Department of Agriculture

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PHILRICE R&D HIGHLIGHTS

DA-PHILRICE BATAC

Content

BRANCH STATION

PhilRice BATAC BRANCH STATION

EXECUTIVE SUMMARY

PhilRice Batac develops and disseminates appropriate rice and rice-based technologies to help farmers cope with climate change and ameliorate adverse rice environments through synergistic partnerships to make rice farming resilient, diversified, productive, and sustainable. The station's Research for Development (R4D) agenda is anchored on rice-based agriculture for semi-arid and adverse places (Rice ASAP), which emphasizes the urgency to develop appropriate technologies addressing issues on climate change exacerbated by the impacts of international trade policies that are inimical to the Philippine rice industry.

In 2021, the station implemented 15 R4D activities consisting of five station-based core projects and studies, three program-based, one division-based, five extra-core-funded projects, and one externally-funded project.

The station R&D projects and studies focused on: 1) evaluation of rice lines for special purposes such as the projects on mutation-induced lines for low glycemic index (Low GI) rice, the confined testing of iron and zinc biofortified transgenic rice (HIZR), and 2) fine-tuning of the integrated crop management for dry-direct seeded, evaluation of package of technologies for the favorable rainfed areas, pre- and postharvest management of aromatic and organic rice, evaluation of approved fertilizers for the best nutrient management, and the validation of nutrient uptake for genotype-specific nutrient management of hybrids and parents; 3) water harvesting and soil water conservation technologies; 4) development of advisories such as weather-based planting calendars for rainfed ecosystem, 10-day weather forecast and specific crop management, crop simulation modeling, and PRISM; and 5) evaluation of the multi-purpose seeder and best management practice (MPS BMP). Technologies developed by the station have reached farmers, local farmer technicians (LFTs), Agricultural Extension Workers (AEWs), and more stakeholders through training programs conducted under the Rice Business Innovations Systems (RiceBIS), the Rice Specialist Training Course,

Training of Trainers (TOT), Farmer Field Schools (FSS), and capacity building activities.

In addition, rice seed requirements of farmers and seed growers in the Ilocos Region were also provided through the Rice Competitive Enhancement Fund (RCEF) and the Business Development Unit (BDU), which basically produced the seed materials of the Ilocano rice farmers.

PROJECT 1

Learn Rice and Farm Wise

Sonia V. Pojas, Cynthiamay O. Lapat, Florence B. Tolentino, Nonilon I. Martin, Melvin S. Andres, Ahlfie James Galanza

The BDI through the Learn Rice project promoted and showcased appropriate technologies to enhance the capacities of the stakeholders and their farming communities. The project provided equal services to men and women in the three component studies. The technology demonstration showcased the Palayamanan model farm with components as vegetable production, vermicomposting, oystermushroomproduction,andriceproduction.Thericecomponent showcased hybrid rice M20 with nutrient uptake-based fertilizer recommendation, which was also used for the location specific technology demonstration of the station. Varietal demonstration of 16 regionally- and nationally recommended varieties, stress-prone, glutinous, and newly released inbred and hybrid rice varieties was also showcased. A varietal demonstration of eight public and private hybrid and five inbred rice varieties was also implemented with the Mariano Marcos State University (MMSU).

Aside from the field day for PhilRice staffers, a field day was conducted on-station with 106 participants (83 males; 23 females). In the participatory variety selection (PVS), male participants preferred the following varieties: NSIC Rc 416 (Sahod Ulan 13), NSIC Rc 420 (Sahod Ulan 15), and NSIC Rc 510 while female preferences were NSIC Rc 416, NSIC Rc 510, and NSIC Rc 160. Seeds of these varieties were distributed to interested farmers for a wider scale of planting especially in the stress-prone areas. Two field walks (one each for hybrid and inbred) were also conducted in the PhilRice-MMSU demo.

The Palayamanan demo did not only provide income to the station but also became a venue for the Rice Specialists Training Course (RSTC) participants to enhance their agricultural skills. Hands-on learning on raising of rice seedlings, vermicomposting, and

mushroom substrate bagging, pasteurization, inoculation of fruiting bags, and grain spawn preparation were conducted in the area. With the the Covid-19 pandemic, trainings were conducted online, which included teaching the PalayCheck System to 110 farmers in the five municipalities of Ilocos Norte. Onsite 5-day training on PalayCheck System was also conducted following safety and health protocols in Piddig with 24 farmer-participants. The overview of the PalayCheck system and the nine Key Checks were also translated into the Iloco dialect and have been video-recorded and streamed during online trainings.

Learn Rice and Farm Wise Component 1: Technology Demonstration: Modern Palayamanan and Promotion and Seed Production of the Varieties for Saline, Rainfed, Newly-release inbred, and Special Purpose Rice

Sonia V. Pojas, Cynthiamay O. Lapat, Melvin S. Andres, Florence B. Tolentino, Ahlfie James Galanza

Palayamanan demo showcased vegetable production, oyster mushroom production, and vermicompost production to provide additional income; promote recommended inbred and hybrid varieties; and produce seeds of saline, rainfed, newly-released inbred, and special purpose rice.

In DS 2021, vegetable production showcased pole sitaw, bitter gourd, bush sitaw, ridge gourd, cucumber, okra, and eggplant but these yielded low due to drought and pest infestation. In WS 2021, ridge gourd, bitter gourd, squash, patola pole sitaw, okra, and eggplant were planted. The crops produced 27.97kg pole sitao, 19.87kg bush sitao, 15.38kg cucumber, 10kg ridge gourd, 11kg okra, 7.5kg tomatoes, 4.95kg bell pepper, 3.21kg bitter gourd, and 0.5kg eggplant (initial fruits). Harvesting of okra, ridge gourd, pole sitao, and eggplant is still ongoing.

Oyster mushroom production utilized rice straw as the main substrate and promoted this to discourage rice straw burning. This year, 250kg of fresh oyster mushrooms were harvested from nine and three batches of fruiting bags established in 2020 and 2021, respectively.

Vermicompost production converts agricultural wastes such as rice straw and corn stover into useful products such as organic fertilizer to reduce inorganic fertilizers for environment-friendly approach,

sustainable, and safer food production. Nine cycles were produced using the Effective Microorganism Activated Solution (EMAS) and sandwich-type piling of substrate, which produced 4,337kg of vermicompost.

In the varietal demonstrations established in WS 2021 at the station, NSIC Rc 508 and Rc 512 produced the highest yield at 5.14t/ha and 4.93t/ha, respectively. Meanwhile, NSIC Rc 510, Rc 416, and Rc 420 were among the preferred varieties. Meanwhile, BR650 (7.73t/ha), NSIC Rc 408 (6.95t/ha), Rc512 (6.76t/ha), and SL-613H (6.43t/ha) were the highest yielder at the MMSU President's Farm.

A location specific technology for public hybrid M20 was also established in 0.4ha at the station using the PalayCheck System.

Learn Rice and Farm Wise Component 2: Trainings

Sonia V. Pojas, Cynthiamay O. Lapat, Melvin S. Andres, Florence B. Tolentino, Ahlfie James Galanza

To enhance the capacity of farmers and stakeholders amidst CoVID-19, an online training on PalayCheck System was conducted in City of Batac, Currimao, Paoay, and San Nicolas in Ilocos Norte with 110 participants. Face-to-face one-week PalayCheck training was also conducted in Piddig with 24 participants. PalayCheck IEC materials translated in Iluko were used during the trainings.

Learn Rice and Farm Wise Component 3: Strategic Communication

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Eight Filipino PalayCheck videos were translated and dubbed in Iluko while 10 PalayCheck presentations were also localized. More than 20,000 copies of IEC materials were distributed, four radio interviews were broadcasted in radio stations, and media plugs are continuously aired in four radio stations in Region I. Two exhibits on rice technologies and rice science museum were showcased during the Farmers' Festival and 2021 Lakbay Palay. The PhilRice Batac Facebook page uploaded 296 posts while 41% increase in page likes was registered. A technology alley was also developed featuring the history, annual milestones, and technology contributions of PhilRice Batac.

PROJECT 2

Fine tuning the Integrated Crop Management (ICM) for Dry Direct-seeded Rice in Favorable Rainfed Ecosystem

Anielyn Y. Alibuyog and Ahlfie James G. Galanza

Direct seeding is a potential solution to sustain rice production in response to evolving threats of increasing shortages of irrigation water, uncertainty of rainfall patterns due to climate change, and rising cost of fuel for irrigation and land preparation and farm labor. Tthis study aimed to: (1) document the farmers' best practices on dry direct seeding technology in Ilocos Region, (2) identify the best soil texture for DDSR using MP seeder under favorable rainfed, (3) determine the underlying cause/s of seedling mortality in DDSR-established seedlings in fine-textured soils, (4) determine the most effective and economical weed management for DDSR, and (5) package and validate the ICM for DDSR under favorable rainfed condition. Twenty farmers in Pasuquin and Nueva Era, Ilocos Norte were interviewed for their practices on DDSR. Most of the farmers established their crop in June by dibbling method. Planting distance is 20cm x 20cm while seeding rate ranged from 40 to 160kg/ha (with mostly using 80kg/ha and 120kg/ha). On crop management, fertilizers were applied thrice with basal fertilizer at seeding and chemical spraying + manual weeding to control weeds (non-selective + post-emergence + manual weeding). For the field set up, coarse-textured soil significantly produced higher yield (3.78t/ha) than the medium- and fine-textured soil (2.98t/ha and 2.99t/ha, respectively).Pot experiment showed that anaerobic condition enabled better seedling growth than in aerobic condition. Coarse-textured soil showed better field and pot experiment performance under aerobic conditions than the medium and fine-textured soils. Hence, the coarse-textured soil is more appropriate for DDSR.

PROJECT 3

Adoptability of the PhilRICE-Developed In-Field Water Harvesting & Soil and Water Conservation System and Integration with Good Agriculture Practices for Rice Intensification and Crop Diversification in Rainfed and Upland Farms

Lex C. Taguda, Reynaldo C. Castro, Massimo Vico U. Quinajon, and Roger B. Bajo

Agriculture is adversely affected by climate change. Erratic rainfall causes water scarcity not only during summer but even during rainy seasons. Breaks in rainfall of more than a week during the rainy season is becoming common. Hence, water harvesting structures are needed to ensure water availability in the farm. The study aimed to introduce the PhilRice water harvesting and soil and water conservation technology at PhilRice Batac Station for farmers in the area as well as other stakeholders; and in Lagangilang, Abra to increase farm productivity and farmers' income. At the station, techno demo on tomato and eggplant using good agricultural practices (GAP) was established with low-cost drip irrigation system (LDIS) and treadle pump retrofitted to the water harvesting technology to increase water-use efficiency and reduce labor cost. The technology was showcased during the PhilRice Batac Lakbay Palay, which was attended by farmers and agriculture technicians from Batac, Paoay, and Banna. Another screen house was also setup with different crops using GAP with LDIS but using water from the renovated small water impounding system to irrigate the crops. In the on-farm demonstration sites in Umingan, Pangasinan, watermelon was irrigated using a solar-powered drip system retrofitted to the water harvesting. In the Abra State Institute of Science and Technology (ASIST), a field trial was established, which focused on GAP on soil and water conservation engineering, ecological engineering, and use of hedgerows. Five farmer-leaders in Sinabaan, Lagangilang committed to initiate the community-wide adoption of the water harvesting system. The local government unit of Lagangilang will also provide backhoes and other equipment needed for the construction of the water harvesting system.

PROJECT 4

Rice Business Innovation System(RICEBIS) Community – PhilRice Batac

Mary Ann U. Baradi, Anielyn Y. Alibuyog, Leah May dC. Tapec, Nida Q. Abrogena, Bethzaida M. Catudan, Juanito M. Maloom, Jessica M. Solero, Marilyn M. Yere, Vida Grace P. Ganiban, Ruby May Eliza P. Solsoloy, Jasper B. Francisco, Clifford Ace B. Rañga

The Phase I of the RiceBIS Community Project in Ilocos Norte was established in 2017 with a pilot site in Rayuray, Batac City. The project has three components: (1) development of agribusiness ventures of the RiceBIS community; (2) development of competence in agribusiness; and (3) monitoring and evaluation (M&E) of the performance of the community. The 50 farmer-partners (36 males; 14 females) consisting of six clusters with 36.47ha farm area of the Rayuray Farmers Agriculture Cooperative (RFAC) continued to engage in product consolidation, value-adding, and marketing of products (paddy, brown, well-milled rice). The cooperative's current total asset is valued at PhP4.2M (48% up from last year's PhP2.19M) including grants (cash, equipment, and machinery from partner agencies). This year, the cooperative received a PhP1M grant from the Kadiwa ni Ani at Kita Program of the Department of Agriculture for their palay trading business.

The coop promoted and sold their products in exhibits and marketed brown rice and well-milled rice to institutional and individual buyers. They also gained income from custom service and rental of the four-wheel tractor.

To develop farmer competence, seven webinars and seminars on cooperative and financial management, and seminar on values reorientation were conducted in collaboration with partner-agencies including the Agricultural Training Institute and Cooperative Development Authority. They were also coached on financial management and bookkeeping.

The PalayCheck System demo area in DS 2021 was planted with LP 937, which yielded 6.78t/ha, higher than 1.10t/ha (19.4%) over the farmer's practice. No techno demo was established in WS 2021.

In WS 2020, yield decreased by 0.36t/ha or 8% due to drought or insufficient rainfall with 53% farmers attaining yield less than 3t/ha while 13% harvested more than 5t/ha. Rice yield also increased by 0.93t/ha or 16% from the baseline in DS 2021 with 81% of the

farmers attaining more than 5t/ha yield, an increase from the 69% of the farmers gaining this yield from the baseline. SFR was used for adequate irrigation.

Production cost of a kilo of palay also decreased for both seasons. During the dry season, the cost decreased by 33% or PhP4/kg from PhP13/kg. Though yield decreased during the wet season, production cost decreased by 16% or PhP2/kg (also from PhP13/kg).

Although yield decreased in the wet season due to insufficient rainfall, production cost decreased while net income increased. Net income increased by 4% or PhP1,027/ha higher than the baseline. Similar results were derived in the dry season with net income increased by 90% or PhP31,507/ha.

PROJECT 5

Modern Rice Production Technologies for the Rainfed Lowland Ecosystem

Leylani M. Juliano, Melvin S. Andres, Juanito M. Maloom, Rica Mae G. Gomez, and Mark Jay D. Sinfuego

The SMARTer Rice program tested new farming methods in Batac City, Ilocos Norte, to improve rice production in areas with unpredictable rain. Package of technologies (POT), like using a specific rice type (NSIC Rc 402), managing nutrients with MOET, managing pests, and using machines for planting and harvesting.

In 2021, six trials in three areas were conducted, each covering 1000sqm, to see how well the new methods worked for different target yields (5, 6, and 7t/ha) compared to what farmers usually practice. Results showed that the new methods produced higher yields (5.2t/ha for the 5t target and 5.7t/ha for 6 and 7t targets) compared with the usual methods used by farmers (4.5t/ha). The new methods gave a yield advantage of 0.7 - 1.2t/ha.

The tests also showed that the new methods could achieve the 5 and 6-ton target yields based on the expected potential yields and the actual yields obtained from the field trials. In some places, the POT even exceeded the target yields, except for the 7-ton target, which was not reached because of different reasons like soil quality, weather conditions, and pests (planthoppers) that were widespread during the season.

Based on the economic analysis, POT could lower the production cost to around PhP10.63-11.19/kg, while the usual farmer practices

cost PhP14.24/kg. By following the new methods, farmers could get more yield and spend less money on production, making better use of their resources.

PROJECT 6

Advisories on the Optimization of Crop-Livestock-Fish Mixes for Upland Farms Under Limited Water Supply, Labor and Capital

Juanito M. Maloom, Reynaldo C. Castro, Marilyn M. Yere, Mhilton Arvy Bacarisa, and Cliff John Rey Cotin

This study collected data on how much it costs to grow certain local vegetables during the off-season. The average cost and farmers' profit were recorded. For off-season planting, growing tomatoes gained a net income of PhP90,837.50/ha. Ridge gourd had the lowest profit at PhP7,658.33/ha. When the cost of producing a kilogram of vegetables was calculated, tomatoes were the cheapest at PhP1.16/kg while ridge gourd was the most expensive at PhP31.00/kg.

A Cropping Plan Advisory System App, which aims to help farmers make the most money from their crops, is also being developed.

Extracore Project 1

Development of Low Glycemic Index Rice Through Induced-Mutation and Marker-Assisted Selection

Mutation was induced to NSIC Rc160 rice using physical (gamma-irradiation) and chemical mutagenesis (sodium azide). Five populations were generated as follows: BIN-001, treated with 250 Gy gamma irradiation; BIN-002, treated with 300 Gy gamma-irradiation; BIN-003, soaked in 1mM of sodium azide (NaN3) for six hours; BIN-004, 250 Gy + NaN3; and BIN-005, 300 Gy + NaN3. In DS 2021, 500 M4 lines were advanced and subjected to trait-based genotyping using ten SNP markers. Initial results led to the selection of 14 lines, and a more comprehensive genotyping analysis will be conducted in DS 2022 using ten SNP markers to assess grain quality.

Extracore Project 2

Rice Business Innovation System (RICEBIS) COMMUNITY – PHILRICE BATAC

Mary Ann U. Baradi, Mary Ann U. Baradi, Anielyn Y. Alibuyog, Leah May dC. Tapec, Nida Q. Abrogena, Bethzaida M. Catudan, Juanito M. Maloom, Jessica M. Solero, Marilyn M. Yere, Vida Grace P. Ganiban, Ruby May Eliza P. Solsoloy, Jasfer B. Francisco, and Clifford Ace B. Rañga

The RiceBIS Community Project in Ilocos Norte (Phase II) began in WS 2020 in Banna and Nueva Era, Ilocos Norte, specifically targeting the Zanjera Sto. Niño de Tabtabagan Association. The main goal was to organize farmers groups in the community, both men and women, to improve their crop yield and income while reducing production costs and postharvest losses. The project had four components: (1) organizing farmers to increase profitability; (2) strengthening farmers' skills in production and agro-enterprise development; (3) involving farmers in profitable agro-enterprises; and (4) monitoring and evaluating the RiceBIS Community's performance.

The Zanjera encompasses six barangays, five in Banna (Bugasi, Valdez, Tabtabagan, Caestebanan, Sinamar) and one in Nueva Era (Sto. Niño). It consists of 45 groups led by elders called Panglakayens, with around 603 members (575 males and 28 females) covering 589ha.

To enhance the farmers' knowledge in rice and rice-based production, three batches of Modified FFS on the PalayCheck System were conducted for irrigated lowland areas, along with one training session on vegetable production. This training reached 184 male and 110 female farmers in the RiceBIS community. Additionally, training on FBS and cooperative development was conducted in collaboration with ATI and MMSU, respectively, training 137 male and 45 female farmers.

Technology demonstrations were carried out, showcasing the PalayCheck System compared with the traditional farmer's practices. Yield-enhancing methods such as using high-yielding varieties, straight-row planting, and nutrient management, as well as cost-reducing techniques like adjusting seeding rate, IPM (Integrated Pest Management), and machine usage during harvesting and threshing

Extracore Project 2

using combine harvester, were promoted in the community to increase yield and income while reducing postharvest losses.

During the WS 2021, the 500 series yielded more than 5t/ha, except for NSIC Rc 512. The PalayCheck System was also compared with the traditional farmer's practice through TDFs. In DS 2020-2021, a 1.21% yield increase was recorded, mainly due to limited water in the area. However, in WS 2021, an average yield increase of 12.33% was recorded using the PalayCheck System.

Monitoring panel farmers in WS 2020 and DS 2020-2021 showed that yield decreased by 0.07% compared to the baseline during the WS 2020, primarily due to insufficient water or low rainfall. In DS 2020-2021, farmers' yield also decreased by 1% compared with the baseline due to insufficient water during the wet season, which affected the water level during the dry season. Most farmers (56%) achieved yields between >3t/ha and <5t/ha during DS 2021.

Despite the decrease in yield, it is interesting to note that farmers net income significantly increased. The increase was 102% during the dry season and 613% during the wet season. This was mainly due to the adoption of yield-enhancing and cost-reducing technologies, especially in pest and nutrient management. Moreover, the total production cost of farmers for both seasons significantly decreased. The cost decreased by 19% during the wet season and 13% during the dry season. The cost per kilogram of producing palay also decreased by 11% (PhP1.58/kg) during the dry season and 19% (PhP3.00/kg) during the wet season (PhP12/kg palay).

Extracore Project 3

Field Evaluation of FPA-Approved Fertilizers For Irrigated Lowland Rice Ecosystem for the Packaging of Best Nutrient Management Technology

Joel G. James, Marilyn M. Yere, Nida Q. Abrogena, Angelica L. Purganan, Rica Mae Gomez

The Fertilizer Derby project evaluated fertilizer products approved by the Fertilizer and Pesticide Authority (FPA) for rice production. The project was carried out in both cropping seasons.

In DS 2021, three private companies (Allied Botanical Corporation, Enviro Scope Synergy Incorporated, and Northern Prime Trading Corporation) and PhilRice participated in the project. They showcased their nutrient management technologies in two field setups: one on a farm in Banna, Ilocos Norte with communal irrigation and one on-station at PhilRice Batac with full supplemental irrigation from a shallow tube well. A hybrid rice variety (Bigante plus) was used in Banna while an inbred variety (NSIC Rc 222) was used on-station. The PalayCheck System was applied to all entries with variations in nutrient management methods among the participants.

In the on-farm setup in Banna, Allied Botanical Corporation obtained the highest yield of 4.28t/ha (PhP12.81/kg cost) using 121.6-60-60 + Neb-88 Ultra + foliar products. Enviro Scope Synergy Inc. achieved 4.1t/ha (PhP12.77/kg cost), Northern Prime at 3.39t/ha (PhP14.21/kg cost), and PhilRice at 3.38t/ha (PhP13.55/kg cost). In the on-station setup, Enviro Scope Synergy obtained the highest yield at 5.91t/ha (PhP13.76/kg cost) using 136-21-36 + Neb 88 plus products, PhilRice at 5.89t/ha (PhP13.07/kg cost), Allied Botanical Corporation at 5.36t/ha (PhP15.70/kg cost), and Northern Prime Trading Corp at 3.64t/ha (PhP20.55/kg cost).

In WS 2021, Golden Valley Agricultural Development Corp. joined the project, and a common farmers' practice was included for comparison. NSIC Rc 480 was tested on-station at PhilRice Batac. Field performance showed that PhilRice obtained 6.58t/ha (PhP8.89/kg cost) using 146-35-50kg NPK/ha, Enviro Scope obtained 5.81t/ha (PhP9.59/kg cost), Golden Valley at 5.24t/ha (PhP10.9/kg cost), farmers' practice at 5.05t/ha (PhP11.23t/ha), Allied Botanical at 4.52t/ha (PhP12.98/kg cost), and Northern Prime at 4.49t/ha (PhP12.64/kg cost).

Extracore Project 3

To assess the soil's nutrient capacity, agronomic efficiency (AE) was calculated based on the results of the nutrient omission plot (NOP) techniques established alongside the field trial. AE for nitrogen (N) showed that 10kg, 9.3kg, and 17.6kg of grains can be obtained from one kilogram of N, suggesting that N is lacking in the soil and requires an additional optimum amount of 140-100kg N/ha based on the applied NPK rates on NOP plots.

Proper fertilizer scheduling and amounts are crucial in crop development. Any excess or improper timing could lead to pest occurrences. This was observed among the plots of Allied Botanical and Northern Prime Trading in Banna, which were infested with stemborers during DS and with brown planthoppers and green leafhoppers during WS. Other plots like Enviro Synergy Inc, PhilRice, and Farmers' Practice prevented pest occurrences due to proper timing and the right amount of N. It is recommended to further validate the results in farmers' fields to identify the best nutrient management and develop a technology package for each Fertilizer Derby participant.

Extracore Study 1

Validation of Nutrient Uptake for Genotype-specific Nutrient Management of Hybrids and Parents (Off-Site)

Ailon V. Capistrano, Marilyn M. Yere, Juanito M. Maloom, Rica Mae G. Gomez

This study validated the nutrient uptake of hybrid and parent plants to develop better crop management practices that can increase yield. The study used the recommended NPK rate in rainfed conditions and assessed how the crops responded to different nutrient levels based on the targeted yield. Unfortunately, the targeted yields for the hybrids in three seasons (two wet seasons and one dry season) were not achieved, except for Mestizo 20 in DS 2021 and Mestizo 73 in WS 2022.

For Mestizo 55 and Mestizo 20, higher yield was obtained with added nitrogen (N), but Mestizo 73's yield remained low even with added N. It is worth noting that the crop does not fully use the applied N in the same year it was given. Agronomic efficiencies (AE) were lower in rainfed conditions compared with irrigated areas, ranging from 13 to 22kg grain/kg N applied for AEN, 1-13 for AEP, and 7-9 for AEK. Due to a typhoon and wind affecting grain filling in the varieties, data on agronomic efficiencies for phosphorus (P) and potassium (K) had no value in WS 2021.

Despite abiotic stress, low AE levels suggest that changes in crop management can still increase yield, and if the NPK levels are sufficient, reducing inputs can lower costs. Further studies are recommended to test the recommended NPK rates not only in research-managed fields but also in farmers' fields.

Extracore Study 2

Simulating Hybrid Rice Yield Using Decision Support System for Agrotechnology Transfer (DSSAT) Model Under Various Growing Environment

Juanito M. Maloom and Marilyn M. Yere

The study focused on using a Decision Support System for Agrotechnology Transfer (DSSAT) Model to predict hybrid rice yield under different growing conditions. The goal was to find the best genotypes that can achieve optimum productivity in various ecosystems with different management practices.

Crop Environmental Resource Synthesis-Rice (CERES-Rice) was used to evaluate and validate the performance of 14 genotypes in irrigated and rainfed environments. These genotypes included five hybrids, four maintainer lines, four restorer lines, and one check variety.

In the rainfed condition of Ilocos Norte, five hybrids and four restorer lines were evaluated in WS 2021. Additionally, field trials were established in two sites in Batac and one in Banna, Ilocos Norte, to assess the performance of six hybrids: M 1, M 20, M55, M 73, and SN758, along with the check variety NSIC Rc 222.

Based on analysis across different seasons and locations, three hybrids (M 20, M 32, and M55) showed the best yield performance, as well as two maintainer lines (IR68897B and IR79128B). These genotypes demonstrated a good fit to the data and proved to be better than others.

However, the remaining genotypes (IR34686, IR73013R, IR58025B, SN758, and TG102M) need further adjustment. To achieve this, the Generalized Likelihood Uncertainty Estimation (GLUE) program will be used to estimate genotype-specific coefficients for the DSSAT crop models. This will help fine-tune and improve the performance of these genotypes during further validation or sensitivity analysis.

Extracore Study 3

Multi-environment YieldTrial of Elite F_1 Hybrids & Parents at PhilRice Batac

Mae Rose M. Maoirat-Abad, Marilyn M. Yere, Ria C. Yate, Rica Mae C. Gomez

The multi-environment yield trial (MET) conducted at PhilRice Batac supports the institute's objectives in evaluating different rice lines for various conditions like rainfed lowlands, saline, and submerged areas. The Hybrid project funded by DA-BAR aimed to identify F1 hybrids and parents that can adapt well to different growing environments in rainfed lowlands.

During the DS and WS 2021 cropping seasons, 43 entries were evaluated to identify F1 hybrids and parents that perform well in multiple environments. Crops were transplanted manually using 12-14 days old seedlings with a planting distance of 20cm x 20cm. Fertilizers were applied based on MOET results, using 165-30-60kg NPK/ha for DS and 192-35-65kg NPK/ha for WS. Agronomic, yield, and yield-related data were collected during the two trials.

In the DS trial, PR51570H (MET-71) achieved the highest yield of 5.7t/ha, followed by M20 (MET-27) at 5.6t/ha and IR34686 (MET-28) had the lowest yield at 3.2t/ha. In the WS trial, PR51557H, PR52538H, PR51549, and PR51587H recorded the highest yields (5.65, 5.63, 5.62, and 5.62 t/ha, respectively), which were comparable with the check variety M73 (5.58 t/ha). These elite F1 hybrids reached the target yield of 5t/ha and are recommended for demonstration trials in farmers' fields.

Extracore Study 4

Mechanized Seeding Technology: Improving Crop Productivity and Increasing Income in Rice-Based Rainfed and Water Scarce Environments in the Philippines

Leylani M. Juliano, John Mark M. Bumanglag, Cariel Q. Abad, Anielyn Y. Alibuyog, Elmer G. Bautista, Aurora M. Corales, Roel R. Suralta, Edwin C. Martin, and Crisanta S. Bueno

Using mechanized crop establishment along with best crop management practices can lower production costs and improve the competitiveness of rice and rice-based farmers. The Multi-purpose Seeder (MPS) Project, funded by DA-BAR, assessed mechanized dry seeding for rice, corn, and legumes in rainfed lowlands and tail-end irrigated areas in Ilocos Norte. The MPS package included the best nutrient and pest management options based on on-farm research trials from 2017 to 2020. The package also promoted the use of drought-tolerant rice varieties in water-scarce environments. With the MPS, farmers can achieve consistent seed density, seeding depth, precise seeding rate, and better seed cover to protect against pests, resulting in improved crop performance. Smallholder farmers, especially in rainfed areas, can benefit from using the MPS for crop establishment compared with manually broadcasting high-value crops like corn and mung bean, which are planted after rice to enhance annual crop production.

In DS 2021, the existing crop management technologies for corn and mungbean were combined with the MPS to create site-specific best management packages (BMP) for corn and mungbean. The MPS achieved a seeding rate of 17-23kg/ha for corn and 17-26kg/ha for furrow seeding, reducing total production costs by 2.5% and increasing yield by 13% higher than manual planting. The profitability analysis showed that using the MPS with BMP increased net income for corn by 48.5%. For mungbean, manual seeding required 37-42kg/ha while using the MPS required 20-23kg/ha with uniform seed distribution and accurate seeding rate during crop establishment. However, while the MPS package reduced seed costs, it required higher expenses for land preparation, crop establishment, and fertilizer than the conventional manual broadcasting of mungbean.

Extracore Study 4

The total production cost for the MPS package increased by 8% compared with the conventional practice, resulting in comparable grain yield but 8.5% lower net income.

In WS 2021, 11 on-farm demonstration trials for rice were conducted in different locations compared with the farmers' practice (FP) of conventional dry direct-seeded rice. The use of the MP seeder significantly reduced labor requirements and seeding rate during crop establishment by 70-110% and 14-51%, respectively, leading to a 63% reduction in seed and crop establishment costs. However, the MPS package required a higher fertilizer rate, increasing the cost by 28%. The average yield and production cost in FP were increased by 34% with the MPS package, resulting in a lower production cost by 35% per kilogram.

Externally-funded Project 1

Nutritionally Enhanced Rice: Finishing and Delivering Golden & High-iron and Zinc Rice Varieties

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Iron (Fe) and zinc (Zn) deficiencies are widespread micronutrient deficiencies globally. In the Philippines, anemia is prevalent among infants (6 months to 1 year old) at 48.2% while stunting is high at 35.1% in 6-7-year-old schoolchildren (FNRI-DOST, 2018) with Zn deficiency being a major cause of stunting. To address this "hidden hunger," biofortification of rice to increase micronutrient content is considered a sustainable option. Popular rice varieties typically contain about 2ppm Fe and 16ppm Zn in their milled grains. The transgenic approach aims to biofortify rice to reach approximately 10ppm Fe and 28ppm Zn in milled grains, fulfilling around 30% of the estimated average requirement (EAR) in humans.

During the WS 2021, a confined test of transgenic rice with Fe and Zn was conducted. The test included two events selected from a previous trial (DOST-BC Ref. No. 2018-0313) with 20 lines (ten lines per event). The trial was conducted from June 3, 2021 until October 6, 2021 (harvest), with the last postharvest monitoring on December 7, 2021. The goal was to select the lead event with desired agronomic characteristics and Fe and Zn traits in polished rice for future trials.

All on-farm and related activities, including biosafety measures, were coordinated with the PhilRice Batac Institute Biosafety Committee (IBC) and monitored by regulatory bodies such as the BPI-PQS throughout the trial. The biosafety measures included temporal isolation, ensuring no overlap in the flowering period of rice plants in the vicinity of the transgenic fields. Spatial isolation of 150m was observed and corn plants were established as pollen barriers and windbreakers. Rat fences and bird nets were installed to prevent potential seed dispersal. Equipment cleaning (e.g., machineries) was monitored to prevent unintended seed release. All materials like non-transgenic borders, vegetative portions of the transgenic plants, and unfilled grains were disposed of in a net-covered pit located within the test site. Panicles from the filler and border plants were devitalized in boiling water for five minutes before disposal. Water levels were kept low, and drainpipes were covered with screens to prevent seed dispersal through water. The facility was always locked during non-working hours.