2019

PHILRICE R&D HIGHLIGHTS

AGUSAN BRANCH STATION

Contents

BRANCH STATION

PhilRice Agusan

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Executive Summary

PhilRice Agusan is mandated to develop, adapt, and promote location-specific technologies suitable to the unique agro-climatic conditions in Northeastern Mindanao.

The station implemented seven projects focused on developing location-specific rice varieties for Caraga conditions; improving soil, nutrient, and water management; developing integrated pest management; supporting research and development efforts; and conducting area-based technology promotion and strategic partnership.

In 2019, three promising rice lines were selected for the transplanted culture. These lines have yields ranging 5.7-5.9t/ha and yield advantage of 5-7% over the best check NSIC Rc 238 (5.5t/ha). For the direct-seeded crop establishment, five rice lines with 5-13% yield advantage over the best check variety were selected. There were 292 rice lines collected to enrich local germplasm.

PhilRice Agusan initially developed soil, water, nutrient, and crop management options that improved yields by 1-2t/ha from the baseline yields of 3.3-3.6t/ha (2014-2017 PSA data) in irrigated lowland rice areas of Caraga.

Simple procedure for culturing the local Lemna sp. exceeding the growth rate requirements for experimental plants was developed. Fertilizer management and two rice straw management were also formulated.

Supporting the station's research and development, Automated Weather Station (AWS), database management, and research laboratory were made available and functional. Accessible and available weather updates and other weather-related events that would aid PhilRice Agusan R&D staff on decision-making were provided.

The station also promoted PhilRice technologies through various platforms. It also provided technical assistance and need-based interventions, and upscaled rice and rice-based production systems in specific target areas through livelihood projects, demonstration and pilot farms, or learning sites for the farmers and their organizations. It also sought support from local legislators on rice production, marketing, and consumption. The station sustained its collaboration with various sectors (i.e., private sector, barangay, municipal, provincial local government units; national government agencies, the Department of Agriculture and its attached bureaus and agencies, and the Armed Forces of the Philippines in conflict-affected areas).

PROJECT 1

Evaluation of Rice Lines Under Caraga Conditions (Low Solar Radiation, Wet and Very Wet Seasons, Problem Soils, and Major Pests And Diseases)

DB Bastasa and NBP Paz

Rice production in Caraga is affected by low solar radiation, high rainfall, problem soils, episodic flooding, and rice pests and diseases. These resulted in the region's low average yield at 3.87t/ha (PSA, 2019). Thus, locally-adapted rice varieties are needed to increase the current yield. This study aimed to select and recommend high-yielding rice lines with high acceptability and adaptability for Caraga using the breeding materials from the yield trials conducted at PhilRice Agusan.

Under the irrigated lowland conditions, two phases of field performance evaluation trials were regularly conducted. The initial phase (NCT 1) was composed of new entries nominated by breeders and breeding institutions in the Philippines. The new entries were established in strategic rice research stations. Promising test entries that passed the criteria of NCT I were elevated to Phase II, the Multi-Adaptation Trials (MAT) or the final stage for variety release. Both trials were conducted under transplanting (TPR) and direct seeding (DSR) method and were managed by researchers. These trials were laid out in Randomized Complete Block Design (RCBD) with three replications and with some check varieties included. The results for July-December 2019 are yet to be available as the samples are on-process

PROJECT *2*

Improving Soil, Water, and Nutrient Management in Lowland Areas of CARAGA

JC Magahud, SLP Dalumpines, and PAB Padios

The project developed soil, water, and nutrient management options that improved yields by 1-2t/ha from the baseline yields of 3.3-3.6t/ha (2014-2017 PSA yields) in irrigated lowland rice areas of Caraga. Specifically, the project aimed to (1) develop diagnostic procedures for soil and water quality assessment that reduce the cost and time required for evaluation, and (2) formulate management options for increasing yield. A simple method for culturing the local Lemna sp. with growth rate exceeding the requirements for experimental plants was developed. Lemna refers to small aquatic plants commonly found in Agusan's poorly drained lowland areas. The same method was used to test Lemna responses to various nutrients and heavy metals and to develop a simple diagnostic procedure for soil and water quality assessments. Compared with farmers' practices, the following yield improvements were observed in response to certain management: (1) 9-25% for PalayCheck fertilizer management at 74-28-43 kg NPK/ha, (2) 1-8% for application of 5t/ha rice biomass, and (3) 1-14% for allowing 10t/ha biomass to decompose two weeks before transplanting. Recommended fertilizer rates were also calculated from yields and amount of N fertilizer in complete fertilizer plots, yields of omission plots, agronomic N efficiency, and yield response to N fertilizer application. Calculations for three cropping seasons showed that 60kg N, 25kg P, and 30-60kg K are the recommended fertilizer rates for one-hectare rice land. Furthermore, growing NSIC Rc 222 under alternate wetting and drying (AWD) and PalayCheck fertilizer management (74-28-43kg NPK/ha) produced 5.1t/ha yield at P9.1/kg cost. Project outputs on diagnostic procedure for soil and water quality assessment and management practices that improve yield directly contribute to the PhilRice strategic outcome on increased productivity, cost-effectiveness, and profitability of rice farming in a sustainable manner.

Potential of Lemna sp. as Health Indicator of Paddy Soil-water System

JC Magahud, SLP Dalumpines, and PAB Padios

The standard laboratory procedure for evaluating environmental quality is expensive, time-consuming, and requires months or years of training. Duckweeds, common in the poorly-drained lowland areas of Agusan, have been known to be ideal test plants for toxicological experiments. Hence, this

study developed a local method that uses duckweeds for soil and water quality assessment to reduce cost and time required for evaluation. Specifically, the study developed a simple culture procedure characterized by growth rate of the local duckweed species that exceeds requirements for test plants. It determined a duckweed response that has a significant relationship with a parameter that contributes to soil and water quality. The study also identified the genus and species of the local duckweed. Laboratory experiments and submission of duckweed samples to the authorized agency were conducted. Growth requirements at 0.303-0.419 fronds/day were achieved in 15% hydroponics solution at 12cm from light source in a 144 x 141 x 46cm chamber with 50µmol photons/m2/s umination. Duckweed growth generally decreased as copper concentrations declined from 0 to 6mg/L. The correlation between Lemna growth and copper levels was highly significant at -0.615 to -0.698 from 3 to 11 days of incubation. Duckweed used in the experiment was identified as Lemna minor L. by the Museum of Natural History in University of the Philippines Los Baňos.

Soil and Water Management of Very Poorly-Drained Soils for Improved Yields in Agusan

JC Magahud, SLP.Dalumpines, and PAB Padios

Lowland rice soils in Agusan are considered fertile due to their high organic matter and available phosphorus levels. However, such soils are poorly drained – a condition that causes the accumulation of decomposition products, which results in nutrient deficiencies and imbalances, leading to reduced rice growth and yield. This study aimed to (1) characterize the poorly-drained rice soils in Agusan's major irrigated lowland rice fields and (2) develop soil or water management recommendation to improve yields in such soils. Screenhouse experiments were conducted to compare improved soil and water management with farmers' management. Seven characteristics – one physical and six chemical – in one test site were assessed from January to April. At an initial water level of 3-5cm, it took 6-7 days for the poorly-drained soil of Agusan to reach -20cm. The first poorly drained soil with silt loam texture had sufficient phosphorus, sulfur, and copper status for four cropping seasons; deficient nitrogen and potassium levels; and varying zinc status. The second soil with silty clay texture had sufficient phosphorus and copper status for four cropping seasons, deficient nitrogen and potassium levels; and varying sulfur and zinc status.
The following soil and water management improved yields compared with farmers' practices: PalayCheck fertilizer management (74-28-43kg NPK/ha) > farmers' fertilizer management (42-4-11kg NPK/ha) by 8.9-25.3% in all varieties x water management treatment; 5t/ha biomass application > no application

in most soil type x water management treatments by 0.8-8.4%, application of partially-decomposed 10t/ha biomass > application of fresh 10t/ha biomass in most variety x soil type treatments by 0.8-14.0%. Relative to alternate wetting and drying, continuous submergence of soil can improve yields by 0.2-25.7% in all varieties x fertilizer management and soil type x biomass management combinations.

Optimization of Nutrient Use to Improve Yield in Transplanted Irrigated Lowland System and Climatic Condition of Agusan

JC Magahud, SLP Dalumpines, and PAB.Padios

Soils in Agusan can be considered fertile owing to their high organic matter and available phosphorus levels. However, nutrient imbalances are very common because the soils are poorly drained. Pest incidences are also high particularly in susceptible rice varieties due to absence of dry season or dry months in the area. As such, rice yields in irrigated fields of Agusan are only 3.6t/ha in the Jan-Jun cropping season; 3.1t/ha in the July-Dec period. In response to such concerns, PhilRice developed a nutrient management recommendation for a specific season under minimum pest damage in Agusan. Specifically, the study (1) assessed soil nutrient status and yields of popular rice varieties; (2) evaluated management, incidence, and damage of major pests; (3) assessed suitability of weather to rice production; (4) formulated fertilizer recommendation based on the yields of complete fertilizer and nutrient omission plots; and (5) analyzed cost and return. The recommendation shall improve yields of popular rice varieties in the locality. Experiments were conducted in the field with SSNM, PalayCheck, and nutrient omissions as treatments. Status of sufficient phosphorus and copper, deficient nitrogen and potassium, and varying sulfur and zinc for four cropping seasons were identified. Yields of PSB Rc 82 ranged from 3.8-3.6t/ha while NSIC Rc 222 ranged from 4.1-5.1t/ha.

Molluscicides were used to control golden apple snails for three cropping seasons; herbicides to manage weeds for four cropping seasons. In most seasons, pest populations – rice black bug, stem borer, bacterial leaf blight, and brown planthopper – did not significantly reduce yield. Temperature was highly suitable; relative humidity, moderately suitable in the Jan-Apr 2018 and 2019 cropping seasons. Fertilizer rates were calculated from yields and amount of N fertilizer in complete fertilizer plots, yields of omission plots, agronomic N efficiency, and yield response to N fertilizer application. Fertilizer rates 60kg N/

ha, 25kg P_2O_5/ha, and 30-60kg K_2O/ha were recommended for three seasons. Lowest production costs for two seasons, at P13.04 and P10.95/kg, were attained in NSIC Rc 222 fertilized with PalayCheck recommendation of 74-28-43kg NPK/ha. Lowest production cost for the Jul-Oct 2019 season, at P9.04/kg, was seen in NSIC Rc 222 under farmer's fertilizer management of 42-4-11kg NPK/ha.

PROJECT 3

Developing Integrated Pest Management for CARAGA

BM Tabudlong

Five studies were conducted from January to November 2019 to develop pest management strategy for the control of some major insect rice pests in Caraga. The project involved pest monitoring and surveillance system of insect pests and natural enemies through the use of light trapping method, identification of indicator species of plants and arthropods for problematic rice environments, conservation and management, mass production and strategic release of biological control agents and efficacy of micronutrient supplementation managing major rice diseases such as sheath blight and bacterial leaf blight in Caraga.

Light trapping method was used to monitor the population patterns of insects and to provide necessary information to effectively manage insect pests that cause havoc to the rice industry. White stem borer or Scirpophaga innotata (Walker) is a major rice insect pest and was intensively monitored in April-May and October-November 2019 during 1st cropping and 2nd cropping season, respectively. Biological control agents, on the other hand, provide information on the best strategy and time of application of fungal biological control agents for some major rice insect pests such as white stem borer, rice black bug, rice bug, brown planthopper, and green leafhopper that infested the rice fields. Most of the insect population was reduced on the 3rd to 4th week post treatment of fungal suspension. Conservation strategies of BCAs in oil form were found to be the best way to optimize the efficacy, stability, safety, and ease of application. Furthermore, there are species of plants and arthropods in the rice environments that can indicate problems in rice such as deficiencies in nutrients as well as presence of diseases and pests. The occurrence of rice diseases such as sheath blight was significantly reduced through the application of either macro or micro nutrients. However, application of micronutrients (granular or foliar) did not significantly reduce the bacterial leaf blight and rice blast incidences in all growth stages. Varieties treated with micronutrients attained 5.41t/ha and 5.45t/ha (NPK+Zn @14DAT). Control varieties only yielded 3.12t/ha and 3.22t/ha during the 1st and 2nd cropping season, respectively.

Insect Pest Monitoring and Surveillance System in PhilRice Agusan

AMM Rojo and GF Estoy Jr.

Rice production in Caraga is often affected by biotic and abiotic stresses resulting in low rice production. Biotic factors threatening rice production in Caraga include insect pests like the white stem borer, rice black bug, rice bug, brown planthopper, and green leafhopper. These rice pests affect the crop at certain stages in rice development. Although a number of control measures or management options were developed against these pests, monitoring their population is necessary to determine needed control measure and the right timing of application of control options to manage the target pests. One way to monitor its population is through light trapping, which determines fluctuating population patterns of insects. This study determined the population of major rice insect pests and natural enemies, identified the most abundant and peak population of some major pests using crop stages and weather parameters, and provided pest population advisory with recommended management options to R & D staff of PhilRice Agusan.

Identification of Indicator Species of Plants and Arthropods as Practical Diagnostic Tools for Problematic Rice Environments

NBB Paz , MB Villaruben, and GF Estoy Jr.

Indicator species are plants and animals that, by their presence, abundance, or chemical composition, demonstrate some distinctive aspect of the character or quality of the environment. In rice environments, these are species of plants and arthropods that can indicate problems such as toxicity, acidity, deficiencies in nutrients, and presence of diseases and pests. Hence, the study aimed to determine the problematic rice environments through indicator species of plants and arthropods. It also aimed to determine the correlation between soil and plant and correlation between plant and arthropods in diagnosing problematic rice environments.

Collected soils were from four sites at Jaliobong, Canaway, Kitcharao, in Agusan del Norte and Sto. Nino, Butuan City. Indicator species of plants and arthropods collected from the sites were sorted, counted, and identified. Species of plants most abundant in Jaliobong were *Fimbristylis miliacea, Cyperus difformis,* and *Cyperus halpan*. MOET results showed that these weeds grow if the area is

deficient in N, P, K, and Cu. In Jaliobong, 22 weed species were found dominant. Digitaria sanguinalis, Selaginella pallescens, and Cyperus difformis were present in areas deficient in N,P,K,S. Nine species associated with common weed were also found like the Paspalum distichum. A dominant species belonging to family graminea, this weed is found in areas deficient in P and K such as in Canaway. Seventeen weed species were collected from Sto. Niño. Cynodon dactylon is most abundant in areas deficient in P and K. The species of arthropods were identified in four sampling sites with three replications. Beneficial arthropods such as Micraspis crocea (lady beetle) had high population in problematic rice areas followed by Agriocnemis pygmaea (damselfly) with seven population counts. Among the insect pests, the rice black bug was the most abundant population (70 RBB).

Conservation and Management of Bio-Control Agents (BCAs) at PhilRice Agusan

MB Villaruben, GF Estoy Jr., and BM Tabudlong

The study was conducted to test different strategies in conserving and preserving biological control agents (BCAs), determine the best conservation strategy, and evaluate the efficacy of the conserved BCAs to control the damage of major rice insect pests. Virulence test of four different strains of Metarhizium anisopliae and three strains of Beauveria bassiana overlaid with mineral oil conserved for more than one year was also conducted in the laboratory. Results showed that after 10 days of post-treatment, six different strains showed 100% mortality except treatment 4. Ma. Capatungan showed 60% mortality. Five different strains of B. bassiana fungus and three strains of M. anisopliae passed through the insect host after five years of incubation. Efficacy of three strains of B. bassiana: Bb.52 (90%), Bb.SPW (60%), Bb.Rb (80%) showed more than 50% mortality. Applying M. anisopliae (Ma. BPI RCPC) and Ma. Guadalupe resulted in mortality rate of 90% and 60%, respectively, after 7 days.

Efficacy tests of the conserved fungal microbial agents using the uniform test insects (rice bug) were conducted in the laboratory and screen house conditions. The treatments were three incubated in the laboratory for three months: T1 Ma. Crack corn; T2 Ma. Corn grits; T3 Bb. Crack corn; T4 Bb. Corn grits; T5 Water (-control) and T6 Cypermethrin (+control). These were evaluated using a direct hand sprayed method with 2ml concentration. Insect mortality was counted and recorded daily within 10 days post-treatment application. Results indicated that T3 Bb. Crack corn, and T4 Bb. Corn grits in both laboratory and screen house condition showed 80-100% efficacy than T6 insecticide control. Efficacy test of 6-month-old Metarhizium anisopliae in *palay* grain and cracked corn substrates showed 33.33% and 36.67% mortality of the rice bug after 7 days. Results

showed that pure cultured isolate of BCAs incubated for 2-5 years remained viable and effective.

Mass Production and Strategic Release of Biological Control Agents (BCAs) Against Some Major Rice Insect Pests

AMM Rojo and GF Estoy, Jr.

Rice plants are ideal hosts for many insect pests' species. Hundreds of insect pests' species could be very harmful to rice while some only cause minimal damage. One of the alternative pest control measures is the use of biological control agents such as the fungi Metarhizium anisopliae, Beauveria bassiana, and the predatory rice earwig Euborellia stali (Dohm), which helped reduce insect pests' population below damaging level. The study aimed to: (a) determine the pathogenicity test of the fungal biological control agents against some major rice insect pests, (2) determine the timing of application/rate of application of the fungal biological control agents under field conditions, and (3) evaluate the predatory efficiency of the laboratory mass-reared rice earwig, Euborellia stali (Dohm) against white stem borer under screenhouse and field conditions.

In January-June cropping season, initial count of rice black bug (RBB) ranged from 3-6. Application of fungal BCA can infect the RBB from 3 to 4 weeks after fungal application, only those that showed fungal spores were considered infected. For the brown planthopper (BPH), initial count ranged from 0 to 90. BPH population was affected by the application of fungal BCAs from 1 week until 4 weeks of fungal application. In the July to December cropping season, GLH population was affected by Metarhizium anisopliae from 4 days up to 18 days after fungal application. T4 or the positive control, which was applied with chemicals showed the highest mortality of GLH compared with T2 and T3 applied with BCAs every 7 days and every 14 days, respectively. For rice bugs with initial population of 50 per treatment, it was observed that Metarhizium anisopliae reduced their population after 18 days of fungal application. Treatment 2 applied with BCA at every 7 days showed the highest mortality with an average of 6.33 rice bugs compared with the positive control with an average of 7.67.

Efficacy of Micronutrient Supplementation in the Prevention of Major Rice Diseases in Caraga

GA Nemeño and GF Estoy Jr.

The study aimed to evaluate the effectiveness of micronutrient supplementation in preventing major rice diseases under Caraga condition. Two field experiments were established in the station for wet and very wet cropping season (January-December 2019) and applied with eight fertilizer combinations. These fertilizer treatments were laid out in Randomized Complete Block Design (RCBD) and replicated three times. The following treatments were imposed in the study: T1 (Control); T2 (NPK); T3 (NPK + ZnSO4 applied @14DAT); T4 (NPK + ZnSO4 applied @ PI); T5 (NPK + Mega Yield Foliar Fertilizer {FF}); T6 (NPK + Gana FF); T7 (NPK + Free Grow FF); and T8 (NPK + Restorer FF). Foliar fertilizers were applied at 35 DAT, booting, and milking stages of the crop. During the second cropping season, T4 (NPK + ZnSO4 applied @ PI); ZnSO4 was replaced with vitalgrow applied at 35 DAT, booting and milking stages of the crop.

The efficacy of different foliar fertilizers and a micronutrient in the prevention of major rice diseases were tested. Results indicated that during the first and second cropping season, T3: NPK+Zn (@14DAT) produced the highest yield with 5.41t/ha and 5.45t/ha compared with the control, which only gained 3.12t/ha and 3.22t/ha. Addition of Zn @ 14DAT doubled the yield by (+2.3 t/ha or 58%) during the first cropping season and (+2.23 t/ha or 59%) during the second cropping season. Addition of Foliar fert (+NPK) was found comparable with +NPK only.

The occurrence of sheath blight (SB) was significantly reduced with the application of either macro or micronutrients. It was observed that significantly low SB rating was noted in T7: NPK + Free Grow FF (applied 3x @ 35DAT, booting and milking stage) during the first cropping season. In general, application of micronutrients (granular or foliar) did not significantly reduce the occurrence or damage of bacterial leaf blight (BLB) and rice blast in all growth stages. BLB infection peaked during the booting stage in the January-June cropping season and during flowering stage in the July-December cropping season. Rice blast infection was highly observed at heading stage during the January - June cropping season and at flowering stage during July-December cropping season.

Disease infection occurred at early stage, which could be attributed to high relative humidity in February. High temperature and high relative humidity in three months could have triggered disease severity.

Support to Research and Development

BM Tabudlong

Enhancement of PhilRice Agusan Weather station

JD Tangog, GA Nemeño, and JJ Reyes

The study aimed to provide accessible and available weather updates and other weather-related events that would guide PhilRice Agusan R&D staff in their researches. The study include weather data handling and management, weather data updates and dissemination, development of simple processes and techniques on summarizing weather data; and maintenance and calibration of weather instruments.

In the first semester of 2019, frequent and heavy rainfall was observed specifically in January, March, April, and June due to the North East Monsoon. The major weather system was observed for eight months. During the second semester, water scarcity in August and September were observed. This was due to the South West Monsoon. Major weather system was observed for four months. Based on the climate historical data of DOST-PAGASA from 1990 to 2018, Caraga generally has a wet climate throughout the year compared with Nueva Ecija, which has a very distinct dry season in the first semester of the year. Weather data were consolidated and summarized monthly, and disseminated to R&D staff through email. The facility was also regular checked and cleaned.

Database Management

KO Kuizon and SDD Taglucop

PhilRice owns a large amount of data and information; however, initiatives in storing the data are still inadequate. Thus, valuable information are lost and not properly transferred. One of the major thrusts of PhilRice Agusan is to identify and improve database strategy and access that would be helpful in addressing the needs of PhilRice Agusan R&D activities. This system would provide easy and timely access of data and information needed by the researchers to help them improve their R&D activities.

An online database management system (Google Drive) was created where significant sets are organized and stored. Weather updates were consolidated from January to November 2019. Online database of institutional photos, templates, terminal reports, rice knowledge products, PhilRice Agusan souvenir manual, PhilRice AES awards, featured stories, weather updates, modules,

posters, station reports, and translated knowledge products were also updated. Visitors' log sheet, attendance sheet, and receiving copies of knowledge products were consolidated to disaggregate sex data and identify and address gender issues.

Research and Analytical Laboratory Systems and Maintenance

BM Tabudlong

Equipment and apparatus at PhilRice Agusan were periodically calibrated to ensure that the station laboratories function properly and safely and provide information management systems that are timely and accurate. The station laboratories accommodate researchers within the station and other extension workers from attached agencies. Inventory of serviceable and unserviceable equipment, apparatus, and other materials in the laboratory were obtained. Various documents such as Equipment Maintenance Log Material Safety Data Sheet (MSDS) and borrowers' logbook were provided in the laboratory. Equipment, apparatus, and glassware were calibrated and certified by the Department of Science and Technology. Furthermore, students conducting investigatory research experiments related to rice were also allowed to use the laboratory.

Area-Based Technology Promotion and Strategic Partnership

JJ Reyes, BM Tabudlong, ST Rivas, AP Tape, CS Agting, SMB Acosta, EM Gaquit, HA Yonson, and SDD Taglucop

This project aimed to develop area-based technology promotion models and strengthen partnerships to help farmers become more competitive amidst challenges in the rice industry. Various information platforms were used to reach out more rice farmers and stakeholders. Mass gatherings such as festivities, fora, trade fairs, and exhibitions were utilized to promote rice and rice-based farming technologies. The project also provided technical assistance and need-based interventions, upscaled rice and rice-based production systems through livelihood projects, showcased demonstration and pilot farms, or established learning sites for the farmers and their organizations. Moreover, the project conducted campaigns and advocacy initiatives to gain policy support on rice production, marketing, and consumption. It also sustained collaboration among the private, government, and non-government sectors. These interventions have

contributed to increased productivity, reduced cost, and augmented profit in project sites.

More than 2,000 farmers, students, and rice stakeholders were reached out through information campaigns while 9,848 knowledge products were distributed. Sixty-one farmer-beneficiaries were involved in the projects, in which 74% are women. It is worthwhile to note that the projects have provided additional food for their tables, and additional income for the farming households.

Transforming Rice Communities through Various Technology Promotion Platforms

KO Kuizon, JJ Reyes, and ST Rivas

In this study, participation in mass gatherings like festivities and other important events in the regional, provincial, and municipal levels was seen as one of the best platforms in intensifying promotion. Promotion activities were conducted through institutional exhibits with 9,848 PhilRice knowledge products provided to the attendees. PhilRice Agusan sustains its partnership and rapport within its area of responsibility through collaborative efforts and participation in community activities. Among these are the conduct of feeding programs, facilitation of educational tours at the branch station, and forging participation of schools during the National Rice Awareness Month (NRAM) celebration. A collaboration between 29th IB of the Armed Forces of the Philippines and the station were forged, in which PhilRice trained and provided swine to rice farmers in armed conflict areas in Agusan del Norte.

Lakbay Palay

ST Rivas, AP Tape, and PR Guindang

Lakbay Palay WS 2019 was held at PhilRice Agusan Station on October 19. This study aimed to integrate technologies and advocacies to ensure that rice farmers will obtain maximum yield potential from using appropriate technologies and availing government interventions. Specifically, Lakbay Palay presented and demonstrated various cost-reducing/cost-effective and yield-enhancing rice and rice-based technologies, innovations, and practices; introduced interventions from government agencies; and facilitated discussions and sharing of rice farming best techniques, practices, and experiences among the participants.

With the theme "Makigrupo, Maging Aktibo, Benepisyo Gikan sa RCEF, Segurado!" the Lakbay Palay focused on Rice Competitiveness Enhancement Fund (RCEF) Program. Three hundred seventy-six male and 250 female farmers, students, and stakeholders participated the event. Field tour and exhibits on varietal adaptation trials on top five recommended varieties in Caraga Region alongside newly released hybrid and inbred varieties; rice farm machineries and post-harvest facilities and equipment; and R&D products and services were displayed. The program included Technology Clinic for yield-enhancing and cost-reducing technologies and Information Clinic for RCEF interventions from government agencies. A kilo of NSIC Rc 160 seeds, rodenticides, bactericides, and rice advocacy collaterals were also distributed during the event. Results showed that Lakbay Palay 2019 had 87% satisfaction ratings in terms of coordination and organization, field tour, rice farming technologies, open forum, reading materials distributed, and food and refreshments. Female participants were more satisfied (93%) of the general activities than their male counterpart (89%).

Building Unified Rice Network (BURN) through campaign and advocacy

AP Tape and SDD Taglucop

Started in 2018, the study aimed to actively influence local policymakers and rice stakeholders towards a supportive rice and rice and rice-based policies. This undertaking gained support from the Local Government Unit (LGU) of Esperanza, Agusan del Sur through the Sangguniang Bayan (SB) for the implementation of light trapping as a means of managing the population of the rice black bug (RBB) in the municipality. The LGU allocated P238,500 in 2018 for the installation of light traps in the three rice barangays of Dakutan, Sta. Fe, and Catmonon.

In 2019, the study advocated the production and consumption of brown rice in RTRomualdez, Agusan del Norte. Implementers already collaborated with the Office of the Municipal Agriculturist and had prepared for a courtesy call with the Sangguniang Bayan members. However, meeting with the council was not realized due to election ban and the study leader's season-long training.

The study lobbied for the provision of electrical transmission to the Pinawa Rice Mill operated by Kahugpungan sa mga Mag-uuma na Nagsubay sa Lihuk Kinaiyahan Inc. (KMNLKI). Supported by the Department of Agriculture-RFO 13, Pinawa Rice Mill produces brown rice or "pinawa."

Palayamanan Plus: Highly Intensified, Diversified, and Integrated Rice-Based Farming System

JJ Reyes, BM Tabudlong, CS Agting, HA Yonson

Palayamanan Plus is a rice-based production system that teaches farmers how to diversify, intensify, and integrate rice farming. This study provided production inputs for mushroom production, vermicomposting, swine production, vegetable production, and rice varietal techno demo. This also served as a startup undertaking and later, as a model of other income-generating projects other than rice production ventures.

The diversification and integration of crop production (rice and vegetable), livestock, and mushroom production enhance the availability of materials and resources like crop residues, manures, and mushroom spent substrates that are essential in organic fertilizer production through ordinary composting, fermentation-decomposition processing or vermicomposting. The study established sites on mushroom and vegetable production and vermi composting (2); provided 60 heads of piglets for swine production; and demonstrated performance of five rice varieties: NSIC Rc 122, Rc 160, Rc 286, Rc 402, and Rc 480 under flood-prone environment. There were 41 farmer-beneficiaries involved in the projects, in which 26% are men and 74% are women. Roll-over scheme was applied for the members of the organization to avail of similar projects. Profits were gained, and the organization started their bank savings. Other produce from vegetables was used for household consumption. Vermicast/compost and tea were used as fertilizers for rice and vegetables. Meanwhile, rice varietal techno demo showed that all sites performed well with yield ranging 5.8-7.8t/ha. NSIC Rc 122 yielded the highest crop cut.

Rice Seeds Systems in Northern Mindanao

AP Tape, SDD Taglucop, and SMB Acosta

This project generally aimed to improve the availability, accessibility, and utilization of high-quality seeds (HQS) in Northeastern Mindanao. Rice data from the major rice-producing provinces were gathered while supply and demand of HQS per province was analyzed. Data showed that 9 of 12 provinces have limited access to supply of HQS. The excess supply in Region XI is inadequate to cover the deficits in Regions X and Caraga. Areas with limited access to HQS supplies were identified, which will be included in the promotion of HQS, introduction of newly released varieties, and training or retraining of seed growers.

Improving Rice Seed System in Northeastern Mindanao through Supply and Demand Analysis

SDD Taglucop

Even with the existing seed system, farmers still prefer using the seeds they harvested or reaped by their co-farmers because for them, these seeds are more affordable, accessible, and easily available. However, there is the need to introduce high-quality seeds as studies show their importance in producing better crops and sustaining enough food for the rising number of populations.

This study aimed to establish an improved and reliable seed system that could enhance the availability, accessibility, and utilization of high-quality seeds in Northeastern Mindanao. Rice data from the major rice producing provinces in Northeastern Mindanao were collected to analyze the demand and supply of high-quality seeds. It was found that 9 of the 12 provinces had shortages on HQS supply. Only Region 11 has surplus in seeds (Table 1); however, not enough to supply the deficit of 17,430 bags in Region 10 and Caraga. This information and results from further data collection and survey interviews will be the bases in crafting the improved seed distribution channel.

Table 1. Data on Certified seed production in Northeastern Mindanao, 2018.

Province	Total Rice Production Area (ha)	No. of Accredited Seed Growers	Average Seeding Rate (bags/ha)	Seed Production area (ha)	Average Seed Production (bags/ha)	Seed Production (1 cropping)	Total Seed Production	Annual Inbred HQS Requirement	Deficit	
Bukidnon	41,641	18	1	250	100	25000	50000	83282	-33,282	-4,772
Lanao del Norte	21,580	39	1	426.5	100	42650	85300	43160	42,140	
Misamis Occidental	8139	8	1	49	100	4900	9800	16278	-6,478	
Misamis Oriental	5976	4	1	24	100	2400	4800	11952	-7,152	
Davao del Norte	18475.6	8	1	109.3	100	10930	21860	36951.2	-15,091	81,872
Davao del Sur	26,584.01	14	1	117	100	11700	23400	53168.02	-29,768	
Davao Oriental	12,819.49	37	1	992	100	99200	198400	25638.98	172,761	
Compostela Valley	27715	6	1	47	100	4700	9400	55430	-46,030	
Agusan del Norte	13455	30	1	339.5	100	33950	67900	26910	40,990	-94,530
Agusan del Sur	86951	87	1	276.65	100	32385	64770	173902	-109,132	
Surigao del Norte	17592	20	1	60.4	100	6040	12080	35184	-23,104	
Surigao del Sur	30764.75	56	1	291.23	100	29123	58246	61529.5	-3,284	
TOTAL/ AVERAGE	**311,693**	**327**	**1**	**2,983**	**100**	**302,978**	**605,956**	**623,386**	**-17,430**	

Abbreviations and acronyms

AYT - Advanced Yield Trial
ABE - Agricultural and Biosystems Engineering
AEW - Agricultural Extension Worker
ATI – Agriculture Training Institute
AESA - Agro-ecosystem Analysis
AC - Amylose Content
BLB - Bacterial Leaf Blight
BLS -Bacterial Leaf Streak
BCA - Biological Control Agent
BS - Breeder Seeds
BPH -Brown Planthopper
BPI - Bureau of Plant Industry
CGMS - Cytoplasmic Genic Male Sterility
COF - Commercial Organic Fertilizer
CDA - Cooperative Development Authority
DAS - Days After Sowing
DAT - Days After Transplanting
DF - Days to Flowering
DM- Days to Maturity
DAR - Department of Agrarian Reform
DA-RFOs - Department of Agriculture-Regional Field Offices
DoF - Department of Finance
DOLE - Department of Labor and Employment
DTI - Department of Trade and Industry
DSR - Direct-seeded Rice
DS - Dry Season
FBS – Farmers' Business School
FC - Farmers' Cooperative
FSM - Farming Systems Models
FAA - Fish Amino Acid
FGD - Focused Group Discussion
FSP - Foundation Seed Production
FRK - Farm Record Keeping
GABA - Gamma-aminobutyric Acid
GT - Gelatinization Temperature
GAD - Gender and Development
GYT - General Yield Trial
GCA - Genetic Combining Ability
GIS - Geographic information system
GEMS - Germplasm Management System
GAS - Golden Apple Snail
GL - Grain Length
GQ - Grain Quality
GW - Grain Weight
GY - Grain Yield
GLH - Green Leafhopper
GOT - Grow Out Test
HR - Head Rice
HRA - Heat Recovery Attachment
HIPS – Highly-intensified Production System
HQS - High-quality Rice Seeds
HON - Hybrid Observational Nursery
HPYT - Hybrid Preliminary Yield Trial
ICT - Information and Communication Technology
IEC - Information Education Communication
IBNM - Inorganic-based Nutrient Management
ICM - Integrated Crop Management
IPM - Integrated Pest Management
JICA - Japan International Cooperation Agency
IRRI - International Rice Research Institute
IA - Irrigators' Association
KP - Knowledge Product
KSL - Knowledge Sharing and Learning
LCC - Leaf Color Chart
LFT - Local Farmer Technicians
LGU - Local Government Units
LPS - Low Pressure Steam-operated
LE-CYPRO - Lowland ecotype Cyperus rotundus
MFE - Male Fertile Environment
MSE - Male Sterile Environment
MAS - Marker-assisted Selection
MRL - Maximum Root Length
MR - Milled Rice
MER - Minimum Enclosing Rectangle
MOET - Minus-one Element Technique
MC - Moisture Content
MAT - Multi-Adaptation Trials

MCRTP - Multi-crop Reduced Till Planter
MET - Multi-environment Trial
MYT - Multi-location Yield Trial
NAAP - National Azolla Action Program
NCT - National Cooperative Test
NFA - National Food Authority
NRAM - National Rice Awareness Month
NSIC - National Seed Industry Council
NSQCS - National Seed Quality Control Services
N - Nitrogen
NBSP - Nucleus and Breeder Seed Production Project
NFGP - Number of Filled Grains Panicle
ON - Observation Nursery
OSIS - One-Stop Information Shop
OBNM - Organic-based Nutrient Management
PL - Panicle Length
PW - Panicle Weight
PVS - Participatory Varietal Selection
PWD - Person with Disabilities
PHilMech - Philippine Center for Postharvest Development and Mechanization
PRISM - Philippine Rice Information System
PhilRice - Philippine Rice Research Institute
PSA - Philippine Statistics Authority
PTC - PhilRice Text Center
P - Phosphorus
PVS - Plant Variety Selection
K - Potassium
QTL - Quantitative Trait Loci
RCBD - Randomized Complete Block Design
RSP - Registered Seed Production
RBB - Rice Black Bug
RCEF - Rice Competitiveness Enhancement Fund
RCEP - Rice Competitiveness Enhancement Program
RCM - Rice Crop Manager
RHGEPS - Rice Hull Gasifier Engine Pump System
RPH - Rice Planthopper
RSTC - Rice Specialists' Training Course
RTV - Rice Tungro Virus
RBFHS - Rice-based Farming Household Survey
KQ - Kernel Quality
SV - Seedling Vigor
ShB - Sheath Blight
ShR - Sheath Rot
SMS - Short Messaging Service
SNP - Single Nucleotide Polymorphism
SWRIP- Small Water Reservoir Irrigation Project
SRB - Stabilized Rice Bran
SUCs - State Universities and Colleges
SB - Stem Borer
TESDA - Technical Education and Skills Development Authority
TDF - Technology Demonstration Farm
TRV - Traditional Rice Varieties
TOT - Training of Trainers
TPR - Transplanted Rice
URBFS - Upland Rice-Based Farming
WS - Wet Season
WCV - Wide Compatibility Variety
YSB - Yellow Stem Borer

Editorial team

We are a government corporate entity (Classification E) under the Department of Agriculture. We were created through Executive Order 1061 on 5 November 1985 (as amended) to help develop high-yielding and cost-reducing technologies so farmers can produce enough rice for all Filipinos.

With a "Rice-Secure Philippines" vision, we want the Filipino rice farmers and the Philippine rice industry to be competitive through research for development in our central and seven branch stations, coordinating with a network that comprises 59 agencies strategically located nationwide.

We have the following certifications: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environmental Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

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