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MEKONG SUSTAINABLE RICE

Message from the Project Leader

Dr Jaquie Mitchell

Happy New Year!! As we begin 2025, it's clear that the end of last year saw a surge in research activity and reporting. I want to thank everyone for their outstanding contributions in 2024, and I'm excited to see that momentum continue and grow even stronger as we head towards our project Final Review meeting in October 2025.

In this newsletter we highlight a story of successful partnership between Hiệp Lợi Cooperative and SunRice, showcasing how trust, innovation, and sustainable practices have transformed traditional rice farming for this community providing access into a globally competitive value chain;

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the development of a drying protocol to improve efficiency and maintain rice quality; the results of the Summer-Autumn 2024 multi-environment trials of short-grain rice varieties; the efforts of boosting gender inclusion in high-quality, low-emission rice farming production in the Mekong Delta in support of and linking to Vietnam’s 1-million-hectare sustainable rice initiative; and highlights of a workshop where stakeholders analysed the Mekong Delta value chain to identify key interventions to enhance EU exports.

It is also with great pleasure that we hear directly from a few of our wonderful PhD candidates on some of their research experiences, reflections and project contributions. Each student has been required to conduct a “deep dive” into their research topics. In doing so not only has their efforts resulted in valuable additions to our project, but they have gained a taste of research for development (R4D) activities, challenges and opportunities either on their research topic or the impact it has had on being involved with a R4D project as part of their PhD journey.

In addition to PhD students we have had a number of Undergraduate and Masters coursework students from UQ, CTU and AGU conduct their research projects as part of the project and again this provides invaluable training and opportunities for all.

This year our focus will be on wrapping up, reporting and providing feedback to stakeholders, I am excited to see the results of our efforts of the last 3 years come together. Your positive contributions have been essential in ensuring our collective efforts align with the project's goals and deliverables, ultimately leading to improved livelihoods for smallholder farmers within the high-quality export market value chain. Keep up the great work in 2025 and beyond!!!

A Story of Successful Partnership: Hiệp Lợi Cooperative and SunRice

SunRice Group

Hiệp Lợi Cooperative, a forward-thinking cooperative in Kiên Giang province, has been an integral part of the ACIAR project since its inception in the 2022-2023 Winter-Spring crop. With the guidance of CTU through training sessions on SRP practices and alternate wetting and drying techniques, and the support of SunRice's field technicians in Vietnam, the cooperative's members have significantly enhanced their skills to thrive in modern rice value chains.

As trust between the cooperative and SunRice has grown with each passing crop, Hiệp Lợi has entered into five supply contracts for fresh rice DS1: Winter-Spring 2022-2023, Summer-Autumn 2023, Winter-Spring 2023-2024, Summer-Autumn 2024, and Winter-Spring 2024-2025. The contracted cultivation area has steadily increased, reaching 37, 38.5, 120.5, 162, and 175 hectares, respectively, all guided by SRP standards.

Over the course of four completed crops, from Winter-Spring 2022-2023 to Summer-Autumn 2024, the cooperative has supplied SunRice with over 3,000 tons of fresh rice DS1, consistently passing MRL tests for the European market. Demonstrating unwavering confidence, the cooperative has agreed to increase the number of pesticide residues tested from 16 to 24 active ingredients, while also allowing SunRice to conduct additional residue tests on any suspected pesticide used in the cooperative's spraying processes, ensuring strict adherence to EU export standards. Remarkably, all 3,000 tons of DS1 fresh rice supplied by the cooperative from Winter-Spring 2022-2023 to Summer-Autumn 2024 have met these stringent requirements.

Photo
Rice production fields of Hiep Loi Cooperative guided by SRP standards during the 2024 Summer-Autumn crop.

Photo
Harvesting and loading rice onto boats produced according to SRP and MRL standards by Hiep Loi Cooperative for transport to the SunRice mill during the 2024 Summer-Autumn crop.

Building on these successes, the cooperative is deeply committed to its enduring partnership with SunRice. Together, they aim to forge a sustainable rice value chain, with Hiệp Lợi playing a pivotal role as a dedicated rice supplier for SunRice in Vietnam. This collaboration exemplifies how trust, innovation, and shared goals can transform traditional agricultural systems into sustainable and globally competitive value chains.

Photo
Mr. Do, Director of the Cooperative Hiệp Lợi, sits reviewing the rice weighing book, excited about the significant increase in rice yield in the 2024 Summer-Autumn crop.

Development of Drying Protocol for COE Dryer to Improve Efficiency and Maintain Rice Quality

An Giang University

The drying system at the Centre of Excellence (COE) simulates an industrial drying system to better understand the impact of drying on a large scale and potentially improve the efficiency of the drying process. Research data shows that the drying speed of DT8 and DS1 can be increased without negatively affecting the quality of rice (head rice yield).

This study established three different drying protocols including:

- Simulated mill drying protocol + air (A): Dry paddy for 15 minutes by blowing air at less than 45°C and rest for 45 minutes at ambient temperature and air blow.
- Simulated mill drying protocol (B): Dry paddy for 15 minutes by blowing air at less than 45°C and rest for 45 minutes at ambient temperature (standard).
- Simulated mill drying protocol + high drying temp + air (C): Dry paddy with blowing air less than 45°C at all the time.

The findings presented in Figure 1 illustrate the variation in moisture reduction among the different drying methods, resulting in different drying times. All samples showed relatively similar initial moisture content and ended up at the target moisture level of 14.5%.

Simulated mill drying protocol + air (A): The integration of airflow into the drying procedure demonstrated significant improvements in drying efficiency. The enhanced airflow effectively facilitated moisture removal, thereby reducing the likelihood of regaining moisture.

Simulated mill drying protocol (B): This standard method exhibited an extended drying time, particularly when the rice was rested for 45 minutes without additional airflow. This condition not only prolonged the drying process but also heightened the risk of regaining moisture in the rice.

Simulated mill drying protocol + high drying temp + air (C): The final method, characterised by continuous drying at elevated temperatures coupled with airflow, resulted in significantly faster drying times. This approach successfully minimised the moisture content of the rice more rapidly than the alternative methods.

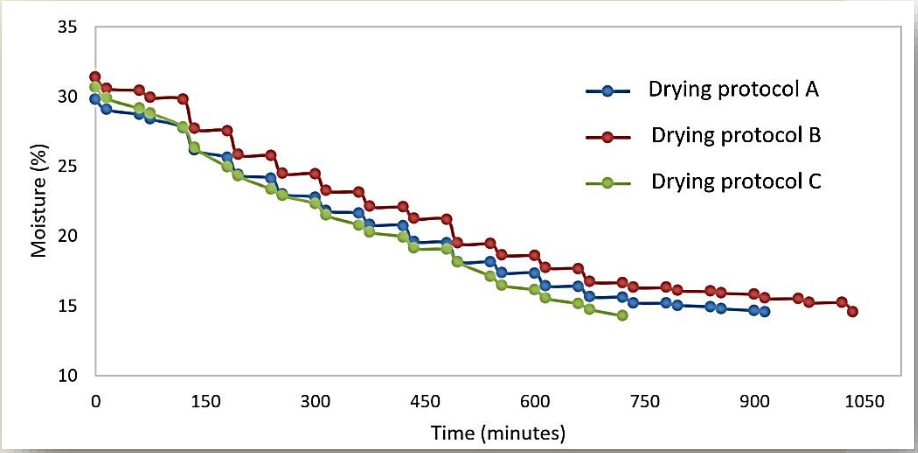


Figure
Reduction in moisture content under different drying protocols.

Photo
Paddy loaded onto a tray for evaluation of head rice yield in the PaddyVision® instrument.

These results underscore the critical role of airflow and temperature management in optimising rice drying efficiency while mitigating the risks associated with moisture reabsorption.

Head rice yield was evaluated using the PaddyVision. here was no significant difference in head rice yield between the standard simulated drying protocol (B) and the simulated drying + air protocol (A), with both achieving between 62-63 % head rice yield. This result reflects a significant improvement in the performance of the recirculating drying system while maintaining high rice quality. Protocol (C) reduced drying time requirement by 30% but also reduced head rice yield to 58%. These results highlight the effectiveness of incorporating airflow into the drying process, demonstrating that it can be achieved without compromising head rice yield e.g. protocols B and A. Further analysis and economic cost/benefit is required to determine whether protocol c would be more appropriate.

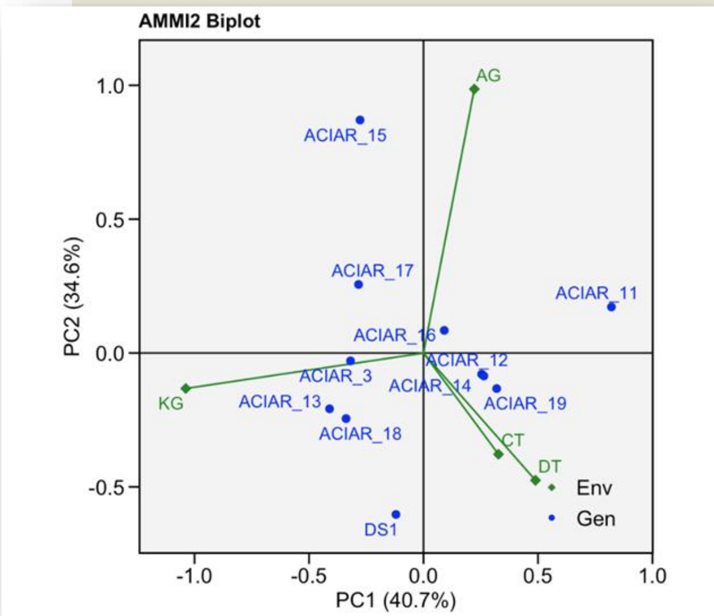
In this experiment, the introduction of air flow proved to be useful in facilitating moisture removal from rice. This innovation effectively addresses the shortcomings of conventional methods, which typically only allow moisture to evaporate without removing moisture from the drying environment. The improvements significantly reduced the risk of moisture reabsorption, an important factor that can prolong drying times. Furthermore, the method effectively mitigated the adverse effects of high humidity conditions, such as those encountered during the rainy season. By reducing drying times while maintaining rice quality, these advances contribute positively to the overall operational efficiency of rice post-harvest production.

Multi-Environment Trials of Short-Grain Rice Varieties at Four Locations in the Mekong Delta during the Summer-Autumn 2024 crop season

Cuu Long Delta Rice Research Institute

In the Summer-Autumn 2024 crop season, a comprehensive experiment was conducted to evaluate 10 advanced short-grain rice lines alongside the check variety DS1 across four representative rice-growing locations in the Mekong Delta: Can Tho, Dong Thap, Kien Giang, and An Giang. This study assessed these rice lines' agronomic, grain yield, and quality performance adaptability and stability under varying environmental conditions.

Photo
(a) A rice trial going to the ripening stage in the MET testing field at An Giang Province. (b) A short grain promising rice line in the MET's field. (c) Rice and seeds of promising short-grain line.



Figure

The AMMI2 Biplot diagram of 11 lines/varieties at four experimental locations in the Summer-Autumn 2024 crop season.

*Note: DS1: Check variety; AG: An Giang, CT: Can Tho, DT: Dong Thap, KG: Kien Giang. Photo: CLRRI Team (August, 2024).

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Generally, the climatic conditions during the growing season were favourable for rice cultivation across the four testing locations. However, late-season heavy rains complicated the harvest process, particularly in Can Tho and Kien Giang, while prolonged heat associated with the El Nino phenomenon adversely affected grain quality and chalkiness levels.

Notably, all tested rice lines exhibited robust resistance to pests and diseases, demonstrating a high level of protection against brown planthopper, blast, and bacterial leaf blight. Agronomic characteristics such as growth duration, plant height, panicle number/m^2, filled grain number/panicle, unfilled grain rate, and 1000-grain weight were assessed. Results indicated that the evaluated lines generally matured faster than the DS1 variety, with ACIAR_13, ACIAR_16, ACIAR_17, and ACIAR_18 achieving a growth duration of approximately 106 to 107 days.

Yield analysis revealed that Kien Giang provided the highest average yield of 5.73 tons/ha, with ACIAR_17 and ACIAR_18 yielding 7.02 and 6.96 tons/ha, respectively. In contrast, Dong Thap recorded the lowest average yield, encapsulating the impact of environmental variability on productivity. The stability and adaptability analysis revealed lines ACIAR_12, ACIAR_16, ACIAR_17, and ACIAR_18 were among those with broad adaptability and stability across the testing sites (Figure ….).

In terms of grain quality, all lines demonstrated low to moderate chalkiness and high head rice percentages, which are vital for meeting market standards. Most lines have an amylose content ranging from 15.5 to 17.6% and are commonly in the low amylose content group. Protein content was high and stable with the average value being higher than 7%, and grain length and width ratio meeting requirements.

Notably, the ACIAR_17 and ACIAR_18 lines not only met but exceeded the quality parameters set forth by SunRice, showing potential for the new variety in production. The promising lines that meet the project's requirements will continue to be used for further testing in the next crop season.

The AGB project Boosts Gender Inclusion in High-Quality, Low-Emission Rice Farming Production in the Mekong Delta

Mekong Delta Development Research Institute, Can Tho University

The Vietnamese Government is rolling out an ambitious initiative to transform the Mekong Delta's rice industry with the "Sustainable Development of 1 million Hectares for Specialised Farming of High-Quality, Low-Emission Rice Associated with Green Growth" project. Launched under Decision No. 1490/QD-TTg on November 27, 2023, the project aims to establish one million hectares of rice farmland adhering to sustainable practices to boost the rice sector's value, enhance farmer livelihoods, and address climate change.

This groundbreaking program focuses on restructuring the rice value chain, adopting environment-friendly farming techniques, and reducing greenhouse gas emissions, all while contributing to Vietnam's global commitments to sustainability and green growth. Key project activities include advocacy, technical support, pilot models, capacity building, and fostering partnerships with suppliers and buyers.

One of central components of the project is gender mainstreaming, recognising the critical role of women in achieving sustainable agricultural development. However, limited resources have hampered gender-focused capacity-building efforts for project staff.

In response, on September 20, 2024, the AGB project, in collaboration between Can Tho University (CTU) and the Departments of Agriculture and Rural Development (DARD) in An Giang, Kien Giang, and Dong Thap provinces, hosted a training course to empower female technicians. The event, titled "Mainstreaming Gender Perspectives into the 1-Million-Hectare High-Quality, Low-Emission Rice Project", brought together 21 women from DARD offices, the Women's Union, the Farmers' Association, and the Cooperative Alliance.

During the training, participants explored the project's objectives, activities, and expected outcomes. Discussions highlighted the vital role of gender in implementing the initiative, analysing strengths, weaknesses, opportunities, and challenges. Participants also developed localised strategies to integrate gender perspectives into the project effectively.

Photo
Focus group discussion on gender mainstreaming plan.

The course emphasised practical applications, such as adopting the farmer-enterprise linkage model and applying advanced techniques in rice cultivation. Participants committed to using these approaches in their roles to advance the project's goals.

Feedback from attendees underscored the course's transformative impact. Many cited a shift in mindset regarding gender integration, enhanced skills in strategic gender planning, and valuable experience-sharing opportunities. Notably, the training also fostered the creation of a network of gender-focused professionals. Participants called for additional training sessions at district and commune levels, emphasising the relevance and practicality of gender mainstreaming in agriculture.

As Vietnam advances toward a sustainable, inclusive future for its rice industry, initiatives like this highlight the crucial role of women in driving progress and innovation across the Mekong Delta.

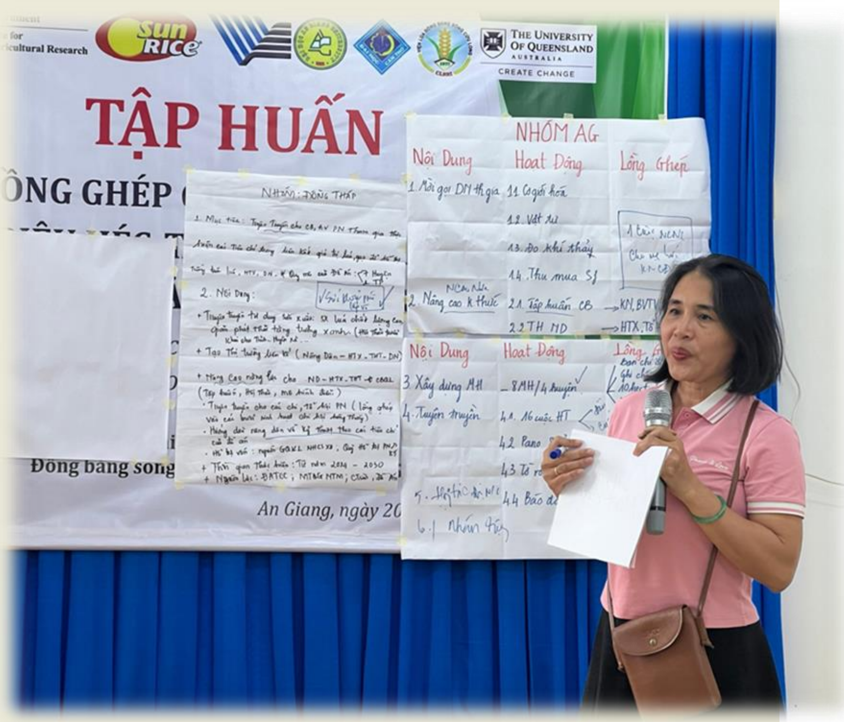


Photo
Trainee presented their focus group discussion on gender mainstreaming for 1 million ha project.

Exploring Solutions for EU Rice Exports: Stakeholders Analyse Mekong Delta Value Chain

The University of Queensland

On November 27, 2024, key stakeholders convened in a virtual workshop to explore solutions for addressing the challenges of exporting rice from Vietnam's Mekong Delta to European Union (EU) markets. Organised by the AGB/2019/153 project team, the workshop brought together a diverse group of experts from Ricegrowers Vietnam, the Department of Cooperative and Rural Development, the Department of Crop Production, the Agricultural Extension Centre, the Department of Industry and Trade, the Institute of Policy and Strategy of Agriculture and Rural Development, Can Tho University, and An Giang University.

This event marked a pivotal stage in the project's systems thinking approach for the value chain component of the project, emphasising stakeholder participation and collaboration. It aimed to evaluate leverage points and initial interventions identified by the project team. Participants collaboratively assessed the potential impact and prioritised these interventions based on their alignment with the practical realities of the rice value chain in the Mekong Delta. The workshop enabled the project team to develop high-impact, consensus-driven, and practical interventions that support the development of a high-value rice value chain.

During the workshop, the project team presented the exporting trend to the EU market, The necessity of the systems thinking approach, an overview of the value chain component and the result of the Causal Loop Diagram (CLD) analysis and identified leverage points. Through discussion, the hot spot of interventions that the participants are particularly interested in is the need to promote the link between businesses and farmers, the willingness to cooperate between farmers and enterprises and the role of traders in the high-value value chain.

The participants agreed that several critical leverage points need immediate attention, including adopting high-quality input, improving the suitability of varieties, enterprise and cooperative capacity building, varietal purity management, improved access to high-quality inputs, and reducing export tariffs through updating the varietal list in EVFTA. The stakeholders particularly emphasised farmers' challenges in meeting EU market requirements and their risk-averse behaviour toward EU-standard production. At the same time, the policy and regulation environment also need to be upgraded to ensure operational capabilities and encourage input-producing enterprises and processing enterprises to focus on high-quality, low-residue products.

Photo
Participants engaging in a virtual session (Note: Participants identifiers have been removed from the photo in adherence to the research's ethical guidelines).

The stakeholders evaluated various intervention strategies proposed by the research team. While there was strong support for solutions such as strengthening cooperatives and flexible contractual agreements in creating change, most proposed solutions will face implementation challenges. Specifically, this must be tied to a long-term and strategic process of shifting perceptions, while also focusing on scaling up production and promoting gender balance in production knowledge. Ranking the interventions based on capacity and impact found that training for SRP or MRL, intervention in the seed market, training cooperative leaders, flexible enterprise-farmer contractual agreements and improved varietal purity of DS1 can have a high impact, and there is sufficient capacity to do so.

Based on the workshop outcomes, the project team will refine these interventions and incorporate them into the CLD analysis. This step will allow for a deeper understanding of their implications on the Mekong Delta rice system and their potential to enhance exports to the EU. The team remains committed to co-developing strategies that balance capacity-building, regulatory improvements, and farmer-business collaboration, paving the way for a sustainable and competitive rice value chain in the region.

Bridging Gaps for Sustainable Rice Production: Feasibility of SRP Standards in the Mekong Delta

Bui Chuc Ly

PhD Candidate

Mekong Delta Development Research Institute, Can Tho University

Growing up in a farming family in the rural Mekong Delta, my childhood was closely tied to rice fields. Those formative years gave me a deep understanding of the hardship farmers endure, from harsh working conditions to the pressure of price fluctuations. I dedicated over a decade to the agricultural sector, where I witnessed the immense challenges caused by prolonged intensive farming and the adverse effects of climate change. These experiences left me constantly wondering how to improve production conditions and minimise risks for rice farmers in the Mekong Delta. To pursue this goal, I returned to university as a PhD student, focusing my research on sustainable solutions for rice production in the region.

During my research journey, I was fortunate to participate in the ACIAR-funded project, "Planning and Establishing a Sustainable Smallholder Rice Chain in the Mekong Delta." This project offered me the valuable opportunity to collaborate with esteemed experts such as Assoc. Prof. Jaquie, Prof. Ammar, and Dr. Gomathy, while also learning from dedicated research fellows like Julia and Tinh. Notably, I had access to extensive scientific literature, insights into advanced agricultural practices in Australia, and working with entrepreneurs from the SunRice Group—a global enterprise that originated as a farmer-led organisation.

I was deeply impressed by the comprehensive implementation of the project, covering the entire production chain—from seed selection and cultivation practices to harvest and post-harvest—to ensure optimal output quality for rice. The project serves as a prime example of a public-private partnership (P-P-P) model involving four key stakeholders: farmers, buyers, scientists, and the government. Through this initiative, rice farmers and cooperatives had the opportunity to enhance their capacities for contracting with companies at higher prices and additional premiums. Meanwhile, rice companies establish direct links with smallholder farmers and maintain stable rice suppliers through contract farming. Scientists contributed by improving production processes, while local authorities played a crucial role in creating an agribusiness landscape for this model.

Building on my initial ideas and the project's direction, I developed a research topic: "Assessing the Feasibility of Applying the SRP Standard in Rice Cultivation in the Mekong Delta." Over three years of working with more than 200 farmers, I gained a clearer understanding of their challenges and actual needs. The research revealed a gap between theoretical frameworks and practical production. While the SRP standard is theoretically sustainable, many of its requirements are challenging to implement in the Mekong Delta due to local conditions and traditional farming practices. Thanks to my dedicated supervisor Dr. Nguyen Hong Tin and project participation activities, I have grown significantly in both professional expertise and research mindset.

Photo
Conducted an interview with a farmer, gaining valuable insights into the challenges and opportunities for implementing SRP standards in the Mekong Delta.

Photo
The project team during harvest, observing sustainable practices in action and engaging with farmers on-site.

I would like to express my heartfelt gratitude to ACIAR, the scientists, rice enterprises, and all stakeholders who have joined efforts to seek solutions for promoting sustainable rice production in the Mekong Delta. I hope to have further opportunities to work with ACIAR to expand the project across the entire Mekong Delta, including my hometown. With continued collaboration, I believe we can transform the Mekong Delta's rice sector into a global model for sustainable agriculture—one that not only uplifts farming communities but also safeguards the region's vital resources for future generations.

Ultrasound and High-Pressure Homogenization for Nanofiber Extraction from Rice Bran

Yadav KC

PhD Candidate

The University of Queensland

The Mekong Delta is a significant rice-producing region that generates a large amount of rice bran, making it a promising resource for innovative applications. Rice bran, a byproduct of rice milling, is a rich source of natural fibers with cellulose (16–29%), hemicellulose (21-31%), and lignin (23-25%). Nanofibers are ultrafine fibers with diameters of 100 nanometres or less (Figure a), and these fibers have become increasingly popular because of their unique properties and potential applications. The escalated specific surface area of nanofibers allows for enhanced interactions with other materials, making them ideal for applications such as nano-filtration, energy, carriers, drug delivery, and tissue engineering scaffolds.

Yadav KC, a second-year PhD candidate at the School of Agriculture and Food Sustainability, UQ, is investigating effective approaches to isolate nanofibers. Furthermore, he is also exploring the application of these nanofibers. Alkaline treatment followed by acid hydrolysis is a frequently used method. Besides chemical treatments, ultrasound and high-pressure homogenization (HPH) offer an environmentally friendly approach to extract cellulose from rice bran. These innovative methods align with the principles of sustainable development, particularly the United Nations Sustainable Development Goals (SDGs) 12 and 9, which are “Responsible Consumption and Production” and “Industry, Innovation, and Infrastructure,” respectively. Ultrasound uses high-frequency sound waves to break down plant cell walls, enhancing cellulose release (Figure b). Similarly, in high-pressure homogenization, the material is forced through a narrow space between two high-pressure chambers, causing the cellulose fibres to shear and disintegrate into nanofibers (Figure c).

These approaches add value to this low-cost byproduct, potentially benefiting the industry and smallholder farmers. By bridging technology with local resources, this work can empower communities and contribute to the circular economy.

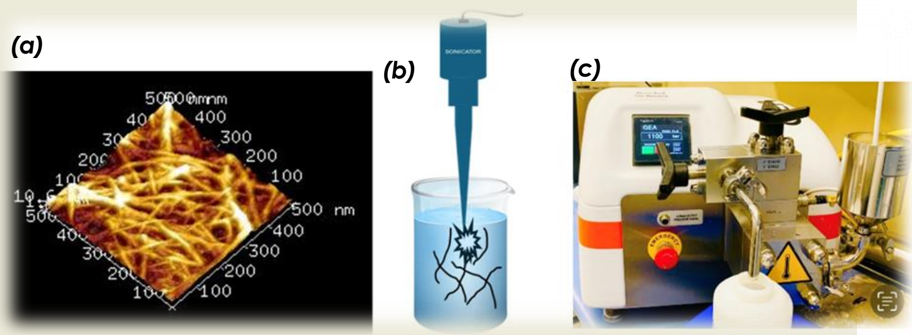


Figure
(a) Rice bran nanofibers (b) Ultrasound treatment (c) Twin Panda Homogenizer.

Field-based monitoring of triazole pesticides in rice farming systems

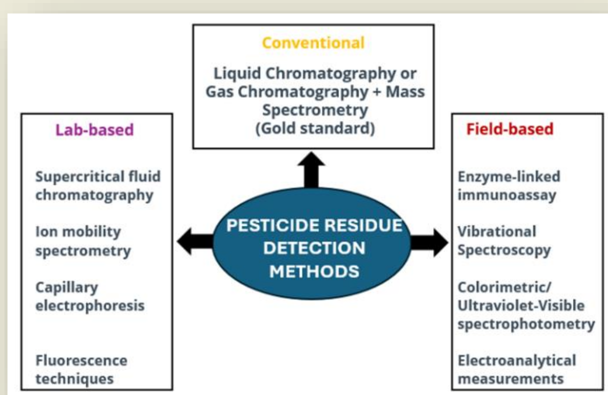
Michelle Anne B. Bunquin

PhD Candidate

The University of Queensland

Azole and triazole fungicides comprise 20-30% of global fungicide use in rice farming, with Vietnam using 25-35% across three seasons in 2023. Farmers apply these products multiple times per season, often less than 10 days before harvest, raising food safety concerns due to potential residue persistence. EU's recent revision of Maximum Residue Limits (MRLs) for pesticides, including triazoles, underscores the need for rapid, on-site detection tools to improve food safety compliance and monitoring in rice production.

A systematic literature review reveals alternative methods for detecting triazole pesticide residues in rice, addressing the drawbacks of conventional LC- or GC-MS methods such as high costs, technical complexity, and lengthy sample preparation (Figure 1). These methods fall into two categories: laboratory-based and field-based techniques. While laboratory-based methods offer high precision, they do not provide rapid, on-site pesticide residue quantification. Field-based approaches typically provide qualitative outcomes, unless a portable analytical device is accessible. These field methods, while more convenient, may lack the quantitative precision of their laboratory counterparts. Studies from 2005-2024 have shown these methods perform comparably to conventional techniques (Figure 2). Current trends show an increased interest in surface-enhanced Raman spectroscopy (SERS) and enzyme-linked immunoassay (ELISA) based methods. These methods have demonstrated sensitivity to pesticide residues at parts per million (ppm) concentrations, with some achieving parts per billion (ppb) detection levels. However, their field application remains limited due to testing only on spiked samples and they remain complex for agronomist and farmer use.



Figure

Summary of methods for detecting pesticide residues.

Michelle Anne B. Bunquin, a PhD student at the University of Queensland is currently developing the foundations for a smartphone-based method for measuring triazole residues at or below MRL in rice. This approach combines nanofabrication and enzymatic assays, using nanoparticles to enhance pesticide binding and signal detection. Once developed and validated, it is hoped that this innovation will enable rapid, on-site quantification of triazole residues in paddy samples using smartphone technology and colorimetric analysis. The project aligns with ACIAR's mission to improve agricultural practices and food safety, potentially benefiting farmers and consumers in Vietnam and beyond.

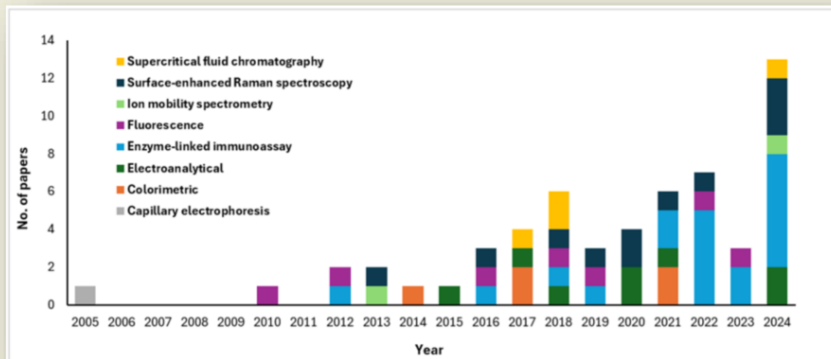


Figure
Number of publications per method from 2005-2024.

The experience of PhD students in a Research-for-Development Project

Julia Checco

PhD Candidate

The University of Queensland

Van Tinh Thai

PhD Candidate

The University of Queensland

Julia Checco and Van Tinh Thai have participated in the AGB/2019/153 project as PhD students at the University of Queensland's (UQ) School of Agriculture and Food Sustainability. Under the supervision of Associate Professor Ammar, Associate Professor Jaquie Mitchell, Dr Yanti Nuraeni Muflikh and Dr Ali Akber, they are working together to look at different angles to provide a holistic view of the sustainability of the rice industry in the Mekong Delta of Vietnam. Accordingly, Julia focused on understanding and addressing social and economic barriers within the rice value chain for accessing the European Union market. While Tinh focused on environmental aspects, including an inventory of greenhouse gas emissions and ecological pollution in the value chain, which is considered a "value-add component" in the project.

Research Contributions

Throughout their doctoral research, they took on multiple responsibilities that shaped the project's success. Together, they developed ethics applications and questionnaire design while coordinating comprehensive data collection efforts with Can Tho University (CTU), SunRice and Cooperatives/Farmer Groups, partners in the project. Through detailed data analysis and research, they contributed to scientific contributions in the field via publications and conferences. They also contributed significantly to project documentation and presented updates during reporting meetings.

Key Research findings

Market Access and Value Chain Analysis

Through Causal Loop Diagram (CLD) analysis, the study revealed the extraordinary complexity of the Mekong Delta rice value chain, encompassing more than 100 variables and over 1,000 feedback loops. This comprehensive analysis highlighted the intricate relationships within the system and their impacts on value chain performance. The research identified critical leverage points that could significantly influence the system's effectiveness. These ranged from enterprise capacity and varietal impurity issues to challenges accessing high-quality inputs and addressing farmer risk-averse behaviour toward EU production. Understanding these leverage points provided valuable insights for potential system improvements.

The analysis generated practical intervention strategies for the main value chain actors. These strategies addressed key operational aspects, including the aggregation of input purchases, implementation of interest-free financing, delivery of MRL training, and development of flexible contractual agreements. The study also outlined important interventions for supporting actors in the value chain. These included strengthening cooperative leadership through training programs, breeding for improved disease tolerance and adaptation, expanding bank support for cooperatives and enterprises, and ensuring the EVFTA list remains current with market requirements.

Environmental Sustainability

Tinh's initial research findings reveal that rice cultivation in the Mekong Delta has a significant environmental impact. The triple-rice cropping system was found to have a much higher environmental footprint compared to the double-rice system. High-emission practices, such as straw burning, straw incorporation, multi-season production, and inefficient water management, are major contributors to these issues. The overuse of agricultural chemicals has also been identified as an area of concern. Tinh's meta-analysis suggested several low-emission farming practices that maintain rice yield, with the potential for widespread adoption in the Mekong Delta's rice production. These include reducing the number of rice seasons, rotary tillage, alternate wetting and drying (AWD), intermittent irrigation, dry direct seeding, and straw removal. His future research will focus on identifying economically viable and socially acceptable solutions to achieve environmental sustainability.

Research Challenges and Solutions

Conducting the PhD research within the framework of an R4D project offers tremendous opportunities but also presents unique challenges for students. Julia and Tinh received full funding and enthusiastic support from project partners, enabling them to effectively carry out fieldwork and enhance the quality of their research. However, participating in such a project also required them to think beyond their own activity and consider the broader perspectives of the project and the Mekong Delta. As Tinh shared, "Doing a PhD within a project means aligning with the objectives of the project and integrating our research aims into the future sector's development directions." This balance demands that they fulfil the developmental goals of the project to ensure its overall success while upholding the scientific rigour of their personal dissertations. Julia also noted, "The workload will increase, but it's worth challenging ourselves. We learn so much more from real-world practices, especially through fieldwork and project events."

For traditional challenges, the project provides PhD students with the mechanisms to address challenges through innovative solutions. A key hurdle was the language barrier, as Julia did not speak Vietnamese. This challenge was effectively managed through teamwork and support from CTU partners, who provided essential support with data collection and translation services. This partnership proved valuable beyond just language assistance - it enabled Julia to gain deeper insights into the Vietnamese context, leading to more culturally informed questionnaires and a richer understanding of Vietnam's agricultural landscape.

Confidentiality emerged as another key challenge, particularly in relation to private entity involvement. Other enterprises were initially reluctant to share information, fearing competitive disadvantage. The team overcame this through a partnership with the Department of Agriculture and Rural Development with CTU's assistance, whose established reputation helped build trust between stakeholders. The complexity of systems thinking presented additional challenges in model development and verification. The team divided the model into smaller subsystems to address this, making validation more accessible for stakeholders. Initially, farmers were reluctant to discuss their partnership challenges. Through transparent communication about research ethics and strong assurances of confidentiality, the team created an environment where farmers felt secure sharing their experiences.

Professional Development and Impact

The project has provided both PhD students with valuable professional development through its unique combination of academic research, international development, and private-sector collaboration. Working within an ACIAR-funded project enhanced their understanding of development research and its impact on agricultural communities, particularly in the Vietnamese context. They gained extensive experience in cross-cultural partnerships and learned how to effectively translate research findings into practical outcomes for farmers and industry stakeholders.

Through multi-stakeholder engagement, they developed expertise in balancing academic rigour with industry needs. Their work with SunRice enhanced their understanding of commercial agriculture and supply chain dynamics internationally, while collaboration with government bodies and research institutions strengthened their ability to bridge public and private sector interests. Regular reporting and presentations to diverse audiences - from farmers to industry executives and academic panels in conferences - refined their ability to communicate complex findings to different stakeholders, adapting their communication style to meet varied audience needs.

This experience has equipped the students with valuable skills in project management and applied research methodology. They have demonstrated how agricultural research can effectively combine academic excellence with practical industry applications while contributing to international development objectives. Their work exemplifies the value of collaborative approaches in addressing agricultural sustainability challenges across different cultural and institutional contexts.

For Tinh, as a Vietnamese, the PhD journey is not merely an academic experience but also a source of pride, as his research can make a meaningful contribution to the livelihoods of rice smallholder farmers and the sustainable development of his homeland. Additionally, participating in a project with multiple partners in Vietnam has enabled Tinh to expand and strengthen his network, creating the momentum needed to pursue his research career and make greater contributions to the agricultural development of the Mekong Delta in particular and Vietnam as a whole.

Future Directions

As Julia prepares to complete her PhD in mid-January 2025, the research continues to evolve. Tinh will build upon this work until the project is complete to continue identifying potential sustainability aspects that should be pursued in the Mekong Delta rice sector in the near future. This transition highlights how the AGB/2019/153 project continues to address critical aspects of rice production in the Mekong Delta, moving from market access challenges to environmental sustainability. From project-based PhD experiences, we firmly believe both researchers will succeed in their future endeavours.

Contributors to this issue

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