ICPTech2025

The 3rd International Conference on PLANTATION TECHNOLOGY

20-21 August 2025 | Dusit Princess, Melaka, Malaysia

"Resilience in Industrial Crop Production through Climate-Friendly Production System"

PROGRAMME AND ABSTRACT BOOK

MAIN ORGANIZER

UPM Universiti Putra Malaysia Berilmu Berbakti | INSTITUT KAJIAN PERLADANGAN INSTITUTE OF PLANTATION STUDIES

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MSAE Malaysian Society of Agricultural and Food Engineers | IGRSM Institution of Geospatial and Remote Sensing Malaysia | PGPR

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ICPTech2025 AT A GLANCE

ICPTech is a biennial plantation conference that brings together the latest advancement of the research innovation and knowledge of the scholars and industry practitioners in the plantation sector. The involvement and collaboration of both researchers and industry players catalyse the development and accelerate the research culture. This conference provides a platform for the researchers to showcase the research outcomes and share groundbreaking ideas and appropriate technologies in shaping the plantation sector in the future.

The 3rd ICPTech2025 with the theme *Resilience in Industrial Crop Production through Climate-Friendly Production Systems* focuses on aspects of modern agriculture. The conference will highlight advancements in biotechnology, automation, mechanization, and digital technologies to enhance sustainability and productivity in plantation industries. Emphasis is also placed on resilient agricultural practices, efficient resource management, and the adoption of eco-friendly technologies to mitigate climate change impacts. Additionally, discussions will cover sustainable pest and disease control, circular bioeconomy approaches, and innovative solutions for waste minimization, aligning with global sustainability goals.

ICPTech2025 is promoting research and technology in the plantation sector by exploring the four relevant topics:

- SACP: Sustainable Agronomy & Crop Protection
- MAD: Mechanization, Automation & Digitalization
- BCP: Biobased Conversion Products, Bioenergy & Biochemicals
- Plantation, Environmental & Bioeconomy Policies

MESSAGE FROM VICE CHANCELLOR UNIVERSITI PUTRA MALAYSIA

Bismillahirrahmanirrahim.

Assalamualaikum warahmatullahi wabarakatuh and Salam Sejahtera,

It is with great honour and anticipation that I welcome all distinguished delegates, researchers, industry leaders, and policy makers to the ICPTech2025 Conference, held under the theme "Resilience in Industrial Crop Production Through Climate Friendly Production System." This timely and vital gathering reflects our collective commitment to advancing sustainable agricultural practices in the face of escalating climate challenges.

Industrial crop production stands at a critical juncture. As global temperatures rise and ecosystems shift, the need for resilient, climate-adaptive technologies has never been more urgent. This conference provides a dynamic platform for thought leaders and innovators to share cutting-edge research, explore transformative technologies, and foster meaningful collaborations across borders and disciplines.

The emphasis on climate-friendly systems, digital agriculture, and sustainable downstream innovations aligns closely with our university's mission to champion research that not only advances knowledge but also serves humanity and the environment. I am particularly heartened by the inclusion of diverse crops from oil palm and rubber to kenaf, coconut, and tropical fruits, highlighting the breadth and depth of industrial agriculture in our region.

I commend the organizers for bringing together a rich tapestry of expertise from academia, government agencies, and industry. Such synergy is essential for translating scientific discovery into practical solutions that benefit farmers, consumers, and ecosystems alike.

May ICPTech2025 inspire new ideas, forge lasting partnerships, and catalyse progress toward a more resilient and sustainable future in industrial crop production.
I wish all participants a fruitful and engaging conference.

Thank you.

"BERILMU BERBAKTI"

YBHG. DATO' PROF. Ir. DR. AHMAD FARHAN MOHD SADULLAH

MESSAGE FROM
DIRECTOR, INSTITUTE OF PLANTATION STUDIES
ADVISOR, ICPTech2025

Assalamualaikum warahmatullahi wabarakatuh and Salam Sejahtera,

It is with immense pride and great pleasure that I welcome all distinguished delegates, esteemed researchers, industry pioneers, and policy makers to the 3rd International Conference on Plantation Technology 2025 (ICPTech2025). Hosted under the visionary theme "Resilience in Industrial Crop Production Through Climate-Friendly Production Systems, this gathering represents a pivotal moment for our collective pursuit of sustainable agricultural excellence in an era of unprecedented climate challenges.

As we stand at the crossroads of ecological transformation, industrial crop production faces both immense challenges and extraordinary opportunities. The escalating impacts of climate change: rising temperatures, erratic weather patterns, and shifting ecosystems demand urgent innovative solutions. This conference serves as a dynamic crucible where groundbreaking research, transformative technologies, and actionable strategies will converge to shape the future of climate-resilient agriculture.

At Institute of Plantation Studies, we are deeply aligned with this mission. The conference's focus on climate-smart systems, digital agriculture, and sustainable value chain innovations resonates powerfully with our institutional commitment to research that bridges knowledge and real-world impact. The inclusive scope spanning key crops like oil palm, rubber, kenaf, coconut, and tropical fruits reflects the rich diversity and strategic importance of our region's agro-industrial landscape.

I extend my highest appreciation to the organizers for curating a platform that unites academia, government, and industry—a synergy essential for turning scientific discovery into tangible benefits for farmers, communities, and our planet. Let us seize this opportunity to: champion innovation through cutting-edge technologies like precision agriculture and AI-driven solutions; forge cross-sector partnerships to scale sustainable practices and policies; empower stakeholders with knowledge and tools to thrive in a climate-constrained world.

To all participants, your expertise and collaboration are the bedrock of this transformative journey. May ICPTech2025 ignite bold ideas, foster enduring connections, and accelerate our shared vision of a resilient, equitable, and sustainable agricultural future.

YBHG. PROF. TS. DR. SITI KHAIRUNNIZA BEJO

MESSAGE FROM CHAIRMAN ICPTech2025

Greetings!

It is a great honor to invite you to attend ICPTech2025 with the theme of this year's conference, “Resilience in Industrial Crop Production through Climate-Friendly Production Systems” reflects a comprehensive and forward-thinking approach to sustainable agriculture. Climate-friendly production systems are crucial for enhancing resilience in industrial crop production, enabling adaptation and mitigation of the impacts of climate change.

In Q1 2025, the agricommodity sector contributed RM19.0 billion to Malaysia's Gross Domestic Product (GDP). This indicates the economic importance of agriculture and related industries in the country. Within the agricommodity sector, oil palm made up a major portion, accounting for 51.8% of the sector's GDP contribution, equivalent to RM10.0 billion. Malaysia's agricommodity sector faces a complex web of challenges, including climate change impacts and technological gaps. These issues threaten the industry's productivity and profitability.

Climate change introduces risks through extreme weather events. It is significantly impacting plantation agriculture in Malaysia, particularly affecting oil palm due to shifts in temperature and rainfall patterns. These changes lead to reduced productivity, increased vulnerability to pests and diseases, and potential economic losses for the producers. Climate-friendly plantation production systems focus on sustainable practices that improve crop yields, reduce environmental impact, and build the capacity of plantation systems to withstand climate-related shocks. This involves adopting practices that minimize greenhouse gas emissions, conserve resources, improve soil health, optimize water usage, integrate renewable energy, and promote carbon sequestration. In addition, the sector is also grappling with a widening technological gap, where many plantations still rely on traditional methods despite the advancements in precision agriculture and automation.

A multifaceted approach focusing on sustainability and technology is also crucial to address challenges in the Malaysian plantation sector. This includes enhancing research and development, adopting smart farming technologies, embracing mechanization, and enhancing downstream processing to add value. In addition, strengthening collaboration between stakeholders, including government and industry players, is also essential for sustainable and inclusive growth. Compliance with MSPO (Malaysian Sustainable Palm Oil) and RSPO (Roundtable on Sustainable Palm Oil) certification standards is essential for continued efforts to achieve 100% sustainability and traceability.

ICPTech2025 proposes a program that responds to the trends in plantation technologies and presents opportunities addressing sustainable, resilient, and climate-friendly practices and approaches and fostering local and international cooperation. This conference creates the perfect environment to debate and discuss these topics, with the overall goal of paving the way to future innovative successes. I am convinced that ICPTech2025 will be an excellent platform for interacting with others and sharing knowledge and innovative ideas on sustainable and climate-friendly plantation production systems.

YBRS. ASSOC. PROF. DR. GANESAN VADEMALAI

KEYNOTE SPEAKERS

Prof. Dr. rer. Nat. Hesham Ali El Enshasy
Universiti Teknologi Malaysia

Prof. Dr. Hesham is a distinguished bioprocess engineering expert and the current Director of the Innovation Centre in Agritechnology for Advanced Bioprocessing (ICA-UTM) since 2024, previously leading the Institute of Bioproduct Development (IBD-UTM) from 2018 to 2024. A professor at Universiti Teknologi Malaysia (UTM) since 2009, he has held prominent academic and advisory roles globally, including adjunct and visiting professorships in Japan and Indonesia. Recognized among the top 2% of global researchers in biotechnology and energy by Stanford University since 2020, he has over 30 years of experience in industrial biotechnology, with more than 450 publications and 60 industrial projects. His leadership emphasizes international visibility, academic and financial sustainability, and strategic industry collaboration. He also serves as a consultant and board member for bioproduct development and ESG-aligned business strategies and is the editor of the CRC Press book series "Industrial Biotechnology."

Mr. M.R. Chandran
Roundtable on Sustainable Palm Oil (RSPO)

Mr. M.R. Chandran is a highly respected veteran in the agro-commodity and plantation industry, with over 60 years of executive experience. He served as Director and Head of Plantations at Socfin Company until 1995 and later became the founding CEO of the Malaysian Palm Oil Association (MPOA) from 1999 to 2005. He played a pivotal role in establishing the Roundtable on Sustainable Palm Oil (RSPO), serving as its first Chairman and later Vice President, and continues as an advisor. Mr. Chandran holds multiple leadership and advisory roles across Malaysian and international organizations, including PT Agro Indomas Group, IRGA Sdn Bhd, and Saraya Hygiene Japan. A graduate in Agricultural Economics and Technology from the University of Adelaide, he is recognized with numerous fellowships and honors, including the Kesatria Mangku Negara by the Malaysian government, for his lifelong commitment to sustainable practices and industry development.

Prof. Gs. Dr. Siva Kumar Balasundram
Universiti Putra Malaysia

Prof. Dr. Siva K. Balasundram is a leading expert in Precision Agriculture and currently heads the Department of Agriculture Technology at Universiti Putra Malaysia (UPM). He serves as the Asia-Oceania Regional Representative on the Board of the International Society of Precision Agriculture. With over two decades of experience, his research integrates geospatial statistics, remote sensing, and artificial intelligence to model spatio-temporal variability in agriculture. He has secured RM1.7 million in research funding, published 85 journal articles, and holds two copyrights and one patent. A passionate educator and speaker, Prof. Siva teaches both undergraduate and graduate courses and has delivered over 50 invited talks globally on Precision, Smart, and Digital Agriculture, contributing significantly to advancing sustainable and data-driven farming practices.

LEAD SPEAKERS

Mr. Romzi Ishak
FGV Holdings Berhad

Mr. Make Jiwan
Sarawak Rubber Industry Board

Prof. Dr. Indu Rani Chandrasekaran
Tamil Nadu Agricultural University, India

Dr. Seetha Jaganathan King
National Institutes of Biotechnology Malaysia (NIBM)

Mr. Chandru Seernyanathan
Bio Terra Agriculture Services Sdn. Bhd.

"Achieving the Ideal Balance Between Growth and Sustainability in the Plantation Industry"

Dato' Seri Dr. Abdul Aziz Sheikh Ab. Kadir, FASc
Secretary-General
International Rubber Research Development Board (IRRDB)

Dr. Tan Sue Sian
Managing Director
Top Fruits Plantation Sdn. Bhd.

Prof. Dr. Norhisam Misron
Universiti Putra Malaysia

Dr. Ramesh Veloo
Incorporated Society of Planters

Dr. Tjahjono Herawan
PT Riset Perkebunan Nusantara, Indonesia

Mr. Barry Wilson
FPhyxd Innovations Group, Australia

FORUM PANELISTS

Prof. Ts. Dr. Siti Khairunniza Bejo
Director
Institute of Plantation Studies

Datuk Dr. Ramle Hj. Kasin
Director General
Malaysian Cocoa Board

Dr. Cheryl Ong
Senior Manager, Research & Knowledge Management
Roundtable on Sustainable Palm Oil (RSPO)

PROGRAMME DAY 1: 20 AUGUST 2025

VENUE: BUNGA RAYA BALLROOM II

08:00 - 09:00	Registration & arrival of participants & guests

OPENING CEREMONY

09:00 - 10:00	Negaraku anthem & Putra Gemilang Doa recitation
	Welcoming remarks by YBhg. Prof. Ts. Dr. Siti Khairunniza Bejo, Director, Institute of Plantation Studies, UPM
	Opening speech and officiation by YBhg. Prof. Dr. Ahmad Zaharin Aris FASc, Chairman of the Institute Congregation,UPM
	Corporate videos
	MoU exchange ceremony between UPM and - Ova Chem Sdn. Bhd. - International Research Rubber Development Board (IRRDB)
	Photography session
10:00 - 10:30	Coffee break / Poster session / Exhibition

KEYNOTE SESSION 1 | Chairman: Prof. Dr. Wong Mui Yun FASc (UPM)

10:30 - 11:10	*Bioproducts Development and Industrialization for Sustainable Oil Palm Plantation* Prof.Dr. rer. Nat. Hesham Ali El Enshasy Universiti Teknologi Malaysia

SCIENTIFIC SESSIONS

Bunga Raya Ballroom II SACP I Chairman: Dr. Mohd Firdaus Sulaiman (UPM)	Bunga Raya Ballroom I MAD I Chairman: Dr. Zailani Khuzaimah (UPM)	Bunga Mawar Room SACP II Chairman: Dr. Mohd Hadi Akbar Basri (UPM)
11:15 - 11:45	**11:15 - 11:45**	**11:15 - 11:45**
Lead Speaker 01 *An Integrated Pest and Disease Management: A Pathway to Sustainable Palm Oil Production* Tuan Haji Romzi Ishak FGV Holdings Bhd., Malaysia	**Lead Speaker 03** *Magnetic Application: Contribution to Oil Palm Industry* Prof. Dr. Norhisam Misron Universiti Putra Malaysia	**Lead Speaker 04** *Revitalizing Sarawak Rubber Industry: SARIB Way* Mr. Make Jiwan Sarawak Rubber Industry Board
11:45 - 12:15	**11:45 - 12:00**	**11:45 - 12:00**
Lead Speaker 02 *Ensuring Business Continuity Through Plantation Turnaround* Dr. Ramesh Veloo Incorporated Society of Planters	**MAD01** *Palm Detection Using Image Processing for Automated Rat Bait Applicator* Mr. Nazlee Azmeer Massuan SD Guthrie Research Sdn Bhd, Malaysia	**SACP04** *Investigating Pestalotiopsis Leaf Fall Disease in Rubber Plantations: Insights from Malaysian Rubber Board Research* Mr. Mohamad Zamir Hadi Ismail Malaysian Rubber Board
12:15 - 12:30	**12:00 - 12:15**	**12:00 - 12:15**
SACP01 *Sustainable Management in Oil Palm Plantation Field to Consider Greenhouse Gas Emissions and Nutrient Dynamics* Prof. Dr. Kazuyuki Inubushi Tokyo Univ. of Agriculture, Japan	**MAD02** *Effect of Liquid Foliar Biofertilizer Application on Glutinous Rice Leaves* Ms. Najidah Abdullah Universiti Putra Malaysia	**SACP05** *Harnessing Nature for Sustainable Management of Rubber Diseases* Prof. Dr. Wong Mui Yun FASc Universiti Putra Malaysia

Bunga Raya Ballroom II SACP I	Bunga Raya Ballroom I MAD I	Bunga Mawar Room SACP II
12:30 - 12:45	**12:15 - 12:30**	**12:15 - 12:30**
SACP02 *Delignification and Structural Alteration of Oil Palm Fibers by Pycnoporus sanguineus in POME-Enriched Fermentation* Dr. Farah Nadia Omar Universiti Malaysia Sabah	**MAD03** *True MATAG Coconut Seedlings Variety Identification Using RGB Images and YOLO-11* Ms. Nur Annisa Mat Nordin Universiti Putra Malaysia	**SACP06** *Addressing Rubber Narrow Genetic Base Through Introduction of Amazonian Germplasm Collection* Mr. Mohd Rahimi Zakaria@Mamat Malaysian Rubber Board
12:45 - 13:00	**12:30 - 12:45**	**12:30 - 12:45**
SACP03 *Green Synthesis of Silver Nanoparticles Using Guava Leaves: An Effective Strategy to Control Chilli Fruit Rot Disease* Dr. Sajjad Hyder Government College Women University, Pakistan	**MAD04** *Spatial Risk Zoning for Oil Palm Replanting Using UAV LiDAR and TWI: A Case Study in Tradewinds Plantation Berhad, Malaysia* Ms. Noor Emi Fadzilah Ramlan Tradewinds Plantation Berhad	**SACP07** *Endophytic Bacteria Colonized on Agricultural Wastes Suppress Early Blight and Enhance Tomato Growth* Dr. Amjad Shahzad Gondal Bahauddin Zakariya Univ., Pakistan
	12:45 - 13:00	**12:45- 13:00**
	MAD05 *Exploring Drone Technology for Efficient Rat Baiting in Oil Palm Plantations* Mr. Ariff Ateed Mohd Noh FGV R&D Sdn Bhd	**SACP08** *Phytochemical Screening and Anti-Bacterial Analysis of Hyptis suaveolens L. (Bush Mint) against Ralstonia solanacearum, Xanthomonas vesicatoria, and X. gardneri Affecting Tomato Fruits* Dr. Adamu Abdullahi Sokoto State University, Nigeria

13:00 - 14:30 Lunch break / Poster session / Exhibition

Bunga Raya Ballroom II MAD II Chairman: Prof. Dr. Siva K. Balasundram (UPM)	Bunga Raya Ballroom I BCP I Chairman: Dr. Farah Nadia Omar (UMS)	Bunga Mawar Room SACP III Chairman: Assoc. Prof. Dr. Ganesan Vadamalai (UPM)
14:30 - 15:00	**14:30 - 15:00**	**14:30 - 15:00**
Lead Speaker 05 *Mitigating Post-harvest Losses Through Technology and Entrepreneurship in Indian Agriculture* Prof. Dr. Indu Rani Tamil Nadu Agricultural Univ.	**Lead Speaker 06** *Agriculture Resources for Renewable Energy and Chemicals* Dr. Tjahjono Herawan PT Riset Perkebunan Nusantara, Indonesia	**Lead Speaker 08** *FPhyxd: A New Innovation for Disease Control in Tropical Plantations* Mr. Barry Wilson FPhyxd Innovations Group
15:00 - 15:15	**15:00 - 15:30**	**15:00 - 15:15**
MAD06 *Detection of Oil Palm Frond Number 17 Using Aerial Imagery and Spiral Angle Modelling* Mr. Muhammad Fitri Abu Muntalib Universiti Putra Malaysia	**Lead Speaker 07** *Advancing Precision Nutrition in Animal Feed through Utilization of Oil Palm Biomass* Dr. Seetha King National Institutes of Biotechnology Malaysia	**SACP14** *The RDCI Pathway of Induced Systemic Resistance Technology for Banana Blood Disease Management* Dr. Ganisan Krishnen Malaysian Agricultural Research and Development Institute, Malaysia
15:15 - 15:30		**15:15 - 15:30**
MAD07 *Development of a Machine Vision System for Automatic Plant Health Levels Evaluation Due to Ganoderma boninense Infection in an in vitro Setup* Ms. Nur'aliah Hanani Mohd Baktiar Universiti Putra Malaysia		**SACP15** *Soil Microbial Diversity under Oil Palm Agroforestry* Ms. Nur Azleen Jamal Jaganathan Universiti Putra Malaysia

15:30 - 15:45 Coffee break / Poster session / Exhibition

Bunga Raya Ballroom II SACP IV Chairman: Prof. Dr. Siva K. Balasundram (UPM)	Bunga Raya Ballroom I BCP I Chairman: Dr. Farah Nadia Omar (UMS)	Bunga Mawar Room SACP V Chairman: Assoc. Prof. Dr. Ganesan Vadamalai (UPM)
15:45 - 16:00	**15:45 - 16:00**	**15:45 - 16:00**
SACP09 *Comparative Evaluation of a New Evapotranspiration Sensor and Conventional Measurement Methods* Dr. Mohd Firdaus Sulaiman Universiti Putra Malaysia	**BCP01** *Palm Fatty Acid Distillates (PFAD) as a Potentially Available Feedstock for the Production of Bio-Lubricant Oil by Using Nanohybrid Catalysts via Ketonization Reaction* Dr. Haslinda Mohd Sidek Universiti Malaysia Sabah	**SACP16** *Prevalence of Citrus Bent Leaf Viroid in Citrus Growing Areas of Sargodha, Pakistan* Dr. Yasir Iftikhar University of Sargodha, Pakistan
16:00 - 16:15	**16:00 - 16:15**	**16:00 - 16:15**
SACP10 *Carbon Assessment and Financial Feasibility of Integrating Low-Carbon Emission Cocoa with Oil Palm* Dr. Albert Ling Sheng Chang Malaysian Cocoa Board	**BCP02** *Valorisation of Palm Oil Mill Effluent Sludge Oil for Sophorolipids Production by Starmerella bombicola DSM 27465* Ms. Chin Sze Jie Universiti Putra Malaysia	**SACP17** *Influence of Phenological Stages and Weather on Durian Pests and Diseases in Malaysia* Ms. Vinailosni Amirthalingam Top Fruits Plantation Sdn. Bhd., Malaysia
16:15 - 16:30	**16:15 - 16:30**	**16:15 - 16:30**
SACP11 *Enhancing Accuracy of Flux Measurements in Oil Palm Ecosystems through Combined Automated and Manual Methods* Dr. Mohd Hadi Akbar Basri Universiti Putra Malaysia	**BCP03** *Application of Constant Impeller Tip Speed for Scale-Up of Rhamnolipids Production in Bioreactor* Ms. Siti Syazwani Mahamad Universiti Putra Malaysia	**SACP18** *Biogas Slurry's Role in Regulating Soil Enzyme Activities for Sustainable Agronomy* Dr. Zhang Xihuan Henan Institute of Science and Technology, China
16:30 - 16:45	**16:30 - 16:45**	**16:30 - 16:45**
SACP12 *Integrated Management of Mango Anthracnose Using Chemical Fungicides and Botanical Extracts* Mr. Asif Mahmood Arif Muhammad Nawaz Shareef University of Agriculture, Pakistan	**BCP04** *Cytotoxicity of Tongkat Ali Leaf Extract against MDA-MB-231 Breast Cancer Cells Highlights Need for Sustainable Plantation Practice* Dr. Lusia Barek Moses Universiti Malaysia Sabah	**SACP19** *Biological Approaches to Sustainable Management of Fusarium Wilt in Cotton* Dr. Muhammad Arslan Khan Muhammad Nawaz Shareef University of Agriculture, Pakistan
16:45 - 17:00		
SACP13 *Evaluation of Rhizobacteria and Biogenic Silver Nanoparticles for the Management of Pseudomonas syringae pv. syringae Causing Bacterial Canker on Plum* Dr. Raees Ahmed University of Poonch Rawalakot, Pakistan		

VENUE: BUNGA RAYA BALLROOM II

20:00 - 22:00 **CONFERENCE DINNER**

PROGRAMME DAY 2: 21 AUGUST 2025

VENUE: BUNGA RAYA BALLROOM II

KEYNOTE SESSION 2 | Chairman: Assoc. Prof. Dr. Ganesan Vadamalai (UPM)

09:00 - 09:40	*ESG (Environmental, Social and Governance) Perspectives in the Palm Oil Industry* Mr. M. R. Chandran Roundtable on Sustainable Palm Oil (RSPO)
09:45 - 10:15	Coffee break / Poster session / Exhibition

FORUM SESSION | Moderator: Prof. Ts. Dr. Siti Khairunniza Bejo (UPM)

10:30 - 12:30	*Achieving the Ideal Balance Between Growth and Sustainability in the Plantation Industry* **Panel:** YBhg. Dato' Seri Dr. Abdul Aziz Sheikh Abdul Kadir (International Rubber Research Development Board) YBhg. Datuk Dr. Ramle Hj. Kasin (Malaysian Cocoa Board) Dr. Cheryl Ong (Roundtable on Sustainable Palm Oil) Dr. Tan Sue Sian (Top Fruits Plantation Sdn Bhd)
12:30 - 14:00	Lunch break / Poster session / Exhibition

KEYNOTE SESSION 3 | Chairman: Dr. Anas Mohd Mustafah (UPM)

14:00 - 14:40	*Data-driven Strategies for Better Resource Use in Plantation Management* Prof. Dr. Siva Kumar Balasundram Faculty of Agriculture, Universiti Putra Malaysia

SCIENTIFIC SESSIONS

Bunga Raya Ballroom II **SACP VI** **Chairman: Prof Dr. Wong Mui Yun FASc (UPM)**	**Bunga Raya Ballroom I** **RSPO SPECIAL SESSION**
14:45 - 15:15	**14:45 - 15:30**
Lead Speaker 09 *Towards Precision Nutrient Management* Mr. Chandru Seernyanathan Bio Terra Agriculture Services Sdn. Bhd.	**Bridging Worlds: Certification, Collaboration, and Smallholder Impact in Malaysia's Palm Oil Sector** **Moderator: Ms. Kertijah Abdul Kadir (Smallholder Programme Manager, RSPO)** *Shared Value in Seemingly Unrelated Interventions: Refocusing on Smallholder Yield* Dr. Tey Yeong Sheng Universiti Putra Malaysia
15:15 - 15:30	
SACP20 *Changes in Soil P and pH Modifies Soil Microbial Communities of Oil Palm Cultivated Landscapes* Ms. Yeong Wei Yan Universiti Putra Malaysia	

15:30 - 15:45	Coffee break

Bunga Raya Ballroom II SACP VI	Bunga Raya Ballroom I RSPO SPECIAL SESSION
15:45 - 16:00	**15:45 - 16:45**
SACP21 *Biosynthesis of Eco-friendly rhamnolipids from Waste Cooking Oil by Pseudomonas aeruginosa RW9 with Insights Into Stability and Toxicity Performance* Ms. Zee Kar Mun Universiti Putra Malaysia	**Moderator: Ms. Kertijah Abdul Kadir (Smallholder Programme Manager, RSPO)** *From Southern Malaysia to the Global Stage: PERTANIAGA's Smallholders' Journey Towards Sustainability* Mr. Saiful Amrin Sudin Pertubuhan Tani Niaga Lestari Negeri Johor (PERTANIAGA) *Tech on the Ground: Making Smallholder Sustainability Work Through Relevant, Adoptable Solutions* Ms. Ooi Kiah Hui Earthworm Foundation
16:00 - 16:15	
SACP22 *Phenolic Compounds as Antagonists in Altering Mycelial Morphology and Enzyme Activity of G. boninense* Ms. Daarshini Ganapathy Universiti Putra Malaysia	
16:15 - 16:30	
SACP23 *Potential of Lemongrass Essential Oil-Based Nanotechnology in Fungal Phytopathogen Control* Ms. Manemegalai Suria Gandi Universiti Putra Malaysia	
16:30 - 16:45	
SACP24 *Eco-Friendly Strategies for Bacterial Disease Management in Industrial Crops: Integrating Biochemical Insights with Sustainable Control* Dr. Muhammad Sajid Bahauddin Zakariya University, Pakistan	

16:45 CLOSING CEREMONY (Bunga Raya Ballroom II)

POSTER PRESENTATION

POST01 | Ms. Nik Nur Fatin Amira Mah Hassan, *SD Guthrie Research Sdn. Bhd., Malaysia*
Autonomous System for Collecting Loose Fruits in Oil Palm

POST02 | Mr. Ahmad Arif Ismail, *Malaysian Agricultural Research and Development Institute, Malaysia*
Effects of Different Green Cote Fertilizer Coating Formulations and Compound Fertilizer Application Rates on Grain Corn Performance

POST03 | Mr. Zal Khan Abdullah, *Universiti Putra Malaysia*
RNAi Technology: The Next Wave of Green Agriculture-Exploring Its Potential, Addressing Challenges, and Bridging the Translational Gap

POST04 | Ms. Siti Nooradzah Adam, *Universiti Putra Malaysia*
Smart Farming for Cocoa: Monitoring Leaf Health with Remote Sensing

POST05 | Dr. Zubaidah Ramli, *Malaysian Palm Oil Board, Malaysia*
The Use of Model Plant *(Arabidopsis Thaliana)* As a Research Tool for Oil Palm Height Improvement

POST06 | Dr. Omar Abd. Rasid, *Malaysian Palm Oil Board, Malaysia*
Soil Microbial Communities Profiling Indicates No Significant Difference Among Genetically Modified (GM) and Non-GM Oil Palms

POST07 | Dr. Kong Lih Ling, *Universiti Putra Malaysia*
Molecular Insights into CCCVd Infection in Oil Palm: Defence and Stress-Related Gene Expression

POSTER PRESENTATION

POST08 | Dr. Zailani Khuzaimah, *Universiti Putra Malaysia*
Biomass Estimation in Rubber Plantation Using UAV LiDAR Data

POST09 | Ms. Hazalina Zulkifli, *Malaysian Agricultural Research and Development Institute, Malaysia*
Assessment of Nanofertilizer Effect on MR 297 Rice Grain Quality

POST10 | Ms. Siti Nur Ezzati Shaharuddin, *FGV R&D Sdn. Bhd., Malaysia*
Prediction of MD2 Pineapple Fruit Weight Based on Correlation with Fruit and Plant Parameters

POST11 | Ms. Nur Khairunnisa Mohd Kamaruzaman, *Universiti Putra Malaysia*
Detection of *Pestalotiopsis* Leaf Fall Disease using Hyperspectral Imaging and Support Vector Machine

POST12 | Dr. Mohd Shafar Jefri Mokhatar, *Universiti Putra Malaysia*
Utilizing Silicate Rock Minerals to Boost Growth and Resilience in *Hevea brasiliensis*: Toward a Sustainable Soil Management Approach

POST13 | Dr. Nik Norasma Che'Ya, *Universiti Putra Malaysia*
RGB Analysis Identification of MATAG Coconut Seedlings Using Deep Learning

POST14 | Dr. Erneeza Mohd Hata, *Universiti Putra Malaysia*
Characterization of the Pathogen Causing Dieback and Defoliation in *Durio zibethinus* in Durian Plantations

POST15 | Dr. Halimatun Saadiah Hafid, *Universiti Putra Malaysia*
Cellulose-Starch Based Composite Materials: Extraction from Agriculture Biomass

POST16 | Dr. Fariz Adzmi, *Universiti Putra Malaysia*
Development of Sustainable Formulation of Alginate-MMT for Encapsulation of Biological Control Agents *Trichoderma harzianum*

POST17 | Mr. Ahmad Faiz Mokhtar, *Universiti Putra Malaysia*
Latex Timber Clone Plantation *(Havea brasiliensis)* in Malaysia

POST18 | Ms. Nur Arisa Mohd Azim Khan, *Universiti Putra Malaysia*
Pathogenicity of Fusarium Species on Durian *(Durio zibethinus)*: Investigating Disease Progression and Host Response

ORGANIZING COMMITTEE

Patron
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Vice-Chancellor, Universiti Putra Malaysia

Advisor
Prof. Ts. Dr. Siti Khairunniza Bejo
Director, Institute of Plantation Studies

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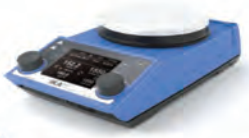

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ABSTRACTS

KEYNOTE SPEAKERS

KEYNOTE SESSION 1

Bioproducts Development and Industrialization for Sustainable Oil Palm Plantation

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Abstract

Oil palm is one of the most important crops for sustainable economic production of edible oil. The oil palm can produce up to 3.6 tons of oil per hectare in average which is almost 8-10 times of soybean oil production per hectare. Malaysia and Indonesia accounts for almost 85% of the world production of palm oil. This based on many years integrated efforts to build a complete agritechnology production system including plantation, harvesting system, refinery, and waste management. However, sustainability of oil palm plantation faces different challenges (economic, social and environment). Nowadays, soil degradation and climate change issues are considered as the two main major threats for oil palm sustainability. The extensive uses of chemicals for many years as biofertilizers and pest control agents affect soil quality, animal and human health as well. In addition, climate change in terms of changes in temperature, humidity, rainfall patterns can cause extreme weather which affects the yield and quality of oil. Therefore, biotechnological solutions need to be used to overcome these effects to secure the sustainability of oil palm plantation industries. Biotechnology solutions in the upstream process of plantation include the utilization of biofertilizers and biological control agents which help to reduce soil erosion/degradation, and quality. In addition, these can reduce the environmental pollutions arise from the extensive uses of chemicals as fertilizers and pest control agents. Furthermore, recent development also shos the potential uses of microbes for soil rehabilitation (regeneration of dead soil) and also to reduce the impact of different biotic and abiotic stresses on plant. This presentation will provide a comprehensive overview about the potential uses of biotechnological solutions for sustainable oil palm plantation. In addition, it shows a case study for production of microbial based fertilizers and biocontrol agents in the large-scale manufacturing process for oil palm plantation.

KEYNOTE SESSION 2

ESG Perspectives in the Palm Oil Industry

M. R. Chandran, KMN, FISP, FBIM, FMOSTA, FMIM
Chairman IRGA Sdn Bhd & Advisor to RSPO, Malaysia

Abstract

As calls for businesses to step up in tackling our social, environmental, governance and economic challenges intensify, it's time to ask some very fundamental questions. Why does a business exist? How can it move beyond short-term profit maximisation enabling both people and the planet to thrive long-term? In 1970, in a NYT Essay, Nobel laureate Milton Friedman wrote - that there is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits. Since then, the world has changed in ways few could have possibly foreseen. Today, businesses confront rapidly growing movements advocating that they also focus on promoting desirable outcomes relating to environmental, social and governance (ESG) and climate change objectives, in addition to profit. Today, ESG factors are an essential consideration to determine whether a company's activities significantly affect the environment, society or people and governance. It aims to understand how a company's actions have positive and negative impacts over the short, medium, and long term, rather than merely reflecting subjective perceptions of what is important. As one of the world's most productive and versatile oil crops, oil palm plays a critical role in the global supply of food, feed, fibre, and fuel. Yet, the sector stands at a crossroads. It faces intensifying scrutiny over its environmental footprint – particularly in relation to deforestation, biodiversity loss, land rights issues, and greenhouse gas emissions. At the same time, a wave of scientific, technological, and policy innovations is emerging, with the potential to reshape the industry and position it as a key driver of sustainable development. Sustainability is no longer a peripheral concern but a fundamental imperative for the long-term viability of the oil palm industry. Certification schemes such as the Roundtable on Sustainable Palm Oil (RSPO) and the Malaysian Sustainable Palm Oil (MSPO), along with the growing adoption of ESG reporting, reflect growing demands for transparency and accountability. Understanding and responding to these shifting forces shall be critical for stakeholders seeking to remain competitive and relevant in a rapidly globalizing and sustainability-conscious economy.

Keywords: Oil Palm Industry, ESG, Sustainability, Climate Change, Transparency, Accountability

KEYNOTE 3

Data-driven strategies for better resource use in plantation management

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Abstract

Precision Agriculture (PA) is rapidly expanding into Smart Agriculture (SA) and Digital Agriculture (DA), driven by advancements in AI, IoT, drones, and big data analytics. This shift is revolutionizing resource management in plantation crops by enabling real-time, automated, and highly optimized decision-making. While PA focuses on optimization of inputs based on spatial and temporal variability, SA integrates autonomous systems and AI-based predictive analytics. Meanwhile, DA encompasses end-to-end farm management through cloud platforms, blockchain traceability, and digital twins, facilitating seamless coordination across the supply chain. By merging information about spatio-temporal variability with real-time data as well as supply chain dynamics, plantation operators have a better chance at minimizing waste, reducing costs, and improving sustainability - which are all critical for plantations facing climate risks and regulatory pressures. This presentation examines key strategies enabling the PA-SA-DA continuum with some examples on oil palm, cocoa and durian.

Keywords: Precision Agriculture, Smart Agriculture, Digital Agriculture, Artificial Intelligence, Plantation Crops

LEAD SPEAKERS

LEAD SPEAKER 01

An Integrated Pest & Disease Management: A Pathway to Sustainable Palm Oil Production

Romzi Ishak[1*], Che Ahmad Hafiz Che Manan[2], Abd Rahman Mohd Tajudin[2], Cik Mohd Rizuan Zainal Abidin[3], Elya Masya Mohd Fishal[4], Haryati Abidin[4]

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Abstract

Oil palm is the leading crop commodity in Malaysia, covering over 5.6 million hectares and is the second-largest producer and exporter of palm oil in the world. Despite its economic importance, oil palm productivity is significantly threatened by pests and diseases that cause substantial yield and financial losses. In FGV plantation, the major threats include basal stem rot (BSR) caused by *Ganoderma boninense*, leaf-eating caterpillars, rhinoceros beetle (*Oryctes rhinoceros*), and rats (*Rattus* spp.), with estimated annual economic losses ranging from RM 1,400 to RM 7,000 per hectare. FGV has implemented a comprehensive integrated pest and disease management (IPDM) framework based on three core principles: prevention, monitoring, and intervention. For BSR, control measures include cultural practices, removal of infected palms, soil mounding, and application of *Trichoderma asperellum* for biological suppression. While the use of fungicides such as hexaconazole and alongside ongoing research into *Ganoderma*-tolerant planting materials and biofertilisers, is in the pipeline. Leaf-eating caterpillars are managed through early detection, selective pesticide or/and *Bacillus thuringiensis* application, and planting of beneficial plants to encourage natural enemies. Rhinoceros beetle control integrates cultural practices, pheromone trapping, and biological control with *Metarhizium anisopliae*, which has shown over 40% infection and effectiveness to all life stages except the egg. Rat populations are suppressed primarily through barn owl (*Tyto javanica*) establishment, supplemented with baiting where necessary. New emergence of pests and diseases, e.g. mealy bug and red rust algae also to be discussed in this paper. To strengthen operational efficiency, FGV has adopted a mobile and web-based pest and disease monitoring system. This system supports early decision-making, targeted interventions, and resource optimisation, reducing dependency on chemical inputs and minimising environmental risks. The integration of traditional control measures with digital agriculture innovations reflects FGV's commitment to sustainable palm oil production. These strategies not only mitigate pest and disease impacts but also contribute to maintaining economic viability, reducing environmental footprints, and enhancing long-term plantation resilience. Continued advancements in biological control, precision agriculture, early warning technologies, and AI-powered pest and disease detection, combined with predictive analytics, will be key to sustaining productivity in the face of evolving pests and diseases.

Keywords: pest and disease management; sustainable palm oil production; early warning system

LEAD SPEAKER 02

Ensuring Business Continuity Through Plantation Turnaround

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Abstract

Sustainable vegetable oil production and business continuity will require plantations to strive for high performance in terms of yield, cost and profitability. Companies with below average performance as compared to the industry peers should strategise to make a decision of divestment to cut loss or go through a rigorous process of turnaround. Turnaround can be defined as a process of transformation of a company into greater financial stability. Financial performance of a plantation requiring turnaround may be affected by lower yields, higher cost of production, leakages, poor sustainability and quality of products etc. Apart from operational performance, weak capital structure resulting in high gearing and financial cost can also be a reason for turnaround. The paper will not only explore the key factors affecting poor performance of a plantation company but also provide action plans and solutions for greater business sustainability within a time frame. The key enablers to enhance or catalyst the turnaround process is also discussed thoroughly. Key Performance Indicators measuring and reflecting the results of the change process remain to be the measure of a successful plantation turnaround.

LEAD SPEAKER 03

Magnetic Application: Contribution to Oil Palm Industry

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Abstract

This paper presents the application of magnetic technology in agriculture, with a particular focus on the oil palm industry. The study begins with a discussion of the fundamental principles of magnetism and their transformation into practical solutions through magnetic-based devices that address critical challenges in palm oil operations. By examining the specific problems and operational requirements of the industry, we have designed and developed specialized devices aimed at targeted problem-solving and performance enhancement. The innovation is the e-cutter system, which draws on our expertise in advanced electric motor design. The system integrates a high-torque motor with a high power density generator, enabling its deployment in oil palm harvesting machines to improve cutting efficiency, operational reliability, and energy utilization. Complementing this is a fruit maturity sensing device, developed to address reduced harvesting quality caused by unripe fruit bunches. Based on magnetic concepts in capacitive and inductive coil configurations, the sensor accurately determines the maturity level of fruit bunches, enabling informed and timely harvesting decisions. In addition, we propose the integration of robotics and artificial intelligence (AI) for plantation maintenance, surveillance, and automated tasks. This includes the use of unmanned ground (UG) vehicles for field monitoring, robotic fruitlet collection systems, and AI-driven data analytics for yield prediction and plantation management. The proposed technologies are intended to enhance productivity, reduce operational inefficiencies, improve harvesting accuracy, and accelerate the adoption of advanced magnetic, robotic, and AI-assisted systems in the modernization of the oil palm industry, contributing to sustainable and efficient agricultural practices.

Keywords: magnetic; e-cutter; maturity sensing; robotics and artificial intelligence

LEAD SPEAKER 04

Revitalizing Sarawak Rubber Industry: SARIB Way

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Abstract

Sarawak has a total area of 161,251.66. 66 hectares planted with rubber, with 7. 54% being young rubber and 92. 46% mature rubber. The total number of smallholders involved in rubber cultivation is 98,643 farmers, with an average of 1.60 hectares per farmer. Betong, Sri Aman, Sarikei, and Sibu are the major rubber- producing areas, with total acreages of 27,319.69 ha, 21,994.86 ha, 20,869.44 ha, and 20,430.57 ha, respectively. Despite its large area, rubber production in Sarawak is only 20,000 MT for the year 2024. This indicates that only 36. 38% of the mature rubber area is being tapped, often inconsistently. As a result, farm productivity is low, averaging 0.37 MT per hectare annually. The Sarawak Rubber Industry Board (SARIB) was established in October 2023 with the purpose to regulate and rebuilt the rubber industry with the vision to revitalize, transform and sustain the rubber industry in Sarawak. SARIB needs to implement drastic. comprehensive and strategic changes to the upstream sector. The upstream sector of the rubber industry must be driven by the private sector. Through a private- public- community partnership program, 5, 000 hectares have been consolidated and operated by four companies, with plans to expand to 10, 000 hectares by 2026. Benefits to the community from this collaboration include: (i) rental income, (ii) dividends, and (iii) a contribution of 5 cents per kilogram of rubber harvested for community welfare under corporate social responsibility (CSR). To achieve Sustainable Development Goals (SDGs), especially in rural Sarawak, an agro- commodity- based economy is vital for the rural communities. Through rubber, an average monthly income of RM 128, 250, 000. 00 can be generated in rural areas, and with proper management- using new fertilization inputs and improved silvicultural practices- this could increase to as much as RM 256, 500, 000. 00 per month. This could result in a monthly rubber production of up to 85, 500 MT. Therefore, with substantial investment in research and development in rubber upstream activities, SARIB aims to attract more investments in leasing mature rubber farms and engage R & D communities to develop improved agronomic and silvicultural practices in rubber management.

Keywords: SARIB; rubber industry; Sarawak rubber; sustainability, community-private-public initiatives

LEAD SPEAKER 05

Mitigating Post-harvest Losses through Technology and Entrepreneurship in Indian Agriculture

Indu Rani Chandrasekaran[1]*, T. Arumuganathan[2], R. Neelavathi[1] and P. Keren Praiselin[1]
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Abstract

Indian agriculture, critical to national food security and rural livelihoods faces considerable post-harvest losses - estimated at 20–40% for fruits and vegetables mainly due to inadequate infrastructure, low processing levels and inefficient value chains. This article reviews the current scenario and technological advances aimed at minimizing such losses. Key interventions include the adoption of improved storage (cold chains, zero-energy cool chambers), advanced sorting and grading machinery and innovative packaging solutions like modified atmosphere and vacuum packaging. Minimal processing techniques, microencapsulation and non-destructive quality assessment have enhanced the shelf life and safety of produce. The promotion of value-added products (e.g., dehydrated banana figs, Moringa-based health foods, biofortified crops) not only reduces waste but also enables wealth creation and employment in rural communities. The Indian Government initiatives such as the Pradhan Mantri Kisan SAMPADA Yojana, Mega Food Parks and targeted entrepreneurship development further support these efforts, particularly among small and women entrepreneurs. The necessity for a national roadmap to integrate agro-processing at local levels, the popularization of value addition and leveraging technology for sustainable, income-generating agribusiness is of greater emphasis. These strategies are essential for enhancing farmers' income, ensuring food security and aiding an efficient and modern agricultural sector in India.

Keywords: Postharvest Losses, Value Addition, Cold Chain, Food Processing, Agri-entrepreneurship

LEAD SPEAKER 06

Sustainable Biochemicals, Biopolymers, Bioplastics, and Bioenergy from Agricultural Feedstocks

Tjahjono Herawan, Meta Rivani, Yora Fara Mitha, Firda Dimawarnita
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Abstract

The global shift toward sustainability has intensified research into biochemicals, biopolymers, bioplastics, and bioenergy sourced from agricultural feedstocks. Conventional petroleum-based materials contribute to environmental degradation, prompting the need for renewable alternatives. Agricultural feedstocks such as oil palm, oil palm biomass, cassava starch, and lignocellulosic waste offer promising raw materials for biobased innovations. Agricultural biomass as residues contains valuable cellulose, hemicellulose, and lignin, which can be converted into biochemicals such as biosurfactants, organic acids, and bio-based solvents. Additionally, fermentation processes can transform agricultural residues into bioethanol and organic acids, supporting sustainable chemical production. Agricultural feedstocks serve as rich sources of cellulose, which can be modified into cellulose esters for biopolymer applications. The esterification of cellulose with fatty acids from plant oils produces bioplastics with high biodegradability and mechanical stability. However, mechanical properties such as tensile strength require enhancement through additives to match conventional plastics. Recent studies have focused on biocomposite pellets made from cassava starch and lignocellulosic fibers, offering an alternative to petroleum-based plastics. By incorporating short agricultural fibers into starch-based composites, researchers have developed biocomposite pellets with improved density and durability. These materials show potential for rigid packaging applications, especially when blended with recycled polymers to enhance performance. Agricultural biomass is also a valuable feedstock for bioenergy production. Studies have explored the conversion of agricultural residues into biofuels, including biodiesel and bioethanol. The anaerobic digestion of agricultural waste generates biogas, which can be used for electricity generation. Additionally, pyrolysis and gasification processes can transform biomass into biochar and syngas, contributing to renewable energy solutions. The sustainable conversion of agricultural feedstocks into biochemicals, biopolymers, bioplastics, and bioenergy presents a viable pathway to reduce reliance on fossil-based resources. Continued research and industrial-scale development are essential to enhance material performance, scalability, and economic feasibility, supporting a circular bioeconomy.

Keywords: biochemicals, biopolymers, bioplastics, bioenergy, agriculture biomass

LEAD SPEAKER 07

Advancing Precision Nutrition in Animal Feed through Utilization of Oil Palm Biomass

Seetha Jaganathan King[1]*, Ahmad Nor Hafzan Mat Roni[1], Muhamad Johnny Ajang bin Abdullah[1], Nursyuhaida binti Mohd Hanafi[1], Nazrien Kaman[1]

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Abstract

The National Institutes of Biotechnology Malaysia (NIBM), under the purview of the Ministry of Science, Technology and Innovation (MOSTI), serves as a national platform for advancing biotechnology RDICE - research, development, innovation, commercialization and economy across agriculture, healthcare, and industrial sectors. The Agro-Biotechnology Institute (ABI), part of NIBM, leads agri-biotechnology initiatives within the agriculture and food security ecosystem, including the sustainable utilization of agricultural waste, particularly oil palm biomass for high-value applications. Malaysia produces over 90 million tonnes of biomass each year; including Empty Fruit Bunches (EFB), Oil Palm Trunk (OPT), Oil Palm Fronds (OPF), and Mesocarp Fibre (MCF) - a significant portion of which remains underutilized despite its strong potential to enhance feed security. In 2023, Malaysia imported over RM4 billion worth of grains such as soybean and corn for animal feed, highlighting the urgent need for alternative, locally developed feed ingredients. This paper highlights ABI-NIBM's initiatives in exploring biotechnological methods to convert oil palm biomass into high-value feed components for monogastric livestock, including poultry, swine, and aquaculture. These efforts aim to achieve optimal protein and amino acid profiles, improved digestibility, and reduced anti-nutritional factors. The efficiency, health, and productivity of monogastric livestock depend on precise nutritional balance, particularly in essential amino acids such as lysine, methionine, and threonine, which are critical for muscle development, immune competence, gut integrity, and overall metabolic health. Implementation is framed within a national biomass utilization strategy integrating research dissemination, technology development, social implementation, and policy engagement. By aligning scientific innovation with industry needs and sustainability goals. ABI-NIBM aims to reduce feed import dependence, enhance rural economic opportunities, and strengthen Malaysia's livestock and aquaculture sectors as key contributors to national food security and the circular bioeconomy.

Keywords: Precision nutrition; oil palm biomass; amino acids; poultry; swine; aquaculture; circular bioeconomy

LEAD SPEAKER 08

FPhyxd - A New Innovation for Disease Control in Tropical Plantations

Barry Wilson
FPhyxd Innovations Group, Australia

Abstract

Phytophthora spp. is indeed a global disease complex causing significant losses in agricultural plantation industries and poses significant threat to the natural environment and ecosystems. Whilst the most significant economic impacts are focussed on the world's wet tropics, temperate regions also represent a significant environment trying to meet the challenges of Phytophthora management. The new FPhyxd technology does not offer to be a panacea solution to the management of Phytophthora spp. but a new mechanism and tool to be integrated into overall management practices with other technologies to aid in optimising the management of the disease. Key aspects of the technology are a different mode of action to other products currently utilised and the fact the product is non-hazardous to both the environment and user/operators. The ICPTech25 paper from FPhyxd innovations looks to share the research to date and insight into management systems on tropical plantations.

LEAD SPEAKER 09

Towards Precision Nutrient Management

Henry Ooi, Chandru Seernyanathan*, Puvaneswaree Nalaya, Noor Idayu, Imran Suppiah

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Abstract

This paper advocates a paradigm shift from field-level to individual tree-level precision in oil palm, not only feasible but essential for optimizing resource use, maximizing yields, and ensuring ecological resilience in the palm oil industry.

Traditional nutrient management in tree crops relies on broad, field-level recommendations based on foliar analysis, soil tests, regional averages, or generic growth stages. However, this approach ignores intra-field variability in soil properties, tree genotype/phenotype, and microclimates, leading to significant inefficiencies. Globally, 30 – 50% of applied fertilizers are not utilized by crops, contributing to economic losses and environmental degradation (FAO, 2022). For perennial tree crops — which require long-term investment and face rising input costs — this inefficiency is wasteful if not unsustainable.

Precision management can be implemented at two scales: (1) Block/Field Level and (2) Individual Tree Level. While block-level precision offers improvements, tree-level management unlocks transformative gains.Oil palm FFB yield data from a large scale to medium scale plantation were gathered and analyzed. The relationships between yield (t/ha and kg/palm) and field size (ha) were studied and it shows strong inverse linear relationships between yield (t/ha and kg/palm) and field size (ha).

Subsequently, palm-to-palm yield variation were studied, and the results show there is a significant variation observed in palm-to-palm yield within the same block.Tree-level precision nutrient management is no longer a theoretical ideal but an operational imperative. By leveraging advances in sensing, robotics, and data analytics, growers can eliminate the "one-size-fits-all" approach that has plagued tree crop systems for decades.

SACP: Sustainable Agronomy & Crop Protection

SACP01

Sustainable Management in Oil Palm Plantation Field to Consider Greenhouse Gas Emission and Nutrient Dynamics

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Abstract

Rapid increase in oil palm cultivation has caused environmental pollution and greenhouse gas (GHG) emissions, such as carbon dioxide (CO_2) and nitrous oxide (N_2O), due to land use change and fertilization. Burning empty fruit bunches (EFB) as fuel in oil palm mill has negative impacts on air quality and boilers because of high content of potassium (K) and other components. Thus, alternative technologies on effective EFB utilization are necessary for carbon-neutral systems. Washed EFB can be processed as fuel pellets for biomass power generation and EFB washing water (ww) can be used as liquid fertilizer. EFB ww has high soluble C and K levels which can enhance palm growth and soil microbial activity. Effect of EFB ww on soil microbial activity and CO_2 production, emissions and palm yield were evaluated for sustainable field management. Prior to the long-term field experiment, we preliminary investigated the effect of EFB applied in oil palm field on the soil microbial activity and GHGs emissions to evaluate the sustainability of the practice in the field. Soil surface of an oil palm plantation was covered by 1 m^3 acrylic chambers in May (dry season) or November (rainy season) and EFB was placed inside the chamber and gas emission was monitored almost monthly. Surface soil inside the chamber, weeded circle near palm, path and frond heap were sampled to measure soil properties such as soil ATP by luciferin reaction and incubation experiment for GHGs production by gas chromatographs. Soil ATP was largest in frond heap almost equal to EFB, then decreased in weeded circle > path, indicating EFB increased soil biological activities by adding organic matter. Decrease tendencies in GHGs were observed after EFB applied for 4 months due to slower decomposition of EFB after initial increase, which was also detected in the incubation experiment. For assessment of sustainable management of EFB in oil palm plantation, long-term monitoring is essential.

Keywords: Soil management; Greenhouse gases; Empty fruit bunches; Land use change, Microorganisms

SACP02

Delignification and Structural Alteration of Oil Palm Fibers by *Pycnoporus sanguineus* in POME-Enriched Fermentation

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Abstract

Investigations into the biodegradation of natural fibers often prioritize physico-chemical analyses, with comparatively less attention paid to the influence of microbial activity on physical attributes such as fiber structure. This study examines the efficacy of *Pycnoporus sanguineus* in delignifying oil palm empty fruit bunch fibers via solid-state fermentation, employing varied ratios of POME sludge. Beyond tensile testing, physico-chemical and X-ray microtomography analyses were performed on the oil palm fibers to assess the degradation process's effectiveness. The optimal fiber-to-fungi ratio was determined by identifying the highest lignin loss and total phenolic content values. Subsequent investigations focused on acquiring fermentation kinetics data for both laccase and manganese peroxidase. Micro-CT results indicated that the delignification process compromised the structure of both pre-treated and untreated fibers, evidenced by volume reduction post-degradation. This observation aligns with the reduction in lignin content and the increase in phenolic content, as well as the lower stress–strain curves observed in pre-treated fibers compared to their untreated counterparts. The findings suggest that *P. sanguineus* preferentially degrades the outer layer of the fiber before penetrating the cellular structure of the inner fiber.

Keywords: Oil palm fiber; biodegradation; solid-state fermentation; microtomography

SACP04

Investigating Pestalotiopsis Leaf Fall Disease in Rubber Plantations: Insights from Malaysian Rubber Board Research

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Abstract

Pestalotiopsis Leaf Fall Disease (PLFD) has emerged as a significant threat to rubber cultivation, causing severe defoliation and impacting latex yield in plantations. First reported in Johor, Malaysia, in 2017, this disease has since spread, affecting all commercially recommended rubber clones and impacting over 73,000 hectares across various states. This study aimed to monitor the occurrence and spread of PLFD and identify the causal pathogens associated with the leaf fall disease in Malaysian rubber plantations. Field surveys were conducted to assess disease incidence through visual observation of symptoms on mature leaves and canopy assessment. Pathogen identification involved sample collection followed by morphological and microscopic examinations. Molecular analyses, utilizing DNA extraction, PCR amplification of the fungal ITS gene with ITS1 and ITS4 primers, and subsequent sequencing, were performed. Sequences were compared against the NCBI BLAST database, and phylogenetic analyses were conducted to determine relationships. Results confirmed the widespread prevalence of PLFD, exacerbated by environmental conditions such as high humidity, particularly during the peak tapping and rainy seasons. Molecular and morphological characterizations revealed a complex of fungal pathogens associated with the disease. Key genera identified include *Colletotrichum*, *Neopestalotiopsis*, *Lasiodiplodia*, *Phyllosticta*, and *Letendraea*, with high sequence similarity to known pathogenic species such as *Colletotrichum conoides*, *Neopestalotiopsis surinamensis*, and *Lasiodiplodia theobromae*. These findings underscore the severity of PLFD as a multigenic disease and provide critical information on the identity of the pathogen complex. This comprehensive understanding is essential for the development of effective and sustainable disease management strategies to mitigate the impact of PLFD and safeguard the productivity of rubber plantations.

Keywords: Pestalotiopsis Leaf Fall Disease (PLFD), rubber cultivation, defoliation, fungal pathogens.

SACP05

Harnessing Nature for Sustainable Management of Rubber Diseases

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Abstract

The rubber tree (*Hevea brasiliensis*) is vulnerable to infections by various fungal pathogens. White Root Disease (WRD) and Leaf Fall Disease (LFD) are two categories of the most serious diseases of rubber trees that threaten the production of natural rubber. Current control measures rely on the use of chemical fungicides which are environmentally damaging and uneconomical. It also causes unintended effects to human and animal health, as well as the growing threat of fungicide-resistant pathogens. Hence, sustainable and eco-friendly alternatives are urgently needed. Nature offers sustainable solutions to combat plant pathogens. Microbial biocontrol agents such as *Trichoderma* spp. and *Enterobacter* sp., a silicate solubilizing bacterium co-inoculated with an AMF (*Glomus mosseae*) and silicon (Si) were shown to suppress WRD pathogen, *Rigidoporus microporus* and improve plant growth of rubber seedlings under greenhouse conditions. Botanical extracts containing antifungal compounds demonstrated strong antifungal properties against WRD pathogen in laboratory bioassays. Elicitor proteins were demonstrated to enhance host plant resistance. Functional analysis on the first cerato-platanin protein isolated from *R. microporus*, RmCP revealed that RmCP triggered cell-death lesions, reactive-oxygen bursts, callose deposition, and induction of four defense-related genes (*HbCDPK5*, *HbMAPK*, *HbPR3* and *HbEDS1*) in both host (*H. brasiliensis*) and non-host (*Nicotiana tabacum*) tissues. RNA interference (RNAi) is a natural cellular process used by most eukaryotes for sequence-specific suppression of gene expression. The development of this technology offers a novel approach to control rubber pathogens by targeting specific genes, thereby reducing their virulence in a natural way. These bio-based strategies not only provide effective disease control but also minimize environmental impact, making them a sustainable choice for managing rubber diseases.

Keywords: natural solutions, induced resistance, crop protection, spray-induced gene silencing (SIGS), antagonists

SACP06

Addressing Rubber Narrow Genetic Base Through Introduction Of Amazonian Germplasm Collection

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Abstract

The global natural rubber industry, primarily reliant on *Hevea brasiliensis*, faces significant challenges including diminishing genetic diversity, susceptibility to diseases, and the impacts of climate change. Genetic improvement of the rubber tree through conventional breeding approaches depends mainly on availability of diverse germplasm and the amount of genetic variability present in the population. There is a large collection of wild germplasm resulting from the 1995 expedition. Since the establishment of the germplasm, none of the genotypes has been incorporated into a breeding programme due to lack of evaluation and characterization of the genotypes which hinder their rapid and effective utilisation. Hence, identification and selection of a collection of genotypes with reduced sample size and enhanced characters are considered as a prerequisite for ultimate utilisation of the germplasm. Fifty genotypes planted will be evaluated in terms of morphological characterization and productivity potential to ascertain the degree of associations between the different traits with the test tap yield and their inter-correlations.

Keywords: *Hevea brasiliensis*; natural rubber; genetic base; yield

SACP09

Comparative Evaluation of a New Evapotranspiration Sensor and Conventional Measurement Methods

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Abstract

Accurate measurement of evapotranspiration (ET) is crucial for understanding crop water use, improving irrigation efficiency, and climate-soil-plant modelling. Conventional methods like lysimetry, Bowen ratio, eddy covariance, and empirical crop coefficient approaches provide valuable insights but are limited by indirect estimation, labour-intensive procedures, high costs, and complex instrumentation. To address these challenges, LI-COR introduced the LI-710 Evapotranspiration Sensor, a novel instrument for direct, real-time ET measurements. This study compares the LI-710 to conventional methods under field conditions. The LI-710 is a compact, integrated system that directly quantifies ET flux without extensive infrastructure or post-processing. It shows strong agreement with reference methods while reducing operational complexity. Its portability, ease of deployment, low maintenance, and high temporal resolution make it a practical alternative to traditional approaches.

Keywords: evapotranspiration, LI-710 sensor, direct measurement, irrigation efficiency, precision agriculture

SACP10

Promoting Cocoa Planting Through Integrating Low Carbon Emission Cocoa with Oil Palm

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Abstract

Malaysia's cocoa industry has experienced a significant decline, with cultivated areas shrinking from 414,236 hectares in 1989 to just 6,203 hectares in 2024. This contraction—primarily driven by pest outbreaks and a national economic shift toward oil palm—presents both critical challenges and emerging opportunities. In light of the European Union Deforestation Regulation (EUDR) and increasing global sustainability demands, there is renewed interest in revitalizing cocoa cultivation through low-carbon emission (LCE) plantation models that integrate cocoa with oil palm. To explore this potential, the Malaysian Cocoa Board (MCB) has commissioned a feasibility study to evaluate the agronomic, economic, and environmental viability of cocoa-oil palm integration under a low-carbon framework. The study is being conducted by an independent consultant using a multi-method approach, combining stakeholder consultations, technical assessments, financial modelling, carbon analysis, and benchmarking of existing integration practices. Primary data sources include industry surveys, focus group discussions, and site-based technical evaluations of current cocoa intercropping systems. Preliminary findings indicate that integrating cocoa with oil palm—via row intercropping or mixed cropping—can reduce farm-level greenhouse gas emissions and enhance net carbon sequestration by up to twofold compared to oil palm monocropping systems. Economically, the integrated model strengthens resilience against palm oil price volatility while leveraging Malaysia's strategic position as a regional cocoa processing hub. Over a 25-year cycle, cocoa-oil palm integration is projected to yield at least 20% higher profits than conventional oil palm monoculture, with further upside depending on planting models and site conditions. However, the study also identifies key implementation challenges, including nutrient competition, high establishment costs, labour requirements, and policy gaps. The financial feasibility of the model can be significantly improved through strengthened value chain integration, targeted incentives, and coordinated institutional support to facilitate broader adoption of sustainable cocoa-oil palm intercropping in Malaysia.

Keywords: Cocoa, Oil Palm, Low-Carbon Emission Plantation, Crop Integration, Economic Diversification

SACP11

Enhancing Accuracy of Flux Measurements in Oil Palm Ecosystems through Combined Automated and Manual Methods

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Abstract

Rapid expansion of agricultural area to meet increasing consumer demand has led to large-scale conversion of tropical peat swamp forest to agricultural plantation, resulting in substantial carbon dioxide (CO_2) emissions. However, the accuracy of reported emission remains highly uncertain due to variability in sampling designs and site-specific factors being poorly quantified on peat soils. These uncertainties propagate into global estimates and are exacerbated by a limited understanding of how fluxes are controlled. Here, we present 6 months of automated chamber data, recording 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 was 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 integrated spatially, 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 emission over six years, corrected for sampling bias ranged from 36 – 53 Mg CO_2 ha^{-1} yr^{-1}. Water table depth and temperature (air and soil) were positively correlated with CO_2 emission though there were notable exceptions within the microforms. Our results emphasize the importance of both accounting the time of day when estimating a mean daily flux from single timepoint sampling and accommodating area weighting when integrating to spatial estimates.

Keywords: soil flux, tropical peat, oil palm plantation, bias measurement, EGM4 chamber measurement, automated chamber.

SACP14

The RDCI Pathway of Induced Systemic Resistance Technology for Banana Blood Disease Management

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Abstract

The Malaysian banana industry was severely impacted by the arrival of blood disease, which was caused by the *Rolstania syzygii subsp. celebesensis*. All the cultivated banana varieties in Malaysia were affected by this disease. Various approaches including chemical and biological controls were tested but none of them were successful in controlling this disease. One of the techniques that was not fully explored was the enhancement of plant resistance against diseases which is known as Induced Systemic Resistance (ISR). The aims of this study were to develop an induced systemic resistance (ISR) technique to control blood disease of bananas. ISR technology was developed by bio-prospection and manipulation of ISR inducing PGPR. When the ISR banana seedlings were challenged with pathogens, three treatments had recorded 100% and another two 75% of disease suppression, where all the control (non-ISR) plants died. All these five treatments when further tested in the hotspot showed improved vegetative growth, yield and disease resistance. The best performing ISR treatments on the hotspot were selected for establishment of a demonstration plot, in which previously the bananas grown in the plot were severely infected by blood disease. The demo plot experiment revealed that no blood infection recorded and demonstrated better vegetative growth and yield increase. Further, this technology was up-scaled (1 ha each) in seven commercial farms for Berangan and Abu varieties with zero infection of blood disease recorded.

Keywords: blood disease, banana bacterial wilt, *Rolstania syzygii subsp. celebesensis*, Plant Growth Promoting Rhizobacteria (PGPR), ISR seedlings

SACP15

Soil Microbial Diversity under Oil Palm Agroforestry

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Abstract

Agroforestry can potentially revive soil biodiversity and other ecosystem services in monoculture oil palm plantations. However, previous studies focused primarily on soil macrofauna response towards agroforestry integration, leaving microbial diversity underexplored. This study investigates the response of microbial diversity and community composition across two land-use systems: agroforestry and monoculture with the aim of assessing the effects of agroforestry implementation on microbial diversity using amplicon sequencing. Native perennial species (*Nauclea subdita*) interplanted between two oil palms along with monoculture plots were established in completely randomised design (CRD) with five replications each. Composite soil samples for physico-chemical and 16S rRNA analysis were collected at two depths (0-15 cm and 15-30 cm) from five sampling points within each plot, including a riparian site within the plantation as a reference of a less-disturbed environment. Riparian (0-15 cm) had the highest Shannon diversity (raw $p<0.05$) from monoculture and the lower soil layer of agroforestry and riparian. Agroforestry (0-15 cm) showed intermediate diversity, suggesting potential transition towards riparian-like diversity, although no significant difference among treatments remain after FDR correction ($p>0.05$). In contrast, beta analysis shows a more distinct pattern in agroforestry microbial community structure to riparian rather than intermediate trend observed in alpha diversity. However, significant difference was not observed in pairwise comparison after FDR correction. No clear class-level taxonomic composition shift was observed through relative abundance and LEfSe analysis between treatments. While agroforestry showed a promising shifting pattern in microbial richness, understanding its compositional recovery towards a more ecologically balanced functional communities require longer-term observations.

Keywords: Soil microbiome; agroforestry systems; plant-microbe interactions; sustainable land use, 16S rRNA sequencing

SACP16

Prevalence of Citrus Bent Leaf Viroid in Citrus Growing Areas of Sargodha, Pakistan

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Abstract

Among the virus and virus-like diseases, citrus viroids are the emerging pathogens in citrus growing areas of Pakistan. Although losses due to citrus viroids are not quantifiable and have not been studied, their contribution to the decline of citrus orchards can be a threat for the country's citrus industry. Citrus bent leaf viroid (CBLVd) has already been reported in citrus growing areas of Punjab, Pakistan. Therefore, the study was carried out to monitor the CBLVd based on symptomology including backward leaf bent of leaves, bark cracking, yellowing and stunting with confirmation by RT-PCR assay using CBLVd specific primer. The interactions of CBLVd with varieties, areas and status of the orchards among 30 samples per tehsil were monitored for the first time in Pakistan. Maximum disease incidence based on severity index according to disease rating scale was recorded in tehsil Kot Momin ranged from 1.76-3.53% with severe symptoms of bark cracking, backward leaf bent and stunting. Minimum disease incidence was recorded in tehsil Bhera (0.57%). Maximum infection percentage was exhibited by declined citrus orchards (2.57%) at severity index 3 showing symptoms of backward leaf bent as compared to others. Based on varietal difference, maximum infection of CBLVd was recorded in Kinnow (1.97%) at severity index 4 showing stunting as compared to bark cracking and backward leaf bent. Molecular detection through RT-PCR confirmed the CBLVd on agarose gel. It is concluded that viroids contribute to the decline of orchards. Therefore, extensive surveys are required to investigate other citrus viroids and their role in citrus decline.

Keywords: citrus; viroid; CBLVd; RT-PCR; Sargodha

SACP17

Influence of Phenological Stages and Weather on Durian Pests and Diseases in Malaysia

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Abstract

Durian, often called the "king of fruits," holds significant economic importance for Malaysia, particularly with the country's recent 2024 initiation of fresh durian exports to China. However, pest infestations and diseases pose serious threats to this revenue stream. Effective management of pests and diseases is essential, which requires identifying the factors influencing their occurrence in durian crops. This study examines the impact of durian's phenological stages and weather conditions on pest infestations and disease incidences. Conducted over a year (January to December 2023), the research utilized sticky traps, light traps, and visual inspections to monitor pest and disease activity across the plantation. A total of ten pests and four diseases were identified. Among the pests, Psyllid, *M. magniplaga*, and *Amrasca* showed significant interactions with durian phenological stages, while *Platypus* and *Tiraleurodes* had a strong positive correlation with rainfall. Disease pathogens such as *P. palmivora* and *P. durionis* also correlated with increased rainfall, while *R. solani* showed a positive correlation with higher temperatures and humidity. These findings underscore the influence of both plant growth stages and weather on pest and disease occurrence. The study's insights offer practical value to durian farmers, enabling targeted pest and disease management strategies aligned with growth stages and seasonal weather patterns. By implementing informed control measures, farmers can mitigate the risks associated with pest and disease pressures, thereby enhancing productivity and economic outcomes for Malaysia's durian industry.

Keywords: Durian, Pest Infestation, Disease of Durian, Weather, Phenological Stages

SACP18

Biogas Slurry's Role in Regulating Soil Enzyme Activities for Sustainable Agronomy

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Abstract

Biogas slurry, a by-product of anaerobic digestion, plays a significant role in sustainable agronomy and crop protection. It serves as a nutrient-rich organic fertilizer, supplying essential elements to crops, thereby reducing reliance on chemical fertilizers and mitigating soil degradation. Additionally, its organic components can enhance soil structure, promote microbial activity, and suppress certain soil-borne pathogens, contributing to improved crop health and yield sustainability. This study investigated the effects of different biogas slurry concentrations (0%, 25%, 50%, 75%, 100%) on soil enzyme activities in winter wheat fields across three soil layers (0-10 cm, 10-20 cm, 20-40 cm). The enzymes measured included sucrase, urease, catalase, and acid phosphatase, which are critical for nutrient cycling and soil fertility. Results showed varying responses of enzyme activities to biogas slurry concentrations across soil layers. Specifically, soil sucrase activity was highest in the 75% biogas slurry treatment (BS75) in all tested soil layers. For urease and acid phosphatase, the 50% biogas slurry treatment (BS50) yielded the highest activities across the soil profiles. In contrast, catalase activity was maximized under the 100% biogas slurry treatment (BS100) in all layers. Additionally, the vertical distribution of soil enzyme activities in the 0-40 cm layer exhibited an obvious regularity: enzyme activities increased with soil depth, and the enzyme activities in the 20-40 cm layer were the highest. These findings demonstrate that optimal BS concentrations can effectively regulate soil enzyme functions, contributing to improved soil health and sustainable crop production.

Keywords: Biogas Slurry; Enzymatic Activity; Sustainable Agronomy; Winter Wheat; Soil Layer

SACP20

Changes in Soil P and pH Modifies Soil Microbial Communities of Oil Palm Cultivated Landscapes

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Abstract

The development of oil palm plantations on deforested and degraded landscapes ignites controversies of ecological destruction due to the modification of soil biogeochemical processes through intensive management inputs. This study aims to examine the influence of oil palm cultivation on soil properties (such as soil texture, soil macro and micro nutrients, Total CEC), which affects soil microbial communities as an indicator of long term soil health. In the TRAILS study established in Sabah, a pilot trial of cultivated landscapes comprises 3.5 year old monoculture oil palm strips, and 3.5 year old oil palm AFS that is uniformly intercropped with *Nauclea subdita*; and a non-cultivated reforested riparian zone with unfelled unproductive 25 year old oil palm trees. A significant increase of soil total and available phosphorus was found in the cultivated landscape, compared to the riparian zone. Both cultivated lands had significantly lower soil pH than the reforested riparian zone. Other soil parameters did not differ significantly between all land use. The coupling of 16s rRNA Illumina sequencing and exploratory data analysis revealed a close relationship between soil pH and P with rare prokaryotic Phyla (< 1% relative abundance) such as *Planctomycetota, Methylomirabilota, Eremiobacterota, Myxococcota_A, Thermoproteota, Bacteroidota* and *Desulfobacterota_G.* These taxa were found to be significantly higher in the reforested riparian zone. After 3.5 years of replanting, this study provides vital baselines to elucidate the extent of AFS as a transitional medium to recover degraded monoculture systems into ecologically more productive and resilient cultivated landscapes.

Keywords: agroforestry; oil palm; soil microbes; 16s rRNA Illumina Sequencing

SACP21

Biosynthesis of eco-friendly rhamnolipids from waste cooking oil by *Pseudomonas aeruginosa* RW9 with insights into stability and toxicity performance.

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Abstract

Rhamnolipids (RLs) are biodegradable and environmentally friendly biosurfactants produced by *Pseudomonas aeruginosa*. Their potential application in green technologies makes them attractive alternatives to synthetic surfactants. This study explores the use of waste cooking oil (WCO), a readily available and low-cost resource, as a carbon source for RLs production. Sodium nitrate ($NaNO_3$) and yeast extract (YE) were selected as nitrogen sources. To optimize the production process, Response Surface Methodology (RSM) with Central Composite Design (CCD) was applied, investigating the effects of WCO (10–30 g/L), $NaNO_3$ (0–0.05 M), and YE (0–2 g/L) concentrations. The optimal conditions at 25.95 g/L WCO, 0.04 M $NaNO_3$, and 0.41 g/L YE, resulted in 7.93 g/L RLs and 4.92 g/L biomass yields. The RLs produced were further assessed for stability under various environmental conditions, including temperature (4–121 °C), pH (4–12), and salinity (5–25% w/v), using emulsification capacity as the indicator. Emulsification remained stable (>50%) up to 100 °C, within pH 4–8, and up to 25% (w/v) salinity, indicating strong environmental resilience.Toxicity tests showed minimal phytotoxic effects, with germination index (GI) values exceeding 90% for choy sum, cabbage, and mung bean seeds at 1 g/L RLs. The RLs also demonstrated low aquatic toxicity, with zebrafish (*Danio rerio*) embryos showing LC_{50} value of 67.42 µg/mL. These findings highlight the potential of WCO-derived RLs for sustainable, low-toxicity applications across multiple industries.

Keywords: Rhamnolipids; *Pseudomonas aeruginosa*; Waste cooking oil; Response surface methodology; Stability; Toxicity.

SACP22

Phenolic Compounds as Antagonists in Altering Mycelial Morphology and Enzyme Activity of *G. boninense*

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Abstract

The primary annual crop that underpins the nation's finances, particularly in Malaysia and Indonesia, is oil palm. With 85% of the world's production, palm oil is among the most in demand oils, surpassing the production of soy, rapeseed, and other crops. The white-rot fungus *Ganoderma boninense*, which destroys the lignin of the oil palm and causes significant threat, Basal Stem Rot (BSR) disease, prevents this significant output, though. Gallic acid, thymol, propolis, and carvacrol are phenolic compounds that have been studied for their action with emphasis on morphological changes, inhibitive effects and significantly abnormal changes on the mycelial structures especially GA exerted inhibition by 94%. In addition, High-Resolution Transmission Microscopy and Scanning Electron Microscopy showed GA and THY treatment severely damaged the mycelium and significantly reduced the radial growth. Of all the phenolic compounds examined, GA was the most effective in impairing the integrity of the fungal cell membrane and suppressing the production of hydrolytic and ligninolytic enzymes. The concentration of phenolic compounds was inversely proportional to the growth and enzyme secretion as it recorded 0.33 U/ml of cellulase, 0.33 U/ml of amylase, 0.21 U/ml of xylanase, 0.48U/ml of laccase, 0.22 U/ml of lignin peroxidase and 0.38 U/ml of manganese peroxidase respectively, indicating their potential as effective inhibitors of *G. boninense*. When *G. boninense* growth was inhibited, significant differences ($p<0.05$) were found. This study emphasises the potency of phenolic chemicals in the fight against *Ganoderma*. Additionally, the results imply that naturally occurring phenolic compounds can be effective substitutes for synthetic fungicides and chemical pesticides, providing a way to stop BSR in oil palm from forming and lessen the difficulties associated with dealing with this problem.

Keywords: Antagonistic impact, basal stem rot disease, ergosterol, *Ganoderma boninense*, gallic acid, hydrolytic enzymes, lignolytic enzymes, mycelial morphology, oil palm, phenolic compounds

SACP23

Potential of Lemongrass Essential Oil - Based Nanotechnology in Fungal Phytopathogen Control

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Abstract

Fungal pathogens pose a major threat to global agriculture, leading to substantial economic losses and compromising food security. Synthetic fungicides remain the primary strategy for controlling the pathogens. However, concerns over the adverse effects on the environment and non-target organisms have driven growing interest in the development of safer and more sustainable fungicide formulations, developed through approaches such as nanotechnology-based interventions. In this context, the development of nanoemulsions as carriers for bioactive compounds and as nanodelivery systems for agrochemicals has garnered considerable attention due to their enhanced efficacy and potential applicability in agricultural systems. Natural products such as plant essential oils are well-documented for their diverse antimicrobial properties, including inhibitory effect against various fungal pathogens. This study explored the potential of a lemongrass essential oil-loaded nanoemulsion to inhibit the growth of several economically important fungal phytopathogens. A stable nanoemulsion formulation characterized by optical transparency, low viscosity, and favourable physicochemical properties, including particle size (45.9 ± 1.72 nm), zeta potential (-12.955 ± 0.06 mV), pH (5.93 ± 0.08) and polydispersity index (0.244 ± 0.02), was developed. Microscopic examination of fungal cells treated with the lemongrass essential oil revealed morphological abnormalities, including irregular shapes and severely sunken surfaces. The developed nanoemulsion demonstrated dose-dependent antifungal activity against several fungal phytopathogens, which include *Phytophthora palmivora, Pestalotiopsis sp., Fusarium oxysporum* and *Pyricularia oryzae* at concentrations ranging from 0.00625 µl/ml to 0.05 µl/ml. Its efficacy highlights its potential as a viable nanofungicide candidate for crop protection applications.

Keywords: Antifungal; Essential oil; Fungal pathogen; Fungicide; Nanoemulsion

MAD: Mechanization, Automation & Digitalization

MAD01

Palm Detection using Image Processing for Automated Rat Bait Applicator

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Abstract

The oil palm industry remains a vital contributor to Malaysia's economy, significantly supporting the nation's GDP. As global demand for palm oil continues to rise, enhancing plantation productivity and reducing crop losses have become increasingly important. One persistent challenge in oil palm estates is rodent infestation, which negatively affects yield and operational efficiency. Conventional manual application of rodenticides is labour- intensive, prone to inconsistency, and often leads to unnecessary bait wastage. This study presents an AI-enabled solution for the Automated Rat Bait Applicator (ARBA) which leverages palm tree detection through image processing and deep learning techniques to optimise bait application. The system comprises an AI processing unit, camera, infrared proximity sensor, and microcontroller, working in tandem to identify the base of palm trees and trigger precise bait dispensing in real time. A custom image dataset of palm tree bases was used to train the detection model. Field testing demonstrated effective real-time inference and accurate activation of the baiting mechanism under varying lighting and environmental conditions. The infrared sensor further enhanced precision by confirming proximity before dispensing. Results indicate the system's potential to significantly improve pest control efficacy and support the broader goal of full mechanisation in the oil palm sector. This work underscores SD Guthrie's commitment to advancing smart plantation technologies that drive sustainability, reduce labour dependency, and enhance overall operational excellence.

Keywords: Palm Oil Plantation; Palm tree detection; Rodent Control, Image processing, Artificial Intelligence.

MAD02

Effect of Liquid Foliar Biofertilizer Application on Glutinous Rice Leaves

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Abstract

An application of fertiliser to crops can be categorised into root and foliar fertilisation, depending on how crops absorb nutrients. Considering the advantages of foliar fertilization, this study applied an organic liquid foliar biofertilizer (LFB) made up from golden apple snail (GAS). Five different dilutions of LFB; control (C), 200 (T1), 400 (T2), 600 (T3), 800(T4) and 1000 (T5) mL integrated with chemical fertilizer were applied on glutinous rice plants from early growth to maturity stage (basal, active, panicle and heading). The effects of these LFB concentrations were assessed based on the occurrence and severity of leaf burn symptoms in on glutinous rice plants. Besides that, to evaluate the plant health, SPAD values were measured using a SPAD meter and short-wave near-infrared (SWNIR) spectroscopy. Minimal leaf burn symptoms were observed at the lowest concentrations, with leaf damage recorded at 5 % for T2 and 3 % for T1. Meanwhile, moderate dilutions showed a noticeable increase in damage, with T3 and T4 resulting in approximately 10% and 30% leaf burn, respectively. In contrast, undiluted LFB (T5) caused severe leaf burn, affected up to 50% of the leaf area. Therefore, T2 and T3 were identified as the most effective dilutions of LFB for application on glutinous rice leaves. In conclusion, LFB is found to be a good supplement for plants because it can provide nutrients instantly.

Keywords**:** Biofertilizer, Leaf Burn, SPAD Values, NIR spectroscopy, Machine Learning

MAD03

True MATAG Coconut Seedlings Variety Identification Using RGB Images and YOLO-11

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Abstract

Accurate identification of MATAG coconut seedlings is vital for ensuring high-quality crop production and avoiding seedling misclassification. This study investigates the application of deep learning techniques to detect true MATAG coconut seedlings using RGB images. By leveraging a dataset of seedling images captured in indoor conditions, the approach focuses on analyzing stem color variations as a distinguishing characteristic. A YOLO-11 was trained to classify seedlings based on these RGB color features, enabling the automated differentiation of MATAG seedlings from other coconut varieties. The model achieved promising classification accuracy, demonstrating that RGB imaging combined with deep learning offers a practical and scalable solution for seedling verification. The results indicate that this method significantly reduces reliance on manual inspection, which can be subjective and error-prone, especially when seedlings are visually similar. Furthermore, the research highlights the feasibility of integrating this model into a mobile application, allowing farmers, nursery managers, and agriculture practitioners to verify seedlings directly in the field using smartphone cameras. This study could significantly streamline the seed selection process, improve plantation management strategies, and enhance overall productivity by verifying that only authenticated MATAG seedlings are cultivated. This research provides a basis for future studies aimed at incorporating additional image-based characteristics, such as texture and leaf morphology, to further improve classification accuracy. Ultimately, the integration of deep learning methodologies with accessible imaging technologies holds considerable potential for advancing seedling identification practices, offering a more precise and efficient solution for the coconut agriculture sector.

Keywords: MATAG; coconut; variety; identification, RGB, YOLO

MAD04

Spatial Risk Zoning for Oil Palm Replanting Using UAV LiDAR and TWI: A case study in Tradewinds Plantation Berhad, Malaysia

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Abstract

A successful oil palm replanting requires accurate spatial data and a comprehensive understanding of site specific topographical and hydrological elements to reduce operational risks while promoting long term sustainability. This study demonstrates the application of UAV based LiDAR technology and high-resolution spatial analysis to enhance replanting methodologies in the Sisek Estate, Johor, Malaysia. By employing detailed digital terrain models (DTM), the analysis of slope, aspect, and Topographic Wetness Index (TWI) enabled the finding of key areas vulnerable to erosion and waterlogging within the 663 hectares designated for replanting. The application of slope and aspect analysis facilitated precise zoning for planting strategies: areas with moderate slopes <12°were suitable for direct planting, while steeper regions >18° required comprehensive terracing and targeted erosion management. The analysis of flow accumulation and TWI facilitated the identification of primary drainage channels, highlighting intersections with areas exhibiting a high risk of flooding. The integration of drainage and risk mapping facilitated estate management in prioritizing maintenance and infrastructure improvements within the most vulnerable blocks. The method uses some ground observations, but it only uses data from one time, which makes it hard to see how things change from season to season. Future initiatives must incorporate multi temporal datasets and continuous monitoring to optimize replanting methodologies. This approach demonstrates a practical, data driven framework designed to enhance the resilience and efficiency of oil palm replanting initiatives, with applicability extending to other estates facing similar topographical and hydrological challenges.

Keywords: Lidar; Replanting; Terrain; Topography Wetness Index (TWI),Slope

MAD05

Exploring Drone Technology for Efficient Rat Baiting in Oil Palm Plantations

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Abstract

Rats are a common and serious pest in oil palm plantations, with yield losses reaching up to 20%, or potentially higher without proper mitigation. To address this issue, chemical control using rodenticide bait is commonly applied. However, the bait is typically applied manually to each palm, risking the safety of chemical handlings and making the process labour-intensive—especially in large plantations where labour shortages and inaccessibility often hinder effective coverage. To improve the precision and efficiency of rat baiting operations, this study evaluated the use of drone technology as an alternative method of application. The study was carried out in the mature oil palm plantation of FGV Selancar, Pahang, with the objective of identifying the most effective and productive drone-based baiting technique. Four drone-based baiting methods were evaluated: application on (T1) 50% and (T2) 100% of palm trees, and on (T3) 50% and (T4) 100% of old frond stacking rows. Manual application was included as a positive control (T5), while an untreated plot served as a negative control (T6). Each treatment was applied to a 3-hectares plot and replicated three times to ensure result consistency and reliability. Results showed that only two methods T2 and T3 were effective in reducing fresh rat damage below the threshold level of 5%. Among all, T3 (drone application on 50% of frond stacking) achieved the highest productivity per working day. These findings highlight the potential of drone technology to replace manual labour in rat baiting, improving operational efficiency and ensuring more effective rodent control in oil palm plantations.

Keywords: Rodent control, Drone application, Baiting efficiency, Productivity, Labour-intensive

MAD06

Detection of Oil Palm Frond Number 17 using Aerial Imagery and Spiral Angle Modelling

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Abstract

Identifying Oil Palm Frond Number 17 (FN17) accurately is important for nutritive sampling in the field. This study presents a novel method that integrates aerial images with spiral angle modeling to detect FN17 by utilizing the plant's natural growth pattern. The Two-Dimensional Phyllotaxis Image Template (2DPIT) was developed to identify key fronds, specifically Frond Number 1 (FN1) and Frond Number 9 (FN9), which serve as references for locating FN17. By analyzing data collected from unmanned aerial vehicles (UAVs) and ground truth measurements, we examined how FN1 and FN9 varied in angles across different age groups of plantations. Our results indicated that FN1 exhibited the most significant angle changes, while FN9 remained vertical throughout the study. To explain these angle changes, we employed an exponential decay model *(θ(n) = A * e^(-kn)),* adjusting the parameters based on the age of the palm. We tested the model using intermediate fronds (FN2–FN8) and found it to be quite accurate, particularly for right-handed spirals, yielding a mean absolute error (MAE) of 3.02° and a root mean square error (RMSE) of 3.85°. The slightly larger errors observed in left-handed spirals may suggest imbalances in frond growth or issues related to UAV detection. This combined approach demonstrates the potential of utilizing aerial imagery and spiral modeling to accurately and non-destructively identify FN17, facilitating advancements in automation and broader applications within oil palm monitoring systems.

Keywords: Oil Palm Frond Detection, Oil Palm Management, Aerial Imaging, Crop Management

MAD07

Development of a Machine Vision System for Automatic Plant Health Levels Evaluation due to *Ganoderma boninense* Infection in an *In vitro* Setup

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Abstract

Basal stem rot (BSR) disease caused by *Ganoderma boninense*, continues to impact oil palm productivity, prompting the use of *in vitro* setups for early-stage infection analysis and system development. This project aimed to develop a system for assessing and monitoring *Ganoderma boninense* infection among oil palm plants in an *in vitro* setup. Ten varieties of oil palm plantlets were utilized for the entire ten-week experiment. Weekly manual inspection on plantlets was conducted for scoring evaluation into six severity levels; healthy (T0), early infection (T1), mild infection (T2), moderate infection (T3), high infection (T4) and severe infection (T5). Image acquisition was done weekly, followed by image processing steps: segmentation, RGB to HSV colour model conversion and HSV colour value extraction. Mean hue, saturation, value and area were treated as the input for classification models. Three variations of training-test ratios were applied; 70:30, 75:25 and 80:20. Results showed that Ensemble Boosted Trees consistently scored the highest accuracy with 75% for those three ratios. The F1-scores were between 0.63-1.00, with the highest value obtained from T3 (1.00). These findings revealed this imaging process could be beneficial in determining BSR infection level at early growth stages of oil palms.

Keywords: *ganoderma boninense*, HSV, automatic detection, machine learning.

BCP: Biobased Conversion Products, Bioenergy & Biochemicals

BCP01

Palm Fatty Acid Distillates (PFAD) as a Potentially Available Feedstock for the Production of Bio-Lubricant Oil by Using Nanohybrid Catalysts via Ketonization Reaction

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Abstract

Due to the depletion of fossil fuel caused by an increasing demand of the resources that also contributes towards climate change caused by carbon dioxide (CO_2) emission, there is an urgent need for an alternative way to replace the non-renewable sources. Therefore, bio lubricant that is made up from renewable bio-based feedstock has attained a great attraction to reduce the dependency on fossil fuel. Palm Fatty Acid Distillated (PFAD) consists of palmitic and oleic acids is suitable for producing paraffinic hydrocarbon products. Owing to its high oxygen constituents, ketonization reaction is commonly applied to convert PFAD to ketones, carbon dioxide (CO_2) and water. However, due to its complexity, an appropriate catalyst is required. This work aims to demonstrate an effective hybridization route for exploring novel efficient MOF-LDO hybrid catalyst prepared by hydrothermal reaction. The ketonization reaction was then performed via reflux system, and the catalytic performance of the resulting products was then evaluated in terms of their free fatty acid conversion (FFA). The catalytic activity was improved resulting from highly exposure of active sites and modification of acid-base sites. Of prime importance is that the formation of a more stable framework will enhance the selectivity and stability of the catalyst. The enhancement of the catalytic performance mainly results from the synergistic effect between MOF and LDO.

Keywords: PFAD; Bio-based Feedstock; Bio- Lubricant; Hybridization; Ketonization

BCP02

Valorisation of Palm Oil Mill Effluent Sludge Oil for Sophorolipids Production by *Starmerella bombicola* DSM 27465

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Abstract

Malaysia, a key palm oil producer, grapples with significant environmental challenges arising from the vast organic waste generated during palm oil production, particularly palm oil mill effluent (POME). The inability to mix POME sludge oil with primary crude palm oil creates an opportunity to fully utilise this material for valuable bio-based products, like sophorolipids (SLs) biosurfactant. The current research was aimed to optimise the production of SLs by *Starmerella bombicola* DSM 27465 using POME sludge oil as a substrate using one factor at a time (OFAT) analysis. Methodologically, different fermentation conditions were adjusted, including glucose concentration, POME sludge oil concentration, nitrogen source, nitrogen concentration and pH. The optimisation study was carried out in shake flask experiments, incubated at 25°C with agitation speed at 200 rpm. The results demonstrated that *S. bombicola* DSM 27465 successfully generated SLs by using POME sludge oil as a substrate. Moreover, the SLs produced from POME sludge oil exhibited a significant reduction in surface tension, as evidenced by the drop-collapse test.The future trajectory suggests POME sludge oil could substitute purified oil as a hydrophobic substrate for biosurfactant production, reducing costs and mitigating environmental impacts. This research highlights the potential for sustainable and cost-effective biosurfactant production within the palm oil industry, contributing to both economic and environmental sustainability.

Keywords: Biosurfactant, Sophorolipids, POME sludge oil, *Starmerella bombicola*, Optimisation

BCP03

Application of Constant Impeller Tip Speed for Scale-Up of Rhamnolipids Production in Bioreactor

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Abstract

Scaling up bioprocesses continues to be a major challenge in rhamnolipids (RLs) fermentation technology. Inadequate scale-up strategies can cause variations in microorganisms' performance and RLs synthesis, ultimately compromising process RLs yield and reproducibility. This study focuses on scaling up RLs production by *Pseudomonas aeruginosa* RS6 with biodiesel side stream glycerol from a 1.5 L to a 5 L bioreactor, using a constant impeller tip speed (V_{tip}) as the scale-up strategy. The study demonstrated improved gas-liquid mass transfer despite the increased production volume, as evidenced by the higher volumetric oxygen transfer coefficient (k_La) of 0.032 s^{-1} in the 5 L bioreactor compared to 0.025 s^{-1} in the 1.5 L system. This enhancement ensured adequate oxygen supply from the gaseous phase to the aqueous medium, directly increasing the oxygen transfer rate (OTR) from 98.8 mmol L^{-1} h^{-1} in the 1.5 L bioreactor to 127.35 mmol L^{-1} h^{-1} in the 5 L bioreactor. Moreover, the RLs concentration achieved in the 5 L bioreactor was significantly higher at 16.48 ± 0.02 g/L, compared to 11.32 ± 1.26 g/L in the 1.5 L bioreactor, demonstrating the effectiveness of the scale-up strategy in enhancing RLs yield. Biomass concentration in the 5 L bioreactor was 4.77 g/L ± 0.18, comparable to the 4.90 g/L ± 0.43 observed in the 1.5 L scale. The results reflect that the cell integrity of *P. aeruginosa* RS6 was not disrupted by the shear forces in the 5 L bioreactor, confirming that the shear environment was maintained within the optimum range across the fermentation scales to support cell viability and proliferation. However, the oxygen uptake rate (OUR) trend exhibited a different pattern, with OUR increasing in the 5 L bioreactor while decreasing in the 1.5 L system over 72 h of fermentation. This behavior can be attributed to the longer residence time of oxygen and the extended bubble path length in the larger working volume, which may prolong oxygen availability and sustain higher levels of cellular respiration even in the later stages of fermentation. The findings from this study contribute to the use of constant V_{tip} as a practical and reliable scale-up strategy, offering valuable guidance for future RLs production efforts towards industrial application.

Keywords: Rhamnolipids; Scale up; Fermentation; Bioreactor, Constant Impeller Tip Speed

BCP04

Cytotoxicity of Tongkat Ali Leaf Extract against MDA-MB-231 Breast Cancer Cells Highlights Need for Sustainable Plantation Practice

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Abstract

Eurycoma longifolia Jack (Tongkat Ali) is a well-known medicinal plant traditionally harvested from forests for its roots, while the leaves are often discarded. This practice limits the sustainable use of the plant and contributes to overharvesting of wild populations. This study investigated the anticancer potential of hot water infusions prepared from *E. longifolia* leaves, aiming to promote whole-plant utilisation and justify plantation cultivation. Leaves were processed into unfermented and fermented batches, followed by freeze-drying or microwave drying. The unfermented freeze-dried (UF-FD) extract showed the strongest cytotoxicity toward MDA-MB-231 cells, with an IC_{50} of 69.3 ± 17.2 µg/mL. Apoptosis induction was confirmed by DNA fragmentation, cell cycle arrest, and Annexin V/PI staining. Treated MDA-MB-231 cells exhibited S-phase arrest beginning at 24 hours, peaking at 48 hours. Apoptotic cell populations (early and late stages) increased significantly to 57.4% at 48 hours before declining at 72 hours. Mechanistically, the extract activated caspase-3 and cytochrome c, indicating apoptosis via the intrinsic mitochondrial pathway. Caspase-8 was not significantly expressed, supporting the dominance of the intrinsic mechanism. Expression of pro-apoptotic proteins p53 and Bax increased at 24 and 48 hours, while anti-apoptotic Bcl-2 was progressively downregulated over time. These findings support the potential development of *E. longifolia* leaf-based anticancer products. Promoting leaf use alongside root harvest could enable more sustainable cultivation through plantations, reduce pressure on forest resources, and diversify product development opportunities from this valuable medicinal species.

Keywords:*Eurycoma longifolia*; Hot water infusion; Cytotoxicity; Apoptosis; MDA-MB-231

POSTER

POST01

Autonomous System for Collecting Loose Fruits in Oil Palm

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Abstract

The Autonomous Loose Fruit Robot (ALFRo) was developed to automate loose fruit collection in the oil palm plantations, addressing the critical challenge of labour shortages in the palm oil industry. The core objective of the project is to develop an autonomous robot capable of navigating and collecting loose fruit directly from the ground without the human intervention. Currently, development is focused on the AI detection and collection system prior to advancing to other components such as the palm-to-palm navigation, circling of individual palms, and overall autonomous mobility. This phased approach is adopted for three key reasons. First, fruit detection serves as the robot's core function. Second, accurate detection results are essential for supporting and guiding navigation. Third, early validation of the AI system helps to reduce technical risks before progressing to subsequent stages of development. ALFRo is equipped with an AI-powered vision system for real-time detection of scattered loose fruits around the palm circle, a gripper-based collection mechanism with current limiting sensors for secure and responsive gripping, and a multi-degree-of-freedom articulated robotic arm capable of adapting to the uneven terrain and collecting loose fruits with precision and efficiency. The AI system, based on YOLOv8 trained on loose fruit characteristics such as colour, shape, and texture, supports accurate and efficient detection and collection. The single gripper design mimics hand-picking, allowing for selective and clean loose fruit collection. Field trials have shown that ALFRo can achieve up to 90% detection accuracy, with a current productivity rate of 40 kg per day.

Keywords: Oil Palm; Loose Fruit Collection; Labour Shortages; AI System

POST02

Effects of Different Green Cote Fertilizer Coating Formulations and Compound Fertilizer Application Rates on Grain Corn Performance

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Abstract

Conventional urea and blended fertilizers lose 30–50 % of applied N to leaching, volatilization, and denitrification, constraining maize (Zea mays) yield and environmental sustainability. Biodegradable polymer-coated controlled-release fertilizers (CRFs) such as Green Cote offer synchronized nutrient delivery, enhancing nitrogen-use efficiency (NUE) while minimizing microplastic accumulation. A field trial (Oct 2024–May 2025) at MARDI Pulau Pinang evaluated four Green Cote coating levels (0, 5, 10, 15 %) and three compound N–P–K rates (265, 397.5, 530 kg ha^{-1}) in a 4 × 3 factorial RCBD (three replicates), plus two commercial controls. Cob weight and grain weight per plot responded significantly to treatments ($P < 0.05$/$P < 0.01$), peaking at 10 % coating + 265 kg ha^{-1} (6.8 kg and 4.9 kg $plot^{-1}$, +161 % and +188 % vs. poorest). Kernel-row number, cob diameter, and cob length were unaffected. A strong cob–grain correlation ($r = 0.86$) confirmed cob biomass as the primary yield driver. Intermediate coating thickness combined with moderate N rates optimizes dry-matter accumulation, improving NUE and reducing losses.

Keywords: Green Cote • controlled-release fertilizer • grain yield • polymer coating • nitrogen efficiency

POST03

RNAi Technology: The Next Wave of Green Agriculture-Exploring Its Potential, Addressing Challenges, and Bridging the Translational Gap

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Abstract

Global crop production faces immense pressure to sustainably feed a growing population while addressing environmental issues and reducing crop losses due to pests and pathogens, which exceed 20–40% annually. Chemical method is commonly used to manage the negative impact caused by these pests and pathogens, thus driving demand for sustainable alternatives to chemical pesticides. RNA interference (RNAi) is considered a groundbreaking tool for sustainable farming, providing species-specific control of pests and pathogens without the environmental damage associated with chemical pesticides. Despite two decades of research, only a few RNAi-based products have reached the market, highlighting ongoing challenges in delivery, stability, and regulation. This review thoroughly explores dsRNA delivery methods, ranging from established techniques such as host-induced gene silencing (HIGS) and spray-induced gene silencing (SIGS) to emerging strategies that integrate technological breakthroughs from recent years. We identify technical obstacles (e.g., dsRNA degradation and off-target effects), economic concerns, and policy gaps, while proposing practical solutions including nanoparticle encapsulation and engineered microbial vectors. While RNAi's sequence-specific gene silencing aligns with precision agriculture, it faces significant field deployment challenges. Importantly, we align RNAi's potential with six United Nations Sustainable Development Goals, demonstrating how optimized RNAi systems could reduce pesticide usage and enhance climate resilience. By integrating interdisciplinary insights, this review provides a roadmap for transforming RNAi from a promising concept into a practical and scalable agricultural application.

Keywords: RNA interference, Plant protection, Host-pathogen interaction, Sustainable Development Goals (SDGs), Biotechnology

POST04

Smart Farming for Cocoa: Monitoring Leaf Health with Remote Sensing

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Abstract

Remote sensing technologies are transforming precision agriculture by enabling efficient, non-destructive monitoring of crop health. This study explores the use of spectrometer and drone-based multispectral imaging systems to assess leaf nutrient status in cocoa (Theobroma cacao), a crop of economic significance in Malaysia. A total of 1,500 leaf samples were collected from a cocoa plantation in Jengka, Pahang, and analyzed for nitrogen (N), phosphorus (P), and potassium (K) content. Spectral reflectance data were acquired using the Ocean Optics HR4000 spectrometer and the DJI Micasense RedEdge multispectral camera. Five vegetation indices, NDVI, GNDVI, LCI, NDRE, and OSAVI were calculated and compared across platforms using band-matching techniques. SPAD chlorophyll measurements and laboratory nutrient analysis were used to validate the indices. Results showed that LCI and NDRE derived from the spectrometer had the strongest correlation with SPAD values ($r = 0.724$), indicating their reliability in estimating leaf chlorophyll and nitrogen content. Drone-derived indices exhibited lower consistency, likely due to broader spectral bandwidths and environmental variability. Statistical analysis revealed that LCI had the lowest error metrics and highest cross-platform agreement. These findings highlight the importance of spectral resolution and calibration in remote sensing applications and support the use of high-resolution spectrometry for accurate nutrient monitoring in cocoa cultivation. This research contributes to the development of smart farming strategies by identifying robust spectral indicators for leaf health, paving the way for more efficient fertilization practices and improved crop management in tropical agriculture.

Keywords: Remote sensing, cocoa leaf health, vegetation indices, spectral reflectance, precision agriculture

POST05

The use of model plant (*Arabidopsis thaliana*) as a research tool for oil palm height improvement

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Abstract

Oil palm is the most important commodity crop in Malaysia and produces the highest oil yield among oilseed crops. However, its long-life cycle and tall stature present challenges for the development of breeding programmes to meet current and future needs. The potential to improve crop traits particularly height by altering the gibberellin (GA) pathway is now well established. Therefore, regulating oil palm height by manipulating gibberellin biosynthesis and signalling genes can be significant and will enhance our understanding of height regulation mechanisms in oil palm. With the availability of the oil palm genome data, more genes and promoters of interest have been isolated, including those related to the GA pathway. However, in planta characterisation of gene function is often limited by time and cost constraints. As such, heterologous systems like *Arabidopsis thaliana* have been adopted to observe and evaluate gene functions. *Arabidopsis thaliana* was chosen as a model plant in this study due to its small size, short generation time, and high transformation efficiency. This research focused on the GA biosynthesis, catabolism, and signalling pathways by altering the expression of the EgGA20ox, EgGA2ox, and DELLA genes, respectively. Functional characterisation of these genes in the Arabidopsis system suggested their possible roles in height regulation. Overall, *Arabidopsis thaliana* provides a convenient and efficient in vivo system for functional gene analysis, offering a cost effective and time saving approach.

Keywords: Oil palm, height, Arabidopsis, gibberellin, functional study

POST06

Soil Microbial Communities Profiling Indicates No Significant Difference among Genetically Modified (GM) and Non-GM Oil Palms

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Abstract

Soil microorganisms are essential to ecosystem function, playing key roles in nutrient cycling, organic matter decomposition, and promoting plant health. The 16S rRNA metagenomic approach can be used to profile the microbial communities and is widely used to assess the potential impacts of genetically modified (GM) plants on soil microbiota. This study aimed to evaluate the effects of GM oil palms, engineered for high oleic acid and biodegradable plastic traits on soil microbial communities. A total of 36 soil samples were collected from six GM palms and three non-GM control palms planted inside a biosafety screenhouse, as well as three control palms outside the screenhouse. Soil total DNA was extracted and subjected to 16S rRNA gene amplicon sequencing targeting the V3–V4 region. Sequence data yielded 2,280,919 reads, clustered into 65,788 operational taxonomic units (OTUs) at 97% similarity using de novo UPARSE clustering. Alpha-diversity analysis revealed a high species richness across most samples, with dominant phyla including *Proteobacteria*, *Acidobacteria* and *Actinobacteria*. Genus-level analysis identified *Acidothermus*, *Acidibacter*, and *Candidatus Solibacter* as the top contributors in the soil samples. Alpha-diversity analysis indicated that almost similar microbial community profiles between GM and non-GM palms were observed. Besides, Beta-diversity analysis showed that no major changes in the microbial community structure among the soil samples from GM and non-GM palms. These findings suggest that the GM oil palms planted in the screenhouse does not significantly alter the rhizosphere microbial community, as similar microbial profile was also observed among the soil samples from non-GM control palms.

Keywords: Metagenomics, Oil palm, Genetically modified, Contained field trial

POST07

Molecular Insights into CCCVd Infection in Oil Palm: Defence and Stress-Related Gene Expression

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Abstract

The oil palm (*Elaeis guineensis Jacq.*), a vital agricultural crop in Malaysia, faces emerging threats from the *Coconut cadang-cadang viroid* (CCCVd), associated with orange spotting (OS) disorder, leading to significant yield losses. This study investigated the molecular host-pathogen interaction by characterizing defence and stress-related genes in CCCVd-infected oil palm seedlings using real-time PCR (qPCR) and Next-Generation Sequencing (NGS). Total of eleven genes: four stress-related (EgGRP, EgC3P2, EgHSP70, EgPRP), four defence-related (EgDFS, EgMT, EgDHN, EgBBI), and three reference genes were analysed. qPCR optimization confirmed primer specificity, with validation through DNA sequencing showing 87–100% similarity to target genes. Standard curve analysis demonstrated high efficiency (100.4%, $R^2 = 0.908$). Gene expression varied significantly over 3–12 months post-inoculation (mpi), with stress-related genes (e.g., EgGRP, EgPRP) showing early upregulation (3–6 mpi), while defence-related genes (e.g., EgMT, EgDFS) exhibited dynamic responses. Conventional PCR detected most genes but was less sensitive than qPCR, failing to detect EgGRP and EgDFS at 12 mpi. NGS revealed 75 differentially expressed genes in diseased seedlings, including heat shock protein and chitinase-like genes, with 33 upregulated and two downregulated. This study provides the first evidence of gene expression changes in CCCVd-infected oil palm, highlighting key stress and defence pathways. The findings underscore qPCR's superiority for sensitive gene detection and offer insights for developing CCCVd management strategies. Future research should explore functional roles of identified genes to enhance oil palm resistance.

Keywords: *Coconut cadang-cadang viroid*; Real-time PCR; Next-Generation Sequencing; Stress gene; Defence gene

POST08

Biomass Estimation in Rubber Plantation Using UAV LiDAR Data

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Abstract

Rubber plantations play a crucial role in enhancing soil quality by reducing erosion and promoting nutrient recycling through leaf litterfall. Beyond these environmental benefits, they also serve as carbon sinks, whether cultivated as monocultures or in agroforestry systems. Studies in Malaysia and across Asia have reported a wide range of aboveground carbon accumulation rates in rubber plantations—approximately 1.4 to 6.7 Mg C ha^{-1} yr^{-1}, contingent on plantation age and local conditions. However, research focusing on *total* carbon accumulation within these stands remains sparse. Accurate estimation of Total Rubber Biomass (TRB) is essential for determining the Total Rubber Carbon Stock (TRCS). Existing remote sensing approaches frequently fall short in terms of speed, reliability, and precision for operational-scale monitoring. The advent of UAV-mounted LiDAR offers great potential by capturing high-resolution three-dimensional structural data, thereby improving biomass estimation accuracy and potentially reducing costs. For instance, Rozlan (2023) demonstrated a strong correlation ($R^2 \approx 0.97$) between LiDAR-derived canopy height and aboveground biomass in Malaysian rubber trees. Furthermore, Nik Effendi et al. (2021) highlighted the value of integrating LiDAR with hyperspectral data for tropical biomass estimation. While several studies have employed satellite data and airborne LiDAR to estimate aboveground biomass in tropical forests—including rubber ecosystems (e.g., Phua et al., 2017) there has been limited application of UAV-based LiDAR for assessing TRB and TRCS in Malaysian rubber plantations. A critical factor in UAV LiDAR biomass estimation is the quality of the Digital Terrain Model (DTM), which directly impacts canopy height and volume derivations necessary for modelling. This study aims to (1) showcase the application of UAV LiDAR-derived 3D data to estimate TRB and TRCS, and (2) evaluate how different DTM generation methods and parameters influence model accuracy. The intended outcome is the development of a robust statistical model capable of generating precise spatial maps of TRB and TRCS—supporting improved carbon stock monitoring and sustainable management in rubber plantations.

POST09

Assessment of Nanofertilizer Effect on MR 297 Rice Grain Quality

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Abstract

The demand for sustainable agriculture has driven innovations in precision nutrient delivery systems such as nanofertilizers that offer enhanced nutrient use efficiency and improved crop quality. In Malaysia, the MR 297 rice variety is extensively cultivated; however, its nutrient management practices can be further optimized. The objective of this study was to investigate the effects of developed nanofertilizer formulation on the grain quality of MR 297 rice under controlled field conditions. Field trials with a plot size of 4m x 4m were conducted at Tg. Karang MARDI Station, employing a randomized complete block design (RCBD) with four treatments: (T1) No fertilizer as negative control, (T2) subsidized fertilizer as basic nutrient, (T3) combination of subsidized fertilizer with commercially available Foliar Fertilizer (VitaGrow) and (T4) combination of subsidized fertilizer with developed Nanofertilizer formulation. The T3 and T4 foliar applications were sprayed at the panicle initiation stage and heading stage. Matured paddy plants were harvested, and the rice grain quality was analysed based on milling recovery and amylose content. The standard equation for amylose percentage was determined as $Y=0.01261x-0.00165$, $R^2=0.9969$. Results showed that the highest milling recovery was T4 at 69.05%, and the lowest was T1 at 66.9 %. A similar trend was found for the amylose percentage in MR 297 rice grain when T4 demonstrated the highest amylose content at 25.4% compared to T1 with the lowest value of 21.5%. These findings suggest that the developed Nanofertilizer formulation improves the grain quality of MR 297 rice while supporting sustainable agricultural practices.

Keywords: Nanofertilizer, MR 297, milling degree, amylose content, rice

POST10

Prediction of MD2 Pineapple Fruit Weight Based on Correlation with Fruit and Plant Parameters

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Abstract

MD2 pineapple export gaining remarkable popularity in recent years presents a significant opportunity for Malaysia. Malaysia export value for fresh fruits has gained an increment of 63% from 2011 until 2021 highlighting strong growth potential in the global market. FGV Chuping Agro Valley (FCAV) has aimed to seize this potential by enhancing field management to meet export standards. This research aimed to predict MD2 pineapple fruit weight based on fruit and plant parameters to estimate the production volume according to export fruit grade prior harvesting for export orders. Fruit sampling was conducted at Chuping, Perlis where several samples of four commercial grades (A, B, C and D) were randomly collected. Four commercial grades have been distributed based on fruit weight (Grade A: 1.4-1.99kg, Grade B: 1.0-1.39kg, Grade C: 0.8-0.99kg and Grade D: ≤0.79kg). Data were recorded for plant parameters (such as plant height, leaf length and leaf width) and fruit parameters (such as fruit diameter, length and eyes' number). Correlation between these parameters and fruit weight was analysed by polynomial regression. The strongest correlation with fruit weight were fruit diameter (R^2 = 0.922), followed by fruit length (R^2 = 0.8761). The best-performing regression model was using fruit diameter as $y = 0.0294x^2 - 0.3528x + 1.3799$, where y = fruit weight and x = fruit diameter. This result justifies the usage of fruit parameters for the selection of export quality pineapples, especially fruit weight. Ultimately, this approach supports more efficient yield estimation and strategic marketing, contributing to the sustained growth of Malaysia's MD2 pineapple export industry.

Keywords: MD2 pineapple, correlation, fresh plant biomass, yield prediction

POST11

Detection of *Pestalotiopsis* leaf fall disease using Hyperspectral Imaging and Support Vector Machine

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Abstract

Pestalotiopsis leaf fall disease poses a significant threat to rubber tree (*Hevea brasiliensis*) plantations, contributing to reduced latex yields and economic losses in rubber-producing regions. Accurate detection of this disease is critical for effective management and mitigation. This study aims to detect *Pestalotiopsis sp.* infection in rubber tree leaves using hyperspectral imaging and machine learning techniques. Hyperspectral data were collected from rubber leaves classified as T0 (healthy, no visible symptoms) and T1 (infected, with visible symptoms), sampled from the bottom canopy layer. Spectral signatures were extracted, and spectral pre-processing along with statistical analysis was conducted. The results revealed that the near-infrared (NIR) region exhibited the highest spectral separability between T0 and T1. The Normalized Difference Vegetation Index (NDVI) and Photochemical Reflectance Index (PRI) were calculated and used as input features for developing a detection model using Support Vector Machine (SVM). The model demonstrated good performance, with an F1-score of 87%, accuracy of 86%, precision of 92.4%, and recall of 82.3%. These findings indicate that hyperspectral imaging, combined with SVM, offers a reliable method for detecting *Pestalotiopsis* infection in rubber trees.

Keywords: *pestalotiopsis*, spectral signature, hyperspectral imaging, machine learning.

POST12

Utilizing Silicate Rock Minerals to Boost Growth and Resilience in *Hevea brasiliensis*: Toward a Sustainable Soil Management Approach

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Abstract

Hevea brasiliensis, the primary source of natural rubber, plays a crucial role in Malaysia's agro-based economy. However, its productivity is often constrained by declining soil fertility, especially in highly weathered, acidic soils typical of tropical regions. This review explores the potential of silicate rock minerals—such as basalt dust —as sustainable soil amendments to improve the growth performance and stress resilience of *Hevea brasiliensis*. Silicate rocks are rich in essential macro- and micronutrients including potassium (K), calcium (Ca), magnesium (Mg), and silicon (Si), which are slowly released through weathering processes. These minerals have been shown to enhance soil structure, buffer pH, increase nutrient availability, and stimulate physiological functions such as photosynthesis and root development. Notably, silicon uptake has been associated with improved disease resistance and drought tolerance in plants. This paper reviews the current scientific understanding of silicate rock applications in agriculture, focusing on their chemical properties, dissolution dynamics, and interaction with tropical soils. Specific attention is given to field studies, greenhouse trials, and soil amendment experiments in Malaysia and comparable environments. By synthesizing evidence from agronomic and soil science perspectives, this review highlights the viability of silicate rocks as an environmentally friendly alternative to conventional fertilizers. Their use supports the transition toward regenerative agriculture in plantations, offering a dual benefit of improving productivity while restoring long-term soil health.

Keywords: *Hevea brasiliensis*, silicate rocks, basalt dust, soil fertility, sustainable agriculture

POST13

RGB Analysis Identification of MATAG Coconut Seedlings Using Deep Learning

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Abstract

Accurately identifying MATAG coconut seedlings is crucial for ensuring high-quality crop yields and preventing errors in seedling classification. This research investigates the application of deep learning techniques to recognize genuine MATAG coconut seedlings from RGB images. By examining stem color differences with a trained deep learning model, it aims to develop a dependable and automated identification system. The study assesses the performance of the YOLOv11 algorithm in detecting and distinguishing MATAG Gold, MATAG Green, MYD, and MRD coconut seedlings based on stem coloration. Using an RGB image dataset, the model differentiates MATAG seedlings from other varieties by leveraging color-based visual features. Findings demonstrate the effectiveness of integrating RGB imaging and deep learning for precise seedling classification. The unique contribution of this work lies in its focus on early-stage detection of authentic MATAG seedlings, helping farmers identify and avoid counterfeit varieties supplied by other sources. This work lays the groundwork for a mobile application that can assist farmers and agricultural professionals in verifying MATAG seedlings in real time, thereby enhancing seed selection accuracy and plantation management efficiency.

Keywords: MATAG; coconut; variety; identification, RGB

POST14

Characterization of the Pathogen Causing Dieback and Defoliation in *Durio zibethinus* in Durian Plantations

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Abstract

Defoliation and dieback are critical symptoms that pose serious threats to durian productivity and quality as well as tree longevity. These symptoms have been associated with *Phytophthora palmivora* infection in durians. In addition, recent findings from Thailand and other Southeast Asian countries have raised concerns about additional causal agents, particularly species of *Fusarium*, which have been implicated in durians with dieback. In 2024, a survey conducted in the Batu Pahat and Kulai area in the state of Johor, Malaysia, showed similar symptoms, with the affected trees exhibiting wilting, defoliation, and progressing to dieback and death of the tree within a short period of time. Soil and root samples from the affected trees were collected and proceeded to the isolation process of the potential causal fungal pathogen. Root (surface sterilized and excised area) and soil (0.1mL of serially diluted soil suspension) were inoculated on Potato Dextrose Agar (PDA) media. Pure fungal cultures were identified based on morphological characteristics and molecular identification using PCR with the ITS primer pair (ITS1/ITS4). The PCR products were sequenced to confirm the identity of the fungal pathogen. The isolates obtained from the root and soil samples were grouped into two different morphological characteristics: (a) white-purple cottony mycelium and dark-purple undersurface and (b) white cottony mycelium and white undersurface, which were later confirmed by sequencing as *Fusarium oxysporum* and *Fusarium solani*, respectively. *F.solani* has been previously linked to durian dieback in Thailand, where its pathogenicity was confirmed and associated with ambrosia beetle transmission. Although Fusarium dieback in durian is less documented in Malaysia, emerging cases suggest its growing relevance. This study illustrates the importance of vigilant disease monitoring and integrated management strategies in durian cultivation.

Keywords: Durian disease, Dieback, Defoliation, Fusarium

POST15

Cellulose-Starch Based Composite Materials: Extraction from Agriculture Biomass

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Abstract

Cellulose is the most abundant natural polymer on earth and has attracted attention for use in a wide range of applications due to its low cost, widespread availability, sustainable production practices, renewability, and biocompatibility. In Malaysia, cellulose can be obtained from the agricultural biomass such as oil palm mill and rice milling process and considered as untapped biomass resources and produce in the large quantity. Cellulose extraction has caused several drawbacks due to toxic chemical used such as chlorine which hazardous to human and environment. In this study, cellulose was extracted from rice husk (RH) using commercial chlorine (control) and nitric acid hydrolysis for lignocellulosic biomass dissolution. The cellulose quality through analysis of lignocellulosic content, thermogravimetric, functional group, X-ray diffraction, and surface morphology were assessed. HNO_3 treatment showed an increment (2.01–fold) in the cellulose content and some enhancement in the crystallinity of cellulose (up to 40.8%) and comparable with chlorine extraction method. Starch-cellulose rice husk composites were prepared after surface modification of cellulose with phosphoric acid mediated hydrolysis and followed by reinforcing process with starch polymer. The results of surface hydrophobicity and mechanical strength were found to be a function of an improvement of hydrophobicity (16 and 5.2%) and tensile strength (3.6 and 23.2 MPa), for both starch-rice husk chlorine and starch-rice husk nitric acid, respectively, as compared to neat starch. Both starch-rice husk composites show an increment in crystallinity to 41.9% and 54.5% indicates the effectiveness of the reinforcement in improving the quality of the film. This study suggested the potential cellulose extraction from rice husk and its applications as composites packaging materials.

Keywords: Cellulose, rice husk, nitric acid, starch, packaging

POST16

Development of Sustainable Formulation of Alginate-MMT for Encapsulation of Biological Control Agents *Trichoderma harzianum*

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Abstract

Encapsulation is the process of entrapping an active ingredient to shield it from adverse environmental conditions. Encapsulation of biological control agents (BCAs) enables the creation of a microenvironment where the viability of the cells can be maintained for storage, controlled release, and easy delivery. An encapsulation extrusion technique was used to prepare the Trichoderma harzianum beads. Based on the physical characterisation, a formulation with 2% (w/v) alginate, 1% (w/v) montmorillonite clay, and 5% (w/v) starch was able to produce T. harzianum beads. This formulation produced almost perfectly shaped beads with 0.041±0.006 sphericity factor. It also offered a good swelling ability (62.11%) and less shrinkage (48.48%) during the drying process. Chemical characterisation through Fourier transform infrared spectroscope (FTIR) showed the interaction between the functional groups of alginate, MMT, and starch in the alginate-MMT-starch beads. Scanning electron microscopy (SEM) revealed a homogeneous distribution of the MMT and starch particles throughout the alginate linkage. Thus, T. harzianum was successfully encapsulated in the alginate-MMT-starch beads. Storage analysis of the encapsulated T. harzianum showed that low temperature (5°C) was a significantly ($P<0.05$) better storage condition compared to at room temperature (30 °C). At low temperature, T. harzianum beads could maintain a viability of 6.59 log cfu/g for up to 7 months.

Keywords: Biological control, Alginate-MMT, encapsulation formulation, *Trichoderma harzianum*

POST17

Latex Timber Clone Plantation (*Havea brasiliensis*) In Malaysia

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Abstract

At present, national plantation sector is now looking for alternative species for forest plantation. Rubber tree has become a popular substitute for light tropical hardwood and as one of major timber for the production of furniture and indoor components. Since the mid 1980's rubber wood has become an important source of timber for furniture production. Malaysia has pioneered the utilization of rubber wood as an alternative new source of raw material for timbers from the natural forest. However the supply of rubber wood from conventional rubber plantations and replanting schemes is declining rapidly as much of rubber tree areas have been replaced with oil palm. In year 1980s, the country had about 2.0 million ha of rubber plantations and declined to 1.2 million ha in 2007. Therefore, the government through the Ministry of Plantation Industries and Commodities (MPIC) has lunched new forest plantation program with a target to establish 375,000 ha of commercial forest plantation including rubber species within the next 15 years cycle. Previously, rubber was categorized as an agricultural plantation and now rubber plantation were included as forest plantation.

Keywords: Forest plantation, rubber plantation, *Havea brasiliensis,ltc*

POST18

Fusarium Induced Disease In Durian: Pathogenic Potential of Species Isolated from Durian

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Abstract

Durian (*Durio zibethinus*), a high-value tropical fruit widely cultivated in Southeast Asia, is increasingly threatened by fungal pathogens, particularly *Fusarium* species, which cause significant losses through root rot, dieback, and stem rot. This study aimed to isolate and characterize the pathogenic potential of *Fusarium spp*. associated with diseased durian tissues and assess their virulence through both morphological and molecular methods, alongside pathogenicity trials. Samples from infected roots, stems, and surrounding soil were collected from symptomatic durian trees. Among the isolates, *Fusarium oxysporum* and *Fusarium solani* were consistently identified as dominant species. Molecular identification using ITS primers confirmed species-level identification. Pathogenicity was assessed through greenhouse trials using a randomized complete block design (RCBD). Durian seedlings inoculated with *Fusarium* isolates exhibited key disease symptoms, including wilting, leaf chlorosis, root browning, and necrosis. Notably, *F. solani* isolates, especially those obtained from stem tissues, caused the most severe symptoms, with several seedlings experiencing complete mortality. In contrast, *F. oxysporum* induced moderate disease symptoms. Koch's postulates were fully satisfied, confirming the causal relationship between the pathogens and observed symptoms. The re-isolation of identical *Fusarium* strains from infected seedlings provided robust evidence of pathogenicity. This study highlights the aggressive nature of *F. solani*, indicating its primary role in durian decline. The differential virulence among isolates suggests a need for targeted disease management strategies. These findings are critical for developing effective control measures and breeding programs aimed at enhancing durian resistance against *Fusarium*-induced diseases.

Keywords: Durian disease, Dieback, *Fusarium*

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