JANUARY | 2023 | ISSUE # 02

MEKONG SUSTAINABLE RICE

Photo: *Delegates in a group photo at the launch event of the project.*

Message from the project leader

Dr Jaquie Mitchell

I am delighted that our project was officially launched on the 19th of October 2022, in Cao Lanh, Vietnam. Alongside representative project team members, I had the pleasure of welcoming both Australian and Vietnamese government dignitaries, actors associated and from within the rice value chain, including farmer cooperative leaders, and shared with them project aims and objectives. The project was well received by all guests. Significant media coverage was achieved with quite a number of articles written about the launch in Vietnam including in a national newspaper as well as the Australian Financial Review. Grain Central also highlighted the project as did the UQ Faculty of Science News. I believe we have project "lift off" and I hope that project team members feel inspired to know that their work is of importance not just to ourselves but also to the wider Mekong community and beyond.

IN THIS ISSUE

So this, our second project newsletter summarises some further results to date. In this quarter, I am thrilled to share that we have engagement with smallholder farmers from six farmer groups/cooperatives across our three target provinces, advanced genetic material for a higher quality short grain rice adapted to the Mekong Delta (MD) and long grain rice for northern Australia, conducted a workshop on sensory and quality of rice to team members and students at An Giang University, conducted two training workshops for Paddy Vision at Lap Vo Mill, Dong Thap Province Vietnam and Brandon, North Queensland, facilitated the conduct of MRL compliance training in 6 groups/cooperatives in MD, conducted quality assessment in the transport of paddy rice from farm gate to mill, and conducted the first in-depth interviews including gender analysis, and focus group discussion (FGDs) with value chain actors and key stakeholders.

Furthermore, we had several participants attend international conferences and workshops including five UQ team members (Gomathy, Ammar, Jaquie, Shona and Julia) that attended TropAg in Brisbane, with two poster presentations highlighting our work to date. Nguyen Anh Minh participated in the Women Empowerment in IPM conference in Bali, Indonesia (hosted by ASEAN FAW Action Plan and CGIAR's Plant Health Initiative).

The project activities have been gaining momentum that undoubtably will lead to a greater understanding of the challenges, solutions and potential impact that results of this project will help develop to support smallholder farmers in engaging in a market-led rice export value chain. I encourage you to read about some of the activities conducted in this quarter that are highlighted in the following pages.

Discussions with Mr Nhan's grower group.

Photo: UQ Team

Compliant MRL training program for rice growers in the Mekong Delta

SunRice Group

Rice farmers in Mekong Delta will benefit from the opportunity to participate in the market-led high-value export rice value chain. This will improve the sustainability of rice production and farmers' livelihood in the long term across the Mekong Delta. To be able to access export markets, production needs to ensure that chemical use is compliant with regulations without exceeding the maximum residual level (MRL) thresholds. To this end a training session was conducted to improve the knowledge and awareness of rice farmers. Providing appropriate training will help ensure paddy is supplied to the SunRice Group's Lap Vo mill as per MRL requirements and traceability, allowing the finished product to be delivered to high-value markets.

In November 2022, the farmers from six groups of farmers/cooperatives participating in the ACIAR project were trained by Bayer Vietnam staff in cooperation with SunRice Group staff in a training session on MRL compliance. Due to the sowing preparation stage and other activities, 76% of our nominated households attended the training session. However, the trained farmers and team leaders of the cooperatives will continue to disseminate the information provided in the 'MRLs-compliant program' to households that have not yet participated in the training.

Training of 'compliant MRLs program' to farmer groups in Dong Thap, An Giang and Kien Giang provinces.

Photo: SunRice Group

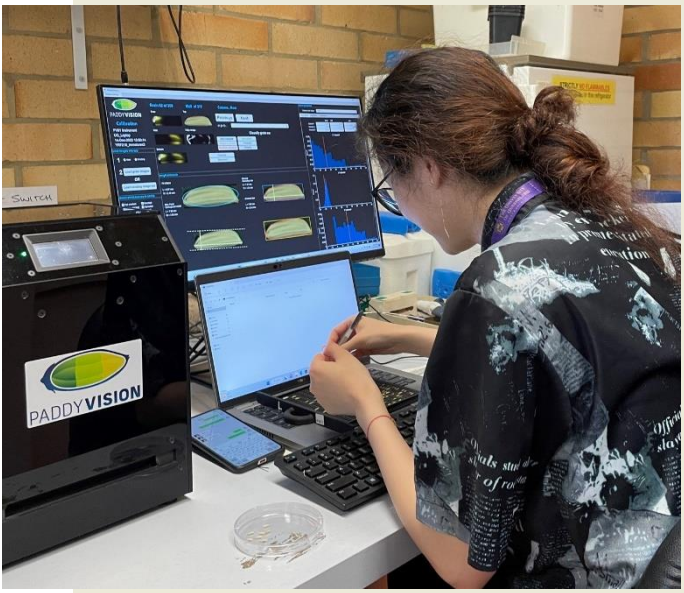
In addition, Bayer and SunRice Group technical staff will monitor and guide the farmers throughout the current season in the farming process under the MRLs program with the aim that the rice produced will meet EU export standards.

It is expected that all cooperatives/farmer groups selected to participate in the project will continue to work with the project and contract with the SunRice Group over the duration of the project and beyond. Project results will be showcased to the surrounding community, smallholder farmers and neighbouring cooperatives to encourage establishment of a sustainable production system to ensure MRL compliance and that SunRice quality requirements are met to enable smallholder farmers to access high-value export markets.

Preliminary verification of PaddyVision measurement alignment with Head Rice Yield at Ricegrowers Vietnam

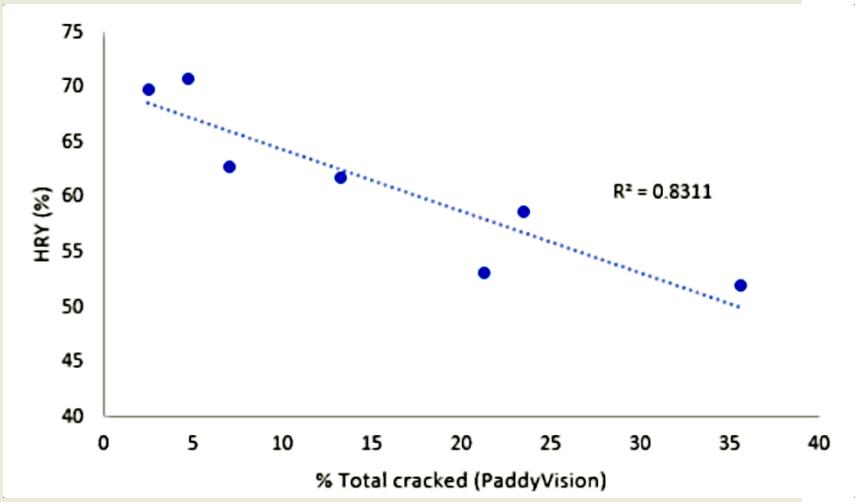
Australian Grain Storage

Ricegrowers Vietnam are working to analyse each receival load of rice with the PaddyVision® to develop a routine grain quality measurement as a basis for payment as well as utilising the instrument in experimental and field studies and in calibration work.



A research student at the University of Queensland is operating PaddyVision®.

Photo: Jaquie Mitchell



Plot shows correlation between percentage cracked as measured in the PaddyVision, and Head Rice Yield (HRY) obtained from samples collected from a field study focusing on header performance. ***Plot***: AGS

Recently a study was conducted to measure grain losses from different combine harvesters from field studies in Hon Dat. As part of this study samples were taken from different headers and PaddyVision measurements and Head Rice Yield (HRY) were tracked. For each sample 3 replicate PaddyVision measurements were collected. The study revealed a correlation coefficient (r2) value of 0.83 between percentage cracked grain and HRY.

This study showed a relatively strong correlation between percentage cracked as measured by the PaddyVision, and HRY. This result agrees well with PaddyVision cracked measurements and HRY correlations in experimental calibration samples, as well as actual harvest receivals in the Riverina, Australia. This study provides preliminary verification of the performance of the PaddyVision in predicting HRY in the MD.

How long before wet paddy quality deteriorates during transport

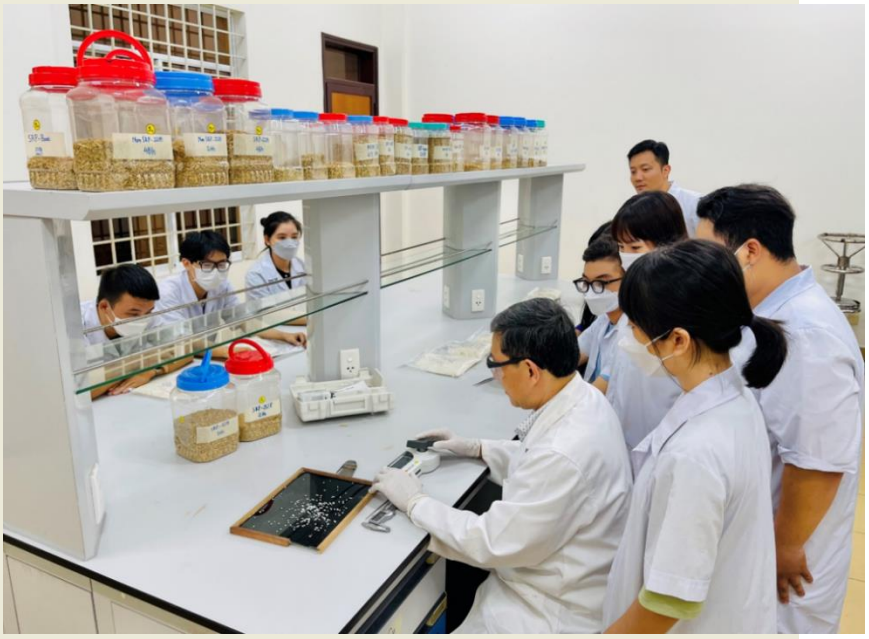
An Giang University

The Mekong delta produces around 45 million tons of paddy rice annually across three/two planting seasons. This implies that about 15 to 25 million tons of rice needs to be transported from fields to rice factories every season. In about a month, millions of tons of paddy rice need to be harvested, transported, dried and passed through the milling processes. These steps must be finished as quickly as possible because paddy rice quality is reduced if they are not appropriately handled and promptly transported to mills and dried after harvest. However, what quality criteria will be changed and how fast these changes will take place remain unclear. Some rice factories require the maximum transport time as short as 8-12 hours, which creates more pressure on transportation practices, especially during the peak harvest time.

Sensors set up in fresh rice paddy bags to measure relative humidity and temperature.

Photo: Duy Trinh

As the drying capacity of most milling factories' is limited, wet paddy rice receival and management must be well coordinated to minimize delay in processing to ensure quality is maintained. The effects of waiting time on milled and paddy rice quality are still poorly understood



A. Prof. Binh Ho, Duy Trinh and students (Quoc Dat, Cuong Le, Kim Son, Han Nguyen, Tan Nguyen, Minh Vy, Tuan Kiet) are analysing physical rice quality.

Photo: Duy Trinh

The An Giang University team has studied the effects of transportation time on rice quality to reveal the behaviours of wet paddy during transportation and find solutions to keep rice quality as high as possible. Based on preliminary results, the wet paddy rice maintained good quality within 48 hours of transport after harvest. After 48 hours, drastic changes in rice quality criteria were recorded such as darker color, increased total acid and reduced head rice yield (by 10 – 20%). The wet paddy temperature was 10-15°C higher in the experimental bag than in the ambient temperature. This may have a negative effect on rice quality. This experiment will be repeated to confirm these preliminary results.

Development of elite and advanced tropical short duration, short-grain lines using traditional and marker-assisted selection

Cuu Long Delta Rice Research Institute

One of the most important activities of the CLRRI is to create new rice lines. In the first year of the project, CLRRI has carried out three main activities: 1) The development of elite and advanced tropical short grain lines using traditional and marker-assisted selection; 2) The validation and utilisation of molecular markers to enhance breeding efficiency; 3) The standardisation of lab protocols that have been established and implemented at CLRRI and aligned with Lap Vo Mill". The results of these activities are summarised as follows:

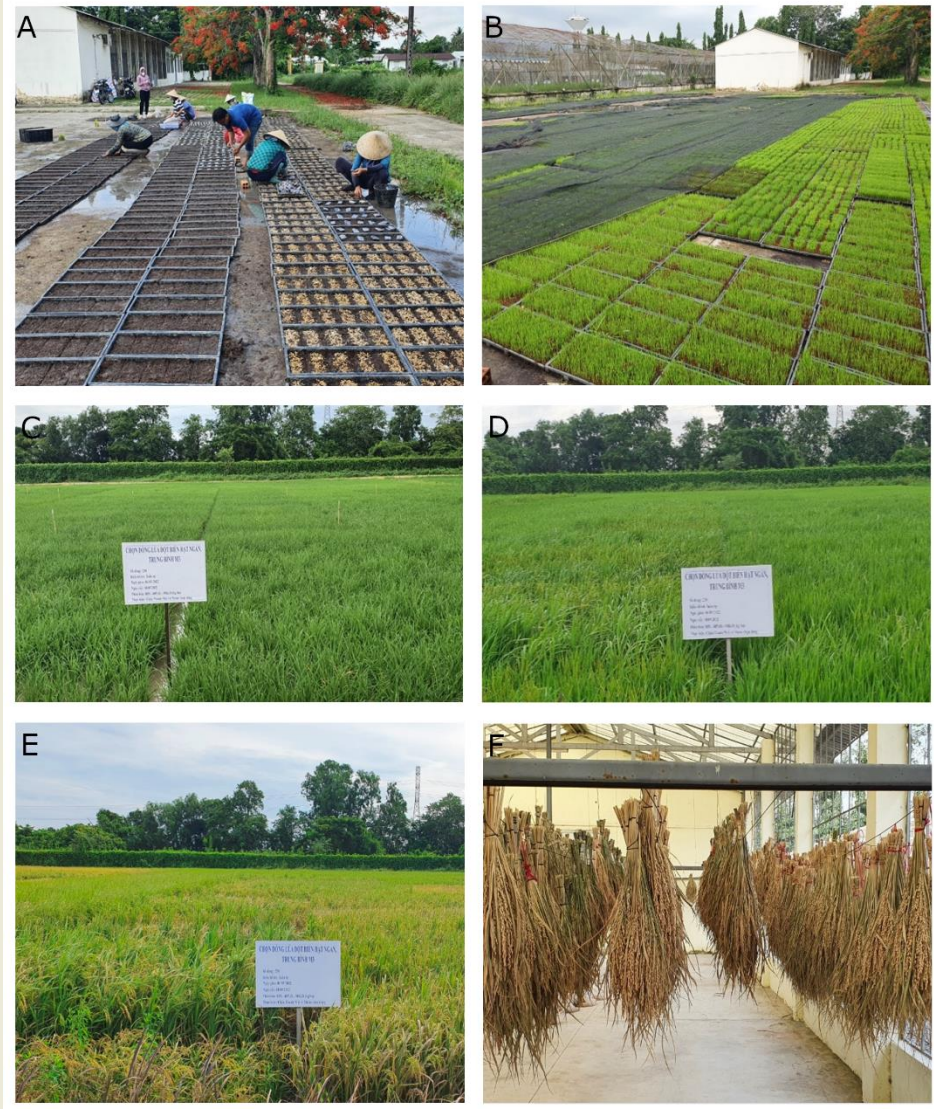
1) Utilizing available primer sources, selected some markers for key-traits (grain quality, biotic resistance, yield potential, and growth duration); Screening potential phenotyping and genotyping of 8 varieties used as parents for creating new crosses were implemented; Twelve new crosses F0 were completed in the early stages of the project. F0, F1 seeds were propagated in a net house, and F2 seeds were planted on the field in the summer-autumn 2022 season. Besides, fifty-six new crosses (diallele crosses) were created at the net house; 347 M3 lines from 16 lines of rice mutation populations that met the project requirement were selected. In addition, thirteen new rice mutation populations are planted in net house, which is now going to the M0 generation; 758 rice lines from F3-F9 populations that meet the requirement of the project were selected; Ten advanced lines were observed for important agronomic traits from already available materials: growth duration fluctuated from 95 to 100 days, plant height (90-95 cm), lodging resistance (level 1-2), brown rice (80.7-83.7%), white rice (72.4-74.6%), whole grain yield (60.7-65.2%), grain length (4.8-5.21 mm), grain width (2.9-3.12 mm), chalk (0-3.2%), gel consistency (level 6), amylose content (16.2-21%), biotic resistance: blast (level: 1-5), PBH (level: 3-5), BB (level: 2-5), yield potential fluctuated 4.7 to 6.4 ton/ha, two promising lines that meet the requirement of the project were selected.

The CLRRI's crossing activity. The rice cross-team is making new potential crosses in the net-house.
Photo: CLRRI Team

2) To assist selection of new rice varieties using molecular markers, some molecular markers were identified and validated for key traits: Blast, blight, aroma and amylose content. The standardized procedure for genotyping breeding materials has been completed that will be applied for routine genotyping of breeding materials for subsequent years.

3) The standardised grain quality processes (amylose content, whole grain yield, chalky rice, grain length, grain width, protein content) were completed that will be applied to measure the grain quality from already available materials and promising lines.

In the upcoming crop seasons, we will conduct a thorough screening to select the promising rice lines that meet the requirements of the project, associating the application of molecular markers and evaluating rice quality.



Selecting F3-F9 population from already available medium grain breeding materials in summer-autumn 2022 season. (A) Seedling tray preparation and sow germinated seeds. (B) Rice seedlings emerged 7 days after sowing. (C, D) Rice emerged ~50 and 70 days after sowing (at the maximum tillering or boosting stages. (E) Breeder group is conducting data gathering, sampling, and selection. (F) All rice samples are dried in the net house.

Photo: CLRRI Team

Suitable fertiliser management strategy treatments for DS1 rice variety

Mekong Delta Development Research Institute, Can Tho University

In Vietnam, GHG emissions from the agriculture sector were the second largest contributor to total Vietnam GHG emissions. GHG emissions in the agriculture sector include livestock (feed digestion) (10.7%), organic fertiliser management (9.7%), agricultural land (27%), and byproducts burning (2.1%), while rice production alone accounted for more than 50%. GHG emissions in rice production are predicted to be around 40 million tons of eCO_2 in 2030. The magnitude and pattern of GHG emissions from rice fields are determined mainly by water regime and organic inputs, and to a lesser extent by soil type, weather, management of tillage, residues and fertilisers, particularly Nitrogen application. Rice farmers in the Vietnam Mekong Delta often use Nitrogen fertiliser excessively and improperly. As a result, this causes increased production costs and GHG emissions.

Rice field fertilizer management strategy experiments

Photo: Tin Hong Nguyen

Rice growth monitoring on day seven after sowing at the fertiliser experiment site-1.
Photo: Tin Hong Nguyen

The project has conducted various strategies for Nitrogen management through field trials with eight fertiliser treatments to produce an appropriate protocol for fertiliser application in rice farming practices. The trials have been undertaken in 02 project sites where farmers are growing DS1 rice variety. The project applied the PTD (Participatory Technology Development) approach to operate the field trials, which allows and encourages farmers to be involved in the trials. This aims to help farmers learn and practice on their own farms. Farmers and project staff monitor and measure the field trials every seven days for agronomic characteristics.

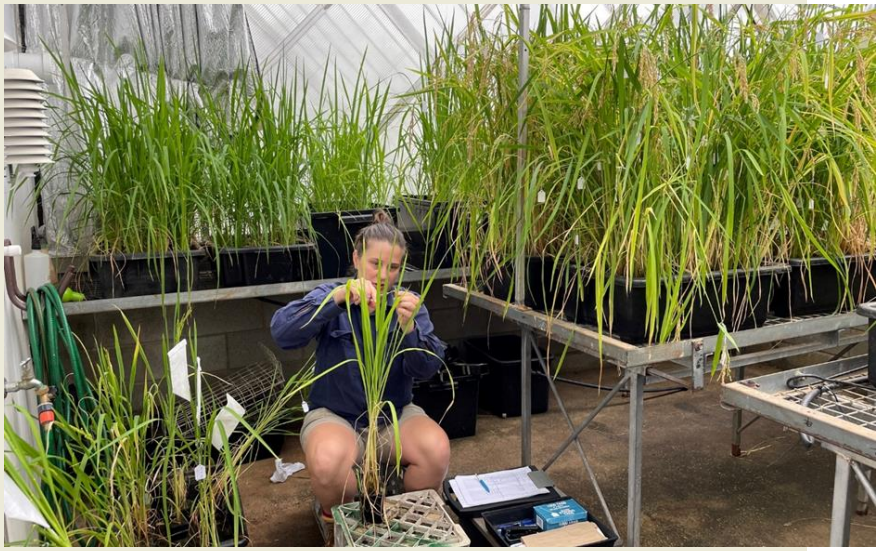
Through participation in field trials, farmers are interested in learning the results of the agronomic data collected. They provided feedback that this helps them have actual evidence and precisely recognise the rice nitrogen needs, then they can apply nitrogen effectively. Ultimately, farmers are happy because they reduce production costs and GHG and increase profit whilst increasing the sustainability of rice production.

Rice pre-breeding for disease resistance in Northern Queensland

The University of Queensland

There has been relatively limited development of Australian rice varieties that are aerobically adapted and specifically bred for the disease prone tropical Northern Australian production system. Currently available commercial rice varieties have predominantly been developed in the disease free temperate growing region of Southern Australia in the Riverina, resulting in variable results in the tropical North.

To improve disease resistance, two crossing blocks have been conducted at The University of Queensland. The first crossing block focused on incorporating single disease resistance into elite backgrounds with high grain quality and adaptation to aerobic growing conditions. Subsequently crossing was conducted over the winter of 2022 to pyramid single disease resistance with multiple others in the second crossing block. Parental lines included Dawn, Tetep and Taichung Native 1 with good brown spot resistance; IRBB60 with good bacterial leaf blight resistance; Jasmin85 for its sheath blight resistance and Shan Huang Zhan 2 for its broad blast resistance. Langi and Topaz were utilized as parents for their high-quality grain characteristics. The progeny of these crossing blocks are currently undergoing rapid generation advancement to fixed lines.



Shona Wood, a researcher working on the Australian pre-breeding component of the project, crossing to incorporate disease resistance in the glasshouse in Gatton.

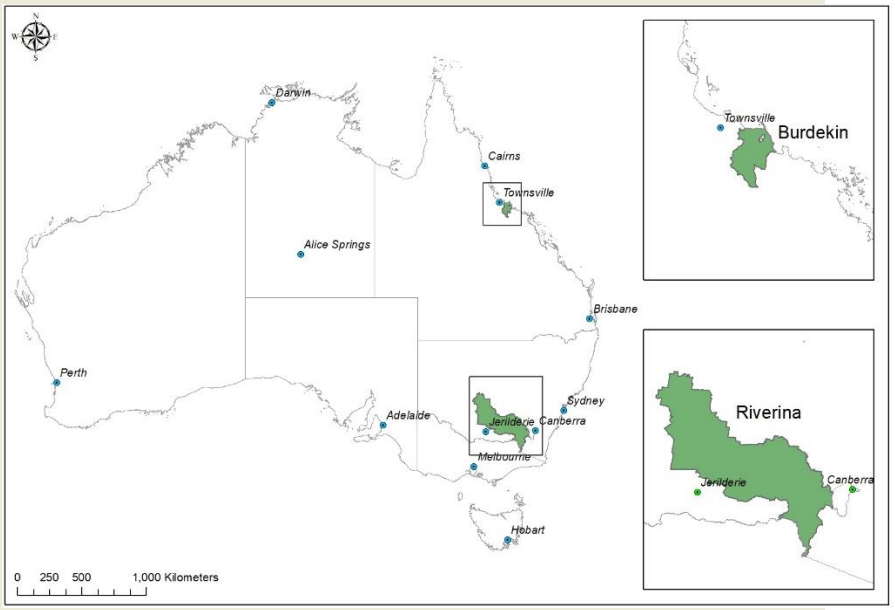
Photo: UQ Team

To assist in our pre-breeding effort and improve breeding efficiencies the project plans to implement genomic selection. To achieve this a training population of parental lines from the crosses and related material have been planted in the field at Gatton, QLD and will be assessed for yield characteristics and other agronomic traits.

To develop potential lines for input into plant breeding programs takes considerable time but must start with an initial cross between two promising lines. The steps we have undertaken so far are the first of many but lay the foundations of achieving our goal of developing disease resistant varieties adapted to production in Northern Queensland.

Seedlings bred for single trait disease resistance undergoing single seed decent advancement in the glasshouse.

Photo: UQ Team



Map of Australian rice growing regions, the southern temperate Riverina and the tropical north Burdekin.

Map: UQ Team

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http://mekongsustainablerice.com/

https://www.aciar.gov.au/project/agb-2019-153

Mekong Sustainable Rice is the quarterly publication of the jointly funded ACIAR-SunRice agribusiness project "Planning and establishing a sustainable smallholder rice chain in the Mekong Delta" in Vietnam. Mekong Sustainable Rice presents articles of summarised results from all participating institutes and organisations involved in this project. The views expressed in this publication are the author's alone and are not necessarily the views of SunRice or ACIAR.

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