Philippines with Machine Learning-based Crop Recommendation System

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Precision agriculture, also known as precision farming or smart farming, is a trend nowadays due to the emergence of data science as a useful tool for garnering meaningful insights hiding in data. This farming management concept largely aims to ensure optimal efficiency and sustainability in the agricultural process using AI technologies. In connection with this, the paper attempts to help farmers make informed decisions about their farming strategy using machine learning. In particular, the researcher utilized a dataset from the Indian Chamber of Food and Agriculture (ICFA) in India, a subtropical to tropical country similar to SEA nations, to build a predictive model to recommend the most suitable crops to grow in farms situated in the Philippines based on various parameters, namely, the ratio of nitrogen (N), phosphorus (P), and potassium (K) content in soil, temperature (in °C), relative humidity (in %), pH level of the soil, and the amount of rainfall (in mm). Results showed that logistic regression outperformed all other machine learning models, with a perfect area under the ROC curve (AUC) and an identical 93.3% classification accuracy (CA) and precision. This result is consistent even when a feature selection method was employed, and does not, in any way, improve the performance of the algorithms tested. This trained model is useful in helping local farmers in the Philippines make better decisions. Farmers can easily identify trends, anticipate problems, and implement strategies to maximize productivity and profitability in planting crops by analyzing data on soil composition, weather patterns, and more.

Keywords: machine learning in agriculture, precision agriculture, smart farming

Oral Paper IID-2

Cashew Nut Circularity using Energy Engineering Intervention

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The cashew tree (*Anacardium occidentale*) is now widely grown primarily in coastal areas. India is the world's largest cashew producer, processor, consumer, and exporter of cashew nuts. 45% of the world's current cashew nut production is in India. It is planted on an area of 10.30 lakh hectares in the nation, with a production of 9.98 lakh metric tons. India's contribution to global cashew exports has decreased due to fierce competition from other nations. The cashew nut cropping system and processing industries produced large biomass in the form of leaf litter, cashew apples, cashew nut shells and testa. The byproducts of cashew nut cropping systems and processing industries have huge potential for value-added products like fuel, soil enricher, cashew nut shell liquid, feedstock for gasification and various nutritional food products from cashew apples. This paper described the concept of circularity of cashew tree biomass, apple and processing waste for value added products for production of energy products. The results of energy engineering interventions like palletization/briquetting of cashew leaves, biochar production, ethanol production from cashew apple, deoiling of cashew nut shell for cashew nut shell liquid extraction and gasification of deoiled cashew nut shell were discussed with experimental results and economic values for overall benefit.

Keywords: Cashew apple, cashew leaves, circularity, energy

Oral Paper IID-3

Spectral Signature Detection in Weeds and Rice Plants for Early Growth Assessment using Hyperspectral Sensors

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For about half of the world's population, rice (*Oryza sativa* L.) is a necessary staple food. However, weeds reduce rice plant production by competing with the plants for nutrients, water, space, and light. In addition, monitoring them visually in rice fields is challenging due to their similarities in color, shape, and size, especially at the early growth stage. Hence, this study uses a hyperspectral sensor to identify the spectral signatures of grasses, sedges, broadleaved weeds, and rice plants for early growth detection. In this study, the weed species present in rice fields such as *Leptochloa chinensis*, *Echinochloa crus-galli*, and *Ischaemum rugosum* for grasses; *Cyperus iria*, *Cyperus difformis*, and *Fimbristylis miliacea* for sedges; and *Monochoria vaginalis*, *Sphenoclea zeylanica*, and *Ludwigia hyssopifolia* for broadleaved weeds were used to discriminate weeds from cultivated rice variety, named Padi Putra 2, using hyperspectral data. The hyperspectral images were acquired at an early stage of rice cultivation using a hyperspectral sensor named Resonon Pika L and were pre-process for normalization and denoising. Three classification models were trained, namely logistic regression, random forest, and support vector machine using the mean spectrum of selected ROI of each species. The result showed that the spectral signatures for grasses, sedges, and broadleaved weeds, as well as cultivated and weedy rice, can be differentiated with high classification accuracy. Based on the feature selection method, the top spectral bands that resulted in promoting classification accuracy were in the near-infrared region. It was shown that the classification model predictions with feature selection achieved higher recognition rates compared to using the full spectrum. In addition, the highly accurate trained model can potentially anticipate new data to distinguish between weed and rice species in rice fields.

Keywords: Classification model, hyperspectral imaging, *Oryza sativa* L., spectral signature

Oral Paper IID-4

Development of Optimized Pineapple Leaf Fiber Scraping Machine

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Pineapple (*Ananas comosus* L.) leaves yield fibers that can be hand-woven into valuable pineapple cloth. According to the Philippine Fiber Development Authority (PhilFIDA), quality fibers are extracted by hand scraping. This method, however, is tedious, and the capacity of hand-scrapers in Aklan, Philippines, is only 250-300 leaves per day. Hence, this research aims to develop two optimized pineapple leaf fiber scraping machines: foot-lever-operated (P1) and electric-powered (P2). P1 comprised a scraping blade assembly, a driving means, a discharge unit, a support frame, and a thorn remover. In addition to those components, P2 comprises a press-scraper roller assembly, feeding hoppers, and a driving means. The machines have been optimized in terms of scraping blade's angle, blade bevel angle, and steel spring force using the Design of Experiments and the Analysis of Variance interpreted at 5% significance levels. The machines were evaluated in terms of scraping time, fiber recovery, and fiber quality. The evaluation showed that the average scraping time using the P1 and P2 were 0.93 and 0.18 minutes per leaf, or 518 and 2,618 leaves per day capacity, respectively. Using P1 resulted in a fiber recovery of 0.75 g/leaf while P2 gave 0.69 g/leaf fiber recovery, greater than the total fiber recovery of 0.681 g/leaf by manual scraping, according to PhilFIDA. The physical testing laboratory of the fibers revealed that the quality of the fine fibers extracted using the machine is finer and has higher tensile and breaking strengths. The transfer of the developed scraping machines to their intended users, the leaf scrapers, has the potential to increase their productivity and income significantly. This, in turn, could lead to a substantial increase in the production of pineapple leaf fibers for hand-woven fabrics, thereby benefiting the textile industry and fostering economic growth in the region.

Keywords: Fiber, leaves, pineapple, scraping machine, textile

Oral Paper IID-5

Innovative Seeding Tool for Climate Resilient Practices in Rice

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Rice cultivation in India is largely dependent on rainfed regions, with the Ramanathapuram district accounting for 1.39 lakh hectares under semi-dry conditions. Low productivity in these areas is often due to inadequate plant populations caused by traditional sowing methods, which use excessive seed quantities and increase crop competition. This study presents an innovative seeding tool, modified from the existing drum seeder designed for wetland conditions, to better suit rainfed environments. The modification ensures seeds are placed at the correct depth and properly covered, improving germination rates. This tool was evaluated as a climate-resilient technique across 20 fields in four blocks and compared to conventional broadcast sowing and a tractor-drawn seed drill. The goal was to determine the most effective sowing methods and tools that, when combined with optimal seed rates, would improve plant populations, yields, and economic returns. Three sowing methods were assessed: broadcasting at 125 kg/ha (farmer practice), a tractor-drawn seed drill at 50 kg/ha, and the modified dry drum seeder with 8-row spacing at 50 kg/ha. Pre-monsoon sowing using the modified drum seeder significantly enhanced yield parameters, resulting in a higher grain yield of 5218 kg/ha. The use of this seeder also reduced cultivation and sowing costs by employing just two women laborers, leading to a higher net income of Rs. 71,814/ha and a benefit-cost ratio (BCR) of 2.80, outperforming other sowing methods. In summary, pre-monsoon sowing with the modified dry drum seeder at an optimal seed rate improves germination, maintains optimal plant populations, and results in higher yields, increased net income, and a superior BCR in rainfed rice cultivation.

Keywords: Economics, modified drum seeder, seed rate, semi dry paddy, yield

Session IIE: Industrial Crop – Coconut

Oral Paper IIE-1

In vitro Screening and Nano-emulsion Formulation of *Nephelium lappaceum* Leaf Extract Against Leaf Spot Disease in Coconut Seedlings

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Coconut seedlings propagated in the nurseries are susceptible to fungal diseases that can affect their seedling development and reduce their commercial value. The most common method to control these fungal diseases is the application of chemical fungicides. However, the increment of chemical usage causes concern on the adverse effects on human health and the environment. Botanical extract from *Nephelium lappaceum* (rambutan) was demonstrated to be a potential bio-fungicide and could serve as a substitute to chemical fungicides. The objectives of this study were to screen *N. lappaceum* leaf extracts by four different solvents (methanol, benzene, ethyl acetate and chloroform) at 5, 10, 15 and 20% concentrations with 3 replications for each treatment against *Neopestalotiopsis clavispora*, the causal agent of leaf spot disease in coconut seedlings *in vitro* using poison agar method and develop nano-emulsion formulation of *N. lappaceum* leaf extracts using phase diagram construction from various combination of non-ionic surfactant, vegetable oil and ultrapure water. For all solvents, 20% concentration showed the highest percent inhibition of radial growth, i.e., 75.75% (methanol), 72.50% (benzene), 85.00% (ethyl acetate) and 92.20% (chloroform). A total of 33 constructed formulations demonstrating one phase solution (optically isotropic and clear) as well as physically stable at ambient temperature (25°C) were selected for further characterization (particle-size, zeta potential, surface tension, viscosity and pH) which is in progress.

Keywords: Bio-fungicide, environmental-friendly, green technology, sustainable crop protection

Oral Paper IIE-2

Coconut Seedling Disease Management through Spray-induced Gene Silencing (SIGS) Targeting Ergosterol Biosynthesis Gene in *Neopestalotiospsis clavispora*

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Neopestalotiopsis clavispora has been reported as a major fungal pathogen on coconut seedlings and other host plants causing leaf spot diseases. A variety of azole fungicides are normally used to control leaf spot diseases, but routinely applied chemicals have caused fungal resistance against these chemicals. Hence, alternative fungicides that are safe and environmentally-friendly are much needed. In this study, a novel approach on applying RNA interference (RNAi) mechanism for plant defense through spray-induced gene silencing (SIGS) targeting *ERG11*, a gene encoding lanosterol 14-alpha-demethylase of *Neopestalotiopsis clavispora* was conducted. The RNAi inducer used was hairpin RNA (HpRNA) which is a form of double stranded RNA (dsRNA) that is responsible for post-transcriptional gene silencing (PTGS). Mass production of this RNAi inducer using *E. coli* was chosen to reduce the production cost of HpRNA-*ERG11*. Two regions of *ERG11* gene from *N. clavispora* were chosen as the target regions for gene silencing. Transcript level was quantified to assess the gene expression of *ERG11* after HpRNA-*ERG11* application. A 5-mm diameter mycelial plug was placed in a tube containing 1 ml of potato dextrose broth (PDB) and 1 ml of each tested concentration of HpRNA dissolved in ultrapure water (50, 500, 5000 and 50,000 ng/ml) with shaking at 45 rpm. Absorption of fluorescent dye labelled-HpRNA-*ERG11* by the fungus was also assessed using fluorescence microscopy. Fluorescence signals could be seen in mycelium and spores of *N. clavispora* after 4 and 24 hours, respectively, indicating the ability of HpRNA absorption. HpRNA-*ERG*11b applied for 7 days at 5000 ng/ml showed significantly lower transcript abundance of *ERG11* compared to other concentrations and another application duration (4 days). The down-regulation of *ERG11* is correlated with lower ergosterol biosynthesis in the fungus which is similar to the mode of action of azole fungicides to exert control over fungal pathogens in agriculture crops.

Keywords: *Cocos nucifera*, disease control, gene silencing, leaf spot, RNAi

Oral Paper IIE-3

Fertilization and MATAG Coconut Seedlings Growth in Nursery

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In Malaysia, there is limited comprehensive information on nursery stage coconut production and fertilization. Moreover, regarding the MATAG coconut variety, there is no available information on the comparison of fertilization effects in one- or two-stage nurseries. Therefore, detailed fertilization assessment and comparison of the coconut MATAG variety at the nursery stages are vital to ensure the quality and uniformity of coconut seedlings. MATAG seedlings were raised in a nursery and later tested with varying fertilization treatments, either in a one-stage field nursery (planting in seed beds) or two-stage nursery (polybags). The fertilizer treatment only started 60 days after seed nuts were sown in beds, roots of seedlings were cut, and fresh roots were allowed to grow. The treatments included current nursery practices (full foliar fertilizer 100% every 2 weeks as control), while the remaining four treatments consisted of varying NPK fertilizer rates mixed with growth medium (sand) (basal fertilization). Similar experimental treatments were applied for polybag set up. MATAG coconut seedlings of a uniform age were planted in beds and polybags. Eight Mataq seedlings were planted in each bed, while only one seedling was planted per polybag of 20 kg sand. Foliar fertilizer was applied at 14 days intervals. The growth of coconut seedlings was observed for 4 months with measured data on plant height, stem girth, and photosynthetic activity. After four months, no significant differences in growth data were noted between fertilization treatments for MATAG seedlings grown in beds. In contrast, the growth of MATAG seedlings raised in polybags and treated with NPK as basal fertilizer was significantly better than that of the control (foliar fertilizer). The findings of the observed seedling root growth (data not shown) in polybags suggested that raising MATAG seedlings fertilized with NPK as a basal fertilizer in polybags is suitable for seedling production of premium coconut varieties.

Keywords: Coconut seedlings, fertilizer, growth, one and two stage nursery

Oral Paper IIE-4

Detection of MATAG Coconut Seedling using a Mobile Application

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Cocos nucifera L. var. MATAG is a coconut variety found in Malaysia. It is the hybrid between the male parent Tagnanan Tall and the female Malayan Yellow/Red Dwarf parents. Farmers in the nation have a chance to start a new business because the new variety's potential economic impact on Malaysia is still unknown. Farmers especially prize the MATAG coconut because of its excellent production and reputation for sturdiness. Regretfully, conventional techniques for detecting MATAG seedlings depend on visual assessment by knowledgeable growers and are frequently laborious and subjective. The smartphone application analyzes photos of coconut seedlings obtained with smartphones' cameras using image processing techniques. Important characteristics including size, color, and form of the leaves are taken out and compared with a database of reference photos of MATAG seedlings that have been validated. By regularly upgrading its identification models and learning from user feedback, machine learning techniques are used to increase accuracy over time. With the help of this breakthrough, farmers and other agricultural professionals will be able to quickly evaluate the quality of seedlings in the field, decreasing the need for specialized expertise and improving the uniformity of seedling selection. In areas where coconuts are grown, the smartphone application helps to increase crop yields and promote sustainable agricultural practices by democratizing access to trustworthy identification techniques.

Keywords: Coconut, detection, intention to use, MATAG, mobile application

Oral Paper IIE-5

Influence of Fertigation Treatments and Growing Media on Coconut (*Cocos nucifera* L.) Phenotypic Traits During Nursery Growth in Tropical Environments

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This study investigates the influence of fertigation and growing media on coconut (*Cocos nucifera* L.) stem diameter, height, and chlorophyll content during nursery stages in tropical environments. Four growing media were evaluated: M1 (100% soil), M2 (70% soil and 30% cocopeat), M3 (50% soil, 30% cocopeat, and 20% perlite), and M4 (30% soil, 50% cocopeat, and 20% perlite). Fertigation treatments included: F1 (no additional fertigation), F2 (8 L per crop per day), F3 (2 L per crop per day), F4 (4 L per crop per day), and F5 (6 L per crop per day). Data collection focused on stem diameter, plant height, and chlorophyll content, analyzed using linear regression and ANOVA. Results indicated significant variations in stem diameter (6.6 to 9.6 cm) across fertigation treatments, with M3 consistently promoting larger diameters, highlighting its efficacy. Analysis of plant height revealed that M4 consistently induced greater growth, particularly under F1, F3, and F4 treatments, underscoring its role in optimizing height. Chlorophyll content ranged from 19.5 to 55.27 units, with M1 exhibiting superior performance in F1, and M3 demonstrating optimal results in F2 and F5. M2 and M4 were effective in F3, while M4 consistently led in F4 treatments. In conclusion, M3 proved superior for promoting stem diameter growth, while M4 was effective for enhancing plant height across various fertigation conditions. Additionally, M1, M3, and M4 showed effectiveness in enhancing chlorophyll content. These findings provide valuable insights for coconut cultivation practices, emphasizing the importance of tailored fertigation and growing media combinations to optimize growth, enhance productivity, and inform sustainable agricultural strategies.

Keywords: Chlorophyll content, coconut cultivation, fertigation, growing media, plant height, stem diameter

Oral Paper IIE-6

Development and Applications of Genome Wide Gene-based Markers in Producing Potential Superior Hybrid Coconuts

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The increasing global demand for coconut products from the food industry and the growing interest from the high value nutraceutical and cosmetic industries shows potential for lucrative income and sustainable future for coconut growers. However, the efforts of the Malaysian Government to raise and position coconut just behind rice as the fourth most important crop face some major hurdles. Foremost is the shortage of high-quality planting materials and infestation by red palm weevils (RPW) which can kill the palms rapidly in the absence of proper surveillance and control measures. This project emphasizes on using genomics approaches supported by phenotypic and physiological data to develop tools for application in molecular breeding to produce planting materials that address these challenges. The presentation will provide an overview of the progress achieved so far which include completion of the field phenotyping of the different coconut varieties and crosses between selected dwarf palms for production of potential high performing hybrids. Whole genome re-sequencing of representative palms of the different varieties focusing on palms with contrasting phenotypes for yield and RPW resistance has also been completed. The bioinformatics analysis is in progress to identify variants in the form of single nucleotide polymorphism and InDels associating with yield and insect resistant traits. These will be used in the development of molecular markers based on genome-wide association studies to aid in breeding programs.

Keywords: Coconut, crop improvement, genome-wide association studies, red palm weevil, whole genome resequencing

Session IIIA: Sustainable Soil and Water Management

Oral Paper IIIA-1

Effect of Salinity Level and N-Ca Fertilizer Dosage on Yield and Quality of Hot Pepper (*Capsicum annuum* L.)

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Hot pepper (*Capsicum annuum* L.) is an annual plant that belongs to various eggplant families (Solanaceae). The high level of pepper consumption is attributed to the spicy taste and hot sensation felt after consuming the fruit. This is caused by the secondary metabolite, capsaicin. Salinity is an environmental condition that increases the capsaicin content. Hot pepper plants grown in saline soils can still achieve good growth and yield by applying calcium nitrate fertilizer. This study aimed to determine the level of salinity and dosage of N-Ca fertilizer that can increase the yield and fruit quality of hot pepper. This research was carried out in April - September 2023 in a greenhouse and at the Plant Physiology Laboratory, Faculty of Agriculture, Brawijaya University. This study was a factorial experiment with a Randomized Block Design (RBD). The first factor was the salinity level (N), which consisted of three treatment levels. The second factor is the dose of N-Ca fertilizer (P), which consists of four treatment levels. The results of this study showed that there was no interaction between the salinity treatment level and the dose of N-Ca fertilizer on the growth, yield, and quality of hot pepper fruit. A salinity level of 40 mM resulted in greater plant height and leaf number compared to the control treatment. A dose of 0.3 g N-Ca/plant resulted in higher plant height, number of fruits, and fruit weight per plant than a dose of 0.4 g/plant.

Keywords: Capsaicin, hot pepper, N-Ca fertilizer, quality, salinity

Oral Paper IIIA-2

Interpreting Uncalibrated Soil Water Content Sensors Dynamics for Irrigation Management

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Soil moisture sensors used to monitor soil water status are key to delivering the right amount of water at the right time to satisfy crop water requirements. However, the installation, calibration, and maintenance of soil moisture sensing devices and the interpretation of data are complicated and tedious for most farmers. Furthermore, the variability, heterogeneity, and complexity of soils, how they interact with individual soil moisture sensors, and the installation of these sensors result in inaccurate soil moisture information. This study aimed to analyze soil moisture data signals to estimate field capacity from soil moisture dynamics to assess the field capacity (FC) or "full point" and management allowable deficit (MAD) or "refill point" for irrigation management. The objectives of this research were to use soil moisture dynamics alone to estimate FC (full point) and MAD (refill points) for irrigation management and to describe the best practices for using soil moisture sensors alone to quantify ET and some of the challenges. The results show that the developed algorithm, with simple interpretation and easy calculation, defines reasonable FC values from the soil water content sensor data, as verified using data from soil water potential sensors co-located with the soil water content sensors. Using the method of estimating the field capacity and the literature values of FC, PWP, and MAD for different soil textures, we can also identify a usable refill point of the soil. Lastly, there are large uncertainties and inherent variabilities in measuring consumptive use, or evapotranspiration (ET), using the soil water balance due to uncertainties and unknowns in measuring deep percolation and capillary rise, and from installation, inaccuracies, and interpretation of soil water content sensors.

Keywords: Irrigation, soil water content, soil moisture sensor

Oral Paper IIIA-3

Characterization of Mycocup Resistance with the Addition of Glycerol and Chitosan Coatings

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Mycocup is a composite product based on mushroom mycelium that utilizes organic substrates, and the ability of mycelium to grow to form a hard and strong solid with a cup shape. Mycocup development must be carried out to increase the resistance of mycelium-based composites to low water content. This study aimed to develop a formulation and analyze the effects of glycerol and chitosan coatings on mycocups by testing their degradation ability and resistance to water and contamination. In this study, a composite based on Pleurotus ostreatus fungus mycelium was prepared with a basic substrate in the form of sawdust formed in a cup, as well as providing a coating with a formulation of 1% glycerol, 2% glycerol, chitosan without Tween 80, chitosan with Tween 80, and control. This research will go through several stages, such as making the planting medium, growing P. ostreatus fungus on the planting medium, molding, drying, and measuring the uniformity, followed by coating and testing. Mycocup with chitosan coated with Tween 80 is a better choice than other coating formulations based on its resistance to contamination and degradation ability. The results of the water resistance test showed that all mycocups could absorb water; however, chitosan with Tween 80 had better water resistance than the other formulations.

Keywords: Chitosan, coating, fungi, glicerol, mycelium

Session IIIB: Crop Production

Oral Paper IIIB-1

Response of Indigo (*Indigofera tinctoria* L.) to Different Seeding Rates Under Upland Ecosystem

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Among the challenges facing agriculture and forestry in the tropics is the need to develop viable technologies for upland farmers to enhance farm productivity. The use of leguminous covering crops with diverse products has been practiced, however, there are still gaps in the propagation aspect. This study was conducted to evaluate the influence of different seeding rates—specifically, 2, 4, 6, 8, and 10 kg/ha on the growth performance, dye yield, dye recovery, and coppicing ability of Indigo sown in an upland ecosystem. The experimental area was laid out in randomized complete block design with four replications conducted in Aklan, Philippines. TThe results showed that seed emergence was observed six days after sowing (DAS), and germination energy peaked at 20 DAS. However, an increase in mortality was observed due to intense rainfall. Plant height, above and belowground fresh biomass, dry matter yield, root-shoot ratio, and the number of coppice developed per plant were highest at 6 kg/ha seeding rate. The amount of dye extracted per plant was highest at 6 kg/ha (1.10 g/plant). Dye yield recovery did not differ statistically, ranging from 1.29% (6 kg/ha) to 1.52% (4 kg/ha). The use of 6 kg/ha will optimize growth and dye yield, enhancing the productivity of marginal upland areas and providing additional income for upland farmers.

Keywords: Dye yield, *Indigofera tinctoria*, natural dye, seeding rates, upland ecosystem

Oral Paper IIIB-2

Volatile Function in the Natural Defense System of *Rumex confertus*

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Crop protection worldwide is dominated by the use of artificial and often toxic pesticides, but their ever-increasing use over long periods has resulted in increased pest/pathogen resistance. To protect the World's fragile environment and agricultural workers, this leads to the need to develop and establish new eco-friendly agro-technical practices that limit the use of toxic pesticides. Plants are well known to emit protective or communicative volatile organic compounds (VOCs) under bacteria/pathogen infestation or under attack by insects. These VOCs have evolved to either repel, harm, or kill infesting/attacking species or attract natural enemies that feed on a given bacteria/pathogen or insect. VOCs also serve to communicate to other similar plants of a possible attack so that their defences can be primed. The goal of the study was to determine if the profile of volatiles, which are organic compounds naturally produced by undamaged plants, is similar to that provoked by the chemical stimulants Z-jasmone (ZJA) and dihydrojasmone (DJA). Second goal of this work was to establish if the *Apion miniatum* beetle's reproductive choices are influenced by their sex and mating status. Finally, assessed if chemically stimulated GLV emissions can be used as signals to attract pests to *R. confertus* for biological control purposes. Synthetic compounds of naturally produced Z-jasmone (ZJA) and dihydrojasmone (DJA) were used to treat mossy sorrel plants. It was found that unmated male insects were fairly equally divided between going for food (Y-tube olfactometer arm with a GLVs blend) and opportunities for reproduction (Y-tube olfactometer arm with unmated females). Meanwhile, unmated females were definitely indifferent to food and, independent of the GLVs blend dose, were more interested in reproduction. Mated males, even with weak feed stimuli, increased their reproduction activity, in opposition to mated females.

Keywords: Ecological chemistry, invasive plants, pest control, synthetic green leaf volatile stimulants, Y-tube olfactometer

Oral Paper IIIB-3

Physiological Dormancy and Temperature Fluctuations in Oil Palm D × P Seed Germination

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Oil palm seeds require more than eight months to achieve 25% germination naturally due to seed dormancy. Currently, seed producers adopted heat treatment to alleviate dormancy in D × P seeds with germination ranging from 62.2 to 72.0%. Since the demand for oil palm is increasing, there is a need to increase the supply of pre-germinated D × P seeds. The first experiment was designed to elucidate the effect of eight dormancy breaking methods (operculum removal, 60 days storage, 60 days heat treatment, 120 days storage, 60 days storage + heat treatment, 180 days storage, 120 days storage + heat treatment and control) on seed germination based on physical, morphological, and physiological dormancy characteristics. Final germination of more than 82% was obtained for heat treated seeds, and seeds stored prior to heat treatments, along with less than 13 days of mean germination time. Morphological dormancy evaluation indicated heat treatment was able to accelerate the growth after being imbibed. The heat and storage treatments also resulted in 36% reduction in peroxidase and 13% in catalase activity levels, with 9% (endosperm) and 26% (embryo) increment of α-amylase. In the second experiment, the efficacy of fluctuating temperature in comparison to constant 30 °C condition on oil palm D × P seed germination was assessed. Oil palm seeds recorded higher germination at fluctuating temperature (70-85%) in comparison with the constant 30 °C (55-65%). In addition, it was found that higher α-amylase activity (209.0 to 223.7 units/µl) was observed for seed that was germinated under fluctuating temperature conditions. From this study, application of heat-treatment (40 ±2 °C) prior to germination at fluctuating temperature conditions is recommended to obtain 85% final germination.

Keywords: Dormancy, germination, oil palm

Oral Paper IIIB-4

The Effect of Nitrogen and Potassium on *In Vitro* Growth and Synthesis of Stevioside and Rebaudioside-A in *Stevia rebaudiana* Bertoni

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The dominance of stevioside than rebaudioside-A in stevia gives a characteristic bitter aftertaste when consumed. The synthesis of these two compounds is known to be affected by the availability of nutrients in culture medium. Therefore, an *in vitro* experiment was carried out on the optimization of nitrogen and potassium in order to produce stevia plants which have a higher ratio of rebaudioside-A to stevioside. Axillary nodes as explants were cultured on MS medium containing eight different compositions of NH_4NO_3 and KNO_3 which were repeated 4 times using a Completely Randomized Block Design. The results showed that differences in the composition of nitrogen and potassium had a significant effect on the growth of *in vitro* stevia cultures. By reducing potassium levels to half in composition of 1650 mg/L NH_4NO_3 and 950 mg/L KNO_3, this led to the maximum number of shoots, length of shoots, number of leaves, and chlorophyll content. In addition, a high ratio of rebaudioside-A to stevioside was observed on three medium compositions, namely 0, 825, 3300 mg/L NH_4NO_3, each followed by 1900 mg/L KNO_3. Conversely, mediums with potassium deficiency critically decreased the ratio of rebaudioside-A/stevioside. It seems that the synthesis of stevioside and rebaudioside-A is more determined by the presence of potassium than nitrogen.

Keywords: *In vitro*, nitrogen, potassium, rebaudioside-A, stevia

Session IIIC: Agricultural Extension and Education

Oral Paper IIIC-1

Extension and Communication Strategies on Natural Farming Technologies: Challenges and Opportunities in Southern Philippines

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The implementation of the policy on organic agriculture is continuously facing a challenge because of the extensive use of inorganic fertilizer and pesticides among farmers. This qualitative study sought to assess the extension and communication strategies of natural farming technologies in the Southern Philippines. Primary data from key informant interviews with model farmers, faculty members from State Universities and Colleges, regional directors of the Department of Agriculture and focus group discussions with agricultural extension workers in provinces were supplemented with secondary documents like photographs, print and online materials. Results show that group methods through group discussions and farmers' meetings supplemented with PowerPoint presentations, posters as well as mass media like mobile announcements, printed materials, radio and Facebook were used to promote natural farming technologies like fermented plant juice, fermented fruit juice, indigenous microorganisms, oriental herbal nutrients and lactic acid bacteria serum. With minimal participation in both theoretical and hands-on training, the agricultural extension workers had a moderate understanding of the government's organic agriculture program, projects and activities. Limited budget affected the frequency of home/farm visits and establishment of demonstration farms. Social media platforms like Facebook have limited promotional use since most of the farmers are senior citizens. Policies enacted by local government committees on agriculture provide a legal framework to push through these initiatives, thus there is a need to lobby and advocate with the Local Government Units to put in place the National Organic Agriculture Program as well extension and communication interventions.

Keywords: Agricultural extension, dissemination, organic agriculture, promotion, Southern Philippines

Oral Paper IIIC-2

Empowering FELDA Settlers: Enhancing Livelihoods through Knowledge Transfer

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This paper delves into a knowledge transfer project to empower participants in the Federal Land Development Authority's (FELDA) Settler Development Program (PPP) in FELDA Bukit Goh, Pahang. The PPP initiative focuses on diversifying economic resources, empowering settlers through livestock and crop management training, and fostering socio-economic development. The knowledge transfer program aims to provide participants with the knowledge and skills necessary for effective crop and livestock management, distinct from the oil palm cultivation they are accustomed to. Participants were introduced to record-keeping systems, good agricultural practices, and innovative methods for diversifying downstream products, thereby increasing the value of their agricultural output. The training modules cover farm financial management, myGAP and myOrganic certification, downstream product processing, and success story sharing. Feedback from participants indicates significant gains in knowledge and understanding post-workshop, with calls for the repetition of similar programs. The workshop effectively addressed the unique challenges in animal husbandry and food cultivation. Skills in record-keeping, budgeting, and practical agricultural practices enable participants to manage livestock and crops more efficiently and expose them to new information on the government incentives for scaling up or diversifying their activities. The program's outcomes suggest that record-keeping systems can facilitate the management of livestock and crops, promoting good agricultural practices and innovation in product diversification. The insights gained from evaluating the program's effectiveness can guide the design of post-PPP initiatives, further supporting the settler community. This empowerment program initiative underscores the positive impact of knowledge transfer and training, leading to long-term agricultural success and continuous learning within settler communities. The success of this workshop highlights the potential for similar initiatives in other FELDA programs.

Keywords: Empowerment, knowledge transfer, rural development

Oral Paper IIIC-3

Agro-tourism: A Sustainable Business

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Agro-tourism is the fusion of agriculture and tourism representing a sustainable business model that leverages the unique aspects of rural life to provide economic, social, and environmental benefits. This work delves into the concept, importance, and practical examples of agro-tourism, highlighting its role in enhancing rural economies and preserving cultural and environmental heritage. Agro-tourism involves integrating agricultural activities with tourism, offering visitors educational and recreational experiences on working farms. The primary goals are to promote sustainable farming practices and provide economic support to rural communities. The importance of agro-tourism spans several dimensions: economically by generating additional income, socially by preserving cultural traditions and educates the public about agricultural practices; environmentally, conserves natural resources. The presentation explores various agro-tourism activities, including farm stays, guided farm tours, pick-your-own produce experiences, and workshops on farming and cooking. Each activity provides unique insights into the farming lifestyle, enriching visitors' understanding and appreciation of agriculture. Two notable case studies are presented: the Farm of Happiness in Maharashtra, India (developing nation), and *Agriturismo La Fonte* in Tuscany, Italy (developed nation). These agro-tourism spots offer immersive experiences in traditional farming, organic agriculture, and cultural activities, thereby promoting sustainable agriculture and supporting the local economy. The presentation contrasts agro-tourism in developed and developing countries. In developed nations, agro-tourism benefits from advanced infrastructure, higher tourism awareness and digitalization in agriculture. In contrast, developing nations emphasize cultural experiences, community-based operations, and significant economic impacts on rural communities. It concludes by outlining strategies to promote agro-tourism, including effective marketing, local businesses collabs, hosting events and festivals, and offering educational programs. Agro-tourism not only enhances rural economies but also fosters sustainable development, making it a vital area for investment.

Keywords: Agro-tourism, social benefits, sustainable business

Oral Paper IIIC-4

An Application of the Household Food Insecurity Access Scale for Measurement of Food Insecurity in Rural Somalia

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Food insecurity has been a major cause for concern in Somalia in the past three decades. In rural areas, household access to food largely depends on what the household grows or they purchase food with the income earned from what they grow. The rural households are also under increasing pressure caused by resource depletion and diminishing resilience against shocks and stresses. This study therefore aims to investigate the status of food insecurity in Southern Somalia. The Household Food Insecurity Access Scale (HFIAS) was used to evaluate food insecurity in households. The data also covered household demographic characteristics in terms of age of the household head, gender of the household head, education, employment status, size of household, geographical location and monthly income. A structured questionnaire created in accordance with the study's objectives was used to collect the primary data from households. The study used a multistage sampling procedure in the selection of the respondents. A total of 420 households were involved in the survey with a representation from male and female headed households from rural areas. The analytical tools used to accomplish the research objectives included the food security index, likert scale, and descriptive statistics. The study employed descriptive analysis to depict the socioeconomic attributes and the ways in which households perceived the impact of food insecurity. The proportion of households with food insecurity was 96.4%, among which mild, moderate, and severe food insecurity accounted for 6.6, 32.9, and 56.9%, respectively. This study is significant in the sense that it provides analysis of the food insecurity for Somali rural households. The unacceptable levels of food insecurity in Southern Somalia can make it difficult to meet the country's goals for nutrition, health, and food security. The primary cause of the severe food insecurity experienced by the majority of the households surveyed was the abandonment of their own food production.

Keywords: Food insecurity, HFIAS, household, Somalia

Session IIID: Precision Agriculture

Oral Paper IIID-1

Vessel Monitoring System: Towards a Resilient Fishing Industry

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With more than 4 million tons of seafood produced annually, the Philippines ranks 11th in the world's seafood producers. In order to ensure the long-term viability of our resources, Vessel Monitoring System strengthens the government's ability to oversee fishing activities and enforce the law in Philippine seas. In this research, Sea-condition Emergency Alert and Warning Apparatus for Vessel Safety (SEAWAVES) is a vessel tracking and monitoring system developed and deployed to provide a safer and more resilient marine communication system. The method integrates contemporary technology using the fused location provider Application Programming Interface to retrieve the device's current location. In addition to managing underlying location technologies like Global Positioning System and Wi-Fi, the fused location provider offers a straightforward API. The work includes calibrating the compass, gyroscope, magnetometer, and Global System for Mobile Communication for vessel tracking and monitoring using Android sensors on mobile phones. This system is deployed on the vessel to monitor location and sea conditions, which are then displayed and supervised in real-time on a web page. This system can be used as a low-cost instrumentation solution through modern technologies. For instance, the fishing industry in Aklan, Philippines, faces numerous challenges, particularly related to the management and oversight for a seasonal fishing activity around the province. To address these concerns and improve maritime safety for vessel and crews, the installation of a vessel tracking and monitoring system on ships and small crafts has been recommended as an essential action in the field of intelligent transportation systems. The system can be deployment on fishing vessels throughout the country to effectively manage and monitor fishing activities. This is particularly relevant in the Philippines since we are an archipelagic country, to address these concerns on tracking and monitoring of vessels plying the Philippine waters.

Keywords: Android application, instrumentation, vessel monitoring system

Oral Paper IIID-2

Controlling Temperature and Humidity for Sustainable Agriculture

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Global climate change has had a direct impact on the agricultural sector. The uncertain climate, with increasing fluctuations in temperature and air humidity, has a major impact on the sustainability of agricultural cultivation. The use of greenhouses equipped with temperature and humidity control can be an alternative in overcoming the impacts of climate change. This research aims to produce a control system that controls the temperature and humidity in the greenhouse, and is monitored using the internet of things. The control system is designed using the Arduino Integrated Development Environment (IDE) application with a closed loop system and works on-off according to the setting point, temperature (38˚C) and air humidity (80%). The research produces a control system that controls air temperature and humidity, remains stable according to the setting point and can be monitored via the ThingSpeak platform. Data of loss at ThingSpeak was 26.04% and the average delay was 1.93 min, due to network instability. Overshoot temperature (1.18%) and humidity (1.38%) at a setting time of 2 min 45 s. The temperature and humidity are stable with a steady state error within tolerance limits

Keywords: Control system, closed loop system, green house, internet of things

Oral Paper IIID-3

Bamboo Places of Interests (POI) Mapping using Google Map - My Maps Application

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Bamboo is a multipurpose plant that thrives in tropical woods. The plant is established in a plantation and grows naturally in the forest. Many researchers have used feature classification using remote sensing imagery from satellites to perform regional bamboo mapping. However, its location within major geographical features, specifically a tourist region, has never been mapped. The initial step in gathering this data is to determine the vegetation's characteristics using remote sensing satellites' spectral reflectance. The satellite provides imagery with varying resolutions. An Unmanned Aerial Vehicle (UAV) pilot controls a man-controlled device to obtain higher-resolution images from both forested and non-forest areas. Second, mapping with Google Maps of My Maps makes it possible to compile more data onto a single map. Data from Google Maps such as distance measurements, particular features, polygon attractive points, tourism attractions, and many other attributes can produce a more accurate and representational map of bamboo. Thus, for this kind of research on resourceful location, it is made possible by the use of UAV data, Google Maps information, and May Maps applications.

Keywords: Bamboo, satellite image, tropical forest, UAV

Session IIIE: Value Chain in Agro-based Industry

Oral Paper IIIE-1

Traditional and Indigenized Recipes at West (TIRAW): Revolutionizing a Locally Prepared Sustainable Menu

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Tiraw is a vernacular term in the locality which means to taste the food. The study aimed to create a menu serving traditional and indigenized recipes in the locale. Selection of recipes was done through a seven-year campus food festival showcasing local food and innovative undergraduate theses on agricultural products preparation. During the final study, these recipes were prepared, and organoleptic evaluation and food action were done by 50 taster-evaluator-guests. Mean comparisons and statistical analysis were done following the non-parametric test using independent samples such as the Mann-Whitney U test between two groups, and Kruskal Wallis test among three groups. Level of probability was set at 5%. Presented products on April 25, 2022 were buffalo fresh milk as creamer for brewed native coffee and young coconut juice, white cheese, and Pan de leche with sessile (*Alternanthera sessilis*); stewed native chicken meat in a banana leaves-lined pot, steamed sessile joyweed with eggs, and Leche flan with squash; and, pork with crushed fresh guava leaves, and *Spondias pinnata*-stuffed roasted whole pig. Guests were grouped according to age, sex, food expertise, location and occupation. The 9-point Hedonic rating scale was used to evaluate the acceptability of the recipes while the willingness to eat used the food action rating scale. Mean comparisons and statistical analysis were done between and or among groups. Results showed that all the recipes were hedonically liked very much to extremely liked by the guests, and they were willing to eat the food very often or every opportunity they would have; the recipes prepared and presented did not significantly vary as to the acceptability and willingness to eat by all guest groups. The researcher recommends that these recipes be preserved and be published into a coffee table book, and be finally created into a whole menu for the guests.

Keywords: Indigenized, menu, organoleptic, tiraw

Oral Paper IIIE-2

Potential of Mulberry Leaves as an Anti-Diabetic Herbal Medicine Induced by Salinity Stress

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Salinity stress treatment can increase secondary metabolites in mulberry leaves. These secondary metabolites include lipids, carboxylic acids, terpenes, amino acids, alkaloids, vitamins, carbohydrates, phenols, phenylpropanoids, sesquiterpenes, flavonoids, and steroids. These secondary metabolites play a role in inhibiting the α-glucosidase enzyme. The mechanism of action of the α-glucosidase enzyme is to inhibit the breakdown of carbohydrates into simple sugars so that it can lower blood sugar. There is still limited information regarding what compounds have the potential to become competitive inhibitors of the α-glucosidase enzyme. Molecular docking can be used to explore protein-ligand binding models, which play a role in revealing the basis for drug discovery. This research aims to find out which compounds play the most crucial role as competitive inhibitors of the α-glucosidase enzyme using 100 metabolites obtained from untargeted metabolomic analysis using the UHPLC-Q-Orbitrap HRMS tool from leaf extracts of mulberry plants (*Morus* sp.) that were treated with salinity stress. Determination of the best α-glucosidase enzyme inhibitor activity based on the ΔG (free energy value) and Ki (inhibition constant) values. This study used 100 metabolites resulting from UHPLC-Q-Orbitrap HRMS from selected mulberry accession leaf samples. The results of the molecular docking analysis showed that seven compounds had the best inhibitory potential against the α-glucosidase enzyme using the virtual screening method. The seven compounds include resveratol-4'-O-glucuronide, obliquine, morusinol, kuwanon C, moracin C, α-tocopherol, and 8-prenylnaringenin. The resveratol-4'-O-glucuronide compound, a carbohydrate derivative, shows the best α-glucosidase enzyme inhibition activity based on the most negative ΔG, -9.9 kcal/mol, forming six hydrogen bonds. Thus, the resveratol-4'-O-glucuronide compound in mulberry leaves exposed to salinity can be used as herbal medicine to reduce hyperglycemia.

Keywords: α-glucosidase, acarbose, competitive inhibitors, diabetes, free energy

Oral Paper IIIE-3

Evaluation of Drying Techniques and Leaf Maturity on Nutrient Content in Orange-Fleshed Sweet Potato (*Ipomoea batatas* L.) Leaves

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Sweet potato leaves are considered more nutritious than the storage root and can be used as everyday vegetables consumed as fresh leaves or dried for extended shelf life. Leafy vegetable's nutritional composition is notably influenced by leaf age. Therefore, this study aimed to determine the effect of leaf age and leaf drying methods on nutritional content in orange-fleshed sweet potatoes. The experiment followed CRD 4 x 3 factorial replicated 3 times, with 4 levels of leaf age (upper, middle, lower, basal) and 3 levels of drying (sun, shade, oven). Nutritional analysis was conducted according to the Association of Official Chemists recommendations. Significant interactions were observed between leaf age and drying methods concerning ash content, crude protein, fat, neutral detergent fiber (NDF), calcium, magnesium, potassium, phosphorus, zinc, manganese, and copper. Ash, calcium, and magnesium content increased with an increase in leaf age with the highest ash content recorded in the basal leaves dried in the shade while the lowest ash content was found in shade-dried upper leaves. However, shade-dried upper leaves, sun-dried upper leaves, sun-dried middle leaves, and shade-dried middle leaves exhibited crude protein content. Lower oven-dried leaves in the oven had higher NDF content while sun-dried upper leaves had lower NDF content. Therefore, shade-dried middle and shade-dried upper leaves are recommended for consumption due to their higher crude protein content, and lower Na content.

Keywords: Drying methods, leaf age, leaves, nutrients, sweet potato

Oral Paper IIIE-4

Investigating The Spectral Properties of Temulawak During Blanching and Drying

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Temulawak, scientifically known as *Curcuma zanthorrhiza* Roxb., belongs to the Zingiberaceae family. These properties are pivotal in reducing bodily inflammation, combating infections, and safeguarding cells from the detrimental effects of free radicals. The rhizome of temulawak is rich in curcuminoids and essential oils, which are its principal components. To prolong its shelf life, temulawak is often transformed into crude drugs through a process involving blanching before drying. The blanching treatment not only enhances the texture and color of the material but also mitigates browning reactions. Typically, the evaluation of materials during processing relies on destructive methods; however, measuring quality based on wavelength presents a non-damaging alternative, focusing on three crucial aspects: absorbance, transmittance, and reflectance. This study aims to investigate the impact of blanching treatment at 45℃ for 15, 30, and 45 minutes, followed by drying at 60℃ on the wavelength, absorbance values, transmittance, and the overall quality of temulawak. The process initiates with slicing temulawak into pieces 3 mm thick and 9 mm in diameter, which are then blanched with aquadest at predetermined intervals. Subsequent steps include measuring the absorbance and transmittance values using a spectrometer, and drying the temulawak in a batch dryer at 60℃ with an air velocity of 1 m/s. Findings from the study indicate that blanching effectively preserves color and enhances reflectance values, albeit at the expense of reducing curcuminoid content, as evidenced by lower absorbance. The most rapid reduction in water content was observed in untreated samples, followed by those subjected to 30 and 15 minutes of blanching, whereas the 45-minutes blanching treatment exhibited the slowest water content reduction. Furthermore, blanching influences the drying rate, moisture ratio, color, and antioxidant activity of temulawak, demonstrating its critical role in processing the plant for medical and nutritional applications.

Keywords: Blanching, drying, spectrometer, temulawak

Session IIIF: Industrial Crop – Coconut

Oral Paper IIIF-1

Genomic Insights into Fruit Yield in Coconut Palms: A Comparative Analysis of SNP and InDel Variants in Low and High Yield Coconut Fruits

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Coconut (*Cocos nucifera* L.) plays a crucial role in the economy of several countries in the tropical region. This palm produces different beneficial products from the fruits generating income for smallholders. Traditional breeding presents significant challenges for genetic improvement of coconut due to its perennial nature, long juvenile phase, and high heterozygosity. Molecular biotechnological approaches, including molecular markers and next-generation sequencing could speed up genetic improvement efforts in coconut. The aim of this study is to identify variants (SNPs and InDels) in twenty-four different coconut accessions using whole genome resequencing technology in order to detect polymorphisms associated with the coconut fruit number. Six different coconut varieties, including dwarf and tall coconut palms, were chosen from three research fields based on high and low fruit number, and the first emerging leaves of these palms were collected for genomic DNA extraction. After verifying the purity, concentration, and integrity of the isolated genomic DNA, whole genome resequencing was carried out using the Illumina NovaSeq X Plus platform. The bioinformatics tool Burrows-Wheeler Aligner was used to map the raw data with reference genome (Cn-Dwarf), and the variants were then called using the Genome Analysis Toolkit. After filtering, around 3–24 million SNPs and 2-3 million InDels were discovered in the different coconut varieties. In the next stage, the number of SNPs and InDels was filtered according to high and low fruit numbers. Gene functional annotation is in progress on the Cn-dwarf reference genome and the result will be discussed. This study aids in the finding of genes associated with an important yield trait. These genes can be potential targets for genetic improvement through marker assisted selection.

Keywords: InDels, gene annotation, SNPs, variant calling, whole genome resequencing

Oral Paper IIIF-2

Assessing the Breeding Potential of Dwarf Coconut Varieties for Tender Nut Traits using Diallel Analysis

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Tender coconut water, which comes from 6 to 7-month-old fruits, is a highly nutritious and delicious beverage. Its bioactive enzymes are beneficial for overall health and metabolism, making it a commercial product with increasing demand in the global market. Various studies on tender coconut water indicate that water from dwarf coconut varieties is preferred due to high levels of total soluble solids and total sugars. This study therefore aimed to investigate the gene action involved in the inheritance of tender nut traits of three dwarf coconut varieties to identify superior parents and also select F1 hybrids with preferred tender nut traits under Malaysian conditions. To achieve the objective, a total of nine crosses were made by mating the three dwarf varieties namely Malayan yellow dwarf, red dwarf, and Pandan. The mating design used for the crosses was a 3x3 full diallel design, where all possible combinations of the three dwarf varieties were crossed. The crosses were done at two different locations - Pusat Pertanian in Lekir and Teluk Bharu, both of which are situated in Perak. Analysis of variance showed significant differences among the parental genotypes for all the traits studied except kernel thickness. Significant differences in the genotypes indicate considerable genetic variability in improving the traits. General combining ability (GCA) was significant for the traits, total soluble solids, fruit weight, kernel thickness, kernel weight, water volume, and water weight. The reciprocal and maternal effects were significant for all traits except kernel thickness. The GCA mean square effects were higher than the specific combining ability effects for all the traits, which means that the additive gene effects control the traits. Therefore, selecting hybrids during the early generations for the studied traits will potentially be successful since the role of additive gene action is predominant.

Keywords: Dwarf coconut varieties, diallel analysis, gene action, tender coconut

Oral Paper IIIF-3

Identification of Single Nucleotide Polymorphism (SNPs) and InDels Associated with the Red Palm Weevil Resistance in Three Different Coconut Varieties

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Coconut (*Cocos nucifera*) is one of the important crops in Malaysia's agriculture sector, contributing to the country's economy especially for rural development of the smallholders. However, the invasive pest red palm weevil (RPW), *Rhynchophorus ferrungineus* originated from Southeast Asia has caused a significant threat to the coconut industry with its rapid infestation in major coconut growing areas across Malaysia. RPW leads to eventual death of the tree without any pre-symptoms, seriously affecting the income and livelihoods of smallholder farmers. Therefore, there is an urgent need for breeding to produce RPW resistant coconut varieties through marker-assisted selection since conventional breeding is time-consuming and labor-intensive. This research aims to identify the genetic variant such as the SNPs and Indels associated with RPW resistance through whole genome re-sequencing. In order to achieve our objective, we have carried out a comprehensive field phenotypic characterization on three coconut varieties which is the Pandan, Malayan Yellow Dwarf and Malayan Tall for the internal and external damage for the selection of trees based on the tolerance to RPW infestation from the infested field. Twelve coconut trees from non-infected fields which are Pusat Pertanian Parit Botak, Johor, Pusat Pertanian Teluk Bahru, Perak and Pusat Pertanian Lekir, Perak and thirteen coconut trees from infected fields from Pantai Batu Burok, Terengganu and Marang, Terengganu were collected and whole genome re-sequencing was performed on them using the NovaSeq X Plus platform at 15x sequencing depth. The whole genome re-sequencing data of the tolerant and susceptible coconut trees were then analyzed using the bioinformatics tools such as the Burrow-Wheeler Aligner (BWA) and Genome Analysis Toolkit (GATK) for SNP and InDel calling within or near the selected genes. This study has revealed a large collection of SNPs and InDel variants distributed throughout the genomes of tolerant and susceptible coconut varieties which is important to identify the source of RPW resistance to be used as genetic markers in molecular breeding.

Keywords: Coconut, InDels, red palm weevil, SNPs, whole genome resequencing

Oral Paper IIIF-4

Field Phenotyping for Yield Traits of Malaysian Coconut Germplasm Materials

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Coconut (*Cocos nucifera* L.) is economically vital in tropical areas due to its versatility, leading to increased global demand. In Malaysia, it ranks fourth in agricultural importance by cultivated area, engaging approximately 63,000 smallholder farmers. However, challenges persist, including low yields from aging trees and a shortage of high-quality seedlings for replantation efforts. This study employed field phenotyping to assess and compare the yield traits and precocity of four tall and three dwarf coconut varieties across three locations: Pusat Pertanian Lekir and Pusat Pertanian Teluk Bharu, Perak, and Pusat Pertanian Parit Botak, Johor. Data was collected from a total of 210 samples, encompassing seven varieties, each with 30 nested samples, utilizing a nested design methodology. Key findings of the mean comparison between (Malayan Yellow Dwarf) MYD and (Malayan Red Dwarf) MRD varieties revealed that MYD exhibits a smaller leaf area but a faster maturation rate, whereas MRD demonstrates a greater leaf area and undergoes a slower maturation process. A yield trait comparison between Pandan and (Tagnanan) TGG shows Pandan having a significantly higher nut yield, while both varieties exhibit a similar maturation rate. Additionally, the mean comparison of yield traits of (Malayan Tall) MT, (Ceylon Tall) CT, and (Rennell Tall) RT indicates that all varieties have similar rates of maturation and annual average nut yield, but different values of (Standing Stem Dry Weight) SSDW and (Projected Leaf Area) PLA. Notably, RT exhibits a unique trait of having the lowest PLA among the three varieties. The correlation analysis identifies SSDW as the key factor for annual nut yield in MRD, Pandan, and RT, as well as for maturation rate in MYD, MRD, and CT. In summary, the findings of this study can be leveraged for informed decision-making and strategic cultivation practices in the Malaysian coconut industry.

Keywords: Coconut, field phenotyping, yield traits

Crop Production

CP_P1

Potential for *In Vitro* Propagation of Kencur with Auxin and Cytokinin

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In Indonesia, kencur (*Kaempferia galanga* L.) is a common rhizome plant that grows in yards. Kencur can be used as a spice, a base for traditional Indonesian herbal medicine, or as an ingredient in other pharmaceutical products. The production of kencur plants should be focused on the quality of the plant's rhizomes, which will subsequently serve as raw materials for the pharmaceutical industry, rather than just quantity as is typically the case. There are a lot of beneficial secondary metabolites in the kencur rhizome. Several barriers to kencur cultivation have been identified in the field, including the long harvesting season, the extended duration required for growing planting material, and issues related to low quality. Addressing the challenge of kencur's planting material can be achieved through in vitro propagation. The key to successful in vitro cultivation is the administration of growth regulators. More research is needed to determine the best growth regulator type, combination, and concentration for high-quality in vitro kencur propagation. A study was conducted at the Tissue Culture Laboratory, Department of Agronomy, Brawijaya University. The experiment followed a factorial completely randomized design, with auxin concentration as the first factor and cytokinin concentration as the second factor. The results of the study indicated that the use of cytokinins and auxins affected the in vitro propagation of kencur. A higher concentration of auxin compared to cytokinin resulted in faster growth.

Keywords: Auxin, *Kaempferia galanga* L., cytokinin, rhizome

CP_P2

Root Plasticity of Selected Corn (*Zea mays* L.) Varieties Grown for Food and Forage in Response to Nano-FertiGroe® and Urea

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To improve yield and overall nitrogen use efficiency (NUE), a deeper understanding of N uptake and utilization is required. Root plasticity is important cues of plant responses to N status and environmental condition, hence, understanding the morphological changes in root traits would help to understand N uptake that influences corn grown for food and forage, estimate the nutrient use efficiency of three corn varieties grown for food (ear shoot) and forage (baby corn fodder) and their morpho-physiological responses to nano FertiGroe®-N and urea fertilizers. Two factor randomized block design with three replications was conducted in pot experiment. Plants were grown in polyvinyl chloride (PVC) tubes that were filled with 20 kg of soil from Quezon Agricultural Research and Experiment Station. PVC tubes measuring 20 cm wide, and 100 cm long were used. Results revealed that root weight, length, root volume and diameter were higher in FertiGroe®-N than other N source, which were more evident at 2-3 days after silking (R1) stage. Variation in response to N among genotypes suggest that genotypes contribute to root plasticity. Better root growth confers advantage in genotypes as shown in higher shoot growth, leaf area, SPAD chlorophyll value, total dry matter, and ear shoot and forage yield. High correlation of root length (0.91), and root weight (0.89), plant height (0.98) and root weight (0.97) showed importance to ear shoot and forage yield, respectively. Total dry matter showed high correlation value of 0.99 and 0.97, suggesting significant contribution to both ear shoot and forage yield, respectively. Root plasticity is an inherent trait that could be enhanced using effective N source such as FertiGroe®-N, making genotypes competent for nutrient uptake. Understanding root plasticity in relevance to nutrient uptake and NUE could be an approach in breeding, and essential for growing dual purpose corn.

Keywords: Corn, nutrient use efficiency, N-source, nanofertilizer, urea

CP_P3

Postharvest Practices Followed by Acid Lime Growers in Vijayapura District

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Acid lime (*Citrus aurantifolia* Swingle), a crucial citrus fruit in India, follows mandarins and sweet oranges in importance. With India leading global production at 14.3 million tons in 2023, primary cultivation areas include Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka, Gujarat, Bihar, and Himachal Pradesh. Karnataka's Vijayapura district, especially Indi and Sindagi talukas, is a key producer. This study, conducted in 2023-24 across five talukas of Vijayapura district, aimed to document postharvest practices among 150 lemon growers. Data collection involved structured questionnaires and personal interviews, revealing that 80% of respondents were rural-based and all were engaged in agriculture, with 75.30% also involved in dairy farming. The findings highlighted that 97.30% of farmers sell their produce weekly, predominantly in the unripe stage (86.00%), with all participants engaged in sorting and grading. Jute bags (88.00%) were the primary packaging method and hired vehicles (85.30%) were commonly used for transportation. Most sales occurred at district APMCs (60.00%). Despite comprehensive postharvest practices, value addition activities were minimal, with only 8.70% producing pickles or juice. The study suggests significant potential for enhancing profitability through diversification into value-added products and broader market opportunities, emphasizing the need for improved infrastructure and support to capitalize on these opportunities.

Keywords: Acid lime, acid lime growers, postharvest practices, value-addition

CP_P4

Rooting Responses of Containerized Calamansi (*Citrus* × *macrocarpa* Bunge) Influenced by Application of Biofertilizer and Complete Fertilizers

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Calamansi (*Citrus* × *macrocarpa* Bunge) is an economically important citrus hybrid predominantly cultivated in the Philippines. Containerized fruit production is beneficial and viable for home gardening with limited spaces given the characteristic mature size of fruit trees like calamansi. This research aimed to investigate the rooting responses of containerized calamansi to the application of bio and complete fertilizer. Calamansi seedlings, which were 6 months old and budded, were grown in a mixture of sandy loam soil and coir dust (3:1) in 38.1 x 53.3 cm plastic pots. There were five treatments, Mykovam+Mycogroe with pinching, complete fertilizers with pinching, Mykovam+Mycogroe+Complete fertilizer with pinching, no fertilizer with pinching, and no fertilizer and no pinching. Nine months of observation revealed that application of Mykovam+Mycogroe+Complete fertilizer with pinching had significantly affected the root biomass with a mean of 124.71 g fresh weight and 68.92 g dry weight followed by complete fertilizers with pinching with 101.70 and 59.36 g, respectively. On the other hand, Mykovam+Mycogroe with pinching application showed only 42.39 g fresh weight and 25.19 g dry weight. Complete fertilizers with pinching showed the highest root length with a mean of 50.9 cm among the treatments. Results on the number of primary and secondary roots did not significantly differ among all treatments. While the results of this study did not show significant effects, utilization of biofertilizers still shows promising opportunities for further research and potential development in various agricultural studies and crop improvement initiatives.

Keywords: Calamansi, Mykovam, Mycogroe, complete fertilizer

CP_P5

Greater Canopy Cover in Containerized Calamansi (*Citrus* × *microcarpa* Bunge) Plant through Fertilizer Application and Pinching

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Calamansi fruit, a good source of vitamin C and a common additive in various food preparations that enhances iron absorption, is advantageous to have in a household. In areas with limited space, containerized fruit production is gaining popularity mainly due to ease of management. However, this method also limits the tree's growth and productivity. This study aimed to develop a small, portable, and aesthetically acceptable containerized calamansi plant. In this regard, the percent canopy cover of calamansi seedlings, six months old, budded, and grown in a mixture of sandy loam soil and coir dust (3:1) in 38.1 x 53.3 cm plastic pots with different fertilizer and pinching combinations, were monitored for 9 months using Canopeo mobile phone application. Fertilizer applications and pinching were done every 3 months. Among the different fertilizer and pinching combinations applied to the containerized calamansi plants, complete fertilizer with pinching (CP) and Mykovam+Mycogroe+Complete fertilizer with pinching (MMCP) produced denser and larger canopy covers four months from transplanting until the end of monitoring, indicating their effectiveness. Greater canopy cover indicates a more aesthetically appealing calamansi fruit plant. The percent canopy cover of CP and MMCP in the ninth month was 58.7% and 63.1%, respectively. The mean percent canopy cover of other treatments (Mykovam+Mycogroe with pinching, no fertilizer with pinching, and no fertilizer and no pinching) ranged from 19.3% to 21.6% in the ninth month of monitoring. These results demonstrate that pinching alone cannot promote dense canopy cover development, and containerized calamansi plants require timely nutrient supplementation with pinching for better canopy development.

Keywords: Calamansi, fertilizer, pinching, canopy cove

CP_P6

Assessment of the Acute and Subacute Toxicity of the *Melastoma malabathricum* Aqueous Crude Extract

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Melastoma malabathricum (MM) also known as "Senduduk", is a well-known herb, commonly used among the indigenous folks in Malaysia for traditional medicine practical purposes. Many toxicity studies have been carried out on MM extract, however very few studies have described the toxicity profile from MM hot aqueous extract. Therefore, this study aimed to investigate acute and sub-acute oral toxicity of aqueous crude extract of MM using Sprague Dawley rats. A total of 34 of female Sprague Dawley rats were randomly divided into 6 groups for both acute (n=5) and sub-acute (n=6) study. The duration for acute and subacute study was 14 days and 28 days, in accordance with OCED 423 (2001) and OCED 407 (2008), respectively, with slight modifications as per system suitability. Single dose extract was fixed at 3000 mg/kg and failed to produce treatment-related signs of toxicity or mortality during the 14 days of observation. Therefore, the LD_{50} of this plant extract was estimated to be more than 3000 mg/kg. In the 28 days repeated dose toxicity test, the rats were orally fed with three different doses; 100, 500, and 1000 mg/kg of body weight/day, revealed no major significant change ($P<0.05$) in their physical appearance, behavior, hematology, serum biochemistry indicators, and relative organ weight when compared to control group. The findings were supported by microscopic histopathology examination of the liver after being fed with MM extract. This study suggests that orally application of 100, 500, and 1000 mg/kg of MM aqueous leave crude extract does not induce acute and subacute adverse effects in rats.

Keywords: Acute toxicity, *Melastoma malabathricum*, , Sprague Dawley rats, sub-acute toxicity

CP_P7

Exploring Liquid Smoke Treatment to Enhance Seed Germination and Seedling Growth of Okra (*Abelmoschus esculentus*) after Prolonged Storage

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Liquid smoke is a readily available solution reported by several studies to enhance seed germination and seedling growth of various plants. This study investigates the germination rate and seedling growth response of F1 hybrid Okra (*Abelmoschus esculentus*) seeds following prolonged storage periods, with a focus on the potential mitigating effects of liquid smoke treatment. Okra seeds were stored for a year under cold (5°C) and room (27°C) temperature conditions to assess the impact of storage on seed germinability. Following storage, seeds were subjected to various treatments, including direct sowing (control), soaking for 24 hr in distilled water, liquid smoke solution (0.5% and 2% v/v), and 10% GA_3. The experiment utilized a 2 x 5 factorial design in a randomized complete block design, with each treatment replicated six times. Data on germination percentage, seedling height, and root length were collected and analyzed using ANOVA and Tukey's honest significant difference test in R statistical software. The study aims to provide insights into liquid smoke's potential as a seed treatment to enhance germination under adverse storage conditions, contributing to strategies for maintaining seed viability and improving crop establishment. The results underscore the critical role of storage temperature in seed viability and treatment efficacy. Seeds stored under room temperature conditions exhibited zero germination, emphasizing the detrimental effects of improper storage conditions on seed germinability. Conversely, seeds stored under cold storage conditions exhibited germination rates ranging from 54% to 95%, with cold storage combined with direct sowing demonstrating the highest germination percentage (95%), root length (13.97 cm), and seedling height (8.23 cm) 14 days after planting. Despite its potential, liquid smoke treatment did not yield favorable responses in Okra seeds compared to control (direct sowing) in this study. Further research is warranted to explore optimization strategies and understand the underlying mechanisms governing its effectiveness.

Keywords: Liquid smoke, seed viability, storage temperature

CP_P8

Growth Enhancement and Protective Effects of Silicate Compounds with Antagonistic Bacteria Against Banana Fusarium Wilt Disease

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Fusarium wilt disease or also known as Panama disease caused by *Fusarium oxysporum* f.sp. *cubense* (FOC) often results in high post-transplanting mortality rate or stunted growth of banana clones which significantly hinders banana production. Aim of study is to investigate the protective effects of silicate compounds and antagonistic bacteria on banana growth performance and disease suppression. Two separate greenhouse experiments with a similar experimental set up were conducted under rain shelter at Field 15, Universiti of Putra Malaysia (UPM), Selangor. Berangan banana clones were used in these experiments. The treatments were laid in split-plot randomized complete block design (RCBD) with 4 replicates. The treatments in the main plot for each greenhouse experiment were divided into healthy plants without FOC inoculation and diseased plants. The sub-plot treatments for Exp. 1, the soil planting media were drenched with different silicate compounds [T0 served as control, T1: 13% SiO_2 and 20% K_2O, T2: 26.6% SiO_2 and 13.4% K_2O and T3: 36.2% SiO_2 and 17% Na_2O]. The sub-plot treatments for Exp. 2 applied with different species of antagonistic bacteria: 0B (without *Bacillus* application served as control), BS (*Bacillus subtilis*) and BT (*Bacillus thuringiensis*) at 15 days interval. Soil application with silicate compounds and antagonistic bacteria on the root of banana at 15 days interval significantly increased morpho-physiology performance in terms of total leaf area, plant height, photosynthesis rate, but significantly decreased Fusarium disease incidence and disease severity of Berangan clones. Application of T3 on the soil and roots of banana plant significantly reduced disease incidence by 56.25% (BS) and 37.5% (BT) as compared to control (0B), but did not inoculate any antagonistic bacteria on the roots of banana gained the highest disease incidence of 83.33% at 12^{th} weeks after treatment of assessment. Thus, effective biological control organisms are important for minimizing chemical fungicide usage in the farm.

Keywords: Antagonistic bacteria, banana, Fusarium, silicate

CP_P9

Identification of SNP Markers Associated with Compactness Traits – Towards Sustainable Land Use in Oil Palm Cultivation

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The Malaysian Palm Oil Board (MPOB) has a large collection of the *Elaeis guineensis* Jacq. germplasm materials. Some of the accessions possessed compactness characteristics such as dwarfism (observed in the Nigerian germplasm), short rachis length (RL) (in Madagascar) and thin petiole cross section (PCS) (in the Cameroon) materials. In this study, a genomic approach was used to identify genetic loci, also known as quantitative trait nucleotides (QTNs) that are associated with these compactness traits, including palm height (HT), leaf area (LA), RL and PCS. A total of 478 palms from 11 origins namely, Nigeria, Ghana, Guinea Conakry, Gambia, Madagascar, Sierra Leone, Angola, Tanzania, Cameroon, Senegal and Zaire were genotyped via Genotyping-by-Sequencing (GBS) and resulted in a total of 5,034 good quality SNP markers. Genome wide association studies (GWAS) using FarmCPU model with pre-determined population structure and Kinship revealed eight significant QTNs associated with HT (3), LA (1), RL (1) and PCS (3), distributing across chromosomes 2, 8, 9, 12 and 15 in the oil palm genome. Each of the QTNs was carefully evaluated to trace the origin of the nucleotide mutations as well as their effects on the phenotypes. The identified SNP markers, especially their respective regions in the oil palm genome, can be exploited further to identify potentially useful genetic components that can help to improve the compactness stature of oil palm. Compact palms allow higher density planting thus may improve productivity in the existing agricultural land.

Keywords: Compact palm, germplasm, GWAS, oil palm, sustainability

CP_P10

High Yields, High Profits: The Impact of Hybrid Rice on Filipino Farmers

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SeedWorks Philippines, Inc. has introduced a groundbreaking hybrid rice variety, demonstrating its transformative potential in rice production. This research aims to evaluate the yield performance, economic impact, and adaptability of this hybrid rice under diverse farming conditions in the Philippines, and to highlight its potential in reducing the country's dependency on rice imports. The study is based on data collected from farmers nationwide, focusing on metrics such as yield per hectare, gross revenue, and input efficiency, as well as the hybrid's adaptability to different climates and resistance to common rice diseases. Notable case studies include Genaro Tamon from Bombon, Camarines Sur, who set a record yield of 15.78 metric tons per hectare, significantly exceeding the national average of 4.17 metric tons per hectare and achieving a gross revenue of ₱339,270 per hectare. Other farmers, such as Manuel Suba from Talavera, Nueva Ecija, and Alemar Castro from Flora, Apayao, also reported yields far surpassing the national average, demonstrating the hybrid's consistent high performance. The hybrid rice's efficiency is further underscored by its minimal seed requirement of 15 kg per hectare and its high milling recovery rate of around 65%, saving over 7,500 kg of milled rice per hectare. These results highlight the hybrid rice's economic viability and adaptability, making it a profitable choice for farmers across different regions. The study concludes that the hybrid rice variety not only significantly enhances rice yields and farmer profitability but also supports national goals of food sufficiency and reduced rice imports. SeedWorks Philippines' innovation in developing and promoting high-quality, high-yielding rice varieties is crucial for the sustainable advancement of Philippine agriculture, ensuring food security and economic stability. The hybrid rice's success illustrates the power of advanced agricultural practices and quality seeds in driving transformative change in the sector.

Keywords: Crop production, economic impact, food security, hybrid rice, yield performance

CP_P11

Cyperus rotundus Weed Management in MD2 Pineapple Plantation

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Weeds compete directly with pineapple planting for sunlight, moisture, nutrients and often act as hosts for insect pests. In MD2 pineapple plantation, silver-shine plastic sheet was mulched on the whole planting beds to avoid weed growth. Two herbicides were used as a standard practice in FGV Chuping Agro Valley (FCAV), Chuping, Perlis, which were Ametryn 40% + Diuron 40%, and Fluazifop-p-butyl 13.2% that was sprayed as pre-emergence and early post-emergence herbicide for effective control against weed that emerged on the planting hole and inter-row of the planting bed. However, there was a hardy weed specifically *Cyperus rotundus* which was unable to be eliminated by the current herbicides sprayed. Therefore, an herbicide study was conducted to evaluate efficacy of three herbicides to eliminate *Cyperus rotundus* in the MD2 pineapple plantation. A quadrat trial of three treatments was laid in a randomized complete block design with three replications, with experimental plots with the size of 2.0 m^2 each. Herbicide treatments used were Diuron 40% + Ametryn 40% (T1), Fluazifop-P- butyl 13.2% (T2), and Bromacil 80% (T3). The result showed that Bromacil herbicide sprayed effectively eliminated *Cyperus rotundus* with complete kills achieved in 2 weeks after treatment (WAT). The result also clearly showed that MD2 pineapple plant is tolerant to Bromacil herbicides without showing any phytotoxicity symptoms on the plant after the herbicide has been sprayed. Hence, Bromacil herbicide is an effective herbicide to be used for eliminating *Cyperus rotundus* and safe to be used for large scale MD2 pineapple plantation.

Keywords: *Cyperus rotundus*, herbicide, MD2 pineapple

CP_P12

Shoot Yield and Quality of Radish (*Raphanus sativus* L. Red Rambo) Microgreen as Affected by Liquid Organic Fertilizer

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Microgreens are considered immature greens that are rich at nutritional level and are considered as living superfood. In the past few decades, interest in organic and nutritional vegetables has gained momentum among people. To determine the potential of liquid organic fertilizers from agricultural waste, the microgreen shoot yield and quality of radish were assessed. The experiment was conducted in a walk-in chamber, Plant Factory Unit at the Faculty of Agriculture. The chamber is an enclosed environment with temperature 20-25°C, relative humidity 55-60% and equipped with LED red and blue light that provide light intensity ranging 123-140 $\mu mol \cdot m^{-2} \cdot s^{-1}$. The first true leaf of radish emerged on day 3 and harvested on day 14. The different type of liquid organic fertilizers treatment (washed rice water, banana peel and eggshell) was arranged using a randomized complete block design (RCBD) with 3 replications. The commercial hydroponic fertilizer, Cooper Formulation was used as a control. Liquid organic fertilizer has no significant effect on plant height, shoot and root fresh weight, shoot and root dry weight, root length, hypocotyl length and diameter at day 5, 8, 11 and 14. Wash-rice water treated microgreen showed the highest shoot and root fresh weight, 0.35 g and 0.09 g respectively. Leaves number and total leaf area significantly affected by liquid organic fertilizer at week 14. Significant ($P \leq 0.05$) differences were observed in radish treated with washed-rice water on titratable acidity as compared to the control. Regarding nutrient quality, there was no significant difference between control, washed-rice water and banana peel treatments. Applying washed-rice water increased the phosphorus and potassium concentration with 5.24% and 2.14% compared to control, respectively. Overall, the results suggest that the readily available organic waste materials have the potential to be successfully recycled and converted into effective substitutes for conventional organic fertilizers in the microgreen production industry.

Keywords: Leaves number, plant factory, rice water, total leaf area

CP_P13

Gene Expression Study of Microgravity Germinated Holy Basil (*Ocimum sanctum*)

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Holy basil (*Ocimum sanctum*) seedlings were grown both in the Japanese Experiment module in the International Space Station (ISS) and on earth for 30 days. Plants were placed in a closed environment incubator under control of light, temperature, humidity and CO_2 conditions, before being brought back to earth. Pools of the first leaf and stem were samples and RNA extracted. The sequences were aligned to reference genome *Ocimum basilicum*. We identified a differential express gen of holy basil ISS vs Grown Control with a total of 1518 (up regulated)/1046 (down regulated) for leaf and 599 (up regulated)/224 (down regulated) for stem. The differential express gene was analyzed for gene ontology enrichment. The top 3 prominent GO enrichments for holy basil leaves were cytosol, chloroplast and cytoplasm, while GO enrichment for stems were cytosol, cytoplasm and Golgi apparatus. The top 3 differential gene for Kyoto Encyclopedia of Genes and Genomes (KEGG) for leaves were metabolic pathway, biosynthesis of secondary metabolites and microbial metabolism in diverse environment, while KEGG enrichment for stems were endocytosis, photosynthesis-antenna protein and photosynthesis.

Keywords: Gene expression, International Space Station, *Ocimum sanctum*, RNA sequencing

CP_P14

Co-Composting of Okara and Pineapple Residue

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The production of soybean milk and tofu leads to the generation of a byproduct called okara, which is difficult to dispose of due to its high-water content. Similarly, in Malaysia, pineapple residues are often managed through open burning, leading to environmental issues such as haze and peat fires. Both okara and pineapple residues contain valuable nutrients and organic matter, making them suitable for composting to produce high-quality organic fertilizer. This study aimed to assess the feasibility of co-composting okara and pineapple residue and the impact of turning activity on compost quality. Different combinations of okara and pineapple residue were prepared in compost boxes with added chicken slurry as a microbial source. The compost mixtures were subjected to either no turning or weekly turning. Throughout the composting process, pH, electrical conductivity (EC), nitrogen (N), phosphorus (P), and potassium (K) concentrations increased, while the C/N ratio, organic matter, and total organic carbon content decreased. Increasing the ratio of pineapple residue led to lower N and P concentrations but higher K and EC levels compared to compost containing only okara. The different turning activities did not significantly affect the changes in C/N ratio, pH value, N, and P concentrations. The matured compost had no foul odor and contained a comparable amount of nutrients. The germination index for a 25% dilution of the compost was above 100%, indicating its potential as a phytostimulant. In conclusion, co-composting okara and pineapple residue can produce high-quality compost, offering a sustainable solution to reduce environmental pollution from agricultural waste management.

Keywords: Agricultural waste management, co-composting, okara, pineapple residue, phytostimulant

CP_P15

Unveiling the Potential of Basalt Waste: A Route to Securing Sustainability

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Approximately 45% of tropical soils are highly weathered, which are classified as Ultisols and Oxisols. These soils, primarily composed of goethite, hematite, and gibbsite, typically lack sufficient levels of essential nutrients like phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) necessary for optimal crop growth. The rising prices and limited availability of K and P fertilizers at the marketplace exacerbate nutrient deficiencies, while prolonged imbalanced fertilizer use has led to soil nutrient depletion, reduced crop yields, and weakened plant health, even contributing to human malnutrition. Therefore, exploring alternative nutrient sources is crucial for sustaining crop production. Recent studies have highlighted the promising potential of basalt dust, abundantly available from a quarry in Segamat, Johor, as a novel source of essential plant nutrients [Ca, Mg, K, P, and sulfur (S)], including silicon (Si). Long-term application of basalt dust on agricultural land can significantly mitigate soil acidity issues and address nutrient deficiencies. Positive outcomes have been observed in rubber crops. When olivine in basalt dissolves under moist conditions, it releases hydroxyl ions (OH^-), effectively raising soil pH levels, which depends on the application rate. This increase in soil pH enhances the soil's cation exchange capacity (CEC), improving nutrient retention and availability for plants. Additionally, the hydrolysis of silicate ions (SiO_4^{4-}) in the soil solution generates silicic acid [$Si(OH)_4$], further supporting crop growth and production. The application of basalt dust induces favorable changes in the soil environment, resulting in improved fertility. This is evident through higher soil pH levels, the infusion of essential nutrients for crops, and increased CEC. Basalt dust can transform and rejuvenate highly weathered Ultisols and Oxisols into productive arable lands.

Keywords: Agriculture, nutrients, silicate, soil fertility, sustainable production

CP_P16

Effect of Storage Duration and Packaging on the Quality and Shelf Life of Microgreen *Coriandrum sativum* L.

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Microgreens are a new class of edible vegetables harvested when the first leaves have fully expanded and used to enhance salads or as edible garnishes in a wide variety of dishes. However, they typically have a short shelf life (1-2 days) at ambient temperature. In the present work, the quality and shelf life of microgreens *Coriander sativum* L. was evaluated by analyzing ascorbic acid content, total chlorophyll content, 2, 2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) scavenging activity, total phenolic content, and total flavonoid content. During storage, the coriander microgreens were kept with open packaging and closed packaging made from polyethylene terephthalate (PET) at 10°C for 12 days of storage. We found that closed packing types demonstrated lower physiological weight loss as compared to open packaging with respective 39 % and 45 % on the 12th day of storage. A greater loss occurred in terms of content of ascorbic acid, phenolic content, and flavonoid content in the open packaging system compared to the closed packing system as the storage time extended. Interestingly, the result also indicated that open packaging showed higher DPPH scavenging activities compared to the other one. For sensory evaluation, coriander microgreens are better kept in closed packaging and they can be stored for up to 8 days when stored at 10°C. The experiment demonstrated that closed packaging using PET material significantly enhances the shelf life and maintains the quality of coriander microgreens better than open packaging. Overall, the study highlights the advantages of closed packaging in prolonging the shelf life and preserving the nutritional and sensory qualities of coriander microgreens, making it a recommended practice for enhancing the marketability and consumer satisfaction of these products.

Keywords: Coriander, *Coriandrum sativum*, microgreens, packaging, shelf life

CP_P17

ZmYTH1 Regulates Ear and Tassel Development in Maize

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YTH domain proteins represent a crucial class of methylation-binding proteins, which directly bind m^6A through the YTH domain and affect mRNA splicing, RNA stability, and RNA translation. These proteins can be categorized into YTHDF and YTHDC subfamilies. The development of maize ears directly impacts crop yield; thus, it is a critical area of research focus worldwide. This study aims to identify key genes and favorable variants from natural resources while investigating their molecular genetic mechanisms to obtain beneficial haplotypes. In this study, a total of 385 materials were used in this study, including 32 teosinte, 68 local varieties and 285 maize inbred lines. The number of tassel branches (TBN) was measured 15 days after pollination. The mixed linear model (MLM) in TASSEL 5.0 software was used to conduct GWAS. There are three significant SNPs on chromosome 2. Eight genes were identified in the range of 50 kb upstream and downstream of significant sites. The expression level of ZmYTH1 was significantly different between materials with high and low TBN. Candidate gene association analysis further confirmed the significant correlation between ZmYTH1 and TBN. Additionally, we discovered 15 variation loci, including 7 SNPs and 8 Indels, which could be classified into three haplotypes. By using the maize reference genome (B73 RefGen_v3) as a template, we performed targeted resequencing on ZmYTH1. Nucleotide polymorphisms in inbred lines were significantly reduced, and ZmYTH1 was selected during domestication. We generated CRISPR-Cas9 knockout plants. The mutant exhibited significantly higher TBN compared to the wild type, while ear length (EL), ear weight (EW), and Ear row number (ERN) were significantly lower in the mutant than in the wild type. In this study, we identified ZmYTH1 belonging to the YTHDF subfamily as an m^6A reader, which plays a crucial role in regulating TBN as well as EL, EW, and ERN. It has an important effect on the yield of maize.

Keywords: Domestication, GWAS, m^6A, number of tassel branches

CP_P18

The OsNAC24-OsNAP Protein Complex Activates OsGBSSI and OsSBEI Expression to Fine Tune Starch Biosynthesis in Rice Endosperm

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Starch accounts for up to 90% of the dry weight of rice endosperm and is a key determinant of grain quality. Although starch biosynthesis enzymes have been comprehensively studied, transcriptional regulation of starch-synthesis enzyme-coding genes (SECGs) is largely unknown. In this study, we explored the role of a NAC transcription factor, OsNAC24, in regulating starch biosynthesis in rice. OsNAC24 is highly expressed in developing endosperms. The endosperm of osnac24 mutants is normal in appearance as is starch granule morphology, while total starch content, amylose content, chain length distribution of amylopectin and the physicochemical properties of the starch are changed. In addition, the expression of several SECGs was altered in osnac24 mutant plants. OsNAC24 is a transcriptional activator that targets the promoters of six SECGs; OsGBSSI, OsSBEI, OsAGPS2, OsSSI, OsSSIIIa and OsSSIVb. Since both the mRNA and protein abundances of OsGBSSI and OsSBEI were decreased in the mutants, OsNAC24 functions to regulate starch synthesis mainly through OsGBSSI and OsSBEI. Furthermore, OsNAC24 binds to the newly identified motifs TTGACAA, AGAAGA and ACAAGA as well as the core NAC-binding motif CACG. Another NAC family member, OsNAP, interacts with OsNAC24 and coactivates target gene expression. Loss-of-function of OsNAP led to altered expression in all tested SECGs and reduced the starch content. These results demonstrate that the OsNAC24-OsNAP complex plays key roles in fine-tuning starch synthesis in rice endosperm and further suggest that manipulating the OsNAC24-OsNAP complex regulatory network could be a potential strategy for breeding rice cultivars with improved cooking and eating quality.

Keywords: Endosperm, NAC transcription factor, rice grain quality, starch biosynthesis, transcriptional regulation

CP_P19

Impact of Salinity Levels on Growth and Andrographolide Content in *Andrographis paniculata* Accessions

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Andrographis paniculata is a medicinal herb species with a high potential for product development, particularly in the medicinal and food industries. *A. paniculata*'s andrographolide is primarily responsible for its therapeutic value. However, cultivating the plant is difficult, especially in highly saline conditions. Plant development and productivity are limited due to salinity stress. To increase therapeutic efficacy and meet the rising demand, the yield and content of andrographolide needs to be enhanced. The study aimed to determine the growth development and phytochemical content of *A. paniculata* under various salinity stress levels (control, 5, 10, 15 and 20 dS/m). As salinity levels increased, physiological characteristics including plant height and root length decreased. The andrographolide content of young *A. paniculata* leaves was measured at harvest using the high-performance liquid chromatography (HPLC) method. With $r^2 = 0.99$, the calibration curve demonstrated a good linear relationship. Varying *A. paniculata* accessions under varying salinity conditions had varying andrographolide contents. Among the accessions, NS and SL accessions influence different salinity concentrations.

Keywords: *Andrographis paniculata*, andrographolide, salinity stress

CP_P20

Crown Rot of *Musa* AAA 'Beranagan' Suppressed by UV-C Irradiation

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Crown rot, caused by a complex of pathogens, is one of the primary diseases affecting banana fruits and is typically controlled using fungicides. Ultraviolet-C (UV-C) irradiation shows potential as an alternative strategy to replace fungicides. This study evaluated the effects of UV-C irradiation on the biochemical properties and cell wall ultrastructure of *Musa* AAA Berangan bananas. Five treatments were investigated: (i) UV-C treatment 24 hours before fungal inoculation (T1), (ii) UV-C treatment 24 hours after fungal inoculation (T2), (iii) fungal inoculation followed by the application of 1.0 g/L Octave® fungicide solution (T3), (iv) fungal inoculation without UV-C irradiation (T4), and (v) no UV-C irradiation and no fungal inoculation (T5). A UV-C dose of 0.01 kJ/m² was used in this study. The fruits were then subjected to 10 ml/L ethylene treatment for 24 hours at 25±2°C. Analyses were conducted on day 0 (before ripening initiation) and on days 1, 3, and 5 after ethylene treatment. The findings reveal that bananas treated with UV-C 24 hours after fungal inoculation exhibited significantly higher lignin content in the crown tissues compared to other treatments. Additionally, bananas irradiated with UV-C 24 hours before inoculation showed higher peroxidase and polyphenol activity on day 5. This is likely because the crown tissues of Berangan bananas respond to the fungal elicitor by strongly depositing lignin, which is preceded by the induction or activation of the enzymes involved in lignin biosynthesis. These responses indicate that UV-C plays an important role in strengthening the cell walls and hardening the tissues, caused by lignin deposition as an inducible defense mechanism in banana crowns against crown rot disease.

Keywords: Cell wall, fungicide, lignin, peroxidase, polyphenol

CP_P21

Effect of Elevated Carbon dioxide and Planting Densities on Growth and Physiological Changes of *Stevia rebaudiana* Bertoni

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Stevia rebaudiana Bertoni produces steviol glycosides (SGs) which are 300-400 times sweeter than table sugar, non-caloric in nature and are used by diabetic patients throughout the world. As a result, environmental pollution and climate change led to the carbon dioxide (CO_2) concentration in the atmosphere rising continuously which can affect crop performance. Additionally, other agronomic practices such as planting density are crucial to increase the productivity of stevia which has not been studied previously. The objective of the study was to determine the effect of elevated CO_2 (eCO_2) under different planting densities on stevia growth and other physiological changes. The experiment was arranged in factorial (2×3) arrangement, representing two CO_2 levels: 1,800 ppm (eCO_2) and 400 ppm (aCO_2) with three planting densities: high density vertical (HDV), high density horizontal (HDH) and low density horizontal (LDH), was established. The growth data were collected monthly until final harvest while physiological data were collected at 1st and 3rd month after planting (MAP). The data were analyzed using two-way (ANOVA) of the SAS and means from all the treatments was separated using (LSD) at 5% probability level. The results from the current experiment showed that regardless of the densities eCO_2 significantly enhanced plant growth where the highest (77.1 cm) plant height was recorded in eCO_2 treated plants as compared to aCO_2 (66.5 cm) at final harvest. Under aCO_2 the HDH and HDV had higher plant height than LDH only at 1st MAP while no significance was seen at late growth stages. Under eCO_2 the trend was the same as aCO_2 for plant height. Similarly, the eCO_2 plant produces 25%, 20%, 30% and 28% more branches at 1st to 4th MAP, respectively than aCO_2. Reading for photosynthesis rate, eCO_2-treated plants were observed with 36% and 42% increment at 1st and 3rd MAP than plants under aCO_2. Our results also showed that LDH plants resulted in higher photosynthetic rate, intercellular CO_2 and water use efficiency and low stomatal conductance and transpiration rate than HDH and HDV. In conclusion, eCO_2 can significantly enhance growth and physiology of stevia despite densities, however plants under LDH and HDH show better performance than HDV.

Keywords: Antioxidant, natural sweetener, stomatal conductance, steviosides, rebaudiosides

CP_P22

Growth, Pollination Rate, Yield and Fruit Quality as Influenced by Integration Fertilizer and Pollination Method

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Fertilizer is crucial for plant growth, available in both organic and inorganic forms. Melons are often grown in greenhouses using fertigation to ensure quality and prevent pest and disease infections. However, high costs for chemical fertilizers and labor for assisted pollination pose challenges. This study investigates the effects of fertilizer type (FT) and pollination method (PM) on the growth, yield, and fruit quality of rockmelon var. Glamour at Universiti Putra Malaysia (UPM). Plants were fertilized with either 100% chemical fertilizer (T1) or a mix of 75% chemical and 25% organic fertilizer (T2), and pollinated using bees, humans, or naturally. The experiment followed a randomized complete block design with factorial and four replications. Plant growth showed no significant differences between treatments, though T1 showed better leaf length and width. Pollination rates differed significantly by PM, FT, and their interaction. T2 plants pollinated by humans had the highest pollination rate, followed by bee-pollinated plants. No significant differences in fruit weight or diameter were found between treatments, though T2 had a higher fruit diameter. Soluble solids content (SSC) and firmness were significantly affected by the interaction between PM and FT, with T2 showing higher SSC and firmness. No significant differences were found in organic acid content, but PM and FT interaction significantly affected sucrose content, with bee-pollinated plants showing the highest levels. Bee-pollinated plants with T2 fertilizer produced more fruits and had the highest bee survival rates in the greenhouse. T1-treated plants had higher N and Mg content but lower K and Ca content in leaf tissue compared to T2, with no significant difference in P content. The number of dead bees increased over time. In conclusion, T2 improved fruit quality and maintained yield while reducing chemical fertilizer use by 25%.

Keywords: Fruit quality, nutrient content, pollinator bees, rockmelon, yield

CP_P23

Floral Development and Pollination Study of Musang King (D197)

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Variety D197 or Raja Kunyit/Musang King durian is one of the trending varieties being planted commercially in Malaysia and has high demand locally and for export purposes. This variety comes from *Durio zibethinus* under the Bombacaceae family. Due to high demand, planters of durian have high interest to change from the conventional method of having poly varieties being planted in an orchard to mono variety planting. However, this does not comply with the planting recommendation and from previous studies conducted with other durian varieties showed some varieties of durian facing self-incompatibility conditions causing problems to set fruit. Observation of floral development and study of compatibility status was conducted at Lembah Temir Orchard located at Lembah Klau, Raub, Pahang, Malaysia. Twelve trees were used for observation and pollination compatibility was done by using completely randomized design. The pollination treatments used were D197 with pollens of D197 of the same tree, D197 with pollens of D197 of different tree, D197 with pollens of D24 (Xenogamy), autonomous autogamy and open pollinated which act as control. Fruit sets of each treatment were recorded at 7th, 14th, 21st, 28th days after anthesis or pollination and at harvest. The results showed xenogamy has the highest percentage of fruit set compared to other pollination treatments and D197 variety is self-incompatible. It was observed the D197 flower has herkogamy condition during anthesis. The herkogamy during anthesis and self-incompatibility affect the ability to set fruits.

Keywords: Durian, D197, Musang King, pollination, self-incompatibility

CP_P24

Review on Biochemical Compositions of *Cocos nucifera* L. Fruit

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Coconut palm tree is well known as the plant of life. The coconut flesh and water can be eaten raw and can be processed into food, beverage, pharmaceutical and cosmetic products. The high demand of coconut fruit in the fresh market and industry is due to the presence of functional biochemicals in its flesh and water. The coconut flesh and water were identified to help in prevention of various chronic diseases. Coconut flesh is well known for its antifungal, antibacterial and antiviral properties. Coconut water is considered to have potential effects against cancers, cardiovascular disease, gastric malfunction, hypertension, diabetes, age related disorders and inflammation. Hence, the aim of this review is to summarize and identify functional biochemicals such as amino acids, fatty acids, carbohydrates, pigments, plant growth hormones, vitamins, polyphenols, flavonoids and saponins profiles in coconut fruit. However, the quantification of those biochemicals is dependent on the method of extraction. Accordingly, this current review attempted to explore up to date on the data of the screened biochemicals, their contents and method of analysis in coconut water, flesh and oil along with the specification of relevant varieties. By understanding the biochemicals in coconut, it may help consumers, product developers and scientists to select specific biochemicals from specific coconut varieties and fruit parts for special purposes.

Keywords: Coconut flesh, coconut oil, coconut water, metabolites, phytochemical profile

CP_P25

Axonopus compressus Variants: Growth and Physiology Responses on Drought

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This study evaluated the morphological and physiological responses of common *Axonopus compressus* (main turfgrass in Malaysia) and its six new variants to three soil moisture conditions, aiming to understand the performance and resilience of this turfgrass under climate-driven drought pressures. An 8-week glasshouse experiment with seven variants (A-0, A-1, A-40, A-46, A-91, A-122, and A-D) under three soil moisture conditions (saturated, field capacity, and drought) was conducted. The results showed that under drought conditions, there were reductions in leaf length, leaf width and turf height, while root mass increased and shoot biomass decreased. Most variants subjected to drought stress exhibited a reduction in chlorophyll content. Furthermore, the activities of proline, soluble sugar, malondialdehyde (MDA), soluble proteins, and antioxidant enzymes, including superoxide dismutase (SOD), peroxidase (POD), and catalase (CAT) were increased under drought conditions. Notably, A-40, A-46, and A-122 yielded smaller leaf areas and shorter statures than the original A-0. Drought stress increased chlorophyll content of A-40 and A-46, while A-40, A-91, and A-122 exhibited higher proline and soluble sugar levels. Additionally, higher levels of soluble protein and antioxidant enzyme activities (POD, SOD, CAT) were shown in A-40, A-46, A-122, and A-D under drought stress. This study demonstrated that A-40, A-46, A-122 and A-D possess advanced morphological and physiological adaptations, showing more enhanced tolerance to water stress of these new variants.

Keywords: *Axonopus compressus*, drought, physiology, water stress

CP_P26

A Comparative Analysis of Fertigation and Hydrogel Amended Systems for the Yield of Tomato (*Solanum lycopersicum*)

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Tomato (*Solanum lycopersicum* L.) is one of the most important vegetables grown throughout the world and a significant trade item, offering substantial nutritional benefits with their high content of vitamins, carotenoids, and phenol. However, growing tomatoes includes a few drawbacks, such as the requirement of sustainable farming methods in the face of challenges with the environment and soil, labor-intensiveness, susceptibility to pests and diseases, and the use of water and nutrient-efficient growing techniques. Soilless agriculture has been embraced as a feasible and sustainable option, allowing for optimal resource utilization as well as an excellent barrier against soil-related diseases. Incorporating hydrogels into these innovative farming practices presents a significant step towards sustainability, particularly in water conservation and nutrient delivery. These studies aim to determine the effect of hydrogel-amended soilless cultivation on the yield of tomato plants compared to conventional fertigation soilless systems. Fifteen advanced tomato lines were cultivated in two different soilless culture systems (cocopeat fertigation system and commercial hydrogel-amended cocopeat fertigation system). The growth and yield were measured throughout the experiment. The total yield of tomatoes was significantly high in hydrogel-amended media systems in this study, with similar performance for fruit number per plant. Hydrogels additionally help improve soil structure and promote healthier plant development, both of which are crucial in the effective growing of tomatoes, increasing output and crop resilience in current farming practices

Keywords: Hydrogel, soilless fertigation systems, tomato

CP_P27

Fertility Restoration of Blast Resistant Restorers on A_1 Cytoplasm of Pearl Millet (*Pennisetum glaucum* (L.) R. Br.)

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Fertility restoration behavior was studied in hybrids developed using twelve blast resistant restorers on A_1 cytoplasm. Twelve blast resistant restorers viz., PMBSN-03, PMBSN-22, PMBSN-25, PMBSN-31, PMBSN-34, PMBSN-66, PMBSN-72, PMBSN-73, PMBSN-80, PMBSN-81, PMBSN-92 and PMBSN-118 were crossed with five A_1 CMS lines viz., ICMA 01888, ICMA 05444, ICMA 94333, ICMA 97555 and ICMA 01666 in line x tester design during summer 2019-2020 to develop sixty experimental hybrids which were planted during kharif 2019-2020 at RARS, Vijayapur for identifying fertility restorers on A_1 cytoplasm. Ten restorers viz., PMBSN-03, PMBSN-22, PMBSN-25, PMBSN-34, PMBSN-66, PMBSN-72, PMBSN-73, PMBSN-80, PMBSN-81 and PMBSN-118 could restore fertility completely (90-100%) on all the five CMS lines. Whereas PMBSN-31 and PMBSN-92 showed complete fertility restoration on three CMS lines while on ICMA 01888 and ICMA 94333 CMS lines the extent of fertility restoration was partial (70-80% and 50-60%, respectively). The identified blast resistant restorers may be used in further development of new experimental hybrids resistant to blast disease in pearl millet.

Keywords: Blast, fertility restoration, line x tester

CP_P28

Genetics of Seed Dormancy and Other Quantitative Characters in Green Gram

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Seed dormancy is a crucial trait for the domestication of cereal and legume crops. Non-dormancy of seeds and non-shattering of pods are the first two traits that are selected for the process of legume domestication due to the advantage of uniform and timely cultivation. However, in tropical, subtropical regions with soils having high moisture retention capacity, non-dormancy in legumes results in yield and quality loss due to pre harvest sprouting. Mung bean [*Vigna radiata* (L.) Wilczek], an important legume in Asia. It has rapid growth, early maturity (60–75 days), relatively tolerance to drought, ability to improve soil fertility through atmospheric nitrogen (N_2) fixation in symbiosis with Rhizobium species in the soil. Mung bean seeds are the sources of protein, amino acids, carbohydrates, vitamins, and minerals. Although, the non-dormant character is a big hindrance for the summer cultivation of mung beans, as the crop harvest stage coincides with the rains. It is estimated that pre-harvest sprouting can cause around 50-70% of yield loss in mung beans. The search for investigation of non-conventional methods of inducing dormancy in mung beans to save the produce and to retain the seed quality against the field sprouting are of greater importance. An understanding of the genetic basis underlying seed dormancy may be useful for exploiting wild genetic resources for the improvement of crops. The objective of this study was to select parents with seed dormancy and maximum divergence in their genetic makeup with potential for heterosis. To identify superior combinations of mung bean lines with enhanced dormancy traits and other desirable characteristics and improving seed quality and resilience across varying environmental conditions. The selection of single cross-hybrids with superior crop performance under varying environmental conditions. Seed dormancy in wild mung bean (*Vigna radiata* var. *sublobata*) may be useful for the breeding of cultivated mung beans (var. *radiata*) with pre-harvest sprouting resistance and amenable to sustainable agricultural practices under climate change scenario.

Keywords: Domestication, mung bean, pre-harvest sprouting, seed dormancy

CP_P29

Impact of Deficit Irrigation Management and Growth Retardants Application on Yield Attributes and Yield of Groundnut (*Arachis hypogaea* L.) Variety VRI8

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Groundnut (*Arachis hypogaea* L.) is a vital oilseed crop cultivated year-round, with seed dormancy influenced by genetic and environmental factors. Preventing pre-harvest sprouting is essential to avoid yield losses. This study aimed to evaluate the impact of deficit irrigation management and foliar application of growth retardants on controlling pre-harvest sprouting and enhancing groundnut yield. A field experiment was conducted during early summer 2024 at the Agricultural College and Research Institute, Madurai, to investigate the effects of deficit irrigation and growth retardant chemicals on reducing in-situ sprouting of groundnut kernels. The experiment included three irrigation strategies: conventional irrigation, and two deficit irrigation treatments where irrigation was withheld from 90 to 105 days after sowing (DAS) and from 85 to 100 DAS. Foliar sprays of growth retardants—maleic hydrazide (MH) @ 1250 ppm, cycocel (CCC) @ 1000 ppm, abscisic acid (ABA) @ 750 ppm, and salicylic acid (SA) @ 750 ppm—were applied at 75 and 90 DAS. Standard agronomic practices were maintained throughout the crop growth cycle. Among the treatments, MH @ 1250 ppm was the most effective in inducing seed dormancy. The deficit irrigation strategy of withholding water from 90 to 105 DAS also significantly promoted dormancy, extending it by more than 5 days post-harvest and reducing pod loss. The combination of MH @ 1250 ppm and irrigation withdrawal from 90 to 105 DAS notably decreased germination by 12.6%, 36.8%, and 60.5% at 5-, 10-, and 15-days post-harvest, respectively, while significantly increasing pod yield. The combined treatment of MH @ 1250 ppm and deficit irrigation from 90 to 105 DAS effectively induced dormancy, minimized in-situ germination, reduced pod loss, and enhanced both pod yield and seed storage potential in groundnut.

Keywords: Bunch type, dormancy, groundnut, growth inhibitor, pre-harvest sprouting

CP_P30

Timing Fertilizer Application for Increased Growth, Yield and Phytochemical Content of Sambung nyawa (*Gynura procumbens*)

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Gynura procumbens or locally known as 'sambung nyawa' has traditionally been used as herbal medicine to treat various health problems such as diabetes, hypertension and urinary tract infection. The herb is reported to have anti-inflammatory and antioxidant properties due to its beneficial phenolic compounds present in the leaves. Agronomic practices have been known as one of the important factors to achieve optimal growth and high yield of most plants. Time of fertilizer application is also one of the agronomic practices considered to influence the growth performance in herbal plants. Thus, a study was conducted to determine the effects of time of fertilizer application on growth and yield of G. procumbens. Plants were harvested three times, with a 35-day interval between each harvest. The first harvest occurred 70 days after sowing. Three times of fertilizer application: 300 kg/ha before planting (T1), 100 kg/ha before each harvest (T2) and 200 kg/ha before planting, 50 kg/ha after harvest 1 and 50 kg/ha after harvest 2 (T3) were tested on the G. procumbens planted in an open field. Treatments were arranged in RCBD with four replications. Organic fertilizer from processed chicken manure were used in the study. All measured variables on plant growth and yield were taken 10 weeks after transplanting. T3 was revealed to result in higher plant growth, dry matter yield/plant, yield in kg/ha, total phenolic content, total flavonoid content, and DPPH free radical scavenging activity ($p \leq 0.05$) compared to T1 and T2. In conclusion, the time of fertilizer application of 200 kg/ha before planting, 50 kg/ha after harvest 1 and 50 kg/ha after harvest 2 per planting season was recommended for high growth and yield of G. procumbens.

Keywords: Agronomic practice, antioxidant properties, *Gynura procumbens* (Lour.) Merr., time of fertilizer application

CP_P31

Investigating the Morpho-physiological Characteristics of Sorghum (*Sorghum bicolor* (Moench) Varieties for Adaptability and Productivity in the Agroclimatic Condition of Malaysia

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Sorghum (*Sorghum bicolor* Moench) belongs to the Poaceae family, which is commonly known as the grass family. It plays a significant role in agriculture due to its versatility, drought tolerance, and wide range of uses. Due to genetic diversity, and wide variations of environmental conditions, the yield obtained and nutritional quality from sorghum varieties are inconsistent. However, due to limited knowledge gap of characterizing sorghum varieties (Bahausa, Sambalma, Kaura, Zabuwa, Janjari, and Kabo) according to their response to environmental conditions, this study necessitates examining basic morphology, growth habits, yield components, and nutritional quality of each variety to identify their effective utilization as food and feed. Treatments were laid out in a randomized complete block design replicated three times. Data collected on morphological, physiological, and biochemical compositions were subjected to analysis of variance. The results showed significant ($p<0.05$) effect on the varieties for example, Zabuwa having the highest (8668.88 kg/ha) seed yield and Janjari with the least (1796.3 kg/ha) seed yield was attributed to their plant height and leaf morphology. Similarly, the nutritional quality and quantity of each variety was obtained from the total biomass yield, protein contents, fiber contents and digestibility which were significantly ($p<0.05$) different among the varieties. Kaura variety was evaluated to have the highest leaf number (22), stem girth (23.16 mm), DMY (39200 kg/ha), protein (13.07%) and digestibility compared with Janjari and SAMSORG45. Based on these findings, varieties were classified by use: Sambalma is ideal for forage, Janjari for breweries and starch production, while Kaura, Zabuwa, Bahausa, Kabo, and SAMSORG45 are suitable for forage and seed production. Therefore, this study concluded that the most suitable sorghum varieties for human and animal feed are Zabuwa and Kaura respectively.

Keywords: Adaptability, genetic diversity, nutritional quality and utilization, sorghum, yield

CP_P32

Nutrient Deficient Related Morphological and Physiological Responses in Clonal Oil Palm

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Recent discoveries in the fields of physiology, molecular biology, and genetics have significantly enhanced our knowledge of oil palm response towards environmental stimuli as well as the importance of varietal diversity for tolerance. Nutrient deficiency was examined in two oil palm clones (CPS1 and CPS2) subjected to several treatments; nutrient [N0 P0 K0, N0 P1 K1, N1 P1 K1 (Control), N1 P0 K1 and N1 P1 K0]. Generally, nutrient-deficient clones decrease in growth, content of chlorophyll pigments, and physiological process of plant. According to a preliminary morphophysiological examination, CPS1 excels over CPS2 in terms of growth performance, photosynthetic capacity, and better nutrient tolerance. Our data suggest that CPS1 exhibit higher photosynthetic capacity (10.90 µmol $CO_2 \cdot m^{-2} \cdot s^{-1}$) compared to CPS2 (9.04 µmol $CO_2 \cdot m^{-2} \cdot s^{-1}$). CPS2 reported lower water use efficiency (3.57 µmol$\cdot m^{-2} \cdot s^{-1}$) however its iWUE value is higher (53.85 µmol/mol) compared to CPS1 (50.61 µmol/mol) indicating its ability to adjust stomatal conductance and CO_2 assimilation rate in response to different nutrient levels. Besides, transpiration rate and stomatal conductance of CPS1 (3.17 mmol $H_2O \cdot m^{-2} \cdot s^{-1}$and 0.25 mol $H_2O \cdot m^{-2} \cdot s^{-1}$) is higher than CPS2 (2.69 mmol $H_2O \cdot m^{-2} \cdot s^{-1}$ and 0.20 mol $H_2O \cdot m^{-2} \cdot s^{-1}$) while both clones share similar Fv/Fm value (0.76). The leaf water potential was found higher in CPS1 (7.53 ψ) than CPS2 (7.03 ψ). Furthermore, nutrient deficiency caused similar decrease in morphological in both clones; however, CPS1 clone displayed higher total frond number, bole diameter and height (11 fronds, 8.0 cm and 101.6 cm, respectively) compared to CPS2 (9 fronds, 6.6 cm and 83 cm). Overall, the lowest photosynthetic activity in both CPS1 and CPS2 was linked to nitrogen deficiency. In conclusion, both clones could tolerate severe nutrient deficiency and were able to adjust physiologically and morphologically to cope with insufficient nutrient conditions.

Keywords: Nutrient stress, oil palm clones, photosynthesis, physiological characteristics

CP_P33

Agronomic Yield and Performance of Grafted Bitter Gourd (*Momordica charantia*) as Scion and Sponge Gourd (*Luffa cylindrica*) as Rootstock in Waterlogged Condition

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Bitter gourd (*Momordica charantia*), locally known as Ampalaya, is an economically significant crop in the Philippines, with high local demand. However, monsoon-season flooding poses a major challenge, limiting yield and profitability. To date, no commercial bitter gourd hybrids are known to be tolerant to waterlogging. Grafting, where elite cultivars are combined with vigorous rootstocks, offers a practical solution for enhancing stress tolerance. In initial screening trials of various rootstock species, including *Cucurbita moschata, Lagenaria siceraria, Benincasa hispida, Luffa acutangula*, and *Luffa cylindrica. L. cylindrica* emerged as the best option for waterlogging tolerance. This study evaluated the yield and performance of grafted hybrid bitter gourd (Thalia F1) scions onto eleven sponge gourd rootstock varieties (23VR001-23VR011) under open-field conditions, with non-grafted Thalia as the control. The study used a nested design, recording characteristics such as fruit count, marketable fruit count, fruit weight, marketable fruit weight, fruit diameter, and fruit length for both grafted and non-grafted plants. Results showed that grafted Thalia consistently outperformed non-grafted Thalia in both waterlogged and normal conditions. In waterlogged conditions, grafted Thalia on 23VR009 and 23VR010 rootstocks exhibited the highest fruit count (10.25 and 11.78 fruits/plant), marketable fruit count (6.42 and 6.9 fruits/plant), and fruit weight (1.66 and 1.81 kg/plant). Grafted Thalia plants with 23VR009 and 23VR010 rootstocks provided higher yields than non-grafted Thalia under both flooded and non-flooded conditions, demonstrating increased plant survivability and yield under flooding. Future research should focus on molecular mechanism analysis to further validate flood tolerance in rootstock-scion combinations.

Keywords: Fruit yield, grafting, hybrid bitter gourd, waterlogged

CP_P34

Forage Quality Assessment of Different Sorghum (*Sorghum bicolor*) Varieties as Animal Feed in Malaysia

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Sorghum (*Sorghum bicolor*) which belongs to the family Poaceae, is the fifth most important cereal crop cultivated for its versatility in the world of Agriculture especially in arid and semi-arid regions. It is widely grown in Africa, America and Asia, however, in Malaysia it is newly introduced as animal feed. The study was conducted in the field two of the Universiti Putra Malaysia. Seven treatments (SAMSORG45, Bahausa, Sambalma, Kaura, Zabuwa, Janjari, and Kabo) were laid out in a randomized complete block design replicated three times. Data was collected on morphological, growth, yield and nutritional compositions at flag and soft dough stages. Results indicated that Kabo (325.95 cm, 418.35 cm), Sambalma (308.69 cm, 414.64 cm), Zabuwa (307.76 cm, 422.20 cm) and Bahausa (308.90 cm, 403.56 cm) were significantly higher on plant height at flag leaf and soft dough stages. However, Kaura variety obtained the highest leaf number (10, 22) and leaf width (3.57). Result of the growth parameters indicated that, Kaura (15.70) and Sambalma (15.82) varieties have the highest net assimilation rate (NAR), however, Kaura variety was significantly higher on leaf area index (LAI) and leaf area ratio (LAR) 3.5 and 31.88 respectively. Results of the CGR were significantly higher with Bahausa (0.94 g•m²•day), Sambalma (0.71 g•m²•day), Kaura (0.99 g•m²•day), Zabuwa (0.73 g•m²•day) and Kabo (0.64 g•m²•day). Crude protein contents were significantly higher with SAMSORG45 (10.72, 6.84%), Kaura (13.01, 9.35%), Zabuwa (10.53, 6.81%) and Kabo (9.77, 6.38%) varieties at flag leaf and soft dough stages. The Kaura variety obtained least neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) 47.49%, 49.36%; 31.58%, 38.65%; 3.18, 5.02% respectively. Due to the higher leaf number, protein content and digestibility of Kaura variety, this variety is recommended for animal feed in Malaysia.

Keywords: Forage, nutrition, quality, sorghum, varieties

CP_P35

Formulation and Characterization of Empty Fruit Bunch Compost (EFB) Formulation with Agro-Waste as Additives in Soilless Growing Media for Native Ornamentals

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One of the leading environmental effects of many systems in horticulture, such as soilless culture, is the generation of organic plant residues and substrate wastes. Nowadays, there is a higher demand for ecologically friendly and lower-cost substrates. There is high interest in assessing compost from agro-wastes that can be used as growing media. This study aimed to test for phytotoxicity effect and evaluate the chemical and physical properties of substrates formulated from oil palm empty fruit bunch (EFB) compost as the main component and EFB biochar, rice husk (RH) biochar, vermiculite, sewage sludge and cocopeat as additives. The components were formulated in different ratios forming 18 formulations, including controls. Experiments were conducted in stages. First was a germination assay phytotoxicity test using *Solanum lycopersicum* (tomato) seeds, and nine formulations were shortlisted (highest germination rate and best root growth within incubation days). The selected formulations were then analyzed for physical and chemical characteristics. The final four formulations were selected for further pot trial; 10VRM (10 % vermiculite + 90 % EFB compost), 10 EBC (10 % EFB biochar + 90 % EFB compost), 10SWS (10 % sewage sludge + 90 % EFB compost) and 10 RHB (10 % rice husk biochar + 90 % EFB compost). Compost-based media with agro-waste biomass as additives are potential soilless media formulations that could be utilized as potting media compared to other soil-only based mixtures in the current ornamental industry. It is recyclable, low-cost, readily available, sequestrates carbon in the soil, helping to mitigate climate change issues, is easy to handle, lightweight and produces uniform plant growth, making it a suitable medium for planting, particularly landscape plants.

Keywords: Agro-waste management, biochar, native ornamentals, soilless media

CP_P36

Effect of Magnetic Field Seed Treatment on Onion Seeds Invigoration

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Onion seeds are microbiotic and lose their viability over a period of three months. This leads to certification hindrances and economic losses for farmers. Enhancing the quality of such seeds is essential. Among the different enhancement techniques, the economical, ecological, effective, and easy-to-handle magnetic field treatment seems promising in modern agriculture. Hence, an experiment was conducted at the Department of Seed Science and Technology, UAS Dharwad, during the Kharif season of 2023 to understand the effect of magnetic field treatment on seed quality and biochemical parameters of aged and medium-vigor onion seeds with 72% germination. The methodology involved subjecting aged onion seeds (6 months old) of the variety Bheema Super to magnetic fields of different intensities and time periods, and comparing them with untreated controls. Data were analyzed using a Completely Randomized Design (CRD) with three replications. Among the magnetic field treatments, 60 mT for 30 min was found to be the most effective, enhancing seed quality and biochemical parameters. Germination increased by 12%, speed of germination by 54.19%, total seedling length by 65.53%, and catalase activity by 47.47% compared to the control. Moreover, the optimum dose maintained the minimum standard of germination (70%) for up to 9 months. Deleterious effects on seed quality were observed at higher intensities of the magnetic field. The effectiveness of the magnetic field depends on both the magnitude and duration of exposure. Hence, magnetic field treatment can be successfully used to improve the quality of marginal-quality onion seeds.

Keywords: Germination, magnetic field, microbiotic, onion, speed of germination

CP_P37

Optimizing Pruning in Rose (*Rosa bourboniana* L.) for Improved Essential Oil Physical and Chemical Properties

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The present work was examined to explore the hypothesis whether pruning time, seasons and harvesting stages would impact rose essential oil physical and chemical properties during the year 2022-23 and 2023-24, respectively. The laboratory work was carried out at the Section of Medicinal and Aromatic plants, Department of Genetics and Plant Breeding, CCSHAU, Hisar, Haryana. Statistically, the investigation was laid out in factorial randomized block design since the rose shrubs were planted in the open field conditions. The field experiment involved three treatments i.e., two pruning times (October and November), two seasons (winter and spring) and two harvesting stages (bud burst and full bloom). The rose essential oil physical and chemical properties were significantly influenced by all the three treatments. According to results obtained, the isolated rose essential oil content, refractive index, color, pH and acid value were found maximum in treatment combination representing full blooms of November month pruned plants under spring season except for specific gravity and ester value which were recorded highest during winter season in both the years, respectively. In conclusion, the essential content of rose was improved with respect to pruning time, seasons and harvesting stages.

Keywords: Essential oil, pruning, seasons, stages

CP_P38

Character Association and Diversity Study of Maize Hybrids under Drought Condition

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More than 80% of maize is cultivated in kharif season where there is a frequent occurrence of drought. Experiment was carried out at EB-II section of the Dept. of Plant Breeding and Genetics, College of agriculture, OUAT, Bhubaneswar in RCBD design with three replications, irrigation was stopped before 15days of flowering and irrigation resumed when soil moisture reached permanent wilting point among 35 maize hybrids. Different physiological parameters were assessed and association of these parameters with grain yield per hectare were carried out. Majority of traits showed smaller difference between PCV and GCV indicating little influence on environment. Based on 13 quantitative characters, 35 maize hybrids were grouped into 6 clusters following D2 analysis and torcher's method of grouping. Among the traits leaf rolling (155.68), no. of kernel row/ear (801.6) were found to be the major contributing characters towards genetic divergence. Much genetic divergence was contributed by each of mono genotypic clusters formed by AHEH-17-7, AHEH 17-31, AHEH-17-31, AHEh-17-26. Higher inter cluster distance was between cluster V and VI. Among all studied 35 maize hybrids only ten varieties are under water stress condition *viz* AHEH-17-2, AHEH-17-4, AHEH-17-6, AHEH-17-8, AHEH-17-12, AHEH-17-14, AHEH-17-21, AHEH-17-24, AHEH-17-28,31Y25 are showing good response with respect to physiological parameters discussed namely proline content, leaf water potential, leaf chlorophyll content along with higher yield. The analysis concludes that the varieties AHEH-24, AHEH-17-26, AHEH-17-11 and 31Y45 revealed high yield potential even under drought stress condition, so this sorted out as a valuable material for broad scale commercial production and further development of drought resilient inbreds and double cross hybrids in breeding program.

Keywords: Character association, D^2 statistics, drought, diversity, grain yield

Plant Protection

PP_P1

Population Dynamics of *Oryctes rhinoceros* Influenced by Environmental Condition of Breeding Grounds in Replanting Areas

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Oryctes rhinoceros (L.) is a major pest of oil palm and coconut plantations. Most oil palm areas that face severe damage by *O. rhinoceros* are in tropical and subtropical climates with high temperatures, frequent rainfall, and humidity. *O. rhinoceros* population dynamics can be impacted by various environmental conditions in its breeding grounds, particularly in replanting areas. This study revealed significant relationships between the *O. rhinoceros* population and its environmental parameters in an oil palm replanting area. Rainfall plays an important role in the population of adult beetles where it shows that the population increases with rainfall. However, the population of male beetles has a more significant relationship ($F = 12.173$, $R^2 = 0.462$, $p < 0.05$) than female beetles ($F = 0.529$, $R^2 = 0.0376$, $p > 0.05$) during rainfall. Rain directly impacts humidity levels at the breeding grounds, since larvae thrived in humid conditions. Larval population positively correlates with rainfall ($F = 15.214$, $R^2 = 0.521$, $p < 0.05$). In addition to rainfall, the moisture content of the decomposed oil palm trunks also plays a role in determining pest population density. Moisture level has a highly positive correlation with the instar larval population, L3 ($F = 2.752$, $R^2 = 0.319$, $p < 0.05$) where larval instar development requires a high moisture content to grow into an adult beetle. As a result of this study, understanding the effects of the environmental conditions on insect pests is critical for successful pest management and ensuring adequate crop production.

Keywords: Environmental factors, moisture content, *Oryctes rhinoceros*, rainfall, planting

PP_P2

Encapsulation of Protein HrpS in Chitosan Nanoparticles for Improved and Increased Resistance Against Papaya Dieback Disease

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Management of papaya dieback disease, caused by *Erwinia mallotivora* (EM), continues to be a challenge due to the scarce availability of treatments and an established resistance variety. Several recombinant protein formulations have shown the potential to increase the resistance of papaya towards the diseases, achieved by a mechanism known as Systemic Acquired Resistance or SAR. In order to lower the treatment cost, there is a need to create a more effective and sustainable delivery system for the SAR formulation. In this study, the selected SAR-inducing recombinant protein, HrpS, was loaded on chitosan nanoparticles (CNPs). It was observed that the size of the chitosan nanoparticle loaded with protein HrpS (CNP-HrpS) increased with increased protein concentration, ranging from 85.26 nm to 675.41 nm, and the polydispersity index remained <0.3 at all concentrations, indicating a homogenous formulation. A preliminary study on the protein release was also conducted and it was found that the protein started to be released from the chitosan nanoparticle after 3 hr at 37^{o}C. Additionally, in-vitro cellular uptake of CNP and CNP-HrpS were studied using fluorescein isothiocyanate (FITC)-tagged CNP and FITC-tagged CNP-HrpS. It was observed in the fluorescent microscopic images that treated leaves have a more intense illuminated lamina compared to the FITC-treated control set. CNP and CNP-HrpS were further evaluated for their efficiency in inducing the defense response of papaya plants by seed priming. Plant samples were collected before and after inoculation with EM to investigate the expression of selected defense-related genes by semi-quantitative RT-PCR. It was found that peroxidase and C4H genes showed relatively higher expression in papaya sprayed with CNP-HrpS formulation than papaya plants sprayed with CNP or protein formulation. This study provides a basis for the development of a chitosan nanoparticle delivery system for protein formulation to be applied for papaya dieback disease management.

Keywords: *Erwinia mallotivora*, nano delivery system, systemic acquired resistance

PP_P3

Impact of Rainfall on the Population of *Metisa plana* in Oil Palm Plantations

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Bagworm infestation poses a significant challenge, particularly in Peninsular Malaysia. Understanding how environmental factors influence these populations is crucial for effective pest management. Environmental shifts can disrupt the bagworm's life cycle, prompting the investigation into the impact of rainfall on bagworm population in oil palm plantations across Perak and Johor. Over a span of three years, monthly rainfall data was collected from meteorological stations and analyzed using SigmaPlot version 14. Results unveiled a positive correlation between rainfall and *Metisa plana* population in smallholdings A (P=0.519, r=0.0755), with a maximum recorded rainfall of 253 mm. Intriguingly, smallholdings B exhibited a negative correlation (P=0.038, r=0.211), suggesting limited impact of rainfall on *M. plana* population. This discrepancy hints at the resilience and adaptability of *M. plana* in smallholdings B, potentially explaining why rainfall does not significantly affect their numbers. Nonetheless, rainfall monitoring remains crucial for early bagworm control planning, empowering oil palm smallholders and estates to mitigate outbreaks before they escalate. The observed influence of rainfall on bagworm population underscores its importance in regulating this pest, as it may affect their generation and spread. However, comprehensive knowledge of this impact necessitates long-term studies. Future research should adopt a scientific approach, incorporating integrated pest management (IPM) techniques and AI-driven modelling tools. These strategies will elucidate the effects of environmental factors on bagworms and facilitate more efficient pest management practices.

Keywords: Integrated pest management, *Metisa plana*, rainfall

PP_P4

Aerial Spraying for Bagworm Control

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Bagworms pose a significant threat to the oil palm industry, particularly affecting smallholdings. MPOB researchers have developed various aerial application techniques to control bagworm infestations. Fixed-wing aircraft, agricultural drones, and helicopters can conduct aerial spraying for pest control, including bagworms. An agricultural drone is equipped with a VP110 nozzle, which operates at a pressure of 0.2 MPa and a constant speed of 2.8 m/s. The drone sets its flying height at 3-5 m above the canopy, with a capacity ranging from 15 to 20 L per flight. This method has shown great potential for controlling bagworms in small oil palm planting areas. We have extensively used fixed-wing aircraft for aerial biopesticide spraying. These aircraft can cover large areas quickly and are often a more cost-effective option because of their wider industry exposure. Fixed-wing aircraft typically travel at a speed of 18.52 km/hr, and their capacities are 1000 L per flight. Helicopters provide greater manoeuvrability and precision in pesticide application, particularly in difficult terrains or smaller areas. Their capacities are 380 L per flight with application speed of 16.09 km/hr. However, they might be a more expensive option compared to fixed-wing aircraft. The choice between fixed-wing aircraft, helicopters, and drones depends on a variety of factors, including the size of the area to be treated, severity of the infestation, resources available, and specific requirements of the operation. Fixed-wing aircraft are better suited for covering larger areas efficiently, while helicopters are more manoeuvrable and can access hard-to-reach areas. Drones, on the other hand, offer flexibility in terms of flying speed and altitude, making them ideal for targeted and urgent treatments in smallholding areas.

Keywords: Aerial spray, bagworm, drone, fixed-wing aircraft, helicopter

PP_P5

Current Classification of *Phytophthora palmivora* Causing Stem Canker Disease of Durian in Malaysia

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Phytophthora palmivora (Ppal) is an infamous pathogen causing disease on more than 100 plant species in sub-tropical and temperate regions. In Southeast Asia (SEA), Ppal has become a severe threat to the durian industry. Durian culture practice is now transitioning from small-scale toward large-scale farming due to increasing local and international demand, particularly in the Chinese market. The stem canker caused by Ppal has caused devastating economic losses estimated at US$2.3 billion in five SEA countries: Malaysia, Indonesia, Thailand, the Philippines, and Vietnam. This study analyzed twenty-five potential Ppal isolates from three different states in Malaysia (Pahang, Terengganu, and Kelantan) via phenotypic characterization. All isolates were cultured on vegetable juice agar (V8JA) and produced stellate pattern colonies after five days of incubation. The morphological characteristics were evaluated by observing the sporangium, chlamydospore, and mycelium structures. Further identification of the isolates by using three different DNA barcoding regions, including the internal transcribed spacer (ITS) region, elongation factor 1-alpha (EF1a), and cytochrome oxidase subunit I (Cox I). PCR amplification of the regions produced a ~900 bp amplicon, respectively. The amplicons were sequenced and the nucleotide sequences were later deposited in the GenBank database. These findings are essential for a better understanding of the current documentation of Ppal genus infection on durian trees in Malaysia and would contribute to taxonomic studies of this destructive pathogen based on ITS, EF1a, and COX I genes.

Keywords: Durian, molecular characterization, Ppal, stem canker disease

PP_P6

Harnessing the Microbiome Mosaic: A Metagenomic Blueprint for Revolutionizing Sustainable Agriculture

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The existing agricultural methods face significant challenges, making it essential to find long-term solutions in light of the growing human population and escalating environmental issues. This work explores a novel strategy that focuses on unlocking the potential hidden within the soil microbiome, a vibrant ecosystem comprising various fungi, bacteria, and microorganisms that play critical roles in plant health, nutrient cycling, and soil resilience. However, conventional farming practices often disrupt this delicate balance. Our research aims to use metagenomics, an advanced DNA sequencing technique, to investigate the soil microbiome and uncover key functional groups and their interactions by analyzing the collective genomes of soil microorganisms. We will collect soil samples from various agricultural systems, including conventional, organic, and no-till farms, to characterize the microbial communities present. Using metagenomic sequencing, we will identify these communities and employ network modeling and statistical analysis to understand their functional relationships. The findings from this study will help identify crucial microbial species and their roles in enhancing soil health, nutrient uptake, and plant growth. By comprehending these interactions, we can create targeted initiatives to improve the microbiome and achieve better agricultural outcomes. Ultimately, this research has the potential to revolutionize sustainable agriculture. By harnessing the power of the microbiome mosaic, we can develop practices that enhance agricultural yields, reduce dependence on chemicals, and improve soil health for future generations. This approach underscores the importance of understanding and managing soil microbiomes to address the pressing challenges faced by modern agriculture and promote sustainable food production.

Keywords: Functional ecology, metagenomics, microbiome, soil health, sustainable agriculture

PP_P7

Biological Control Activities of Rice-Associated Rhizobacteria Against Bacterial Panicle Blight (BPB) of Rice

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Bacterial panicle blight (BPB), caused primarily by *Bukhloderia glumae* is highly destructive and can cause significant losses of up to 75% in severely infested fields. Symptoms of the disease include a reduction in grain weight, sterility of florets, inhibition of seed germination and reduction of stands. Despite the economic importance of bacterial panicle blight, there are few control measures for this disease. Instead of these challenges, initiatives towards developing alternative strategies to cope and overcome the disease efficiently are urgently needed. This research highlights the promising approach of utilizing antagonistic rhizobacteria against BPB. In this study, rhizosphere soil samples were collected from low-land rice fields in Kg. Semaloi, Endau Johor where a total of 149 bacterial isolates from the soil samples were screened for antagonistic activity and quorum quenching activity against *B. glumae*. For each characteristic, 20 isolates and 19 isolates were tested positive. These isolates were then identified through 16S rRNA gene sequencing where most of the isolates were found to belong to the Bacillus and Pseudomonas genus. The effectiveness of the final four selected isolates, which are B1-2-4, B1-2-11, B2-5-2 and 4-4-1 in decreasing the severity of BPB symptoms in paddy, were studied in a control environment at MARDI Seberang Prai. Plants treated with B1-2-4 showed the lowest BPB disease severity followed by 4-4-1 and B1-2-11, leading to disease reduction up to 33% for B1-2-4 and 25% for both 4-4-1 and B1-2-11. All isolates were also evaluated for several growth-promoting activities, specifically their abilities as nitrogen fixers, phosphorus and potassium solubilizers as well as IAA and ammonium producers. Results indicated that all isolates possessed all capabilities except for isolate B1-2-11. These results are promising towards developing alternative strategies, such as biocontrol, to cope and overcome BPB efficiently.

Keywords: Bacterial disease, biocontrol, paddy

PP_P8

Molecular Identification of Lepidopteran Pests of Maize from Peninsular Malaysia

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Lepidopteran pests represent a formidable challenge to agriculture and horticulture worldwide. Their larvae, called caterpillars, are well known for their voracious appetites. They can quickly strip plants of their foliage, reducing crop yields and increasing vulnerability to other stressors. Therefore, a study was conducted to identify lepidopteran maize pests in Peninsular Malaysia using molecular techniques. More than 300 specimens of pest larvae were collected from maize fields in Peninsular Malaysia, and only 18 lepidopteran larvae were subjected to molecular identification. Polymerase chain reaction (PCR) protocol using cytochrome oxidase subunit 1 (CO1) marker was used to amplify the CO1 region from DNA extracted from lepidopteran maize pests. BLAST result analysis showed that all DNA specimens shared a high similarity percentage, over 98%, with known species in GenBank, where 16 moth larvae were identified as Fall Armyworm, *Spodoptera frugiperda*, and two moth larvae were identified as Asian Corn Borer, *Ostrinia furnacalis*, both common pests of maize. The results of this study are crucial as they provide a basis for further studies on the control and management of these pest species in the maize field, thus helping to mitigate the impact of these pests on maize production, optimizing pest management practices, and ultimately contributing to improved crop yields and sustainable agriculture in Peninsular Malaysia.

Keywords: Agriculture, CO1, Lepidoptera, maize pests, Malaysia

PP_P9

Evaluating the Efficacy of Insecticides Against Major Pests of Sesame

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Sesame (*Sesamum indicum* L.) holds significant importance as an oilseed crop in India, known as the "Queen of oilseed crop" due to its high-quality polyunsaturated stable fatty acids. The present study investigated the efficacy of novel insecticides against major pests of sesame. The field study was conducted during the Kharif and Summer season at Krishi Vigyan Kendra, Kalaburagi, University of Agricultural Sciences, Raichur, Karnataka. The experiment was comprised of seven treatments with three replications with spacing of 30 cm x 15 cm. The results revealed promising outcomes with chlorantraniliprole 18.5% SC @ 0.3 ml exhibiting the highest efficacy against gall fly *Asphondylia sesame* (Felt) infestation in both season with pooled per cent reduction of 70.17%. Broflanilide 20% SC @ 0.3 ml emerged as the most effective treatment against Capsule borer *Antigastra catalaunalis* (Duponchel) and Hawk moth larvae *Acherontia styx* (Westwood) with per cent reduction of 66.31 and 67.41%, respectively in Kharif and in Summer novaluron+indoxacarb 5.25% + 4.5% SC @ 1.5 ml shown the efficacy with 54% reduction. Imidacloprid 17.8% SL @ 0.3 ml showed superior efficacy against leafhopper *Orosius albicinctus* (Distant) infestation in Kharif with 64.8% reduction, in Summer Chlorantraniliprole 18.5% SC @ 0.3 ml with 75.41% reduction. In Kharif Fluxametamide 10% EC @ 0.6 ml show cased the highest efficacy against Whitefly *Bemisia tabaci* (Genn.) with 63.8% reduction and in Summer Chlorantraniliprole 18.5% SC @ 0.3 ml with 74.1% reduction.

Keywords: Sesame, insecticides, major pests

PP_P10

Application of Seaweed as Biofertilizers for Improving Crop Protection

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Sustainable agriculture transition is a global socioeconomic challenge. Due to the detrimental impacts of chemicals, the global biofertilizer industry is expanding substantially. Modern agriculture requires appropriate alternatives to counteract the present-day trend of mitigated application of fertilizers and pesticides. Biofertilizers offer a new eco-friendly technology that would overcome the shortcomings of conventional chemical-based farming practices. Seaweed, a remarkable natural resource found in abundance across the world's coastal regions, has emerged as a promising biofertilizer with the potential to enhance crop production due to its rich nutrient profile and beneficial growth-promoting properties. The three divisions of seaweeds were specifically classified as Chlorophyta (green seaweed), Phaeophyta (brown seaweed), and Rhodophyta (red seaweed). Studies across various crops, including vegetables, grains, and fruits, demonstrate that seaweed applications can significantly increase the quantity and quality of produce. Seaweeds are rich in essential macro and micronutrients such as nitrogen, phosphorus, potassium, calcium, and magnesium. The demand is rising consistently because seaweed extract is cost- effective and environmentally friendly. Studies have shown that seaweed fertilizers can significantly improve soil quality and increase agricultural production. The application of seaweed as biofertilizer is expected to be an alternative solution to environmental problems since it is safe for soil and plant microbes, as well as to overcome hazards caused by the extensive use of chemical fertilizers. Overall, these findings highlight seaweed biofertilizers as a promising tool for improving agricultural productivity and sustainability, with ongoing research further optimizing their application for diverse farming systems.

Keywords: Biofertilizer, crop health, macronutrient, micronutrient, plant diseases

PP_P11

Morphometric Variation of *Phytophthora palmivora* Causing Stem Canker of Durian

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Phytophthora palmivora (Ppal) is an oomycete that causes stem canker of durian. The present study was conducted to observe the morphological variability of *P. palmivora* isolates from durian stem canker. A series of sampling was conducted on several durian orchards in Peninsular Malaysia. The isolation of Phytophthora from the infected tissue was conducted using selective media. The genomic DNA was extracted from the pure isolates and used for molecular identification. PCR amplification method was used to amplify the internal transcribed spacer regions (ITS) of the ribosomal RNA gene and sent for Sanger DNA sequencing. The DNA sequences was compared with the sequences in the NCBI database using the Blastn search. Phylogenetic analysis was performed using the DNA sequences. The colony characteristic of the isolate on V8JA, PDA and MEA was observed after 5-days of incubation. Morphometric characters analysis was performed using the characteristics of sporangia. A representative isolate was selected to perform a pathogenicity test on durian clone seedlings. A total of 25 potential isolates were recovered from the stem canker of durian. The Blastn search of the nucleotide sequences showed the sequences share 98% - 100% similarity with *P. palmivora* and *P. taxon banihashemiana*. Phylogenetic analysis has revealed the isolates has clustered with *P. palmivora*, *P. taxon banihashemiana* and *P. heterospora* supported with 100% bootstrap value. The isolates colony have varied growth patterns on V8JA, MEA and PDA. Analysis of the sporangia characters has separated the isolates into four clusters. A high variability of sporangia characteristics was observed between the clusters. Koch's postulates were achieved by isolating identical fungal isolates from the symptomatic inoculated stems of durian and confirming their identities through morphological features. This study emphasizes the variation in the morphology of *P. palmivora* isolates, which may help to understand the current disease epidemiology.

Keywords: Durian, molecular identification, morphological variability, Ppal, stem canker

PP_P12

Utility of Metal Nanoparticles for Pest Management

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Nanotechnology is an interdisciplinary field that has made significant advancements in diverse areas of science and technology. It is an emerging field with significant potential in insect pest management. By manipulating materials at the nanoscale (1 to 100 nm), scientists have developed innovative solutions for controlling pest populations more efficiently and sustainably than traditional methods. Here, we have focused on insect *Spodoptera litura* F. (Order: Lepidoptera, Family: Noctuidae), also known as tobacco cutworm or cotton leafworm – a major polyphagous insect pest in Asia and the Indian subcontinent. With the regular use of conventional insecticides for management, insect pests have developed insecticidal resistance making the control measures ineffective and causing deleterious effect to environment. Nanotechnology has proved to be a novel and less harmful approach to effectively manage *Spodoptera litura* F. In this study, we have selected two metal nanoparticles – silver nanoparticles (AgNPs) and silica nanoparticles (SiNPs) and characterized them in terms of shape, size, morphology and topography by using UV-Visible spectrophotometer, particles size analyzer (PSA), atomic force microscope, scanning electron microscope (SEM) and X-ray diffraction study We observed that the absorption spectrum of AgNPs and SiNPs as 434 nm and 220 nm, respectively. The PSA analysis revealed the size of AgNPs and SiNPs are 77.8 nm and 64.7 nm, respectively. The X-ray diffraction patterns showed the crystalline nature of AgNPs and amorphous nature of SiNPs. The SEM micrographs showed that spherical nature of nanoparticles with different particle sizes. We also aim at assessing the insecticidal efficacy of AgNPs and SiNPs against *Spodoptera litura* F. and also plan to investigate the potential nanotoxicity mechanism through biochemical assays and gene expression studies in future.

Keywords: Characterization, nanotechnology, nanoparticles, nanotoxicity, pest management

PP_P13

Efficacy of Emamectin Benzoate Solid Nano Dispersion Against *Spodoptera* spp.

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The highly polyphagous pests like armyworms and cutworms are distributed throughout India. They are known to cause significant crop loss to several cultivated crops. Chemical insecticides have been extensively used due to which environment pollution is a major issue and it's a concern. So, the notion of incorporating the nano formulations which have the potential for avoiding organic solvents, reducing surfactants, and enhancing water solubility of poorly water-soluble pesticide. This study investigated the synthesis of a nano formulation of emamectin benzoate for the management of *Spodoptera* spp. under laboratory conditions during 2023-24. The Standard protocol developed for the synthesis of emamectin benzoate solid nano dispersion by optimizing the independent variables using a central composite design of response surface methodology. Laboratory bioassays were performed to assess the effectiveness of a solid nano dispersion formulation of emamectin benzoate against the second instar larvae of *Spodoptera frugiperda* (fall armyworm) and *Spodoptera litura* (tobacco cutworm) using the standard leaf dip method. The emamectin benzoate solid nano dispersion demonstrated superior efficacy against *Spodoptera frugiperda*, achieving the highest mortality (86.66%) at 4 ppm compared to the commercial emamectin benzoate 5 SG formulation (76.66%). Similarly, for *Spodoptera litura*, the nano dispersion at 4 ppm caused higher mortality (83.33%) than the commercial formulation causing toxicity 2.01, 1.5, 1.4 for and 1.3, 1.4, 1.5 times that of emamectin benzoate 5% SG at 1, 3 and 5 days after treatment for *Spodoptera frugiperda* and *Spodoptera litura*. These results highlight the enhanced toxicity of the nano formulation compared to the conventional one. This suggests that nano insecticides can be a promising eco-friendly tool for minimizing pest damage in agriculture.

Keywords: Emamectin benzoate, nano formulations, *Spodoptera* spp.

AH_P1

Effect of Palm Kernel Expeller and Empty Fruit Bunch in Beef Cattle Feed Formulation on *In Vitro* Gas Production

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Oil palm by-product has great potential to be utilized as ingredients in beef cattle feed formulation to replace the expensive imported feed ingredients. The objective of this study was to evaluate the effect of palm kernel expeller (PKE) and empty fruit bunch (EFB) inclusion at different percentages in beef cattle feed formulation on in vitro gas production and rumen fermentation. A total of six (6) treatment groups have been developed; T1 = 70% PKE + 5% EFB; T2 = 70% PKE + 10% EFB; T3 = 70% PKE + 15% EFB; T4 = 65% PKE + 5% EFB; T5 = 65% PKE + 10% EFB; T6 = 65% PKE + 15% EFB. Feed samples from the treatment groups were analyzed to determine moisture, ash, protein, fat and fibre content. Rumen fluids were obtained from beef cattle during slaughtering and incubated with incubation medium and feed samples from the treatment groups as substrate. The volume of gas production was recorded at 0, 2, 4, 6, 8, 10, 12, 24, 30, 36 and 48 h of incubation. At 48 h of incubation, T5 had a significantly higher gas production value ($p<0.05$) with 99.25 ml/500 mg. T5 also showed high values for in vitro dry matter degradability (IVDMD) and in vitro organic matter degradability (IVOMD) with 55.11% and 69.45% respectively, but there was no significant difference ($p>0.05$) with other treatment groups. The utilization of PKE and EFB in beef cattle feed formulations can increase their nutritional values and produce good in vitro rumen fermentation profiles with more significant effect was found in the formulation that used 65% PKE and 10% EFB (T5). However, further in vivo studies should be considered to evaluate the effect of using PKE and EFB in feed formulations on the performance of beef cattle.

Keywords: Dry matter degradability, organic matter degradability, palm by-products

AQ_P1

Unveiling Immune Mechanisms and Potential Biomarkers in *Vibrio*-Resistant Hybrid Grouper: A Comparative Proteome Analysis

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Vibrio alginolyticus, a notorious pathogen in grouper aquaculture, is responsible for vibriosis, a bacterial infection characterized by haemorrhagic and non-haemorrhagic ulcerations on the fish. This infection poses a significant threat to the health and productivity of grouper populations. In the current study, the molecular basis of disease resistance in groupers is uncovered by performing a comprehensive comparative proteome analysis on serum samples from *Vibrio*-resistant and *Vibrio*-susceptible groupers. Using high-throughput liquid chromatography-tandem mass spectrometry (LC-MS/MS), 2,770 unique peptides corresponding to 344 proteins were successfully identified. Detailed analysis indicated that 21 proteins were significantly up-regulated in the Vibrio-resistant group compared to both the control and the susceptible groups. These proteins play crucial roles in various biological processes, including immunostimulatory effects, signaling and binding cascades, metabolism, and the maintenance of tissue integrity and physiological conditions. The up-regulation of these proteins suggests enhanced immune responses and better physiological resilience in Vibrio-resistant groupers. Notably, several potential protein biomarkers related to the immune system were identified. These biomarkers are likely associated with the disease-resistant phenotype and could serve as valuable indicators for breeding and selecting disease-resistant grouper strains. The identification of these biomarkers provides a deeper understanding of the immune mechanisms that confer resistance to Vibrio sp. Infections. This study not only highlights the significant differences in the proteome profiles of resistant and susceptible groupers but also offers valuable insights into the molecular underpinnings of disease resistance. The findings reveal the potential for developing targeted strategies to enhance disease resistance in grouper aquaculture, and improve disease management practices, leading to more sustainable and productive grouper farming operations.

Keywords: Disease-resistant phenotype, hybrid grouper, serum proteome, *Vibrio alginolyticus*

AQ_P2

Investigations of Stress Handling and Histopathological Alterations in Hybrid Red Tilapia (*Oreochromis niloticus* x *Oreochromis mossambicus*) Exposed to Air

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In aquatic environments, hypoxia is one of the most important environmental stressors for fish. Fish that are often being transported will experience stress, which can lead to tissue damage and decreased productivity. One of the approaches to determine the normal and pathological conditions in fish is through histopathological observation. Implementing strategies to lessen stress will result in the wellbeing and health of the animals. The effects of air exposure on hybrid red tilapia (*Oreochromis mossambicus* x *Oreochromis niloticus*) were determined with respect to histopathological conditions. Experiments were conducted for seven days with two treatments, control and stress. Stressed fish were selected based on behavior and external lesions. Samples of liver and spleen of tilapias were collected and processed for histological observation under light microscope. Fish exposed to air displayed histopathologic alterations in the liver. Hydropic degeneration and swelling in the liver, and presence of melanomacrophage centers in both liver and spleen were characteristic of the chronic stress. It is concluded that exposure to air or hypoxic condition induces certain level of oxidative stress, thus resulted in histological alterations in the tissues of tilapia.

Keywords: Histopathology, stress, tilapia

Bio_P1

Identification of the R-gene Isoforms in Ganoderma-Infected Oil Palm using Iso-Seq Approach

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There is an increasing demand to expedite the development of elite oil palm varieties with desirable traits, such as high-yield production and enhanced resilience against environmental and biological stressors. Basal stem rot (BSR) disease, primarily attributed to *Ganoderma boninense*, significantly compromises oil palm productivity, resulting in yield reduction of up to 80%, and necessitating costly field sanitation practices and premature replanting plans. Despite the discovery of resistance genes (R-gene) that govern disease tolerance in plants, the genetic architecture of Ganoderma tolerance in oil palm has yet to be explored. To address this issue, this project was initiated to focus primarily on the identification of expressed R-genes and their isoforms using PacBio Iso-Seq sequencing analysis. Isoforms are distinct transcript structures that resulted from a similar gene owing to alternative splicing events, which often occur to increase protein diversity in an organism. For this purpose, the total RNAs extracted from Ganoderma-infected oil palm roots at seven different infection time points were used to generate the transcriptome databases. Through data mining and analyses using PRGdb 3.0 bioinformatic prediction platform, a total of 628 R-genes were identified, with 13.9% accounting for R-genes expressing isoforms. The expressed R-genes discovered in this study included both genes expressed at the basal level and those that may be particularly induced by the pathogen, *G. boninense*, in response to the host's defense system. Further research is required to acquire more functional information about the potential R-genes, especially those that express isoforms during the interaction. The output of this study could lay the groundwork for the future development of biomarkers for molecular breeding, aiming to produce Ganoderma-tolerant planting material, ensuring more sustainable production and longer-term economic stability for planters.

Keywords: *Ganoderma boninense*, Iso-Seq transcriptome, oil palm, resistance gene, splice variants

Bio_P2

Reducing Bias on Flux Measurement in Oil Palm Ecosystem: Combination of Automatic and Manual Approach

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The rapid expansion of agricultural areas to meet increasing consumer demand has led to the large-scale conversion of tropical peat swamp forests to agricultural plantations, resulting in substantial carbon dioxide (CO_2) emissions. However, the accuracy of reported emissions remains highly uncertain because of variability in sampling designs and site-specific factors being poorly quantified in peat soils. These uncertainties propagate into global estimates and are exacerbated by a limited understanding of how fluxes are controlled. Here, we present six months of automated chamber data, recording the soil CO_2 flux at an hourly timestamp, under an oil palm plantation in Malaysian Borneo. Multiplexed individual chambers, captured topographical microforms separately, representing Palm Base (PB), Harvest Path (HP), Frond Pile (FP), Drain (DR) and Inter row (IR). Hourly data were used to produce mean diurnal patterns of fluxes from individual microforms and compared to a monthly CO_2 flux dataset, collected over six years at the same site and microforms, using manual chambers to understand the potential biases that arise from estimating integrated flux sums using infrequent, single timepoint flux sampling. Individual microform measurements were also spatially integrated using weighted microform area scaling to produce plantation-scale estimates of CO_2 flux. Bias range was widest for HP (-18 to 24%), followed by PB (-13 to 11%), DR (-10 to 9%) and FP (-5 to 3%). Estimates of annual plantation-scale emissions over six years, corrected for sampling bias, ranged from 36 to 53 Mg CO_2 ha/yr. The water table depth and temperature (air and soil) were positively correlated with CO_2 emissions, although there were notable exceptions within the microforms. Our results emphasize the importance of both accounting for the time of day when estimating a mean daily flux from single time point sampling and accommodating area weighting when integrating spatial estimates.

Keywords: Automated chamber, bias measurement, EGM4 chamber measurement, soil flux, tropical peat

Bio_P3

Screening and Characterization of Phosphate Solubilizing Microbes (PSM) from Oil Palm Plantations

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Phosphorus is an essential element after nitrogen, which plays an important role in plant growth, metabolism, and soil microbiology. The introduction of phosphate-solubilizing microbes (PSM) as biofertilizer is a renewable energy source that can increase the availability of phosphate to plants and, at the same time, reduce the use of inorganic P fertilizer. Indigenous PSB isolated from palm oil plantations could be used as a better and friendly bio-agent to improve soil fertility, specifically for phosphate availability. Six PSM were isolated from mineral soil in oil palm plantations. Morphological and molecular identification showed that the six isolates belonged to Actinobacteria and Proteobacteria genera; more precisely, *Streptomyces* sp. and *Burkholderia* sp. All identified bacterial colonies were screened for phosphate solubilization on solid PVK media. Based on these results, four bacterial isolates had a solubilizing index (SI) >3.0, one isolate had SI >2.0, and one isolate had SI <2.0. After screening for phosphate solubilization on media, the percentage of radial growth (PIRG) was determined against Ganoderma, PER71. Based on the results, two isolates [*Burkholderia ubonensis* (P2R1_L) and *Streptomyces monashensis* (P1R2_1)] showed PIRG >70%, three isolates [*Streptomyces monashensis* (P1R3), *Burkholderia cenocepacia* (P1R3_L), and *Streptomyces corchorusiI* (P2R2)] showed PIRG >50%, and one isolate [*Burkholderia* sp. (P4R5_X)] with a PIRG >30%.

Keywords: Oil palm, plant growth, phosphate solubilizing microbes

Bio_P4

Detection of Phytopathogenic Ganoderma using Loop-Mediated Isothermal Amplification in Comparison to Conventional PCR

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Basal stem rot (BSR) is a devastating disease of oil palms caused by three phytopathogenic fungi, *Ganoderma boninense, G. zonatum,* and *G. miniatocinctum*. It has a significant impact on the economy due to the losses of oil palm trees. Among the three species, G. boninense was reported as the most virulent and pathogenic to oil palm. In previous studies, detection of pathogens was found to be tedious and cross-reactive with other fungi; therefore, a molecular based nucleic acid is developed to provide a rapid and accurate detection of the pathogen, namely loop-mediated isothermal amplification (LAMP) and polymerase chain reaction (PCR). The optimization of genomic DNA extraction was done using five methods with modifications, with the highest yield and purity at 2197.8 ng/µl using polyvinylpyrrolidone and sodium dodecyl sulphate. A sensitivity study was done to compare the detection limit between LAMP (0.002 ng/µl) and conventional PCR (0.02 ng/µl). A specificity study was carried out against 19 fungi isolates from ascomycetes, basidiomycetes, and oomycetes. Amplification and validation were done using 13 primers that were designed from transcriptomic data for LAMP and PCR detection. Results showed that only eight and four primers have the potential to be used as biology markers to distinguish Ganoderma pathogenic to oil palm using LAMP and PCR detection, respectively. The potential primers were tested using three biological replicates and four technical replicates to confirm the result. The results also confirmed that LAMP is more sensitive and specific as compared to PCR in detecting pathogenic Ganoderma, especially at the early stage of infection, so that action can be taken to mitigate the disease.

Keywords: Basal stem rot, *Ganoderma boninense*, loop-mediated isothermal amplification, oil palm

Bio_P5

Recent Developments and Limitations in Microbial Fuel Cell's for Sustainable Bioelectricity Generation

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As the global population continues to grow rapidly, there is a greater thrust for clean, alternative and sustainable green energy to fulfil the basic energy requirements and to substitute the depleting fossil fuels. This has led to the development of novel and promising technology called microbial fuel (MFC) cell technology. A MFC is a device that converts chemical energy from the substrate into electrical energy by the action of microorganisms. A typical MFC consists of anode and cathode chambers, physically separated by a proton-exchange membrane, and substrate. Anode chamber is made completely anaerobic, whereas cathode chamber is made aerobic. It uses an active microorganism as a biocatalyst in an anaerobic anode compartment for the production of bioelectricity. It also has significant application in wastewater treatment, bio-hydrogen production and their usage in biosensors. The study focuses on the role of polymer coated nanocomposite materials for anode construction in order to, overcome the practical commercial barriers of low power and current density and also factors affecting the performance of MFC. But still there is a research gap in understanding the limitations of MFCs which can further improve its performance by increasing the surface area of anode and also by using genetically modified micro-organisms to form highly reducing recombinant strains producing more electrons at anode.

Keywords: Polymer coated nanocomposite materials, proton-exchange membrane, sustainable bioelectricity

Bio_P6

Bio Designing the Future - Urban Algae Farms Lead the Way

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Urban algae farms present a sustainable solution for pressing issues of environmental challenges, food security, and renewable energy needs in urban areas. Despite being a comparatively new branch of agriculture, it can mitigate land scarcity, climate change, and also unsustainable fertilizer usage. Algae can be cultivated independent of arable land. Produces oil and also protein rich biomass with high spatial efficiency. However, high investment and production and production costs limit algae's competitiveness with cheap commodities. Monetization of ecosystem services like water treatment and co2 sequestration along with production of high value and low value products from algal biomass. A sustainable algae industry can contribute to future bioeconomy enabling fuel production, resource efficient food, creating new products, companies, and jobs. Benefits include efficient use of urban space, low water efficiency, and CO_2 absorption. Technologies like photobioreactors, vertical farming and living facades enable efficient algae cultivation. Examples like Ecologic studios and 3D ocean Farming. Urban algae canopy demonstrates innovative approaches. Despite challenges like high costs, regulatory hurdles and maintenance requirements. Urban algae farms promote green infrastructure and renewable energy. By embracing this innovative approach, cities can foster a more sustainable future.

Keywords: Biomass processing, green infrastructure, landless food, microalgae, renewable energy

Bio_P7

Preliminary Assessment of Polyploid Oil Palm

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The polyploid plant in oil palm offers a fresh perspective and a new source of genetic diversity. There is a potential enhancement in the phenotypes expressed and possible tolerance to biotic and abiotic threats, among other advantages over diploids. This superiority of traits in polyploids has provided the incentive to plant breeders to induce polyploidy and/or use natural polyploids to attain improved plant cultivars. Oil palm (*Elaeis guineensis*) is a diploid species (2n=32; 1.8 Gb), cultivated extensively for the production of palm oil and palm kernel oil. Perennial crops like oil palm have a long breeding cycle, where conventional breeding is an expensive and tedious exercise. Inducing polyploid oil palm using an anti-tubulin agent is an interesting approach in oil palm breeding to obtain superior materials at a much faster pace. Here, a panel of 40 induced-polyploid palms aged 17 years were profiled for their ploidy level, yield components, and selected vegetative traits. Fresh fruit bunch (FFB) data for eight consecutive years showed an expected increased pattern from year one to year eight with a mean FFB range from 32.90-213.25 kg/palm/year with bunch number (BNO) of 9.88-13.75 bunches/palm/year. The recorded height increment ranged from 24.67 to 52.83 cm/year. Two palms (3BO6_R1 and 2AC3_R4) showed outstanding FFB yields ranging from 195-216 kg/palm/year and two palms (1AO5_R5 and 2AC6_R1) showed height increments less than 30 cm/year. Ploidy evaluation indicates that these four palms showed a deviation from the normal diploid ploidy state and cytology analysis indicates that the total chromosome numbers range from 32-48. The preliminary data in this study suggests the potential of polyploid palms as commercial planting material for high yield.

Keywords: Breeding, chromosome, *Elaeis guineensis*, oil palm, polyploidy

Bio_P8

Determination of Jasmonic Acid in Paddy Leaves using Liquid Chromatogram Mass Spectrometry

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The phytohormone named jasmonic acid (JA) has been identified to play a significant role as a potential plant growth regulator. It includes the induction of trichome and seed formation, modulation in seed germination, regulation in the reproductive organ development, regulation in plant responses to various biotic and abiotic stresses and root growth and development. We have formulated a foliar fertilizer containing JA to enhance the paddy yield. The experiment was design using complete randomized design (CRD) in the glasshouse. Paddy plants were exposed to three different treatments (0.8% from stock 5 mM JA fertilizer formulation, commercial fertilizer, and distilled water) by foliar spray at 65 days after transplant. The paddy leaves were harvested on the following day after spraying procedure. The leaves samples were frozen in liquid nitrogen and ground to fine powder with a sterile mortar and pestle. Then, the leaves were extracted with methanol and applied onto the Waters Sep-Pak C18 cartridge according to manufacturing manual. The eluted solution was collected as the samples extract was sent to liquid chromatogram mass spectrometry (LCMS). The LCMS results showed that all paddy leaves extraction content JA element at retention time ± 30 min. The area below graph showed that the JA amount in paddy leaves sample treated with JA fertilizer formulation is double compare with the paddy leaves treated with commercial fertilizer, and distilled water. This result demonstrated that paddy leaves manage to absorb exogenous JA provided using foliar spraying via trichome and stomata. The paddy yield information is yet to be determined.

Keywords: Foliar fertilizer, jasmonic acid, liquid chromatogram mass spectrometry, phytohormone, plant growth regulator

Bio_P9

Ensuring the Wellbeing of the Oil Palm Pollinator, *Elaeidobius kamerunicus*, by Identifying its Cobionts through Molecular-Based Bioinformatics Tools

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Introduction of the oil palm pollinating weevil, *Elaeidobius kamerunicus* (Coleoptera: Curculionidae) from Africa in the 1980s has brought substantial benefit to the yield of palm oil. However, the existence of pathogenic nematodes and bacteria such as *Elaeolenchus parthenonema* and *Serratia marcescens* inside the *E. kamerunicus* gut may affect the viability of the species as these types of cobionts were reported to cause mortality in some insects. Cobionts refer to the various microbes, including beneficial symbionts, harmful parasites, and disease-causing pathogens, which live on or inside a host organism. These microbes can include bacteria, viruses, and other tiny living organisms that interact with their hosts in different ways, ranging from mutually beneficial to harmful relationships. We used the BlobToolKit program to asses and identify cobiont contaminants from our assembled genome sequences for both sexes of the *E. kamerunicus*. Three major phyla of cobiont contaminants were identified as Nematoda, Mycoplasmatota and Pseudomonadota. About 0.6% and 1.7% of cobiont sequences were detected in the total contigs of our assembled male and female *E. kamerunicus* genomes respectively. Comparatively, a higher diversity of cobionts was detected in the genome sequences of the female *E. kamerunicus* compared to the male. In addition, these analyses addressed the coverage and species identification, which facilitates the process of identifying the specific contaminants more easily. These results help to gain insights into the cobionts residing with or within *E. kamerunicus* and their potential impacts on the weevil's health and pollination efficiency. This knowledge can help in the development of management strategies to support robust weevil populations and sustain oil palm yields.

Keywords: Cobionts, contaminants, pollinating weevil, viability

VC_P1

Home-Made Ice Cream using Buffalo Fresh Milk and Mixed with Different Plant Extracts: Its Preparation, Organoleptic Evaluation and Food Action

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This study aimed to determine the consumers' acceptability of home-made ice cream using buffalo fresh milk and different local plant extracts for coloration. The study consisted of five treatments, namely; Treatment A (Blue ternate/*Clitoria ternate* L.), Treatment B (native lettuce/*Amaranthus spinosus* L.), Treatment C (red lupo/*Althernantera sessilis*), Treatment D (turmeric/*Curcuma longa*) and Treatment E (no plant extracts). The five treatments were arranged using a Randomized Complete Block Design (RCBD), and each respondent represented a replication. Thirty panel taster-evaluators who were faculty, staff and students of the College were convened during a local food festival in the College on October 7, 2022 to do the organoleptic evaluation of the ice cream using the 9-point Hedonic rating scale in terms of appearance, color, flavor, texture, aroma, general acceptability, and the willingness to eat using the food action (FACT) rating scale. The analysis of variance (ANOVA) for RCBD was used to analyze the data. General acceptability results showed that ice cream with plant extracts scored from 7.9 to 8.23 being liked very much by the taster-evaluators while ice cream with pure buffalo fresh milk being liked extremely having a score of 8.73. The food action scored from 7.6 to 8.03 which means that the taster-evaluators or consumers are willing to eat the ice cream with plant extracts very often, or in every opportunity they have for the pure fresh buffalo milk having a score of 8.63. Thus, home-made ice cream using fresh buffalo milk may be enhanced more with different plant extracts for the appearance, color, aroma, flavor and texture for better nutritional and nutritive values.

Keywords: Food action, organoleptic, plant extract

VC_P2

Role of Trees in the Carbon Cycle: Estimation of Carbon Content in Trees

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Trees play an important role in the carbon cycle by removing carbon from the atmosphere through photosynthesis. They also release carbon through respiration. All plants and animals contain and use carbon to sustain life. The element carbon is found in the carbohydrates, fats, nucleic acids, and proteins of every biological life form. During photosynthesis, trees use sunlight, water, and carbon dioxide to produce oxygen and glucose a carbon-based sugar molecule. Carbon estimation done on 12 plants in the EPTRI. Selected different diameter trees, instruments used in this study are one worker and tape. The parameters collected are circumference and height, to calculate tree diameter, a measuring tape is used to measure the tree's circumference. The circumference measurement is then divided by pi (p). Because diameter can vary with tree height, measurements are taken at a standard height from the ground 1.4 m. For carbon estimation in a tree, we have calculated green weight and dry weight, theoretically when the mass of a living tree is measured, it is called the green weight and includes both the biomass of the tree and the moisture in the tree. In general, the amount of carbon stored in an individual tree is about half of the tree's dry weight. Stored carbon is the amount of carbon that exists in a tree's leaves, wood, stem, roots, and bark at a particular point in time. Because older trees are larger than younger trees, they are able to store more carbon. Green weight of all the trees is 9917.5 kg, dry weight is 4958.7 kg and total carbon content stored in 12 trees is 2479.2 kg.

Keywords: Carbon estimation, carbon cycle, photosynthesis, tree

VC_P3

Algae Unleashed: A Cutting-Edge Sustainable Solution Bridging the Global Protein Gap and Satisfying Evolving Dietary Demands

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With the global population projected to reach 9 billion by 2050, the demand for protein is expected to grow significantly, particularly as more people adopt vegetarian diets. This rising demand for sustainable and nutritious protein sources has brought algae into focus as a viable alternative. This paper explores the potential of algae, especially microalgae, which are rich in protein and various other nutritious compounds, including peptides, carbohydrates, lipids, vitamins, and minerals. Their rapid growth rates and lower environmental impact—characterized by reduced carbon footprints and greenhouse gas emissions—make them an attractive solution to protein shortages. Our study employs a comprehensive research approach that addresses both scientific and consumer perspectives. It begins with a systematic literature review to select algae based on protein content, growth conditions, and environmental sustainability. Laboratory analyses, including HPLC and mass spectrometry, are conducted to assess protein composition and bioavailability. Additionally, we evaluate nutritional aspects and consumer acceptance through sensory evaluations and surveys, focusing on vegetarians' willingness to adopt algae-based proteins. Microalgae like spirulina and chlorella provide a complete amino acid profile, effectively addressing dietary deficiencies commonly found in vegetarian diets. The sustainable cultivation of algae further enhances its appeal. Our discussions include the economic viability of algae production, improvements in taste and texture, regulatory considerations, and potential long-term health impacts. In summary, algae present a promising protein substitute for vegetarians, boasting a robust nutritional profile and minimal land and water requirements. Continued research and development could position algae as a mainstream protein source, significantly contributing to the nutritional needs and sustainability goals of the vegetarian population.

Keywords: Algal foods, complete amino acid profile, microalgal supplements, sustainability

VC_P4

Vriksh Ayurved

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In today's fast-paced world, sustainability is more critical than ever. Yet, the right to work is fundamental, and as stewards of the Earth, it is our duty to find solutions that respect both human and ecological needs. This philosophy underpins the ancient Indian practice of Vriksh Ayurved, a holistic approach to agriculture that integrates traditional wisdom with modern sustainability principles. The term "Vriksh Ayurved" combines "Ayurved," which means the science of life, with "Vriksh," referring to plant-derived products, symbolizing a life-centered approach to agriculture. Vriksh Ayurved emphasizes natural methods and ecological balance in farming. A common concern about organic farming is its ability to meet the food demands of a growing global population. However, it's important to remember that when these traditional practices were widespread, agricultural yields were sufficient for communities. Today, various Krishi Vigyan Kendras, startups, and NGOs continue to promote organic farming techniques that achieve high yields without harmful chemicals. The United Nations has also recognized the potential of indigenous Indian practices like Vriksh Ayurved to address global challenges such as climate change and food security. Dr. Sunita Pandey, a principal investigator on a Vriksh Ayurved project, highlighted during a G20 parallel session that ancient Indian wisdom offers practical solutions, not just philosophical ideas. She explained that belief fosters perseverance, which shapes attitudes, actions, and ultimately values that can transform our world. In ancient India, nature was revered not only in worship but also in conservation. The wealth of knowledge and resources left by our ancestors has been neglected over time. It is crucial that we revive these practices to harness their potential for a sustainable future. By doing so, we can pave the way for a healthier, more sustainable tomorrow.

Keywords: Ayurveda, conservation, potential utilization, sustainability, Vriksh

VC_P5

Value Chain in Millet Production

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Millet plays a crucial role in agriculture, nutritional security and food industry of our country. The millets are suited to the Indian climate and good for changing climatic conditions also. Millets have many nutrients like fiber, essential amino acids and minerals compared to other cereals. Crop has medicinal value and can be used to fight against malnutrition. These millets are superior to other cereals and high priced in the market. Farmers are not ready to cultivate the crop due to the low price they are getting for the unprocessed grains they are selling in the market. They have less exposure to the processing and value addition to these grains. The millets value chain is highly underdeveloped. Farmers usually sell the grains to local market and traders. These local traders sell them to the processors. Millet processors use grain to process and packing millet rice for the consumption and secondary processing activities. It has been observed that after processing the value of millets increases to considerable level and traders usually get the higher share of profits. The farmers participation in value chain activities has been limited due to the higher labor cost, lack of technologies, guidance in value chain process and non-availability of processing technologies to farmers. Hence, popularization of new varieties in millets should be supported by encouragement to farmers to establish their own processing and value chain activities through Farmer Producer Organization's (FPOs). This would generate good profit for the farmers and customers will get all millet-based products at affordable price too. The success stories of some of the organizations like Bhoomika farmer producer company can inspire the fellow farmers in this direction.

Keywords: Millets, nutrition, processing, value chain

AB_P1

Maximizing Economic Return through Natural Resource Management

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Afghanistan's natural resource sector holds immense promise for job creation and economic expansion, boasting diverse landscapes and abundant resources crucial for future self-sufficiency and prosperity. This study aimed to ascertain the contribution of natural resources to the nation's economy. Findings reveal that current exports of non-timber products, such as fruits and wood, significantly bolster the economy. Plans to reforest pistachio and pine nut areas, alongside initiatives for commercial farming of poplars, walnuts, almonds, and jujube, are poised to generate substantial revenue. Furthermore, cultivating medicinal plants offers income opportunities and foreign exchange prospects. Restoration efforts for medicinal and aromatic plants aim to boost farmers' income and national revenue while fostering employment and environmental benefits, including soil erosion prevention, groundwater replenishment, and climate change mitigation. Successful implementation of these measures could yield integrated benefits totaling USD 443.9 million, with potential tax revenues for the government. Afghanistan's emphasis on natural resource management underscores its commitment to economic growth, environmental sustainability, and resilience against climate change.

Keywords: Economy, export, natural resource, job creation, non-timber

AB_P2

Innovative Urban Community Farming: Sustainable Solutions for City Dwellers

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Urban community hi-tech farming offers a groundbreaking solution to sustainable agriculture, addressing food security challenges from rapid urbanization and limited land by integrating advanced farming practices in urban settings. This business plan outlines techniques like vertical farming, hydroponics, and aeroponics, using spaces such as rooftops, balconies, and community gardens. These methods optimize space, reduce carbon emissions, and foster community. Enabling residential communities to produce fresh and organic produce, this model promotes self-sufficiency and reduces reliance on external food sources. It highlights local food production, environmental sustainability, and economic benefits, such as job creation. The business model targets these communities, offering vertical and soil-less farm setups, ongoing maintenance, and resident training. Tailored solutions include design, consultancy, and trained farm management personnel. This approach ensures year-round, high-quality food production, reduces food miles, and mitigates traditional agriculture's environmental impact. By addressing the initial challenges of high investment costs, lack of skilled personnel and dependency on power, this business model proposes a scalable and replicable model aims to create resilient urban environments, contributing to the well-being of urban populations.

Keywords: Food security, hi–tech farming, sustainable communities, urban farming

AB_P3

Agripreneurship 2.0: Harnessing the Power of Digitalization and Innovation to Revolutionize Indian Agriculture

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In response to economic crises, entrepreneurship development drives economic growth in developing countries like India. We emphasize agricultural entrepreneurship's role in uplifting backward regions through targeted programs. India's agricultural sector has undergone significant technological advancements, driven by economic liberalization and societal changes. Developing entrepreneurial skills among farmers is crucial for business growth and survival. Strategies like diversification and value chain integration can foster growth. With nearly 2800 Agritech startups recognized by Startup India, innovation transforms traditional agriculture, promoting sustainable development. We explore the impact of entrepreneurship and Agritech on India's agricultural sector, emphasizing the need for a comprehensive approach to stimulate entrepreneurial culture and sustainable development. By leveraging technology and innovation, Agritech startups bridge traditional farming practices and modern agriculture, contributing to India's economic growth.

Keywords: Agritech startups, business growth, economic development

AB_P4

Factors that Influence the Adoption of Disease Prevention Technologies Among Shrimp Farmers

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Malaysia primarily farms two species of marine shrimp: the native giant tiger prawn (*Penaeus monodon*) and the non-native white shrimp (*Penaeus vannamei*). Recently, disease has become a significant issue impacting shrimp production. Because shrimp lack a specific immune system, they are particularly vulnerable to pathogens. Consequently, shrimp farmers often opt for inexpensive antibiotics and antimicrobial drugs. However, the overuse of these substances has led to antimicrobial resistance (AMR) problems in shrimp farming. To address this issue, adopting advanced disease treatment technologies at the farm level is essential. This study aims to identify the factors influencing the adoption of disease prevention technologies among shrimp farmers. A sample of 105 shrimp farms in Peninsular Malaysia was selected using stratified sampling, and data were collected through a structured questionnaire. Various statistical methods, including descriptive statistics, Pearson correlation, Chi-square, factor analysis, and multiple regression analysis, were employed to analyze the data. The study's findings underline the importance of understanding the factors that influence the adoption of disease prevention technologies among shrimp farmers. This knowledge is crucial for developing and promoting new, affordable, and effective technologies in shrimp farming.

Keywords: Adoption, attitude, disease prevention technologies, perceived resources, shrimp farmers

AE_P1

Effectiveness of the KAANIB Enterprise Development Project – Community/ Household Level Coconut Processing Project Component in Bukidnon: The Case of Damulog

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The Philippine government spends a lot of resources to aid the farming sector. Still, most of the farmers are considered economically poor. This study assessed the effectiveness of the Kasaganaan sa Niyugan ay Kaunlaran ng Bayan (KAANIB) Enterprise Development Project, Community/Household Level Coconut Processing Project component of the Philippine Coconut Authority in Bukidnon, Philippines. It focused on one municipality, Damulog, and used a descriptive research design to identify the socio-demographic profile of the farmer beneficiaries, and level of attainment of project objectives. The study identified 70 respondents with the help of the Philippine Coconut Authority Region X Officials. A descriptive statistic with the use of mean was used to identify the socio – demographic profile of the respondents and their level of attainment to the project objectives. A paired sample t – test was used to identify the change brought about by the project after the implementation. Results showed that there were more females than males, farmers with more than 20 years of farming experience, mostly Roman Catholics, Cebuanos, high school level as their highest educational attainment, and owns the land they are tilling. The study also found that the respondents' perceived the objectives of the project were attained. Statistics also showed the ROI, ROE, GPM and NPM were statistically significant. Problems were encountered during the implementation of the project, such as proper needs assessment, insufficient budget, expensive labor cost, poor monitoring and limited market linkage. It is recommended to do a proper needs assessment to properly identify the needs of the community and a comprehensive impact assessment to identify any setbacks of the current project.

Keywords: Effectiveness, farmers, profitability

AE_P2

Rice Farmers Knowledge on Stem Borer and Bacterial Panicle Blight Management Methods

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Rice farmers have been facing problems from various pests. Some of the major pests in IADA Barat Laut are the stem borer and bacterial panicle blight. The pest attacks have resulted in declining paddy yield and increased cost of production. To improve the yield, the farmer's knowledge of the pest and correct management is crucial. Various methods have been employed to control the pest, however there was little success. This might be due to either farmer's lack of knowledge of the pest, its management practices and own attitude. Therefore, the object of this study was to determine the level of farmers' understanding and management of stem borer and bacterial panicle blight. 150 farmers from IADA Barat Laut were interviewed face-to-face, the data were analyzed using SPSS. The result showed farmers know and recognize the stem borer and bacterial panicle blight symptoms, most reliant on chemical pesticide in control of the pest. They are also willing to adapt the good agricultural practices on farms.

Keywords: Bacterial panicle blight, farmer’s knowledge, stem borer

AE_P3

Adoption Behavior of Frontier Agricultural Technologies in Malaysia – A Review

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Frontier agriculture technologies are emerging technologies that have the potential to benefit our society and economy. Technology adoption is critical for improving productivity and reducing labor costs. Most of the research regarding new technologies are focused only on the technical implementation of technology. However, the prospect of technological change is always shaped by human behavior. Hence, the role of social science in technology adoption research is inevitable. Therefore, this review focuses on the adoption behavior of farmers in Malaysia towards frontier agriculture technologies. The main objective of this paper is to identify the factors that influence the challenges faced and the current technology adoption of frontier agriculture technologies in Malaysia. The study used the PRISMA method to identify the relevant literature and included 18 research papers to draw the results. It also identifies the suggestions while implementing frontier agricultural technologies. The results show mainly five categories of factors that influence the adoption of frontier agricultural technologies: socio-personal, economic, psychological, cognitive, and technical. The critical constraints observed are lack of awareness, poor connectivity, lack of experience, and high capital expenditure for buying the technology. The suggestions while implementing technologies in agriculture include creating awareness and knowledge of the rural community, stakeholder support, connectivity, economic improvement, attractiveness to the farmers, and data security.

Keywords: Adoption, frontier agriculture technology, PRISMA

AE_P4

Consumers' Acceptance of E-Wallets in the Food and Beverage Industry in Klang Valley

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With the rapid advancement of electronic wallets globally, Malaysia aims to become a cashless society by 2030. However, despite projections that over 50% of the world's population will use e-wallets within the next three years, many Malaysian consumers still lack confidence in these digital payment methods. Security concerns are a significant barrier, deterring a large number of users from utilizing mobile payment devices. Those who do use e-wallets often do so due to substantial encouragement through brand promotions and social influence. This study aims to identify the factors influencing consumer acceptance of e-wallets in the Food and Beverages (F&B) industry in Klang Valley. It also seeks to explore the relationship between these factors and consumer acceptance and provide suggestions for improving e-wallet adoption. Data for this research was collected via convenience sampling, using both online and printed questionnaires, targeting 385 respondents in Klang Valley. This study relies on primary data and employs a quantitative research approach, analyzed using SPSS software. The statistical methods used include descriptive analysis, factor analysis, and multiple regression analysis. The findings reveal that perceived convenience, perceived risk, and social influence are the three main factors affecting consumer acceptance of e-wallets in the F&B industry in Klang Valley. While all three factors significantly impact consumer acceptance, perceived risk has a negative influence. These results offer valuable insights for consumers, e-wallet merchants, and government bodies to better understand and leverage the emerging digital payment trend in the F&B sector. By recognizing these factors, stakeholders can address concerns and enhance the benefits of e-wallets, facilitating a smoother transition towards a cashless society.

Keywords: Acceptance, e-wallet, F&B industry

AE_P5

Farmers and Agribusiness Actors' Preparedness Toward Natural Disasters for Developing Cameron Highlands Agriculture

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The agricultural sector is frequently exposed to natural disasters, with floods and landslides causing crop failures, food insecurity, famine, property and life losses, mass migration, and negative economic growth. Cameron Highlands, a key agrotourism site, is particularly vulnerable due to deforestation and land development for agriculture and tourism, leading to frequent landslides and flash floods. These incidents severely impact farmers and agribusinesses, causing significant production and business losses. This study aims to assess farmers' preparedness for natural disasters in Cameron Highlands, Pahang. The objectives are to: 1) evaluate farmers' preparedness levels, 2) determine self-assessment levels regarding motivation and personality, 3) examine the information content and density on disaster preparedness, and 4) assess the perceived effectiveness of preparedness actions. The study surveyed 150 respondents involved in agricultural activities in Cameron Highlands, using descriptive analysis. Results indicate that the mean level of preparedness among respondents is 2.75. The mean self-assessment scores for motivation and personality are 4.71 and 3.74, respectively. Information content received on preparedness is low, with a mean of 2.18, while observed information has an even lower mean of 1.72. The perceived effectiveness of preparedness actions averages 2.81, and overall preparedness actions have a low mean of 2.25. In conclusion, to mitigate natural disaster risks, farmers in Cameron Highlands require better preparation. Maintaining Cameron Highlands as a leading agricultural producer in Malaysia necessitates planning adaptation and mitigation strategies for floods and natural disasters. Increasing awareness among farmers and agribusinesses about preparedness, environmental issues, and sustainable land development is crucial. Relevant agencies should provide appropriate guidance and support to farmers to enhance their disaster preparedness.

Keywords: Agriculture, Cameron Highlands, farmers, natural disaster, preparedness

AE_P6

Enhancing Food Security through Household Food Waste Reduction: Smart Tech

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Food security is a major component of Sustainable Development Goals (SDG). Food security is affected by global warming, armed conflicts, natural disasters, food price inflation, economic shocks, health pandemics, food loss and food waste. Food insecurity is a severe problem in Nigeria. Nigerian households waste more food in Africa. Despite this high volume of household food waste, smart methods for household food waste classification, drying, detoxification and recycling at source are yet to be put in practice. Instead of taking food waste to the landfills, why not use smart technology and mobile applications to prevent, reduce, manage, or recycle the waste for both human and agricultural reuse. The main objective is to examine how smart technology and mobile applications can support household sustainable consumption and food waste reduction. The study examined the interaction of six variables to enhance food security. These variables are food waste reductions, smart technology, mobile application, food bank, recycling, and creation of awareness. This research employed a large-scale multiple case study approach and an experimental design methodology using linear quadratic Gaussian (LQG) controllers. The study was conducted in Bauchi Metropolis among 240 households. Purposive sampling was used through Focus group interviews. The unit of analysis was housewives. Data was analyzed by means of descriptive statistics, structural equation modelling, and simulation methods. The tools of analysis will be NVIVO. The LQG methodology will be analyzed using sensitivity analysis. The result shows smart technology and mobile applications support sustainable consumption and household food waste reduction.

Keywords: Food loss, food waste, linear quadratic Gaussian

AE_P7

Assessing Urban Agriculture Practice and its Economic Impact on Low-Income (B40 group) Households in Klang Valley, Malaysia

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Access to essential food items and agricultural products has become more difficult, particularly for low- income urban dwellers, due to the growing urban population and rising food prices. The food supply chain can be disrupted by natural and man-made disasters, including pandemics, floods, and other tragedies. Low-income households, especially those in the B40 group, are more vulnerable to food security issues due to economic limitations. In response to these challenges, the Malaysian government introduced Urban Agriculture (UA) initiatives such as the Community Garden Program and the Urban Community Garden Policy to enhance food security and improve the quality of life for low-income urban dwellers. These initiatives have increased the number of UA practitioners, specifically in low-income B40 households. Therefore, it is essential to determine how urban agricultural programs affect their lives, particularly in low-income urban groups in Malaysia. This study seeks to fill this gap by examining the impact of urban agriculture on low-income B40 households in Klang Valley. The study was conducted in Klang Valley, Malaysia, using primary data from urban low-income (B40) households participating in the Urban Agriculture program. Structured questionnaires based on the research objectives were given to a total of 378 respondents, who were chosen using a multistage random sampling method. Descriptive analysis was used to describe the practice level of urban agriculture among participants, and a paired t-test measured the economic benefits of reducing food expenses through urban agriculture. The study revealed a positive contribution of urban agriculture to the economic aspect, with UA practicing saving up to RM91 per month. However, UA practitioners, especially B40 households, face many challenges. It is crucial to address these challenges with targeted interventions and increase awareness of the overall benefits of urban agriculture and its economic contributions among UA participants.

Keywords: B40 group, community garden, economic impact, Klang Valley, UA practice

AE_P8

Addressing Food Insecurity: Coping Mechanisms of Low-Income Households in Klang Valley, Malaysia

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Food insecurity occurs whenever the households have lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life. The previous studies shown that the low-income households were more vulnerable to the food insecurity. The increase in food prices give significant impact to the low-income household as they spend larger proportion of their income for food as compared to the higher income households. Thus, the objective of this study is to determine the coping strategies used by low-income households in order to cope with food insecurity situation. The data was collected among low-income households in Klang Valley involving 449 respondents. There were four dimensions considered in this study namely; dietary change, short-term measures to increase household food availability, short-term measures to reduce the number of people to feed, and rationing strategies. These dimensions were used to establish the Coping Strategies Index (CSI). The study showed that the low-income households employed various coping strategies to cope with the food insecurity situation. The findings of this study found that 11.36%, 43.21%, 38.75% and 6.68% of the respondents were using low, mildly, moderately and severely coping strategies, respectively. The results suggested that financial and food assistance is required to help this vulnerable group of households to cope with the food insecurity situation and consequently will help them for a better livelihood.

Keywords: Coping strategies index, food insecurity, urban low-income households

SM_P1

Sustainability through Green Technology: Mycorrhiza and Microbial Nutrient Solubilizers

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Plants have historically adapted to thrive in nutrient-deficient conditions, making plant–bacterium–mycorrhizal symbioses crucial in natural environments. However, modern agriculture has focused on the extensive application of fertilizers, neglecting the importance of the natural symbionts of plants. This approach has led to soil quality degradation, decreased income for farmers, and a diminished capacity of plants to sequester carbon in the soil. The effectiveness of this natural carbon capture mechanism is closely tied to plant health and growth, which in turn depends on the availability of essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K). These elements are vital for plant growth and carbon assimilation; however, their scarcity in natural soils and the rapid degradation of soil health and quality can limit plant productivity. There is a pressing need to adopt sustainable farming practices that incorporate eco-friendly inputs, such as microbial inoculants, including mycorrhiza and other nutrient-solubilizing microorganism-based biofertilizers. Multiple inoculants have been developed for BIOTECH-UPLB. Mycorrhizal inoculants like (Vesicular-Arbuscular Mycorrhizal Root Inoculant (VAMRI), enhance plant water and nutrient absorption and help manage soil-borne diseases and nematodes. Similarly, nitrogen-fixing microorganisms such as BIO-N improve nitrogen assimilation in crops. Another approach is the use of Oryzinc, a zinc-solubilizing inoculant that enhances zinc uptake by plants, but also contributes to biofortification, potentially increasing the zinc concentration in rice and corn by up to 50%. Additionally, potassium- and phosphate-solubilizing inoculants have been developed and can be tailored according to the specific agricultural needs of a particular region. This study delves into the novel and green technologies developed at BIOTECH, which focuses on research on plant growth-promoting rhizobacteria, particularly mycorrhiza, for its multifaceted applications in crop production, biocontrol, bioremediation, and the enhancement of nutrient uptake by solubilizing microorganisms.

Keywords: Green technology, microbial inoculant, nitrogen-fixing microorganisms, zinc solubilizing microorganisms

SM_P2

Effect of Soil Moisture Conservation Practices and Foliar Fertilization on Growth, Yield Attributes and Yield of Hybrid Maize (*Zea mays* L.)

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Soil moisture is one of the important factors that manipulates the growth and yield of the maize crop. It will help to supply soil nutrients to the plant to enhance the growth and yield of the crop. Due to the lack of moisture in the soil, foliar nutrition is very much affected and thus it reflects on the growth and yield of the crop. The field experiment was conducted during 2021 – 22 at Annamalai University Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamilnadu, India to maximize the productivity and profitability of maize by adopting various soil moisture conservation techniques and foliar fertilization. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The experiment consists of two factors. In factor I, soil moisture conservation techniques were adopted viz., M_1 – Control, M_2 - Sugarcane trash, M_3 - Water hyacinth and M_4 – Hydrogel. In factor II, foliar nutrient management practice was accommodated such as F_1 - control (without nutrient), F_2 - foliar spray of 1% 19:19:19, F_3 - 1% DAP + 1% MOP, F_4 - 1% PPFM, F_5 - 1% 19:19:19 + 1% PPFM and F_6 - 1% DAP + 1% MOP + 1% PPFM. Foliar nutrients were applied at both Knee high and tasseling stages. Among the soil moisture conservation techniques, the results indicated that mulching with Water hyacinth has registered higher growth parameters, yield parameters and yield than other techniques. While different foliar nutrients, the foliar application of 1% DAP + 1% MOP + 1% PPFM (F_6) shown higher growth, yield parameters and yield than other treatments. With respect to integration of soil moisture conservation techniques and foliar nutrients, mulching with Water hyacinth and foliar application of 1% DAP + 1% MOP + 1% PPFM (M_3F_6) recorded higher growth, yield parameters and yield than the rest of the treatment combinations.

Keywords: Conservation, foliar fertilization, maize, mulching, soil moisture

SM_P3

Multifunctional Rhizobacteria as Agents of Growth Promotion, Biocontrol, and Soil Regeneration in Various Crops

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Single-strain biofertilizers with a specific function, though effective, require farmers to apply multiple types of different nutrient needs. Biofertilizers containing multiple strains or single strains with multiple functions enhance plant benefits across various soils and conditions, reducing synthetic fertilizer use and costs by providing multiple nutrients and additional benefits in a single product. In line with this, the study aimed to isolate, screen, and characterize rhizobacteria with growth-promoting, biocontrol, and soil regeneration abilities to be used in the development of multifunctional biofertilizers. Rhizospheric soils of rice, corn, cassava, tomato, and eggplant were collected, and bacteria were isolated using the dilution plating method. Colonies representing different species or strains based on morphology were purified, identified, and characterized. Subsequently, the isolates were screened for plant growth-promoting traits. Some key functional capabilities include nitrogen fixation, solubilization of phosphate, potassium, zinc, and phytohormone production. Moreover, antifungal activity against selected fungal plant pathogens, such as *Rhizoctonia solani, Sclerotium,* and *Fusarium solani*, was also assessed. All promising isolates were identified through 16s rRNA sequencing and further tested for positive results under controlled growth room and screenhouse conditions. Thus, the isolates candidates for biofertilizer formulation

Keywords: Biofertilizer, multifunctional PGPR, nutrients

SM_P4

Preliminary Study on the Effectiveness of Biological Nitrogen Fixation (BNF) Liquid Formulation on the Paddy Productivity, MRQ76

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The utilization of biological nitrogen fixation (BNF) liquid formulations in paddy cultivation is a promising alternative to chemical fertilizers for enhancing crop growth and yield. FGV R&D has developed a BNF liquid formulation containing the endophytic bacterium *Paenibacillus alvei* M3-12 to evaluate its effectiveness in improving paddy productivity. A glasshouse trial was conducted using a completely randomized design to compare the effects of the BNF liquid formulation with a control treatment. The diluted BNF liquid formulation, with a concentration of 10^7 cfu/ml, was sprayed over paddy seedlings 14 d post-transplantation. Rice growth and yield components were assessed at the end of the study. The results demonstrated that paddy grown with the BNF liquid formulation was significantly taller, had a higher number of tillers, longer and wider flag leaf size, and higher chlorophyll content than the control treatment. Additionally, key yield components such as the number of panicles, filled grains, and 1000-grain weight were significantly higher in the BNF-treated group. These findings suggest that the BNF liquid formulation has the potential to enhance paddy growth and production, warranting future research to explore its capacity to reduce inorganic fertilizer usage.

Keywords: Biological Nitrogen Fixation, Liquid biofertilizer, MRQ76, Paddy, *Paenibacillus alvei*

SM_P5

Fertilizers using Topsoil Covering Promote Wheat Growth and Grain Yield Resulting from Enhanced Shallow-Soil Nutrition and Bioactivity in Rice-Wheat Rotation Areas in the Middle and Lower Reaches of the Yangtze River

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Although most reports of increasing fertilizer use efficiency and crop yield by deep fertilizer application have been confirmed in arid or semi-arid regions, this does not mean that all regions are applicable because the study of local conditions needs to pay more attention to regional characteristics. In this study, deep-mixing fertilizers and soil (DM), shallow-mixing fertilizers and soil (SM), and topcovering fertilizers with soil (TC) were used as three basic fertilizer application methods to analyze the effects of soil physical and chemical environment and soil microbial activity on wheat seedling quality and grain yield in a rice-wheat rotation area in the middle and lower reaches of the Yangtze River. The results showed that the yield of TC was 40.40%, 9.49%, and 35.72% higher than that of DM (2018-2019, 2019-2020, 2021-2022), respectively). DM increased fertilizer loss from sowing to the overwintering stage, which was not conducive to the nutrient supply of shallow soil. Soil biochemical characteristics were determined by sampling 0–10 cm, 10–20 cm, and 20–30 cm soil during the overwintering period, and it was found that TC promoted the absorption and utilization of nutrients by increasing AN, AP, and OM at 0–20 cm, weakened the specific competition within the microbial community, and enabled seedlings to obtain higher quality under a stable soil environment. The number of tillers per plant and productivity in the overwintering period were effectively improved, which provided a guarantee for an increase in spike number and grain number per spike during the maturity period. Therefore, TC is a suitable fertilization method in rice-wheat rotation areas in the middle and lower reaches of the Yangtze River.

Keywords: Application of base fertilizer, middle and lower reaches of Yangtze River, rice-wheat rotation area, soil chemical properties, soil microorganism

SM_P6

Coated and Un-coated Urea Incorporated with Organic Fertilizer Improves Rice Nitrogen Uptake and Mitigates Gaseous Active Nitrogen Loss and Microplastic Pollution

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Coated urea can improve the nitrogen use efficiency (NUE) of crops, but it has also been identified as a potential source of microplastics (MPs). Organic fertilizers (OF) have the potential to promote MP degradation. However, little is known about the influence of OF incorporated with coated urea on MP accumulation, NUE, or gaseous N loss (NH_3 and N_2O) in paddy fields. Therefore, a field experiment was conducted to address this gap with five fertilization treatments: urea (uncoated) with full rates (U), coated urea with full rates (CU), coated urea with reduced rates (RCU), 70% coated urea with 30% urea with reduced rates (RBU), and RBU blending OF (ORBU). The results showed that compared with U, CU increased the number of MPs by 62.23-117.38%. ORBU significantly reduced the weight of MPs by 53.18% by decreasing the size of large particles. Additionally, ORBU enhanced the effect of CU on increasing grain yield and NUE, mainly because of the improvement in the yield components and N accumulation. The distribution of NH_4^+ in water and soil is a major factor that drives NH_3 and N_2O emissions. ORBU elevated the activities of N-assimilation enzymes, decreased water NH_4^+ and NH_3 emissions, and increased soil NH_4^+ and ammonium-oxidation bacteria and (nirK+nirS)/nosZ, ultimately increasing soil N_2O emissions compared with RBU. However, the reduction in NH_3 significantly outweighed the increase in N_2O emission. In conclusion, this study highlighted coated urea as a source of MP pollution, emphasized OF amendment as a strategy to diminish MP accumulation, and found that OF incorporated with coated urea could increase the grain yield and NUE of rice while mitigating gaseous N loss in paddy fields.

Keywords: Coated urea, organic fertilizer, microplastic, gaseous active nitrogen emission

SM_P7

Foliar N Supplementation Improved Transplanting Survival Rate and Grain Yield by Optimizing C:N Ratio to Promote Root Regeneration and Up-regulate Positive Physiological Feedback

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Transplanting shock induced by mechanical transplanting in dry land has a negative effect on the growth and grain yield of rapeseed. We attempted to find simple and effective measures to mitigate this negative impact and elucidate the relevant mechanisms. In the 1-year and 2-year field experiments, foliar N supplementation at concentrations of 0, 2.5, 5.0 and 7.5 g N/m^2 was set up to investigate the regulation of foliar N supplementation on the C and N structure of seedlings before transplanting and the responses of leaf color, leaf area, water content of shoots, osmotic regulatory substances, antioxidant system, root regeneration ability, transplanting survival rate, and grain yield to transplanting shock. Compared with the control, the C: N ratio of rapeseed seedlings was optimized by the foliar N supplementation at the concentration of 2.5–5.0 g N/m^2 before transplanting, which promoted the recovery of root function and the increase of green leaf area, and up-regulated the positive feedback of osmoregulatory substances and antioxidant system after transplanting. Therefore, the transplanting survival rate increased by 13.81–19.20 percentage points, and the grain yield increased by 25.15%–30.56%. Optimal foliar N supplementation before transplanting can be used as a simple and effective agricultural measure to alleviate the negative effects of transplanting shock on rapeseed.

Keywords: Nitrogen, rapeseed seedling, transplanting shock, transplanting survival rate

SM_P8

Combining Urea and Controlled Release Nitrogen Fertilizer to Enhance Lodging Resistance of Rice (*Oryza sativa* L.) by Altering Accumulation of Silicon and Cell Wall Polymers at High Yielding Levels

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Context and problem: Lodging has been a limiting factor for the achievement of high grain yield in rice (*Oryza sativa* L.) production, especially under high nitrogen input. However, little is known about the effects of nitrogen fertilizer management on lodging and the potential for improving lodging resistance in rice by nitrogen management. The objective of this study was to evaluate lodging resistance of rice plants under different nitrogen management conditions. Based on a two-year experiment, we investigated lodging incidence in the field and traits associated with lodging in two rice cultivars with contrasting lodging susceptibility. Four fertilization schemes were established with different ratios of urea to controlled-release nitrogen fertilizer (CRNF): control (CK), local farmers' practices with split nitrogen application of common urea (100% urea, CU), 100% CRNF applied once as basal fertilizer (CRNF), and the combined application of 70% CRNF and 30% urea as basal fertilizer (CRNF-CU). We studied the morphological traits, anatomical structures, and biochemical components related to lodging resistance in rice. Our results showed that at high yielding levels with high nitrogen inputs, lodging resistance was highest in the CRNF-CU treatment, followed by the CU and CRNF treatments. The lodging index (LI, susceptibility to lodging) could be decreased by 10.52% and 24.63% when compared to CRNF-CU with CU and CRNF treatments, respectively. These significant differences in LI were attributed to variations in multiple parameters, that is, silicon content (SiC), cellulose content (CC), lignin content (LC), number of large vascular bundles (NLVB), number of small vascular bundles (NSVB), sclerenchyma cell thickness (SECT), and silicon deposition in the culm, which is the most important contributor to enhanced lodging resistance. In conclusions, combining urea and controlled-release nitrogen fertilizer could enhance the lodging resistance of rice at high yield levels.

Keywords: Lodging resistance, lignin and cellulose content, nitrogen managements, rice (*Oryza sativa* L.), silicon content

SM_P9

Effects of Different Controlled-Release Nitrogen Fertilizer Combined with Urea Application Modes on Annual Rice-Wheat Rotation Yield and N Recovery Efficiency under Nitrogen Reduction

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Controlled-release nitrogen fertilizers (CRNFs) can maintain crop nitrogen uptake even under reduced nitrogen fertilizer applications due to their efficient nitrogen utilization. Nevertheless, the release patterns of CRNFs were unable to perfectly align with the fertilizer demand patterns of crops. Exploring the potential for cooperation with urea applications can achieve the highest ecological and economic benefits. The objective of this experiment was to investigate the impact of different CRNFs combined with urea (U) application modes on annual rice-wheat yield, nitrogen utilization, and soil nutrients under nitrogen reduction. To this end, a 2-year rice-wheat rotation experiment was conducted utilizing Jin Xiangyu 1 and Yangmai 23 as the rice and wheat test varieties and polymer-coated urea (PCU) as controlled-release nitrogen fertilizer. Four nitrogen fertilizer modes (A1, 70% PCU+30% U base fertilizer; A2, 70% PCU+30% U spike fertilizer; A3, 40% PCU+30% U base fertilizer and 30% U spike fertilizer) and CK (Urea) were established at both conventional (A) and reduced nitrogen levels (B). Results indicated that except for the 100% PCU mode, yields under different PCU modes (A2, A3, and A4) were higher than the control (CK) by 9.16, 11.65, and 15%, respectively. Furthermore, the yields under PCU + U spike fertilizers were higher, and nitrogen reduction in the mode of PCU + U base fertilizer resulted in more stable yields, particularly in rice. Applying PCU and reducing nitrogen can increase nitrogen utilization in the crop. The highest N recovery efficiency of rice-wheat rotation was observed under the A4 treatment, on the basis of which nitrogen fertilizer reduction application further increased nitrogen fertilizer utilization. In conclusion, under the trend of nitrogen reduction in agriculture, CRNFs+U mode has a good application prospect. Taking into account the convenience of operation, the 70% PCU+30% U base application mode is optimal.

Keywords: Controlled-release nitrogen fertilizer mode, N recovery efficiently, nitrogen reduction, rice-wheat rotation, yield

SM_P10

Soil Application of Biochar from Different Biomass Sources on Growth of Sweetcorn (*Zea mays*)

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Oil palm and rice biomass wastes are the two most widely used feedstocks for biochar production in Malaysia. Apart from oil palm and rice biomass wastes, bamboo is another potential biomass that can be used to produce biochar, as it can be sustainably planted and harvested from the forest. This study investigated the effects of oil palm biochar (OPB), rice husk biochar (RHB), and bamboo biochar (BB) as soil amendments for the plant growth development of sweet corn. The experimental treatments consisted of three biochars that were applied at a rate of 6 t/ha with one control treatment (no biochar application). Each treatment was replicated four times and arranged in a randomized complete block design (RCBD). The soil CEC, pH, and macronutrients were measured before and after harvesting. Leaf greenness index, plant nutrient uptake, and plant height were measured throughout the growth of sweet corn, while plant biomass dry weight and yield were measured during harvest. Overall, the results showed no significant differences among treatments in terms of soil analysis, plant analysis, and plant physiological behavior of sweetcorn. However, biochar may be a good carbon sequester in soil, as shown by the application of RHB, which increased soil carbon by 2.34% compared to other treatments.

Keywords: Bamboo biochar, oil palm biochar, rice husk biochar, sweetcorn

SM_P11

Effects of Biochar Application with Inorganic Fertilizer on Soil Chemical Properties and Corn Growth

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The use of inorganic fertilizers in agriculture has led to depletion of soil organic matter and decreased soil fertility. To mitigate these problems, there is growing interest in using biochar as a soil amendment because of its potential to enhance soil health and promote plant growth. However, there is a limited understanding of the optimal rates of biochar and inorganic fertilizer application that can improve soil chemical properties and plant growth, particularly for corn. Therefore, the aim of this study was to determine the optimal combination of biochar and inorganic fertilizer application rates to improve soil fertility and enhance corn growth. The experiment was conducted using a Randomized Complete Block Design (RCBD) with four treatments combining bamboo biochar (BB) and four rates of inorganic fertilizer (IF): T1 (0% IF), T2 (25% IF), T3 (50% IF), and T4 (100% IF). The measured parameters were plant height, leaf area, chlorophyll content, plant biomass, corn yield, and plant nutrients (N, P, K, Ca, and Mg). Additionally, soil chemical properties, such as initial and final soil pH, cation exchange capacity (CEC), total N, available P, K, Ca, Mg, and C, were determined. Analysis of Variance (ANOVA) was carried out, and Least Significant Difference (LSD) tests were used to compare the means. The initial soil pH before biochar application was 7.32. The results indicated that the combined application of biochar and different rates of inorganic fertilizer had no significant effect on most soil properties and plant growth parameters, except for the total N in plant tissue. T4 (100% IF) showed the highest total N in plant tissues (2.83%), whereas T1 (0% IF) had the lowest (2.14%). Future research should extend the study period to three years to capture longer-term impacts and include detailed planning for field studies, considering the many factors that can influence the results.

Keywords: Biochar, corn soil chemical properties

SM_P12

Bio-based Polyurethane-coated Controlled Release Fertilizer (CRF) for Oil Palm: Evaluation in Oil Palm Seedlings

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Controlled release fertilizer (CRF) enables regulated nutrient release for more efficient plant uptake than conventional granular fertilizers. This reduces nutrient loss via surface runoff and leaching, thereby promoting sustainable agriculture. Although the ability of CRF to provide a consistent and timely supply of nutrients is well known, its high cost limits its use in large-scale plantations. This study was conducted to evaluate the properties and performance of bio-based polyurethane (PU)-coated CRF in laboratory and oil palm nursery seedling trials. CRF was produced by coating a commercial compound granular fertilizer from FGV Fertiliser Sdn. Bhd., namely, FPM 10 (10-8-20-3+0.5B), and then designated as CRF FGV10. Based on laboratory evaluation, CRF FGV10 can sustain nutrient release for more than six months. Vegetative growth parameters, such as girth size, palm height, third frond length, and total number of fronds produced, were recorded. In addition, the dry biomass of the oil palm seedlings was determined. From the evaluation, it was proved that at a 50% reduction in the rate of nutrient application and only two applications (T3), CRF FGV10 enabled the oil palm seedlings to achieve vegetative growth similar to that of the control samples (T1). CRFFGV10 also produced dry biomass comparable to of that T1. It was also shown that only coated CRF reduced fertilizer rates and application rounds.

Keywords: Manuring, nursery, nutrition, polyurethane, sustainable

SM_P13

Agronomic Effectiveness of Urea on Malaysian Soil with Special Reference to Ammonia Volatilization

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Urea is a widely used nitrogen fertilizer due to its high nitrogen content and relatively low cost. However, its application is often associated with significant nitrogen (N) loss through ammonia (NH_3) volatilization, a process that can lead to N losses of up to 40% when applied to soils. This high level of volatilization not only reduces the efficiency of nitrogen fertilization but also contributes to environmental pollution, including air and water quality degradation. The volatilization of ammonia from urea is influenced by several factors, including (1) pH level of the soil, (2) amount of organic matter, (3) ambient temperature, (4) humidity, and (5) wind speed. Each of these factors plays a crucial role in determining the extent of N loss after urea application. In this study, we try to assess the agronomic effectiveness of using urea and compare the performance to other nitrogen fertilizers such as calcium ammonium nitrate (CAN), sulphate ammonia (SOA), and Urea coated sulphur fertilizer in three different crops. Next, incubation analysis of these nitrogen fertilizers was conducted to assess the volatilization by using force-draft technique. The experiment shows the addition of N fertilizer did not reflect the relationship between control and N fertilizers in soils for the mass of shoot and yield. However, except control, all treatments show an increase in SPAD value overtime. The incubation study shows SOA does not release NH_3 during the incubation study while CAN has a tendency to release NH_3. Highest amount of NH_3 volatilization observed in Urea however, Urea coated with sulphur shows lesser rate of volatilization.

Keywords: Ammonia volatilization, nitrogen fertilizer, urea

SM_P14

Assessing the Contributions of Sand, Clay, and Silt Soil Fractions on Oil Palm Heights and Trunk Diameter

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Plant height indicates the health and growth vigor of plants. Soil texture is a key determinant of soil quality, productivity, and resilience through its multiple effects. Since sand, silt, and clay fractions possess non-identical properties, their individual effects on the height and diameter of the oil palm (OP) were hypothesized to differ and hence investigated. In this study, four OP plantations were selected, and palm trees were classified into Short and Tall clusters based on physical observations. Trunk height and diameter were measured using a Nikon Forestry Pro II and a diameter tape, respectively. Stratified random sampling was adopted for soil sampling and particle distribution analysis was conducted on the collected samples using the pipette method. Field and laboratory data were analyzed using RStudio. The independent t-test results showed that the tall cluster was significantly higher than the short cluster in plant height by 25.0%, 24.0%, 27.2%, and 28.0% in OP1, OP2, OP3, and OP4, respectively. The regression output suggested that soil texture explained 64.3% of the causal effect of OP height across the plantations. Moreover, the fraction of sand showed a strong to moderate positive correlation with total and trunk heights, and a moderate negative correlation with trunk diameter. Although clay showed an inconsistent correlation, it was more negatively correlated with height and trunk diameter. The silt at the 0–30 cm surface showed a strong to moderate negative correlation with height. In conclusion, soil texture exerted an overriding influence on oil palm height, with sand grains exhibiting the greatest positive effect. Therefore, clay- and silt-rich soils should be avoided if possible, when selecting an oil palm site. Appropriate leveling should be executed in OP fields to minimize erosion, which results in excessive silt and clay translocation onto the bottom slope.

Keyword: Clay, plant height, sand, silt, trunk diameter,

SM_P15

Nutrient Leaching Problems in Oil Palm Plantation in Malaysia: A Review and Future Studies

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This paper offers an overview of the leaching challenges frequently encountered in Malaysian oil palm (*Elaeis guineensis*) plantations. The oil palm stands as a vital cash crop extensively grown in tropical regions like Malaysia, a major global palm oil producer. Given Malaysia's predominantly weathered and less fertile soil, effective fertilization is essential to ensure optimal oil palm growth and yield which requires a substantial supply of soluble nitrogen and potassium for crop uptake. Malaysia is a tropical country and typically experiences annual rainfall exceeding 2,500 mm, inevitably giving rise to leaching issues that exerts environmental impacts. This review identifies five key aspects related to leaching problems. Firstly, groundwater pollution poses a significant concern. Runoff and deep percolation beyond the root zone can carry significant quantities of soluble plant nutrients, causing health risks when entering local community water sources due to high nitrate content. Secondly, nutrient leaching from oil palm plantations can detrimentally affect freshwater systems by contributing to nitrate-nitrogen (NO_3-N) loads that can trigger surface water eutrophication, leading to algal blooms and disruptions to aquatic ecosystems. Next, intensive management of oil palm plantations can result in nutrient leaching that negatively impacts soil quality and fertility. Consequently, this may diminish soil organic matter content and natural biodiversity. Excessive leaching may also hinder efficient nutrient absorption by crops, potentially causing nutrient deficiencies, manifesting as visual symptoms like necrosis and stunted growth. Lastly, if nutrients are not retained in the soil, the land can become toxic and unsuitable for future use unless a sustainable replacement strategy is implemented.

Keywords: Fertilizer, groundwater pollution, leaching, oil palm, runoff

SM_P16

Nutrient Removal and Release in Wetland Buffer Zone and Perception of the Local Community: Opportunities and Threats to Nature-based Wastewater Treatment in Lake Danao, Ormoc City, Philippines

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Lakes are essential ecosystems, as they serve as invaluable sources of domestic water, irrigation for agriculture, freshwater food for the residents and tourists, and they are also utilized as eco-tourism sites which contributes to the income of the locals living around them. However, the quality of lake water is increasingly threatened by a myriad of anthropogenic activities, particularly in those lakes surrounded by land. One of the lakes found in the Philippines is Lake Danao, which is nestled at the heart of Lake Danao Natural Park in Ormoc City. Lake Danao is vulnerable to water quality degradation and pollution caused by discharge of unfiltered wastewater and runoff mainly from agricultural, residential and socio-economic activities. This study explores the opportunities and threats to sustainable nature-based wastewater treatment by assessing the nutrient removal capacity of the wetland buffer zone (WBZ) surrounding Lake Danao and evaluating the important community attributes in the protected area. Results showed that nitrate (NO_3^{2-}) removal ranges from 0 - 100% and phosphate (PO_4^{3-}) removal ranges from 43.64 - 75.47%. However, phosphate release was observed near residential areas, and may be attributed to low vegetation cover, which was confirmed by examining the normalized difference vegetation index of the WBZ. In terms of local perspective on lake water utilization and management, there was a positive outcome on the knowledge, perceptions, and attitude of the community towards the WBZ. Sustainable lake management practices were also employed by most of the respondents. However, a few destructive practices were observed during site visits, such as bathing with body soap and doing laundry directly into the lake, and application of inorganic fertilizers in agricultural plots less than 50-m away from the lake water. The results will serve as preliminary data for recommending nature-based and behavioral approaches in maintaining and managing the quality of water resources in Lake Danao.

Keywords: Nitrates, nutrient removal, phosphates, wetland buffer zone

SM_P17

Impact of Ball Milling on Photocatalysis of Methylene Blue by Zinc Oxide Nanoparticles

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Photocatalysis is an effective method of removing pollutants from air and water. Ball milling has been shown to produce fine photocatalytic particles from large particles and enhance catalytic performance through increasing surface area. In this study, ZnO nanoparticles (ZnO NP) were obtained by ball milling of commercial ZnO powder for 6 and 12 hr. UV Vis spectra analysis showed a slight blue shift of absorbance for the milled samples compared to commercial ZnO. The X-ray diffraction (XRD) patterns revealed hexagonal wurtzite crystal phase of the milled powders. XRD analysis also confirmed the progressive broadening of the peaks as the milling time elapsed. FESEM results indicated that ball-milled ZnO NP consisted of agglomerated nanoparticles with gradual size reduction with increasing grinding time. The decrease in average crystallite size for the milled samples were also noted. The photocatalytic properties of samples were evaluated through the degradation of methylene blue (MB) under UV light irradiation. Over 90% MB degradation occurred within 20 min for commercial ZnO NP. The MB degradation was 16% for 6-hr milled ZnO NP while 30% MB degradation was recorded for 12-hr milled ZnO NP within 80 min. The reduced photocatalytic performance for the milled samples can be attributed to increased surface defects caused during the ball milling process. Thus, this work provides insight into the design of high performance photocatalysts.

Keywords: Ball mill, methylene blue, photocatalysis, zinc oxide

Precision Agriculture

PA_P1

Development of a Roller-Press-Type Calamansi Juice Extractor

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Philippine Lime (*Citrofortunella microcarpa*) is one of the most important fruit crops grown in the Philippines. This fruit, however, is highly perishable after harvest, thus necessitating processing into juice. The traditional method of juice extraction involves peeling, slicing, and pressing; hence, it is time-consuming. On the other hand, it was reported that when the juice is machine-extracted, the seeds are crushed together, thus making the juice bitter. Hence, this study aims to develop a roller-press type calamansi juice extractor and find the advantages of using the machine in juice processing. The essential components of the extractor include a feeding hopper, slitting rollers, extraction chamber, meal outlet, juice outlet, power transmission assembly, and support frame. In operation, the slitting rollers slit the fruits before the roller assembly's extraction. The juice extracted is collected from the juice outlet, while the residual waste is discharged through the meal outlet. Its performance was evaluated based on input capacity, extraction recovery, efficiency, percentage weight of broken seeds, and sensory analysis. The developed technology was deployed to a calamansi juice processing facility, and its advantages were assessed through an interview based on productivity and income. The machine's performance evaluation showed an input capacity of 351.50 kg/hr, an extraction efficiency of 82.25%, an extraction recovery of 26%, and a percentage of broken seeds of 2.60%. The efficiency is higher than the minimum standard required by the Philippine Agricultural Engineering Standards for Multi-Crop Juice Extractors (PAES 234:2008) of 75%. Sensory evaluation of the juice revealed no significant difference between the machine-extracted and manually extracted. Using the developed machine resulted in a 75% increase in daily production capacity and an additional profit of PhP1.00/bottle of calamansi juice drink. This study provides an advantageous technology for increasing the income of Calamansi farmers and juice drink processors.

Keywords: Calamansi, juice, juice extractor, extraction efficiency

PA_P2

Maize Height Estimation using Combined Unmanned Aerial Vehicle Oblique Photography and Lidar Canopy Dynamic Characteristics

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The traditional plant height (PH) measurement method is small-scale, inefficient, and time-consuming, which has restricted crop breeding progress and agricultural production efficiency improvements. Therefore, in this study, we aimed to estimate the maize populations' PH in the field using multisource unmanned aerial vehicle (UAV) images and to explore the factors that affect the accuracy of oblique photography (OP) and light detection and ranging (LIDAR) measurements of the populations' PH. To this end, we acquired red-green-blue (RGB), LIDAR, and multispectral image data for a maize population canopy using a UAV in four growth stages in two maize production regions. First, we reconstructed the three-dimensional point cloud using OP and LIDAR, and we used the 2nd and 100th percentiles of the elevation information as the lower and upper boundaries, respectively, to estimate the maize height. In addition, we used multispectral-based vegetation indices (VIs) and RGB-based texture indices (TIs) to describe the population canopy's characteristics, and we compared and analyzed the accuracy of the PH estimation for four data types and ten data fusion methods. The results revealed that all four data types could accurately estimate the maize PH and that the R^2 values were all greater than 0.75. The light detection and ranging elevation (LIDAR_elev) had the highest estimation accuracy, and the R^2 values of the maximum, minimum, and average PH of the population were all greater than 0.90. We also found that the dynamic characteristics of the canopy growth were important factors affecting the estimation of the PH using the oblique photography elevation (OP_elev) and LIDAR_elev. Thus, after fusing the VIs and TIs, the R^2 value reached a maximum of 0.98. Our research provides an effective method for high-throughput evaluation of a maize population's PH growth and serves as a reference for studying other phenotype parameters.

Keywords: Canopy dynamic characteristics, LIDAR, oblique photography, plant height, UAV

PA_P3

Implementation of Digital Parent Selector for Crops Traceability Program

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The increasing complexity and globalization of the food supply chain necessitates reliable crops traceability towards achieving sustainable food production systems. With networks spanning vast distances, meticulous tracking of crop origins and movements is essential at every stage. This study aims to improve crop traceability by addressing the limitations of traditional pen-and-paper data collection methods during a critical yet often overlooked, parental crop selection phase. This phase is crucial for identifying the best crops for mass growing or cloning. Traditionally, parental data collection relied on pen-and-paper methods which lack real-time data access and tracking capabilities. This study introduces a digital application for parental data collection activity built using the Flutter framework for mobile application development. This application empowers users to efficiently collect vital data directly at the field, including geographical coordinates, even in remote areas with limited internet connectivity. To safeguard the integrity of the collected data, a token-based authentication system was implemented. Upon reconnection, the data seamlessly synchronizes with a secure Laravel back-end web platform that enables data approval, selection, and comprehensive analysis. This integrated mobile application and web platform offers a transformative solution for streamlining data collection and management during the parental crop selection phase. By addressing this often-overlooked aspect, the study enhances the reliability of crop traceability systems, thereby supporting sustainable food production through preservation of crops' true-to-type characteristics across the supply chain.

Keywords: Crop traceability, data collection, mobile application, web platform

PA_P4

Development of Deep Neural Algorithms for Detection and Classification of Bagworm Instar Stages

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The adoption of deep learning (DL) technology in agricultural industries has been notably significant, leveraging its versatility to enhance informed decision-making in pest and disease management. This AI- driven development study possesses potential benefits in detection and classification of bagworm (*Metisa plana*) instar stages, a prevalent pest in the oil palm industry that contributes up to 43% yield loss if not monitored and treated. The primary objective of the study is to develop DL models with high model accuracy for effective object detection tasks applied to Joint Photographic Experts Group (JPEG) image datasets. A selection of convolutional neural network (CNN) architectures was developed and optimized in this study, with specific emphasis on refining the following parameters: i) optimizers, ii) activation functions, and iii) epochs. Addressing dataset imbalance, resampling techniques were implemented using cross-validation methods. These approaches significantly enhance models' capability to detect and classify bagworm larvae across all seven instar stages (S1 to S7), crucial for effective decision-making prior to control of bagworm pests. Furthermore, the adaptation of the trained model to images captured by mobile phones facilitates development of practical mobile and web applications suitable for deployment in field settings. This AI- based image recognition system is practical for the high-precision regular monitoring of the bagworm population, offering the capability to reduce operational costs, reliance on labor, and improve efficiency in bagworm census and data capturing. This advancement highlights the commitment to enhance sustainable agricultural practices in line with Environmental, Social, and Governance (ESG) principles.

Keywords: Artificial intelligence, convolutional neural network, machine learning, object detection

PA_P5

Motion Analysis based on Tapping Force Data for Newly Design Rubber Tapping Machine

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Issue of untapped rubber areas in Malaysia are increasing due to shortage of labor or tappers. This phenomenon has already been reflected in low national rubber production over the past 20 years. One proposed solution is the development of a mechanized tool for rubber tapping, which would allow more trees to be tapped and thereby improve the productivity of tappers. In the 1980s, a tool called MOTORAY was developed, but it was discontinued due to issues with its size, weight, challenges in tapping activities, and battery problems. The objectives of this study are to redesign MOTORAY and address all the issues related to the previous machine to make it practical in current circumstances. This study also emphasizes the use of motion simulation software to determine the optimal motor torque, ensuring the blade can tap effectively. Regarding difficulties during tapping, there is a close relationship between tapping force and clonal characteristics, specifically the presence of stone cells. In tapping with a half-spiral tapping cut, the RRIM 3001 clone required the maximum tapping force at 67.9N, while the PB260 clone had the minimum at 50.9N. Initial simulations using the current motor torque of 0.3Nm resulted in a tapping force of 35N. To address this limitation, further simulations were performed to determine the required torque to achieve a tapping force of 67.9N. This identified torque was then used in the machine's redesign. Additional simulations were conducted to validate the machine's capability in maintaining the desired tapping force, ensuring its efficiency and effectiveness in real-world applications.

Keywords: Mechanized tapping machine, MOTORAY, simulation analysis, tapping force

PA_P6

Precision Weed Management in Irrigated Barnyard Millet using Drone-based System

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Millets are climate-smart crops and nutritional powerhouses, with barnyard millet particularly resilient to climate change. As cultivation shifts from rainfed to irrigated systems, managing crop-weed competition becomes critical to maintaining yield. While chemical weed management is effective, its success hinges on precise application. Drones offer a promising solution by enabling precise, timely herbicide application, which enhances weed control efficiency and crop yield. This study investigated the optimal herbicide dosage and spray fluid volume for drone application to maximize weed control and energy use efficiency in barnyard millet cultivation. The experiment employed a Randomized Block Design with three replications, testing two doses of Pretilachlor (375 g/ha and 500 g/ha), three spray fluid volumes (40, 50, and 60 L/ha for drones, and 500 L/ha for manual spraying), and two application methods (drone and manual). The findings revealed that a pre-emergence application of Pretilachlor at 500 g/ha with 40 L/ha of spray fluid, applied by drone three days after transplanting, was most effective. This treatment achieved the highest reduction in weed density (3.46/m²) and weed dry weight (3.33 g/m²), with a weed control efficiency of 92.66% at 15 days after transplanting. It also resulted in the highest grain yield (2025 kg/ha), net income (Rs. 33,297/ha), and benefit-cost ratio (2.21). In conclusion, applying Pretilachlor at 500 g/ha with 40 L/ha of spray fluid using drone technology, along with appropriate agronomic practices, is recommended as the optimal strategy for achieving superior weed control during the critical early growth period (within 30 days), ultimately leading to higher yields and increased profitability in barnyard millet cultivation.

Keywords: Economics, optimum dose, spray fluid, weed control efficiency, yield

PA_P7

MATAG Coconut Seedlings Detection using Hyperspectral Data

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Cocos nucifera, known as coconut, is regarded as the fourth industrial crop in our nation. Because every element of the coconut crop, from the trunk to the fruit, may be fully exploited, the crop is known as the "Tree of Life." Sadly, in Malaysia, the coconut sector was seen as a "dying industry." Because of its shorter tree, high yielding variety, and beverage-grade kernel, the growers chose the MATAG hybrid variety. The MATAG variety is limited, though, in that its seedlings are not true-to-type, making it impossible to verify that particular features are adhered to. Thus, the objective of the research is to use hyperspectral data to identify the real MATAG seedlings. Pusat Pertanian Lekir in Perak and the UPM Faculty of Engineering conducted this study. Utilizing the StellarRAD Handheld Spectroradiometer (StellarNet. Inc., Tampa FL, USA), spectral ground data was gathered. On December 29, 2022, and December 30, 2022, in study area 1, and January 14, 2023, in study area 2, spectral ground data were gathered. Every species was five months old. Three distinct species of coconut seedlings were classified using the Support Vector Machine (SVM), Random Forest (RF), and Neural Network (NN) methods in order to distinguish the true seedlings.

Keywords: Hyperspectral, machine learning, MATAG detection, species detection

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