# 2022 PhilRice R&D Highlights

## PhilRice Bicol

Philippine Rice Research Institute
Central Experiment Station
Maligaya, Science City of Muñoz, 3119 Nueva Ecija

# CONTENTS

BRANCH STATION

# PHILRICE BICOL

Branch Director: **VICKY C. LAPITAN**

## EXECUTIVE SUMMARY

The DA-PhilRice Bicol was established to develop and disseminate strategies and technologies that will make rice farming in calamity-vulnerable regions of Bicol and Eastern Visayas more resilient to climate change. The station helps increase rice productivity by developing, adapting, and sharing technologies through the continual implementation of Research for Development (R4D) projects in rice communities, particularly in adverse rice environments such as saline, drought, and flood-prone areas, including upland ecosystems.

In 2022, DA-PhilRice Bicol successfully implemented six research projects (*Palayamanan*®, Long-Term Soil Fertility Experiment, National Cooperative Testing, OneRicePh, Asian Food and Agriculture Cooperation Initiative, and Philippine Rice Information System) and for development projects (RiceBIS, Rice SUSTAIN, Scaling Integrated Crop Management for saline, and *Binhing Palay* Farm) in Bicol and Eastern Visayas Regions. Research projects and studies focused more on generating and validating field data and information to eventually develop a package of technologies (POT) for specific environmental conditions. Development projects, on the other hand, utilized data and information generated by research to extend and disseminate POTs and catalyze scaling of mature technologies to appropriate rice environments and communities.

CORE-FUNDED PROJECT 1

## Reducing Vulnerability to Climate Change through *Palayamanan* Approach

**Gian Carlo C. Enot**

The project aims to reduce the vulnerability to climate change of men and women farmers under drought and saline-prone rice environments by improving their productivity through the use of adapted and suitable rice varieties, efficient fertilizer rates, and appropriate water management. The

project has two major components: (1) Development of *Palayamanan*® farming system model for saline stress-prone rice ecosystem; and (2) Development of *Palayamanan*® farming system model for drought stress-prone rice ecosystem. Through implementation of this project, the *Palayamanan* farming system in saline-prone rice environment in Brgy. San Nicolas, Canaman, Camarines Sur was improved with the POT developed for rice. The addition of mushroom production contributed to a 35.8% increase in annual gross income (from P60,000.00 to P81,477.50). The POT developed for rice grown in saline-prone environment includes the use of high-quality seeds of Salinas varieties (NSIC Rc 290 and Rc 330); direct wet seeding at rate of 60-80kg seeds/ha; and fertilizer rate of 100-30-80kg nitrogen, phosphorus, potassium (NPK) per ha for both for dry and wet seasons (WS), resulting yield increases of 5t/ha to 8t/ha (an increase of 4t/ha-7t/ha from the baseline yields).

Likewise, it has also improved the *Palayamanan* farming system in drought-prone rice environment in Brgy. Batang, Pamplona, Camarines Sur with POT for rice and the production of high-value crops and/or vegetable components, resulting in 44.9% increase inannual gross income (from baseline of P60,000 to P86,950). The POT developed for drought-prone rice environment during dry season (DS) includes the use of high-quality seeds of a rainfed rice variety (i.e., NSIC Rc 434), use of direct wet seeding at a rate of 60-80kg seeds/ha, and fertilizer rate of 100-30-80kg NPK/ha resulting in yields of 2.91t/ha (1.1t/ha increase from the baseline yields); NSIC Rc 472 is recommended with yields of 6.22t/ha for WS (yield increase of 4.4t/ha from the baseline).

## CORE-FUNDED PROJECT 2

# Long-term Soil Fertility Experiment

**Gian Carlo C. Enot**

The effects of the long-term use of inorganic fertilizer on rice productivity, yield gap, and soil fertility were assessed under irrigated lowland rice environment at PhilRice Bicol, Ligao, Albay starting 2019 DS. Field experiments were conducted every cropping season following two-factor factorial (fertilizer by variety) in randomized complete block design (RCBD) with three replications. Three different varieties were used: V1-NSIC Rc 160, V2-NSIC RC 222, and V3-PR43504-14-3-1-1; with six NPK levels as follows: F1 (control)-0-0-0; F2-SSNM-30-100; F3-210-0-50; F4-210-30-100; F5-210-30-100; and F6-0-30-50. During WS treatments F3, F4, and F5 with 210kg/ha-N were replaced with

80kg/ha-N. Crop cut yields were subjected to analysis of variance at 5% level of significance using statistical tool for agricultural research.

In 2022, results identified NSIC Rc 506, and fertilizer rate of 80-30-100kg/ha NPK; and NSIC Rc 506 with fertilizer rate of 210-30-100kg/ha NPK, with 56.8% yield increase (6.9t/ha) and 31.8% yield increase (5.8t/ha) for wet and dry seasons, respectively (baseline yield of 4.4t/ha). Yield gap was reduced from 5.6t/ha to 3.4t/ha in 2022 WS. While soil NPK and Zinc remain in sufficient levels after seven cropping seasons.

## CORE-FUNDED PROJECT 3

# Philippine Rice Information System (PRiSM)

**Jean Rochielle F. Mirandilla, Gina B. de Mesa, and Don B. Bañares**

The Philippine Rice Information System (PRiSM) project aimed to sustain, maintain, and improve an online system that consolidates and presents timely information on the status of the rice crops. This information is significant to the Department of Agriculture (DA) in planning and decision-making to provide appropriate interventions to address production gaps. PRiSM uses data from Synthetic Aperture Radar (SAR) satellite images and smartphone-based field surveys to gather actual crop growth parameter, and processes them using a remote sensing software for rice and crop models. Primary and derived data from the process are further processed using geographic information system (GIS) software for visualization, further analysis, and presentation. Information and data generated by PRiSM are shared with target users through information and communication technologies (ICT) platforms. PRiSM data and outputs are accessible to target users, project partners, and decision-makers through the website (https://prism.philrice.gov.ph/).

The implementation of the PRiSM project within the station's area of concern generated start of season (SOS) maps from 22 provinces in Region 5, 6, 7, and 8 through the use of satellite images, image processing, and field validation data (Figure 1). There was a difference in generated areas between two semesters for the four Regions. The semesters were divided based on Philippine Statistics Authority (PSA) semester; 1st semester includes rice areas planted from September 16, 2021 to March 15, 2022 while the 2nd semester includes areas planted from March 16, 2022 to September 15, 2022. The accuracy ranges from 93 to 100% and 86 to 100% during the 1st and 2nd semester, respectively. These accuracies were computed from the rice and non-rice (RnR) validation points collected by PRiSM regional implementers. However, the number of collected

RnR points in Region 5 for the 2nd semester was inadequate to verify the accuracy of the output.

The estimated monthly planting in each province and region was also identified and computed from the generated SOS maps. Most of the Bicol rice farmers established their rice fields in January, while farmers in Eastern Visayas had their planting peak in December. In comparison to 2nd semester 2022, most farmers in Bicol and Eastern Visayas established their rice fields in July. Ground-truthing, or the collection of ground data, was conducted in 205 monitoring fields (MFs) during the 1st semester and 240 MFs in the 2nd semester, distributed across Bicol and Eastern Visayas (EV) regions.

Likewise, damage caused by Tropical Storm Agaton, which affected most of rice areas in EV was assessed with 31ha at reproductive phase, 14ha at ripening, and 784ha harvested rice areas were flooded on April 11, 2022.

## CORE-FUNDED PROJECT 4

# Rice Business Innovations System (RiceBIS) Community in Bicol

**Melanie Aileen C. de Peralta, Senior SRS**

The Rice Business Innovations System (RiceBIS) Community was geared in developing rice and rice-based enterprises within a province to address farmers' needs—from production, to processing, to marketing—in a resilient and sustainable manner while ensuring the availability and affordability of rice. While it strengthens the production system, it also adopts a market-driven approach catering to demand.

The project is comprises of three components: (1) Engaging and Strengthening Farmers' Organizations for a Progressive RiceBIS Community, (2) Agroenterprise Development: Developing Rice and Rice-Based Enterprises, and (3) Performance Monitoring and Evaluation covering Albay (Phase I) and Masbate (Phase II and Extension) provinces. Component 1 is focused on enhancing farmers' engagement in the community and strengthening farmers' organizations through community organizing and capacity enhancement to achieve a competitive and sustainable agroenterprise. Component 2 is centered on developing an inclusive, competitive, and sustainable agroenterprise community model with a targeted income increased of 25%, while Component 3 focused on monitoring and evaluating the development interventions of the RiceBIS project both for men and women farmer beneficiaries. All of these are geared towards the institutional target of increasing *palay* yield (1t/ha in irrigated, 0.5t/ha in rainfed),

reducing cost of *palay* up to P8/kg, reducing postharvest losses to 14%, and increasing household income by 25%.

A total of 249 farmers (143 male, 106 female) were trained in rice production using Modified PalayCheck System, organizational building and management, and mushroom production with an average gain in knowledge (GIK) of 35.0%; 22.3%, and 48.4%, respectively. Moreover, an average audience reach of 2,503 with 317 engagements was recorded from RiceBIS activities on Facebook. Additionally, "PalayTambayans" were established in Milagros, Masbate to serve as information learning sites where information, education and communication (IEC) materials including flyers, rice technology bulletin, magazines, and books were provided to the selected farmers' organizations.

On-farm technology demonstrations for both dry and wet seasons showcased high-yielding and cost-reducing technologies such as the use of high-quality seeds (HQS), nutrient management through rice crop manager (RCM) and minus-one element technique (MOET), mechanical transplanting, and plastic drum seeder. For Phase II, the average yield was 2.02t/ha (DS) and 2.15t/ha (WS) which was 0.83% lower and 1.19% higher than the baseline, respectively. For Expansion site in Mandaon, Masbate, average yields for both dry (2.80t/ha) and wet season (2.65t/ha) were higher than the baseline (2.10 and 1.95t/ha, respectively).

One agroenterprise plan was developed for "Proudly Masbate" pigmented rice (unpolished black glutinous rice) and commercial rice. Since there is no brown rice mill in Masbate, one strategy implemented was to facilitate the marketing of unpolished red rice through the Business Development Unit-Bicol. Big brother-small brother scheme was adopted, and three farmers' organizations were identified to serve as head consolidators of the produce from the small clusters and marketed to the identified buyers. Balangibang Farmer's Association (Phase I), Baclay Agrarian Reform Beneficiaries Cooperative (Phase II), and Cabitan Masipag Farmer's Association (Expansion) were identified as the Big Brother, since these organizations have initial capitalization, farm equipment, and machinery to conduct agroenterprise.

Monitoring survey for the DS 2022 was conducted for RiceBIS farmers across all sites: Phase I (n= 38; 24 M, 13 F), Phase II (n=63; 39 M, 24 F), and Expansion (n= 100; 46 M, 54 F). Non-RiceBIS participants were also included for comparison: Phase I (n= 30; 12 M, 18 F), Phase II (n=30; 17 M, 13 F), and Expansion (n=30; 18 M, 12 F). Data on profitability (yield, production cost, and income) for Phase I showed a yield decline of 4.6 % from the baseline. High market price of fertilizer significantly affected the farmers financially which led to the 24.0% of the total production cost and a rise in cost per kilogram of *palay* at P13, thus, a return of investment (ROI) of 2.1%, much lower than the baseline of 36.9%.

In Phase II, the adoption of yield-enhancing technologies such as the use of high-quality seeds (42.0%) and nutrient management through the RCM (89.9%) contributed to yield increase of 31.9% in irrigated ecosystems and 34.0% for rainfed ecosystems. The cost of *palay* per kilogram decreased to P14.9 (irrigated) and P22.1 (rainfed) compared to the baseline, despite increases in total production costs. High price of fertilizer and fuel were among the contributory factors affecting cost of production. In the Expansion, an increase of 67.4% (irrigated) and 37.3% (rainfed) in average yield per hectare for DS 2022 was attributed to use of high-quality seeds (54%) and adoption of RCM recommendations (73%) for nutrient management. However, with high market prices of farm inputs, the total cost of production increased by 61.8% for irrigated and 25.2% for rainfed ecosystem, which led to P17.36 (irrigated) and P19.64 (rainfed) cost of producing one kilogram of *palay*.

CORE-FUNDED PROJECT 5

# Branch Development Initiative (BDI): Rice Sustain (Sustainable Technologies and Appropriate Information Needs) for Increased Productivity and Profitability

**Rona T. Dollentas, Supervising SRS**

The DA-PhilRice Bicol, under the Branch Development Initiative (BDI) project, helps achieve a rice-secure country by enhancing the competitiveness of rice farmers through intensive dissemination and accelerating adoption of cost-reducing and yield-enhancing rice and rice-based production technologies and techniques. With Bicol and Eastern Visayas Regions (EVR) as its area of responsibility, these project has two major components: (A) the conduct of regular development and extension services and activities and (B) the scaling or catalyzing of appropriate rice farming technologies.

Component A is further categorized into: (1) gender-based capacity enhancement activities such as trainings, seminars, knowledge-sharing and learning (KSL) activities, and technical expert dispatching; (2) mass-based and social media technology promotion through distribution of PhilRice Knowledge Products (KPs), conduct of exhibits, and the use of PhilRice Text Center (PTC) and social media as digital platforms; and, (3) the establishment of technology demonstration farms. On the other hand, Component B is more focused on catalyzing mature technologies, such as the establishment of *Binhing Palay*

Farms as a modality to accelerate the dissemination and adoption of rice varieties for adverse environments in both Bicol and EVR; and scaling of the Integrated Crop Management (ICM) for saline-prone rice ecosystems in Albay, Bicol.

In 2022, under the capacity enhancement activities, four farmers' training, six *PalayAralan* activities, and one staff training were implemented with gain in knowledge (GIK) of 43% for farmers and 33% for PhilRice Bicol staff, with an overall satisfactory evaluation rating of 4.36 for the conduct of activities. A total of 11 requests to serve as resource persons in other rice-related activities were catered. In addition, one webinar and two seminars were conducted, one of which included concepts on gender and development (GAD) and another one on healthy rice consumption, as part of the National Rice Awareness Month (NRAM), station's contribution to raising awareness among rice stakeholders.

Dissemination of knowledge and technologies on rice production was implemented through strategic distribution of 66,990 copies of various PhilRice KPs/IEC materials across Regions V and VIII. In partnership with six state universities and colleges and seven farmers' association as regular repositories for these materials through the installation of One-Stop Information Shop (OSIS) also known as *Palaytambayan*. The KPs were also circulated to 10 farm schools, nine FAs, nine SUCs, 13 LGUs, 16 other government offices, and 2,497 clients during station visits and various Research, Development, and Extension (RDE) activities. Technology exhibits were conducted at six invitational events, with an estimated audience reach of about 4,000 (43% men and 57% women).

Using digital platforms to disseminate technologies and other rice-related information, the DA-PhilRice Bicol Facebook page garnered 10,027 followers (28% increase from 2021) with 170 organic and 66 shared posts. In addition, a total of 2,370 new registrants (21% from Bicol and 79% from EVR) of the PhilRice Text Center (PTC) were recorded.

Rice production technology demonstration fields were continuously set-up at the station for visitors and training purposes. The 1,510m$^2$ Learning Farm was maintained to provide experiential learning on modern farming techniques and to showcase mature technologies e.g. MOET, LCC, AWD including growth stages of rice —a critical aspect for crop management. Yield performance and adaptability of five inbred, three public, and five private hybrid varieties during DS 2021-2022; and seven inbred, two public hybrids, and 12 private hybrids during WS 2022 were demonstrated at DA-PhilRice Bicol along with technologies such as *Abonong Swak*, use of transplanter, and application of BioPrime Fertilizer. In addition, the 1,018m$^2$ *Palayamanan* model farm was maintained at the station to optimize farm productivity, demonstrate additional sources of income aside from rice production, and promote biomass recycling with vegetable, mushroom, and vermicomposting, and aquaculture components.

DA-PhilRice Bicol also participated in three invitational rice derby events organized by DA-Regional Field Offices (i.e. 14th Hybrid Rice Derby in Bula, Camarines Sur, Provincial Hybrid Rice Cluster Farm Demo in Hilongos, Southern Leyte, and Balance Fertilization Strategies Demo Farm in Tabon-Tabon, Leyte), showcasing Mestiso 20 and Mestiso 73 (all sites), and new inbred varieties (NSIC Rc 436, Rc 438, and Rc 480) in Camarines Sur.

Through *Binhing Palay* farms established across Bicol and EVR, 34 inbred rice varieties with tolerance to various environmental stresses (seven rainfed, 11 saline-prones, one upland, one submergence-tolerance, eight newly released-irrigated, and two special rice), were promoted and scaled in the regions. About 74,090kg seeds were produced in 2022, with 30% used for seed purposes. These benefited more than 278 farmers through purchases from partner accredited seed growers, barter, or LGU initiatives.

To address the effects of salinity in rice production, Integrated Crop Management (ICM) including saline rice varieties, specific crop establishment methods, and site-specific nutrient management was scaled to 25 farmers covering 10.37ha of saline-prone areas in Tiwi, Albay. Despite high variability of salt intrusions in sites, a 0.51t/ha (15.7%) increase in yields of NSIC Rc 468 and NSIC Rc 470 was achieved, and fertilizer application reduced to 3 to 4 bags/ha, saving about P7,000/ha. Farmers also recorded a 4-51% GIK through season-long training and knowledge-sharing and learning (KSL) activities.

In total, 12 Lakbay Palay events were conducted: seven initiated by the station across on- and off-station technology field demonstration sites; and four through invitation organized by DA-RFOs for rice derbies; and one through a station visit from Barangay officials from Basud, Camarines Norte, initiated by the Department of Interior and Local Government. A total of 1,992 individuals (47% male, 53% female) and an overall evaluation rating of 4.44 (satisfactory) were recorded for these station-initiated events.

Overall, the project reached 15,331 clients (higher by 46% from the previous year) with almost equal representation of men (48%) and women (52%). Access to and adoption of cost-reducing and yield enhancing rice production technologies were enhanced with the increase in client reached, GIK improvement of stakeholders (49%), and satisfactory evaluation rating (4.36) for various extension activities, which contributed to the increase in productivity of rice in Bicol and Eastern Visayas Region for the current year.

EXTRA-CORE STUDIES (CES-ANCHORED)

# National Cooperative Test – Hybrid

**Marie Antoinette R. Orbase, SRS II**

The National Cooperative Test (NCT) is a nationwide testing scheme implemented by the Rice Varietal Improvement Group (RVIG) and coordinated by the Rice Technical Working Group (RTWG). It is the convergence of elite rice lines developed by breeding institutions and the last post breeding stage before these elite lines (whether inbred or hybrid) become accredited and commercialized for general cultivation in the Philippines.

In 2022, 30 and 22 test hybrids were evaluated in dry and wet seasons, respectively at the DA-PhilRice Bicol Station, Ligao City, Albay. The trial was laid in randomized complete block design (RCBD) in three replications with two maturity groups. Data on agronomic characteristics, phenotypic acceptability, pest reaction, and yield were gathered. Significant differences were observed among hybrids in terms of maturity, plant height, panicle number, and yield. In DS, eight hybrids outperformed the best performing check, M103 (6702kg/ha) in Group I, with yield advantage from 6-18%. Meanwhile, three hybrids out-yielded M99 (6607kg/ha), with a yield advantage of 5-8%. WS evaluation resulted in the identification of seven hybrids in Group I with better performance over SL-8H (5755kg/ha) with yield advantages of 5-33%. However, no hybrid outyielded M99 (6896kg/ha) in Group II.

EXTRA-CORE STUDIES (CES-ANCHORED)

# OneRicePH: Development of Product Concepts for Target Rice Market Segments and Establishment of the National Breeding Network (Module 2. Stage 1-MET (Dry Direct Seeded Rice)

**Marie Antoinette R. Orbase, SRS II**

Rice yields are low in the rainfed lowlands due to drought and drought-associated problems. Under rainfed lowland, the environment (E) component is variable and unpredictable, thus the challenge is to maximize the positive Genotype (G) by Environment (G x E) that matches farmers' expectation and needs, including

their ability to handle risks. It's crucial to make available cultivars that are stable but responsive to specific environment. In the 2022 WS, multi-environment trial was conducted under rainfed, drought-prone, direct seeded condition in Brgy. Tambangan, San Jose, Camarines Sur. A total of 480 rice breeding lines and check varieties (300 breeding lines, six global checks and six local checks) were tested in an augmented RCBD. Intermittent drought was observed during the cropping season with recorded occurrence of rain showers and heavy rainfall caused by monsoon during the ripening stage. A maximum of six rain less days was recorded, with water table depth reaching 90cm below soil surface. Data on seedling emergence, early vegetative vigor, plant height, days to flowering, pest reaction, phenotypic acceptability, and yield were gathered. Significant differences ($p>0.05$) were observed among treatments. Of the total entries, 117 breeding lines out-yielded the best yielding check (NSIC Rc 222) with a yield of 4,847kg/ha. Same entries were evaluated during the 2023 DS.

## EXTERNALLY-FUNDED STUDIES (CES-ANCHORED)

# Stress-tolerant, High-yielding Rice Varieties Suitable for AFACI Member Countries

**Marie Antoinette R. Orbase, SRS II**

Salinity is one of the most important stress conditions other than high and low temperatures, and submergence that affect farm communities in the Philippines. To address this, rice must be genetically improved to withstand abiotic stresses. Screening rice breeding lines under these adverse conditions is imperative to help farmers in marginal areas increase their productivity and income. In the 2022 WS, 140 rice breeding lines and check varieties (global and local) were evaluated under non-stress and saline-stress conditions in Malinao, Albay. Saline intrusion and flooding were recorded during the cropping season. However, low to moderate salinity was observed due to high rainfall and freshwater intrusion of fresh water from the neighboring fields. Significant differences ($p>0.05$) were observed among treatments for both set-ups. Under non-stress, 11 breeding lines outyielded NSIC Rc 222 (2,159kg/ha), while 30 lines outyielded NSIC Rc 604 (1768kg/ha). Under saline-stress conditions, 36 breeding lines surpassed NSIC Rc 222 (3,500kg/ha) and NSIC Rc 468 (3,487kg/ha). These breeding lines were further evaluated in 2023 DS.

SPECIAL PROJECT

# Malusog Rice Program

**Victoria C. Lapitan, Director I; Glenn C. De Peralta, Senior SRS**

In collaboration with the International Rice Research Institute (IRRI) and local government units, DA-PhilRice is leading the preparations for the pilot-scale deployment of Malusog Rice (MR) also known as Golden Rice (GR) in the Philippines to help address the country's malnutrition problem. The approval for commercial propagation of this genetically engineered rice and its pilot-scale deployment will be the first direct community/public experience of MR in the world following the issuance of Memorandum Order No. 19, Series of 2022, "Operational Support to Golden Rice Production and Distribution" by Department of Agriculture (DA) Secretary William D. Dar.

In 2022, major accomplishments included the stakeholder outreach, technical briefings, and presentation of deployment plans to partners and stakeholders. The provinces of Catanduanes and Samar were identified as priority areas for pilot-scale deployment. Following a series of consultations, and with full support from the offices of the governors, both provinces established their technical working group to manage the planning and implementation of the deployment plan.

A media briefing to mobilize the media, raise awareness, and increase acceptability of MR in Region 5 was conducted in Legazpi City. Distribution of milled MR in Catanduanes was conducted 100 recipients, including preschoolers, children aged 6 to 59 month, and pregnant or lactating women. The MR Ceremonial Tasting and Stakeholders' Field Day in Calbiga and Basey, Samar was conducted in partnership with IRRI and local stakeholder stakeholders. These activities aimed to share updates on MR and assure the public of its health benefits, especially those with Vitamin A-deficiency. During the 2022 WS, the Malusog Rice Program in Samar established 2.5ha for seed production and an additional 2.5ha for grain production, while in Catanduanes, 0.6ha was established for seed production and 1.5ha for grain production.