

2020

PhilRice R&D Highlights



PhilRice Agusan

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PhilRice Agusan

Branch director: Caesar Joventino M. Tado

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.

Results from the two cropping seasons showed eight transplanted (TPR) lines and eight direct-seeded (DWSR) lines from different maturity groups surpassing the yields of the best check varieties by 6-20%.

The project implementers of improving soil, water, nutrient, and crop management in lowland areas of Caraga has localized the procedure of the International Organization of Standardization and Organization for Economic Co-operation and Development that uses *Lemna minor* to qualitatively assess water quality.

From January to December, researchers on developing integrated pest management for Caraga found that light trapping method is an effective tool in monitoring the population patterns of insects, providing information on managing white stem borer (WSB), which is the most prevalent in the area.

The on-farm field evaluation on reducing major rice diseases through micronutrient application in combination with recommended NPK fertilizer rate increased rice yields by 4.88t/ha during the January-June cropping season (CS) and 5.47t/ha in the July-December CS. The treatments did not reduce or prevent rice disease occurrence compared with the control and farmers' practice

The station's automatic weather system (AWS) and its instruments were regularly maintained and updated for reliability and data accuracy. The station also maintained a database that serves as a resource for institutional photos; templates; reports; knowledge products; weather updates; light trap catches; and modules.

EXECUTIVE SUMMARY

Training courses on livelihood projects were conducted with the private sector and national government agencies such as the Armed Forces of the Philippines and Philippine National Police.

More than 50,000 farmers, students, and other rice stakeholders were reached/engaged in the information and advocacy campaigns in social and print media.

In a benchmark survey conducted with 83 accredited seed growers (ASG) in Caraga Region, results showed that only 20% of them are engaged in seed production as their main income while 53% ventured on this endeavor as additional income. The ASGs allocated 80-100% of their time managing their seed production area and attending farmers' field school and PalayCheck System training.

The Phase 1 of the RiceBIS community project in Esperanza, Agusan del Sur attained an average yield of 4.2t/ha yield in the 2020 DS, higher than the 3t/ha baseline yield. In the RiceBIS communities in Cabadbaran City (Phase 2) and RT Romualdez (Expansion site), package of technologies (POTs) was developed. The POTs include three yield-enhancing and cost-reducing technologies, which can increase yield by 6t/ha and reduce costs up to 26% (Phase 2) and 38% (Expansion).

In collaboration with the Department of Trade and Industry – Negosyo Center and the PhilRice Agusan Development Initiative Study funded by DA-RFO 13, 20 members of Bukid-Bukid Farmers' Association, Inc. (BUFA) in La Union Cabadbaran City, Agusan del Norte were trained on financial literacy and agricultural entrepreneurship.

For January to June 2020 CS, 15 lines together with three tolerant and two susceptible checks were evaluated for submergence or flash flood-prone rice environment in the National Cooperative Tests (NCT). Results showed that no rice lines outperformed the best check variety PSB Rc 68 (Tolerant) with recorded yield of 5.57t/ha. All four entries achieved more than 5t/ha yields while one new entry did not yield 3t/ha. To date, crops established for July - December 2020 evaluation are still in the milking stage.

The station conducted one batch of Rice Specialists Training Course (RSTC) – Module 2 to develop more competent rice specialists from different partner agencies. PhilRice Agusan has distributed all the knowledge products under RCEF including Gabay sa Pagpapalayan brochures, PalayCheck primers, PalayCheck booklet, Nutrient Management posters, and RCEF calendars. All planned KSL activities such as media briefing and information caravan were implemented amidst COVID-19. The RCEF-Comm team in Agusan distributed technical briefing audio and video materials to 130 RCEF municipalities in Regions 10, 11, and 13.

Developing Location-Specific Rice Varieties for Caraga Condition

Dexter B. Bastasa

Rice production in Caraga region is affected by low solar radiation, high rainfall, episodic flooding, and pests. These conditions are major rice yield constraints placing the region among the lowest yielders throughout the country with an average of 3.87t/ha (PSA, 2019). Locally-adapted rice varieties are needed to further increase the current yield level. This project aimed to recommend high-yielding rice lines with high consumer acceptability for Caraga region. The selection criteria are based on their local yield performance in the National Cooperative Tests (NCT) fields in PhilRice Agusan.

Six (6) rice lines with 8-20% yield advantages over the best check variety were selected from the transplanted yield trial in January- to June 2020 CS. These include PR37942-3B-5-12 (7.22t/ha), FR13A-2012DS101-1 (6.82t/ha), PR40517-17-6-5-1 (6.64t/ha), PR39924-B-V-3-2 (6.56t/ha), Raeline 5-B-B-B (6.51t/ha), and PR38963 (Fe) (6.49t/ha). The very early-maturing group has the highest average yield and yield advantage over the best check variety. The selected rice lines can be recommended as location-specific rice varieties or can be used as parents of upcoming local varieties.

Improving Soil, Water, Nutrient, and Crop Management in Lowland Areas of Caraga

Jehru C. Magahud

The project aimed to develop soil, water, nutrient, and crop management options that will improve yield in Caraga lowland rice areas by 1-2t/ha from the baseline 3.3-3.6t/ha (2014-2017 PSA yields) and reduce cost from the P11.9-13.7/kg baseline. Specifically, the project aimed to (1) develop diagnostic procedures for soil and water quality assessment and (2) formulate management options.

A simple method for culturing the local *Lemna* sp. with rate that meets the growth quality criteria for *Lemna* pre-cultures and controls in testing substance toxicity or water quality was developed in the laboratory. Growth quality criteria include exponential growth, relative growth rates (RTR) at >0.275 fronds/day, and RGR's coefficient of variation (CV) at <10%. Two duckweed responses (relative growth rate and root length), which have significant relationships with two parameters that contribute to water quality (copper and calcium: magnesium levels), were also determined. The method for water quality assessment developed by the project can reduce cost by 87 and 61% and time by -200 and 40%.

Field experiments for six cropping seasons were conducted to formulate crop management options for improving yields in Agusan soil. Growing NSIC Rc 222 under alternate-wetting-and-drying (irrigating when water level goes down to -15 to -20cm) technology and PalayCheck fertilizer recommendation (74-28-43kg N-P₂O₅-K₂O/ha) resulted in 4.1-5.1t/ha yield levels at P9.21-12.36/kg production costs for five cropping seasons.

Results showed that varieties applied with 60 kg N, 20-25 kg P₂O₅, and 30-60 kg K₂O /ha performed well; thus, this fertilizer application was recommended. Results also showed that NSIC Rc 222 and PSB Rc 82 produced low yield at high production cost when fertilized with PalayCheck NPKZn. Yields were also low with farmer's fertilizer management (42-5-11kg N-P₂O₅-K₂O/ha).

Fertilizer application of 74-28-43 kg N-P₂O₅-K₂O/ha yielded 3.3t/ha in the farmers' field – lower than the 4.7t/ha yield in the experimental field. Conducted in Jan-April, the study was constrained with leaf folders and bacterial leaf blight infestations.

Another recommended rate, 60-25-31 N-P₂O₅-K₂O, yielded better than usual farmer's application, 76-21-51). Results from the Jan-Apr 2020 study showed that the recommended rate attained lower yield (3.5t/ha) than farmers' fertilizer rate (3.6t/ha). Moreover, production cost was lower in the recommended rate (P11.25/kg) than farmer's practice (P13.29/kg). Reduced production cost was due to lower fertilizer cost by 12% and lower pesticide cost by 88%.

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

Jehru C. Magahud, Sheena Lourdes P. Dalumpines,
and Princess Ann B. Padios

The standard laboratory procedure for evaluating environmental quality is expensive, time-consuming, and requires months or years of training. Duckweeds (*Lemna* spp.), common in the poorly-drained lowland areas of Agusan, have been known to be ideal test plants for toxicological experiments. Hence, this study develops a local method that uses duckweeds for soil and water quality assessment to reduce cost and time required for evaluating soil and water quality.

The developed culture procedure met the *Lemna* growth quality criteria due to the following observations: (1) growth was exponential at 0, 5, 10, 15, and 20% nutrient solutions at high and low light intensities; (2) relative growth rates were >0.275 fronds/day, and RGR's CV were $<10\%$ in the same nutrient solution-light intensity combinations. The SNAPTM nutrient solution was used; light intensities were achieved by placing *Lemna* 12 (high intensity) and 15cm (medium intensity) from lamps that emit $49\mu\text{mol photons/m}^2/\text{s}$ for 24 hours. Duckweed growth rates generally decreased as copper concentrations increased at 0-15 mg/L from 5 to 11 days after incubation. Root length generally decreased with increasing copper concentrations at 0-15mg/L 11 days after incubation. Growth rates decreased with increasing calcium: magnesium ratios 1.1-1.7 from 1 to 7 days after incubation. Duckweeds used in the experiment were identified as *Lemna* minor L. by the Museum of Natural History in the University of the Philippines Los Baños. The method for water quality assessment developed by the study can reduce cost required for evaluation by 87 and 61% the time required by -200 and 40%.

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

Jehru C. Magahud, Sheena Lourdes P. Dalumpines, and Princess Ann B. Padios

Stunted growth of rice plants is observed in very poorly drained areas of Caraga. Grain yields ranged 3.3-3.6t/ha and production costs P11.9-P13.7/kg palay in irrigated areas. The recorded yield is the second lowest while production cost is the fourth highest among the 16 regions in the country. Specifically, this study (1) characterized the very poorly-drained rice soils in Agusan's major irrigated lowland rice fields; (2) tested soil (fertilizer, stubble, rice straw management) and water management options for very poorly drained soils; (3) assessed yield of rice varieties with high yield potential under improved soil and water management;

PROJECT 2

and (4) developed soil or water management recommendation to improve yields in such soils.

Observations and experiments in screenhouse and farmer's fields were conducted for six cropping seasons. Two soils were classified as Butuan soil series as they have clay with yellow mottles at the subsurface. Both soils have roots at 0-58cm from the surface. Surface texture of the first soil is sandy clay loam; second soil, silty clay. Based on their profile characteristics, the soils are periodically submerged at 0-21cm from surface while continuously submerged at <21 cm from surface. Water losses ranged 2.1-4.9cm/day during high evapotranspiration months and 1.1-2.2cm/day during low evapotranspiration months. At initial level of 2-3cm, it took 6-7 days for the soil to reach -18 to -20cm. Status of sufficient phosphorus (P) and copper, deficient nitrogen (N) and potassium (K), and sulfur and zinc (Zn) were observed in three soils for five cropping seasons. Meanwhile, status of sufficient phosphorus (P), copper, sulfur, and zinc (Zn) and deficient nitrogen (N) and potassium (K) were noted in two soils for four cropping seasons.

The following soil and water management improved yields: PalayCheck fertilizer management (74-28-43kg N-P₂O₅-K₂O/ha) > farmers' fertilizer management (42-4-11kg N-P₂O₅-K₂O) by 8.9 – 25.3% in all variety x water management treatment; 5t/ha (field equivalent) biomass application > no application in most soil type x water management treatments by 0.8 – 8.4%, application of partially-decomposed 10t/ha biomass (field equivalent) > 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 yield by 0.2-25.7% in all variety x fertilizer management and soil type x biomass management combinations.

In a screenhouse experiment, grain yields of Rc 18 were higher than Rc 82 in most fertilizer-water management treatments by 4-19%. Grain yields of Rc 122 were also higher than Rc 82 in most fertilizer-water management treatments. Recommended rate (60-25-35 N-P₂O₅-K₂O rate + no molluscicides and insecticide applications) had the following performance was compared with farmer's practice (76-21-51 N-P₂O₅-K₂O rate + molluscicides and insecticide applications) in a season with low leaf folder and BLB damage: (1) slightly lower yield (3.5t/ha) than the farmer's practice (3.6t/ha) and (2) 15% lower production cost (P11.25/kg) than the farmer's practice (P13.29/kg).

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

Jehru C. Magahud, Sheena Lourdes P. Dalumpines,
Princess Ann B. Padios, and Warriën A. Vitor

The studies (1) characterized the very poorly-drained rice soils in Agusan's major irrigated lowland rice fields; (2) assessed nutrient status of soils, and yields of popular rice varieties; (3) evaluated management, incidence, and damage of major pests; (4) assessed suitability of weather to rice production; (5) developed soil or water management recommendation to improve yields in such soils; (6) formulated fertilizer recommendation based on the yields of complete fertilizer and nutrient omission plots; and (7) analyze cost and return.

PSB Rc 82 yielded 3.8 and 3.6t/ha. Yields of NSIC Rc 222 ranged 4.1 – 5.1t/ha if fertilized with NPK; 4.3 and 3.4 t/ha if fertilized with NPKZn. Yields were higher by 0.2 – 0.8t/ha in 74-28-43 N-P₂O₅-K₂Okg/ha (PalayCheck) than 42-5-11 N-P₂O₅-K₂Okg/ha (farmers' practice). Golden apple snails were controlled using molluscicides for three seasons, and water management for three seasons. Weeds were managed using herbicides for six seasons. In most seasons, populations rice black bug, stem borer, bacterial leaf blight, and brown plant hopper did not significantly reduce yield. Temperature was highly suitable; relative humidity, moderately suitable in the Jan-Apr 2018 and 2019 cropping seasons.

The following soil and water management improved yields: PalayCheck fertilizer management (74-28-43 kg NPK/ha) > farmers' fertilizer management (42-4-11 kg NPK/ha) by 8.9 – 25.3% in all variety x water management treatment; 5t/ha (field equivalent) biomass application > no application in most soil type x water management treatments by 0.8 – 8.4%, application of partially-decomposed 10t/ha biomass (field equivalent) > 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 to 25.7% in all variety x fertilizer management and soil type x biomass management combinations. 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 for four seasons using two varieties. Fertilizer rates were recommended at 60 kg N/ha, 20-25 kg P₂O₅/ha and 30-60 kg K₂O/ha. Rc 222 recorded the lowest production costs for two seasons, at P12.36 and P11.24/kg, when fertilized with PalayCheck NPK. Rc 222 and Rc 82 recorded lower production cost, P8.87/kg and P10.03/kg, respectively, using farmer's practice NPK than PalayCheck NPK. However, Rc 222 was produced at a lower cost of P9.21/kg applying the PalayCheck NPK in Jan-Apr 2020. NPK recommendation than PalayCheck and farmer's practice NPK.

Developing Integrated Pest Management for Caraga

Belen M. Tabudlong

Three studies were conducted from January to November 2020 to develop pest management strategy for the control of some major insect pests and diseases of rice in Caraga. The project involved pest monitoring and surveillance system of insect pests and natural enemies through the use of light trapping method; conservation, mass production and management of fungal biocontrol agents (BCAs) against major rice insect pests; and efficacy of micronutrient supplementation in managing major rice diseases such as sheath blight and bacterial leaf blight in Caraga.

Light trapping method was effective in monitoring population patterns of insects and in providing necessary information to manage insect pests.

The project also studied the efficacy of conserved biological control agents (BCAs) and determined the best strategy and time of application of fungal BCAs.

Furthermore, the efficacy of different macro and micronutrient fertilizer sources in preventing the occurrence of major rice diseases was conducted in farmers' field.

Insect Pest Monitoring and Surveillance System in PhilRice Agusan

Belen M. Tabudlong and Anna Marie M. Rojo

Determining the population dynamics of rice pests is important in managing their damage. Light traps are used in minimizing the population of destructive insects in rice fields. This study was conducted to determine and identify the most abundant and peak population of major insect pests and correlate the abundance of these insect pests to weather patterns.

Rice black bug (RBB) was the most abundant major insect pest (198,911) from January to November 2020. Highest population was observed and recorded in May. Peak population of white stemborer (WSB) was recorded in the 2nd week of May and 3rd week of October 2020. Planthoppers and leafhoppers populations follow similar trend.

Conservation, Mass Production and Management of Fungal Biocontrol Agents (BCAs) against Major Rice Insect Pests at PhilRice Agusan

Belen M. Tabudlong, Malou B. Villaruben, and Anna Marie M. Rojo

This study determined the conservation management of fungal BCAs such as *Metarhizium anisopliae* and *Beauveria bassiana* against major rice insect pests such as white stem borer, rice bug, brown planthopper, and green leafhopper. These conserved BCAs were tested under screenhouse condition and found pathogenic to rice bug adults, which caused 50% mortality at 6 days after application using the standard concentration of 1×10^8 conidia/ml fungal suspension. Infection of applied BCAs further increased at 100% (*M. anisopliae*) and 86.67% to 96.67% (*B. bassiana*) mortality 14 days after application. BCAs conserved in dry formulation in cracked corn and oil formulation were tested against brown planthopper (BPH), greenleaf hopper (GLH), and WSB under field condition. Initial populations of major insect pests before treatment were very low ranging from 0 to 1 (WSB), 63-79 (BPH) and 7-25 (GLH). BPH mortality was low ranging from 3.20 to 14.38% was observed at 2 days post treatment. Mortality rate was further increased to 57.51-71.18% at 12 days after application or after two applications of the fungus. With 43.50% mortality, application of BCAs was found to be more effective than insecticide application.

In the case of GLH population, mortality rate of GLH ranged from 0.93 to -17.34% at 2 days after treatment and further increased to 47.05-80.45% at 9 days after application or after two applications of the fungus. It was observed that GLH mortality was significantly higher with BCAs applied at 47 DAT or 12 days application than insecticide application (21%).

Results from sweep netting method showed that populations of natural enemies fluctuated within four weeks after treatment; indicating that populations were not affected by the application of any fungal suspension of BCAs.

Mortality of up to 80% of insects applied with *Metarhizium anisopliae* and *Beauveria bassiana* either in dry or oil formulation reduced populations of the major rice pests of rice, which resulted in higher yield ranging from 4.18 to 4.80t/ha for two cropping seasons. This indicated that application of BCAs is 52% cost effective than chemical spray.

Efficacy of Micronutrient Supplementation in Preventing Major Rice Diseases in Caraga

Belen M. Tabudlong, Genevive A. Nemeño, and Anna Marie Rojo

Micronutrients are required in smaller quantities for normal plant nutrition. The resistance of the crop with imbalanced nutrients or with nutrient deficiency is low, making the crop susceptible to major pests' attacks and damages. Rice diseases such as bacterial leaf blight, sheath blight, dirty panicle or panicle blast, leaf blast, brown spot and false smut are currently observed in the station. This study was conducted to test the efficacy of different macro and micronutrient fertilizer sources in preventing the occurrence of major rice diseases; determine the rate and timing of application that can prevent the occurrence of major rice diseases; and identify the environmental conditions or factors that can enhance disease prevalence in the area.

The experiment was conducted in farmer's field with four treatments and three replications using 10 x 10 m² per treatment. Macro nutrients were applied at 10-14 days after transplanting (DAT). Sixty percent and 40% of the recommended rate (RR) will be applied at 5-7 days before panicle initiation (PI). Additional micronutrients were applied at 35 DAT, booting, and milking stages of the crop.

For January to June cropping season, T3: NPK+ZnSO₄ (@14DAT) gave the highest yield of 4.81t/ha. For July-Dec cropping season, NPK + foliar fertilizer gave the highest yield of 5.38t/ha but was not significantly different with application of NPK + ZnSO₄ and with the farmer's practice. Application of micronutrients (granular or foliar) did not significantly reduce the occurrence/damage of diseases in all growth stages from January to December cropping season.

Support to Research and Development

Genevieve A. Nemeño

The project summarized the recorded weather data (rainfall, temperature, relative humidity, and solar radiation) from Automatic Weather Station (AWS) (daily, weekly, monthly) from January to November 2020. The summarized data were presented through tables and graphs and emailed to PhilRice Agusan R&D staff. Gmail). Weather update/forecast and weather summary review from January to November 2020 was also posted in the station's official social media page. Time of data generation and consolidation was minimized by 75% from 3 hours to 45 minutes. Accuracy of the instrument was maintained through regular cleaning of the AWS and its instruments, software updating (Davis Weatherlink), and troubleshooting of Vantage Pro 2.

Online database, which contain institutional photos, templates, reports, rice knowledge products, weather updates, modules, and consolidated visitors' log sheet was maintained. The database also keeps attendance sheets, technical dispatch monitoring, summary of trainings conducted, and y sex disaggregated data.

An inventory of equipment, apparatus, and materials in the laboratory and periodic cleaning and maintenance of laboratory properties were conducted. EPhilRice researchers were also assisted in the use of the laboratory facilities.

Area-Based Technology Promotion and Strategic Partnership

Caesar Joventino M. Tado, Jasmin J. Reyes, Belen M. Tabudlong, Sharen T. Rivas, Alona P. Tape, Caryl S. Agting, Sherlyn Dawn D. Taglucop, and Brian P. Gepiga

The project aimed to develop area-based technology promotion models and strengthen partnership to forge enabling mechanisms for improved access to extension services of farmers and farming households. Various information platforms and coordination links were used to reach out rice farmers and stakeholders. Technical assistance and need-based interventions were provided by the project. Rice and rice-based production systems were upscaled in specific intended areas through livelihood projects, demonstration and pilot farms, or learning sites. Campaigns and advocacy for policy support were implemented while collaboration with various sectors was maintained.

More than 50,000 farmers, students and other rice stakeholders were reached/engaged through the information and advocacy campaigns in social and print media. of the 107 farmer-beneficiaries, 38% were men while 62% were women.

Transforming Rice Communities through Various Technology Promotion Platforms

Kevin O. Kuizon, Jasmin J. Reyes, and Sharen T. Rivas

Rice technologies were promoted through institutional exhibits with 500 knowledge products distributed to the stations. PhilRice Corners were also installed in Caraga Region. The station also maintained a One-Stop Information Shop (OSIS).

Educational tours were facilitated while partnerships with schools were forged for the National Rice Awareness Month celebration. Capacity Enhancement Training for Financial Literacy and Agricultural Entrepreneurship was also conducted to Bukid-bukid Farmers Association (BUFA).

Building Unified Rice Network through Campaign and Advocacy

Alona P. Tape and Sherlyn Dawn D. Taglucop

The study, which started in 2018, aimed to actively influence local policymakers and other rice stakeholders towards a supportive rice and rice and rice-based policies.

For 2019-2020, the study advocated for the production and consumption of brown rice in RTRomualdez, Agusan del Norte. The Office of the Municipal Agriculturist was already tapped.

LGU-Esperanza in Agusan del Sur incorporated the maintenance of lights traps in its 2021 budget.

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

Jasmin J. Reyes, Belen M. Tabudlong, Caryl S. Agting, Brian Gepiga

Palayamanan Plus is a rice-based production system that teaches the farmers how to diversify, intensify, and integrate rice farming. The study provided production inputs for mushroom production, vermicomposting, swine production, vegetable production, and rice varietal techno-demo. Four farmer-organizations are involved in these projects.

The study established one mushroom production, one vegetable production, and two vermicomposting projects; provided 60 heads of piglets for swine production; and demonstrated performance of five rice varieties under flood-prone environment. Private sectors, national government agencies especially the Armed Forces of the Philippines and Philippine National Police co-implemented a Palayamanan project. Initial set-up of the rice varietal techno demo showed a 5.8-7.8t/ha yield.