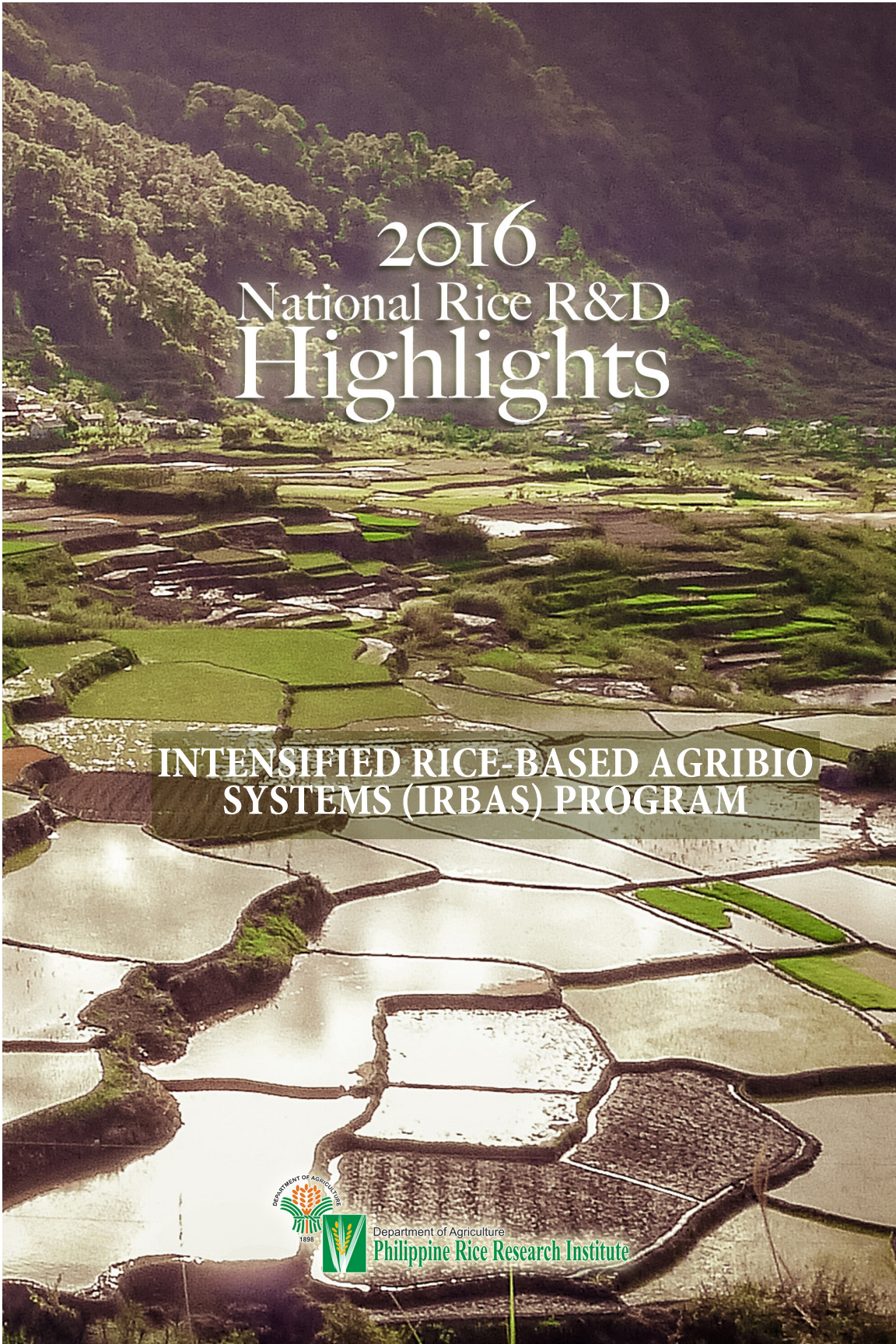

# 2016 National Rice R&D Highlights

## INTENSIFIED RICE-BASED AGRIBIO SYSTEMS (IRBAS) PROGRAM

Department of Agriculture
Philippine Rice Research Institute

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# Intesified Rice-Based AgriBio Systems (IRBAS) Program

*Program Leader: Rizal G. Corales*

## Executive Summary

The IRBAS program prioritize key rice-based agri-bio systems for impact within target agro-ecosystems, increase efficiency and sustainability of resources and make it more resilient to production risks and climate variability, improve the productivity and profitability through sustainable intensification, value-adding, and market linkages. It will investigate ways to improve the contribution of local agri-bio systems to community or rural growth through improvements in productivity and profitability while reducing environmental impacts, enhancing biodiversity and delivering wider ecosystem services. The program aims to develop intensified rice-based production models that can increase productivity, reduce costs, improve resource use efficiency, reduce environmental impacts, more resilient to climate change; generate mathematical rice-based production models than can generate an income of 1M/ha/year; enhance value-adding with the development of rice-based products; explore market opportunities; and conduct capacity building and enhancement.

Palayamanan Plus models focuses on the development of agri-enterprises that enhance productivity and income of rice-based systems. Crop enterprises e. g. rice seed production can provide an income of around PhP280,000/ha which is more than 100 percent higher income compared with commercial rice production. Growing vegetables on rice paddy bunds provides additional source of nutritious food and income for daily needs plus its contribution to ecological balance. These crops also generated biomasses which are essential inputs to the livestock and mushroom enterprises. The rice straw and other crop residues were utilized as feeds for the buffaloes. The ducks provided additional food and income, and help in controlling snails, weeds and insects. Mushroom component also provides affordable and accessible source of nutritious food. It can provide meaningful employment for baggers and substantial income of around PhP35,000.00/month for the growers. The Sorjan production system maximizes the utilization of resources in space and in time. Different commodities like vegetables, cash crops, fish and even rice can be grown simultaneously in the same area. This provides continuous supply of food, and more stable higher income.

The development of marketing and rice-based food products with excellent palatability, high market appeal, and nutritional value encourage the cultivation and consumption of these products. This can be done through cooking competitions to generate recipes that would be packaged into popular publications.

Entrepreneurship is one of the key drivers for development because it contributes to the economic, social and political development of the society. There is a need to promote and strengthen entrepreneurial spirit among partners to help address constraints in market engagement. Market chain studies and analysis and establish/strengthen partnerships with the private sector are being conducted.

The Palayamanan Plus was established in selected rice-based communities to accelerate its adoption. The Palayamanan Plus model in each site was based on local resources and agro climatic conditions. To improve the rice production, the use of quality seeds or hybrid rice were emphasized to increase productivity. Rice production was also intensified with planting other crops like cash crops especially in areas with limited water supply. In most areas the rice productivity had been improved based on the baseline yields. Other crops had been planted in more areas. Livestock integration and mushroom production although not yet fully established provided opportunities to increase family income. The capacity enhancement activities like specialized training on livestock, mushroom vegetable production including S & T updates, and field days provided the farmer beneficiaries as well as the implementing partners to enhance their knowledge.

## I. Development, Establishment and Assessment of Intensified Rice-Based Agribio Systems Model (Palayamanan Plus Model) (IRB 011-00-CES)

*Project Leader: RG Corales*

PhilRice actively promoted the Palayamanan System to address food security and economic instability in the rice-based communities. The Palayamanan System was transformed into a rice-based production systems model known as Palayamanan Plus, directed towards increasing income and profitability in the rice environments through purposive diversification, intensification, integration of certain farming components and development of agri-enterprises such as crops, livestock, aquaculture, mushroom, and biomass recovery system to enhance higher crop productivity, enhanced resource use efficiency, value-adding and marketing that will help spin-off rural economy in the rice farming communities by enhancing food and nutrition security, creating employment and income-generating opportunities to help reduce poverty. Specifically, the project help to identify and clarify issues regarding productivity, profitability and sustainability of local agri-bio systems through integrated assessment, and refinement of agri-bio systems components, to improve economic perforamance and practicability, ecological soundness, social acceptability, and market potential, and to identify and evaluate efficient technologies for increasing productivity, resource use efficiency and value-adding agri-bio systems.



**Component 1. Crop Enterprise Development & Assessment.**

*JM Rivera, GA Bantonilo & RG Corales*

The crop enterprise focuses on the different rice-based cropping systems that can enhance crop diversity and intensity. Rice is the main crop component then diversified or intensified with various crops such as cash crops, vegetables or root crops. The strategy employed was the alteration of crops in space and in time in order to increase productivity and income. The economic and other benefits of the crop enterprise to the other components were evaluated.

**Activities**

- Planted and managed a rice seed production area of 3.30 ha with a target yield of 4.0 t/ha for the DS and 4.10 ha with 3.0t/ha target yield for the WS.
- Planted and assessed cash crops planted after the WS rice
- Planted vegetables on the rice paddy bunds as part of the diversification and intensification strategy.

**Results**

- There was an increase in the seed yield attained from the rice seed production area during the 2016 DS. Table 1 shows that the 3.30ha seed production produced 8.18t foundation seeds, 1.99t registered seeds and 5.48t certified seeds. The average seed yield attained was 4.90/ha which is higher than the 4.0t/ha target. From the main target of producing foundation and registered seeds, a certain portion (5.48t) was downgraded to certified seeds. The same yield trend was also noted during the wet season cropping. The 4.10 ha seed production area during the 2016 WS (Table 2) produced 4.02t foundation seeds and 6.10t registered seeds with an average yield of 3.19t/ha. The gross value of the seeds produced during the DS was P 917,075.00 and P 750,900 during the WS or a total of PhP1,667,975.00.
- The cash crops assessed were corn, mungbean, sweet potato and vegetables. The short growth duration of green corn (var. Klasica with an average growth duration of 65 days) allows the production of two cycles during the dry season provided that water supply is available. The average yield attained was 3.20t/ha/cycle with an income of around PhP60,000.00/ha at PhP20.00/kg. Mungbean can also be grown for two cycles after rice. The average yield of mungbean is 1.40t/ha with a gross value of PhP112,000.00/ha when sold at PhP80.00/kg.

Sweet potato produced around 10t/ha yield with a gross value of PhP150,000.00/ha if sold at PhP15.00/kg. Garlic was also evaluated under CES condition but the result attained was not good because of seepage from the water channels for the rice production.

- Planting of vegetables on paddy bunds is part of the crop diversification and intensification strategy which also provide additional food source and income. Cowpea planted on the bunds produced an average yield of around 1.0kg fresh pods or 0.40kg dry seeds/10 linear meter (LM) during the dry season (DS), and 2.37kg fresh pods during the wet season (WS). Okra produced 1.0kg and 2.35 kg/10LM during the DS and WS, respectively. Sesame planted during the DS also had a yield of 0.7kg/10LM. The price of fresh cowpea pods was P20.00/kg, Okra at P30.00/kg, and Cowpea seeds at P 50.00/kg.

**Table 1.** Rice seed production. PhilRice. 2016 DS.

| Variety | Area Planted (ha) | Seed Class | Yield (t) | Price/kg | Gross Value (P) |
|---|---|---|---|---|---|
| NSIC Rc216 | **1.60** | FS | 7.12 | 80.00 | **569,600.00** |
| NSIC Rc218 | **0.30** | FS | 0.47 | 80.00 | **37,600.00** |
| NSIC Rc300 | **0.30** | FS | 0.59 | 80.00 | **47,200.00** |
| ***Sub-Total*** | ***2.20*** | | ***8.18*** | ***80.00*** | ***654,400.00*** |
| NSIC Rc222 | **0.30** | RS | **1.99** | 42.50 | **84,575.00** |
| NSIC Rc222 | **0.80** | CS | **5.48** | 32.50 | **178,100.00** |
| **Total** | **3.30** | | **15.65** | | **917,075.00** |

**Table 2.** Rice seed production. PhilRice. 2016 WS.

| Variety | Area Planted (ha) | Seed Class | Yield (t) | Price/kg | Gross Value (P) |
|---|---|---|---|---|---|
| NSIC Rc160 | **0.50** | FS | 2.44 | 80.00 | **195,200.00** |
| NSIC Rc360 | **0.50** | FS | 1.56 | 80.00 | **124,800.00** |
| PSB Rc18 | **0.50** | FS | 1.20 | 80.00 | **96,000.00** |
| ***Sub-Total*** | ***1.50*** | | ***5.20*** | ***80.00*** | ***416,000.00*** |
| NSIC Rc160 | **1.00** | RS | 2.92 | 42.50 | **124,100.00** |
| NSIC Rc360 | **0.70** | RS | 2.07 | 42.50 | **87,975.00** |
| PSB Rc18 | **0.90** | RS | 2.89 | 42.50 | **122,825.00** |
| ***Sub-Total*** | ***2.60*** | | ***7.88*** | ***4.50*** | **334,900.00** |
| **Total** | **4.10** | | **13.08** | | **750,900.00** |



**Figure 1**. Cash crops and vegetables grown during the dry season. PhilRice CES. 2016DS.

**Component 2. Establishment and Assessment of the Livestock Enterprise.**
*RG Corales & JM Rivera*

Diversification of livestock extends the risk reduction strategies beyond multiple cropping thus increases the economic stability of the farm. The availability of huge volume of biomass and by-products from crop production component make it feasible for livestock as an integral component of Palayamanan Plus. Livestock are the most practical and efficient bio-converter of biomass into organic materials essential in crop production. The existing livestock component of the Palayamanan Plus are Dairy Buffalo and Duck production.

**Activities:**

- Establishment of the dairy housing facilities.
- Collection, establishment and maintenance of livestock feedstocks.
- Capacity building so staff involved in the dairy buffalo component.

- Care and maintenance of the livestock component.

**Results:**

- Figure 2 shows the 10-head capacity dairy buffalo shed which was turned over last April 2016.
- Turn-over of 5 heads of pregnant buffaloes from the Philippine Carabao Center (PCC) was done in June 2016 (Fig.2).
- Two staff and 3 field workers were trained on buffalo management by PCC.
- Established forage farm, and collected and stored rice straw. Also planted corn for feed supplement.
- Figure 2 also shows the newly born calf. Based on the information provided by PCC, the pregnant buffaloes turned-over to PhilRice should give birth by December however, three of them already delivered this November. Unfortunately, one of the calf died after birth due to abnormalities.
- There were 347 heads of ducks and 814 eggs produced from the duck component of the project in 2016. The Future Rice Program requested the transfer 72 heads ducks last March to be featured during the institute field day in April. Last November, 161 ducks were transferred to the Business Development Division (BDD) to be sold. Ducks were sold at PhP75.00/head. The remaining stock in the Palayamanan Plus farm is 114 heads.

**Figure 2.** Turn over ceremony of dairy buffaloes from PCC; Livestock shed; buffalo calf, and ducks. PhilRice CES. 2016.



**Component 3. Establishment and Assessment of the Mushroom Enterprise.**

SE Santiago, JT Sajor & RG Corales

The Philippines produces 15.2 million tons of rice that leave behind 11.3 million tons of rice straw every year. Although there are some uses of rice straw available such as livestock feeds, plant nutrient sources, biofuel and paper making, a significant amount of rice straw produced is still being unused and burned in open fields boosting air pollution and human health risks.

The Palayamanan Plus includes mushroom production as an integral component of the rice production system which aims to enhance rice biomass utilization, productivity and profitability of the rice environments.

Mushroom is a traditional part of human diet by many cultures. However, mushroom culture in the Philippines is still a backyard undertaking unlike in neighboring countries such as China, Taiwan, Vietnam, Indonesia and Thailand. The availability of abundant biomass resources like rice straw as substrate in mushroom production and processing opens up opportunities for the development of commercial scale production in the Philippines.

As a start-up of the mushroom project, the biomass recovery facility was renovated into a mushroom laboratory, incubation room, and growing room facility with a capacity with a capacity of around 3,000 fruiting bags/month. The facility was up-graded to accommodate around 5,000 fruiting bags per month, and to accommodate other species that will enhance biomass utilization, time factor and income.

**Activities:**

- Upgrading of mushroom facilities.
- Optimization of oyster mushroom production.
- Spawn culture and maintenance of different rice-based mushroom species.

**Results:**

- The new mushroom facilities were turned-over last April 2016. The facilities composed of the soaking tank, working and processing area, laboratory and inoculation building, and the growing area with a capacity of 7,000 fruiting bag/production cycle. The new facilities will enhance the improvement of mushroom production and research. A new design of pasteurizer was also developed featuring perforated pipe steam

distributor and wheeled fruiting bag rack providing ease to the workers especially for women.

- Table 3 shows the production of oyster mushroom at Palayamanan Plus at PhilRice CES for 2016. There were 26,952 fruiting bags of oyster mushroom produced from January to October 2016 or an average of 2,700 fruiting bags/month. The pasteurization efficiency was improved as shown by the average contamination rate of only 7.16% which is lower than the general allowable contamination rate of 10%. The improved efficiency can be attributed to the new pasteurizer design.

- The mushroom center also supported the activities of the mushroom component of the Palayamanan Plus in the communities. This year, 1,400 fruiting bags were provided as start-up kit to the mushroom beneficiaries of Palayamanan Plus in San Fabian, Pangasinan (750 bags), Talavera, Nueva Ecija (500 bags) and Guagua, Pampanga (175 bags). Moreover, there were 6,686 fruiting bags sold to outside clients at PhP20.00/ fruiting bag.

- The fresh oyster mushroom produced from January to October was 2,215kg (Table 3). The local price of fresh oyster mushroom ranges from PhP160.00 to PhP180.00/kg.

- Grain spawn culture of Pleurotus, Calocybe, and Volvariela were regularly produced and maintained. There were 810 bags of oyster mushroom (Pleurotus), 54 bags of milky mushroom (Calocybe), and 89 bags of straw mushroom (Volvariela) grain spawns were produced from January to October 2016. One bag of grain spawn can inoculate around 200 fruiting bags (approximately 1kg weight). One bag of grain spawn cost PhP150.00/bag. This year, there were 312 bags, 43 bags, and 49 bags of Pleurotus, Calocybe, and Volvariela, resapectively were sold to outside clients.



**Table 3.** Oyster mushroom production. PhilRice CES 2016.

| Month | Fruiting bag production | Contamination | | Number of Fruiting Bag | | Fresh Mushroom Harvested (kg) |
|---|---|---|---|---|---|---|
| | | No. of bags | % | Sold | For Fruiting | |
| January | 2520 | 74 | 2.94 | 580 | | 224.75 |
| February | 4013 | 741 | 18.46 | 70 | 2391 | 191.5 |
| March | 1880 | 91 | 4.84 | 462 | 2430 | 380.6 |
| April | 2020 | 42 | 2.08 | 606 | 1620 | 198.85 |
| May | 3531 | 354 | 10.03 | 515 | 821 | 142.7 |
| June | 2720 | 300 | 11.03 | 403 | 2138 | 164.3 |
| July | 1538 | 17 | 1.11 | 2142 | 41 | 261.4 |
| August | 4381 | 274 | 6.25 | 82 | 1182 | 218.5 |
| September | 2699 | 37 | 1.37 | 1366 | 2978 | 336.95 |
| October | 1650 | 0 | 0.00 | 460 | 2239 | 195.6 |
| **Total** | **26,952** | **1,930** | **7.16** | **6,686** | **15,840** | **2,315.15** |

**Component 4. Establishment and Assessment of the Organic Fertilizer Enterprise.**

*JT Sajor and RG Corales*

Organic fertilizers are essential component in the farming ventures to reduce production costs as well as improving the soil quality, and helps in protecting the environment. The availability of materials like crop residues, spent mushroom substrates (SMS), and animal manure from the different Palayamanan Plus components makes it very viable to produce organic fertilizers through vermicomposting.

**Activity:**

- Collection, storage and processing off biomass resources from the different Palayamaan Plus components at IRBAS complex.

- Started the operation of vermiculture, which is the production of earthworms to be later used in vermicomposting.

**Results:**

- The collected pre-decomposed carabao manure the shredded SMS and other farm biomass were mixed together at 28:1 C:N ratio, watered at 40% moisture content (MC) then pre-decomposed in the vermibins.

- There were about 20kg of African night crawler juveniles procured used in starting-up the 4 bins (1m x 4m dimension) of vermiculture.

**Component 5. Adaptability and Model Development of Sorjan Production System.**

*PDO Roman, JJ delaCruz & RG Corales*

Sorjan production system is an indigenous technology of Java, Indonesia composed of series of raised beds alternating with sinks or canals. The technology is common in swampy or flooded areas. Rice is planted in the sinks while a wide variety of dryland crops is concurrently grown on the raised beds. Production increases in Sorjan because water is used more efficiently, weed control is easier and both upland and lowland crops are grown in environments more closely tailored to their needs. The collected water in the sinks aids rice growth and control weeds. The upland crops on the raised beds have a stable water supply combined with good drainage and air circulation.

The growing of upland and lowland crops at the same time in the same field practically assures good harvest of at least one of the crops. High-value crops, such as tomatoes, bush beans and onions, fetch very high price when grown in the rainy season which is possible in Sorjan. Fish can be introduced along the sink portion while trellises for vegetable production are also feasible at the top portion of the sink.

**Activity:**

- Establishment and assessment of three sorjan production models or design.
- Adaptability assessment of different crops that can be grown with the sorjan production models.

**Results:**

- Three Sorjan production designs were established and evaluated (Figure 3). The first design is the Vegetable + Fish Sorjan production system established in a 1,200m$^2$ area with 8 vegetable beds (780m$^2$), pond area of around 500m$^2$. The second design is the Rice + Vegetable + Fish Sorjan production system established in a 1,000m$^2$ area with 4 vegetable beds (270m$^2$), 2 rice sinks (270m$^2$) and pond area of around 320m$^2$. The third design is the Rice-Vegetable-Fish+Trellis design established in a 1160 m$^2$ with 6 raised vegetable beds with a bed area of 51m$^2$, 46m$^2$, 41m$^2$, 36m2, 31m$^2$, 24m$^2$, 4 rice beds with total rea of 431m$^2$ , and a pond area 430m$^2$.
- The different vegetables planted and evaluated from the sorjan production design 1 during the dry season (Jan-Jun) were pepper, eggplant, tomato, pechay, mustard, lettuce, kangkong, okra, cowpea, corn, string beans, bottle gourd, and sponge gourd. All these crops were grown favorably. The income attained was PhP11,769.00. During the wet season (Jul-Oct), the crops planted and assessed were eggplant, pepper, cowpea, kangkong, okra, string beans, sweet potato for tops, sponge gourd and bottle gourd. The eggplant and pepper did not grow well due to so much rain. The income generated was PhP10,494.00. Around 2,000 fingerlings were released in the pond last May but were lost with the flood last August.



**Figure 3.** Sorjan designs, L-R: Design 1,2 & 3. PhilRice CES. 2016.

- The crops planted under the Sorjan design 2 generated an annual income of PhP11,089.00. The crops planted and evaluated January to June were rice on the lower sink, and vegetables like eggplant, gabi, squash and string beans. All the crops grown during the dry season performed well with an income of PhP7,326.00. During the wet season (July to October), the crops planted were rice on the sink, eggplant, kangkong and sweet potato for tops. The eggplant was a failure due to excess rainfall. The income generated is only PhP3,763.00. No fish was also produced due to flood and poaching.
- The 3rd Sorjan design was rehabilitated during the dry season so only limited crops like pechay, mustard and pepper were only planted which provided an income of only PhP400.00. For the second semester (July to Oct), the crops planted were rice on the sink which is still not harvested. On the vegetable beds, okra, cowpea, kangkong and sweet potato for tops were planted. Bottle gourd was planted on the trellis above the pond. The vegetables are still existing but already provided an income of more than PhP5,000.00. Around 1000 pieces of tilapia fingerling was also released in the ponds and to be harvested by December.

## II. Development and Marketing of Food Products from Palayamanan Plus Crops (IRB 015-00-CES)

*Project Leader: RV Manaois*

Vegetable and mushroom production are an essential component of Palayamanan Plus as they serve as additional sources of income and nutrition and improve the resource use efficiency in the system. Some of the problems encountered in the production of these commodities are the high perishability and their unpopularity among consumers, especially in the case of certain vegetables, which usually end up as animal feed. Effective utilization through the preparation of food and food products with excellent palatability, high market appeal, and nutritional value would encourage the cultivation and consumption of these products. Cooking competitions were conducted to generate recipes that would be packaged into popular publications (e.g. cookbook or techno-bulletin) and distributed to stakeholders. An exploratory market research of mushroom and mushroom products was also conducted to be able to formulate innovative and market-driven food products from mushroom.

**Activities:**

- Compilation of oyster, milky, and ear mushroom recipes from the elimination and final round of cook fests held at PhilRice CES and Batac, respectively. Compilation of food preparations using milky mushroom by RCFSD, PhilRice CES as well as recipes from the Department of Hospitality Management (DHM), CLSU.

- Conducted exploratory market research on product quality preference of consumers and identify product ideas for mushroom. Developed a questionnaire and pre-tested at PhilRice CES to determine the buying decision role in the household, different product attributes they considered important, their level of interest toward different mushroom product ideas, their consumption behavior towards mushroom, common or popular local mushroom dishes in their area, and the variety of mushrooms locally grown in their respective areas .

- Conceptualized a cooking competition featuring green leafy vegetables commonly planted in rice-based farms. Sent invitations to schools with culinary arts, restaurant and hotel management, and food technology curriculums to participate in the event. Posted advertisements in the PhilRice website for the general public.



**Results:**

- The recipe book containing 38 recipe collected from the two mushroom cook fests held in CES and in Batac is on the printing process (Figure 4).

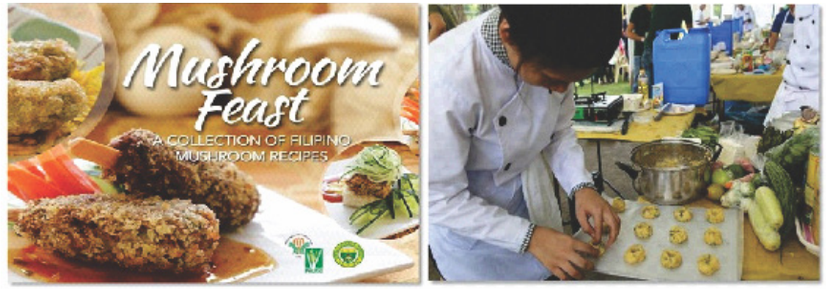


**Figure 4.** Mushroom book (L) and "Going Greens: A Cook-off Show down" (R)

- Obtained 30 product recipes of using green leafy vegetables (GLVs) from the cooking competition dubbed as "Going Greens: A Cook-off Showdown" featuring GLVs such as pechay, spinach, camote tops, bitter gourd leaves, string bean leaves, chili pepper leaves, and upland kangkong (Figure 4).

- Result of the exploratory market survey of mushroom products from different Palayamanan Plus sites showed that appearance (72%), taste (90%), nutritional content/health benefit (84%), price (69%), and aroma were very important (51%) for acceptability. It also shows that the respondents interest on mushroom chips/crackers was 53% and food supplement 51%. The most common mushroom recipe was tempura, and the most popular dish eaten was mushroom sisig. Some of respondents (43%) consumed mushroom once a month, and the commonly used specie is the oyster mushroom.

## III. Agribusiness Analysis of IRBAS Enterprises (IRB-016-00-CES)

*Project Leader: BM Catudan*

The Intensified Rice-Based Agri-Bio Systems (IRBAS) is a development program of PhilRice that intends to treat the operation of a portion of the farm assets of each branch station as profit-earning resources. The program targets to generate Php 1M per ha gross income annually by integrating potential income sources that can be super-imposed into a rice-based farm. These include other crops, vermicomposting, mushroom, livestock, poultry, fish, and farm machinery and equipment custom service. It also eyes post-production ventures that can add value to its farm outputs. PhilRice envisions coming up with efficient farming system models that can be later duplicated by farmers in actual realm. Since 2014, PhilRice stations have each been implementing a combination of the component enterprises. Over the years, they have fine-tuned the technology package and assessed the performance and input requirements of each enterprise. It is then high time to produce a technology bulletin for each enterprise that can be adopted by local farmers and agri-entrepreneurs in the stations' respective areas of operation.

**Activities:**

- Development of templates of the production technology bulletins of each component enterprise.

**Results:**

- Constructed the templates of the production technology bulletins for rice seed and other crops, livestock, duck, fish, mushroom, vermicomposting.

## IV. Capacity Building to Enhance Market Linkage (IRB 018-00-CES)

*Project Leader: AM Corales*

Entrepreneurship is one of the key drivers for development because it contributes to the economic, social and political development of the society. Unfortunately, the development of capacities for creative and innovative thinking, skills, and building of mindset related to entrepreneurship is not given much attention.

Promoting entrepreneurship development through a properly coordinated education would assist in changing this scenario. Building the requisite capacity to realize this is therefore an important prerequisite. Thus, this project focuses on ways for developing the capacity appropriate for providing entrepreneurship education for agricultural professionals and farmer-leaders in order to address constraints in market engagement.



The general objective of the project is to create sustainable capacity to promote entrepreneurship and strengthen the entrepreneurial spirit among partners in the project sites.

**Activities:**

- Conduct of briefing for agro-enterprise facilitators coming from LGU and SUCs.
- Conduct of training on market chain study and analysis.
- Establish/strengthen partnership with the private sector for better market linkage.

**Results:**

- A total of 34 agro-enterprise facilitators who are partners of PhilRice in the implementation of Palayamanan Plus were given orientation by Catholic Relief Services (CRS) on the 8-Step Clustering Approach in Agro-entrepreneurship. The activity was conducted in Balanga, Bataan on March 1, 2016. Through the orientation, the participants were expected to widen their perspective on the importance of market linkage in any development project.
- The training proposal on how to conduct a Market Chain study was drafted. A service contractor was recently recruited to assist in the implementation of the activity.
- An initial discussion with Allied Botanical Corporation (ABC) on sweet corn and grain sorghum production and marketing was recently conducted. The market requirements such as volume, frequency, and delivery were explained by the ABC representative. However, it was agreed by the group that the concerned farmer-organizations shall be consulted first to determine whether they are capable and willing to meet the requirements set by ABC.
- Coordinated the conduct of seminar on social entrepreneurship in agriculture to the Palayamanan Plus implementers at PhilRice.

## V. Accelerating the Development, Demonstration and Adoption of Palayamanan Plus in Lowland Farms (171A RTF-022)

*Project Leader: RG Corales*
*Co-Project Leader: AM Corales*

Agriculture faces many challenges ahead. It has to address the food requirements of the ever increasing population with also increasing competition for resources. Innovative farming systems and management approaches have been developed recently to increase farm income and productivity. Palayamanan Plus - a community-based rice-based production system has been developed directed towards increasing income and profitability in the rice environments through diversification, intensification and integration of different farming components. The project aims to develop and enhance the adoption of Palayamanan Plus models in lowland farms, specifically to (1) generate database on socio-economic, site profile and market information as basis in designing location-specific Palayamanan Plus models, (2) design and assess the adaptability of Palayamanan Plus models based on the local resources and agro-climatic conditions, (3)enhance the capacity of farmers, other beneficiaries and implementers in the implementation and successful operation of Palayamanan Plus and (4)assess and document the sustainability of the project.

**Activities:**

- Benchmarking and site profiling.
- Development and Assessment of Palayamanan Plus Models.
- Capacity enhancement.
- Sustainability assessment.

### Development and Assessment of Palayamanan Plus Model for San Rafael, Bulacan

*JJ dCruz, PO Roman, RG Corales, AM Corales, RB Malasa, JdelaCruz*

**Activities:**

- Establishment and assessment of Palayamanan Plus model.
- Conduct capacity enhancement activities.
- Monitoring and evaluation.



Results:

- The rice production component had an area planted of 14.25ha and 24.7ha during the dry and wet season, respectively. The average yield attained during the DS was higher than the baseline yield of 4.24t/ha (Table 4). During the wet season, the yield attained was almost 50% lower than the baseline yield (Table 4) because of damage caused by the two typhoons in the area.
- Five farmers planted bitter gourd, bottle gourd and bell pepper in a 1.4ha area (Figure 5). The total sale was around P 585,000.00.
- Six farmers were beneficiaries of the 12 piglets for the livestock component. Three heads were sold after four months at an average weight of 55kg/head. The gross sales for the three pigs was PhP19,410.00. Three of the sows delivered 28 piglets. Two piglets were given to another farmer beneficiary. The project also provided 15 goats and one buck to 15 beneficiaries last September. Three of the goats already gave birth to 3 kids.
- The construction of the mushroom facility is underway (Figure 6).
- Season long FFS on Palayamanan Plus was conducted in partnership with LGU-San Rafael. This was attended by 37 farmer-benficiaries. A field day was conducted last October attended by around 200 farmers from Pulongmasle and surrounding barangays. The field day was participated by the officials in the surrounding barangays, Municipal LGU of San Rafael, ATI, and Allied Botanical Corporation.


**Figure 5.** Bitter gourd production. San Rafael, Bulacan. 2016.

**Figure 6.** Construction of mushroom facility. San Rafael, Bulacan. 2016.



**Table 4.** Rice production. San Rafael, Bulacan. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | 11 | 23 |
| Area Planted (ha) | 14.25 | 24.7 |
| Varieties | NSIC Rc308, PSB Rc10 | NSIC Rc222, Rc216, Rc238, Rc298, PSB Rc18 and Rc10 |
| Average Yield/ha | 5.11 | 4.83 |
| Baseline yield/ha | 4.24 | 5.73 |
| Gross Income/ha | P55,196.60 | P64,034.43 |
| Production cost/ha | P24,598.49 | P22,385.24 |
| Average Income/ha | P30,598.11 | P41,649.19 |

## Development and Assessment od Palayamanan Plus Model for Guagua, Pampanga

*MAC Tan, RG Corales, AM Corales, RB Malasa*

**Activities:**

- Establishment and assessment of Palayamanan Plus model.
- Conduct capacity enhancement activities.
- Monitoring and evaluation.

**Results:**

- The cropping system in Pulongmasle, Guagua is Rice – Rice - Cash crop production. The rice production outlook is presented in Table 5. The area planted to rice during the dry season was 14.60ha and 26.70ha during the wet season. The average yield attained during the DS was 5.47t/ha which is slightly higher than the benchmark yield of 5.43t/ha. On the other hand, the average yield attained during the wet season was only 4.53t/ha due to damage caused by typhoon Lawin and Karen.
- To further enhance the utilization of quality rice seeds, five farmers were trained and registered as rice seed growers. During the dry season, 60 bags of certified seeds was produced from the 0.80ha seed production area while 133 bags of certified seeds produced from the 1.4ha seed planted during the west season.
- The cash crops planted after rice were corn, sweet potato, peanut and mungbean. The corn planted in a 0.90ha area attained a yield of 2.06t/ha green corn with a net income of PhP14,333.37. The area planted with the other cash crops was 2.58ha. The yield attained was 3.99t for the sweet potato,

0.93t for the peanut and 0.06t for the mungbean. The total yield value of these cash crops was PhP137, 522.33 with an average computed income of PhP53,000/ha.

- The chickens (175 heads) provided to 7 farmer-beneficiaries last year as part of the livestock component started laying eggs early this year but unfortunately they died due to avian flu outbreak. In addition, 8 farmer-beneficiaries were provided with 15 female goats and 1 buck.

- Despite the delay of the establishment of the mushroom facility, the mushroom beneficiaries continued the operation of the mushroom component. The group produced around 20kg fresh oyster mushroom from the 500 bags starter kit provided by the project. Some of the produce was sold and part was consumed. The group produced 100 fruiting bags but the result was high contamination. To avoid this, they decided to buy 200 oyster mushroom fruiting bags from PhilRice while waiting for the establishment of the facility. The materials of the facility have just been delivered.

- For the capacity enhancement activities, three (3) new member beneficiaries of the mushroom component and five member beneficiaries of the vermicomposting component attended the mushroom and organic fertilizer production training on February 25 to 29, 2016 at PhilRice CES. FFS was conducted during the wet season participated by 20 farmers (Figure 7). Field day was also conducted last October which were participated by around 150 farmers.

**Table 5.** Rice production. Guagua, Pampanga. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | 15 | 32 |
| Area Planted (ha) | 14.60 | 26.70 |
| Varieties | SL8, NSIC Rc216 &Rc222 | NSIC Rc216 &Rc222 |
| Average Yield/ha | 5.47 | 4.53 |
| Baseline yield/ha | 5.43 | 5.15 |
| Gross Income/ha | P81,419.09 | P67,397.56 |
| Production cost/ha | P43,320.16 | P43,038.93 |
| Average Income/ha | P38,098.93 | P24,358.63 |



**Figure 7.** Conduct of agro-ecological systems analysis (AESA). Guagua, Pampanga. 2016.

**Development and Assessment of Palayamanan Plus Model for Maria Aurora, Aurora**

*GD Martin, RG Corales, AM Corales & RB Malasa*

**Activities:**

- Establishment and assessment of Palayamanan Plus model.
- Assist in processing and procurement of needed inputs and facilities.
- Conduct capacity enhancement activities.
- Monitoring and evaluation.

**Results:**

- There were 17.72ha planted with rice in Sto Cristo from January to May growing season but most of them were damaged by flash floods. The total yield obtained was only 18.4 tons with an average yield of only 1.26t/ha. The 2.2ha seed production established in Diat obtained a total yield of 7.65t with an average yield of only 3.29t/ha. The June to December rice planting was delayed due to El Nino. Harvesting is still on going.

- Cash crops such as corn, mungbean and sweet potato (Figure

8) were planted in 11.65ha by 17 farmer-beneficiaries which produced an income of PhP270,885.00.

- Out of the 11 heads of piglets provided to the livestock component of the project last year, five heads were sold after four months with an average of 55kg/head live weight. The total gross sales was PhP29,410.00. Eight of the remaining sows delivered 41 piglets, 12 piglets were given to 6 new beneficiaries.

- Despite the delay in the establishment of the mushroom facilities, the group continued the mushroom operation by buying grain spawns and fruiting bags out of their initial income. The fresh oyster mushroom produced was 62.5kg which generated an income of PhP12,500.00.

- The FFS attended by 25 farmer beneficiaries started last August, 2016. A farmers' field day and forum was conducted last November 24 attended by around 100 farmers, LGU-partners and ASCOT (Figure 9).

**Figure 8.** Sweet potato production. Maria Aurora, Aurora. 2016.




**Figure 9.** Farmers' forum held during the conduct of the field day. Maria Aurora, Aurora. 2016.

**Development and Assessment of Palayamanaan Plus Model for Talavera, Nueva Ecija**

*JM Rivera, RG Corales, AM Corales, and RB Malasa*

Activities:

- Establishment and assessment of Palayamanan Plus model.

- Assist in processing and procurement of needed inputs and facilities.

- Conduct capacity enhancement activities.

- Monitoring and evaluation.

Results:

- The total rice area during the DS was 23.23ha planted with Mestiso 20 hybrid and NSIC Rc358 with an average yield of 6.80t/ha (Table 6). During the wet season, the area planted was 36.2ha planted with certified inbred varieties. The average yield attained was 5.83t/ha. The net income during the dry and wet season were PhP49,138.46 and PhP53,582.09, respectively (Table 6).

- Seventeen farmer beneficiaries planted pechay in 6.42ha

from September to November just after the wet season rice crop (Figure 10). The yield obtained from the 4.05ha area was 11.14t with a contracted price of PhP275,140.00. The computed net income is P55,814.81/ha.

- The mushroom beneficiaries were provided with 500 oyster mushroom fruiting bags as their starter kit. They were able to produce 97 kilograms fresh mushroom with a gross sales of PhP17, 900.00. Their net income was PhP7, 900.00. The net income was used in the operation of the mushroom component. The group produced 1,374 fruiting bags of oyster mushroom from September to November 2016. They sold 685 fruiting bags to neighboring barangays, and retained 217 fruiting bags for fresh oyster mushroom production. They initially harvested 18.5kg which they sell at PhP200.00/kg.

- The dairy buffalo production established by the Philippine Carabao Center composed of 102 buffaloes was integrated to the Palayamanan Plus project in 2015 (Figure 11). The amount of milk produced this year was 20,541.4 liters valued at PhP924, 363.00.

- Farmer's Field Day and Forum was conducted last April and October 2016 in partnership with the LGU-Talavera, PCC, Minabuyoc Elementary School, ATI and local officials (Figure 12). The event was attended by by more or less 450 farmers from barangays Minabuyoc and Bagong Sikat.

**Table 6.** Rice production. Talavera, Nueva Ecija. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | 22 | 17 |
| Area Planted (ha) | 23.23 | 22.2 |
| Varieties | M20, NSIC Rc358 | NSIC Rc222, NSIC Rc216, NSIC Rc358, NSIC Rc308 |
| Average Yield t/ha | 6.80 | 5.83 |
| Baseline yield t/ha | 6.50 | 5.80 |
| Gross Income P/ha | P96,532.38 | P90,490.53 |
| Production cost P/ha | P47,393.92 | P36,908.44 |
| Average Income P/ha | P49,138.46 | P53,582.09 |



**Development and Assessment of Palayamanaan Plus Model for San Fabian, Pangasinan**

GABantolino, SESantiago, RGCorales, AMCorales, RBMalasa and JTSajor

**Activities:**

- Establishment and assessment of Palayamanan Plus model
- Assist in processing and procurement of needed inputs and facilities
- Conduct capacity enhancement activities
- Monitoring and evaluation

**Results:**

- The area planted to rice during the wet season was 35.22ha. The average yield attained was 4.63t/ha which range from 2.82 to 5.64t/ha (Table 7). The quite low yield obtained was due to damage inflicted by the two typhoons in the area.
- During the dry season, cash crops were planted in 36.5 hectares. The crops planted were corn and mungbean a total yield of 159,182.50kg valued at PhP2,155,717.00 .
- One of the trained and certified rice seed growers planted 1.25ha area for seed production and attained a yield of 110 bags which generated an income of PhP144,760.00.
- The Farmer's Field Day and Forum conducted last March 18, 2016 in collaboration with LGU-San Fabian, and DA-RFU 1 was attended by more than 150 farmers. The second Farmer's Field Day and Forum conducted last October, 2016 in partnership with LGU, ATI, and private seed companies. The activity was attended by more than 150 farmers and other stakeholders.

**Table 7.** Rice production. San Fabian, Pangasinan. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | | 47 |
| Area Planted (ha) | | 35.22 |
| Varieties | | NSIC Rc216, Rc218, Rc222, Rc308, Rc214, Rc150, Rc212, and Pioneer TH82 |
| Average Yield t/ha | | 4.63 |
| Baseline yield t/ha | | 5.52 |
| Gross Income P/ha | | P59,315.27 |
| Production cost P/ha | | P31,048.81 |
| Average Income P/ha | | P28,266.46 |

**Development and Assessment of Palayamanan Plus Model for Cabadbaran, Agusan Del Norte**

*BM Tabudlong, SA Boquil, RG Corales, AM Corales, GF Estoy*

**Activities:**

- Establishment and assessment of Palayamanan Plus model.
- Assist in processing and procurement of needed inputs and facilities.
- Conduct capacity enhancement activities.
- Monitoring and evaluation.

**Results:**

- The rice area was 40.8 ha planted to inbreed varieties. The rice yields attained range from 3.99 to 6.20t/ha with an average yield was 4.90 t/ha (Table 8). The yield was affected by drought as a result of the el Nino phenomenon. with a yield difference of 1.03t/ha higher than the baseline yield.
- Fifteen member beneficiaries were provided with 32 piglets. After four months, 17 heads were sold at an average of 73kg live weight. The gross sales was PhP124,100.00 and the net income was PhP53,125.00
- For the mushroom component, 500 fruiting bags were provided to the farmer beneficiaries as start-up kit and hands-on learning. This 500 fruiting bags produced 65.2kg fresh oyster mushroom which was sold at Php120/kg with a total income of PhP7,830.00. Another batch of 300 fruiting bags was provided, to date they harvested 22.80kg with an income of PhP2,736.00. Harvesting of fresh fruit still on-going (Figure 13)



**Figure 13.** Mushroom production, Cabadbaran, Agusan del Norte. 2016DS.

- Training conducted were: (1) S and T Updates on Rice Production on May 24 to 25, 2016 with 32 participants including 2 agricultural technicians from LGU Cabadbaran; (2) Mushroom production and cultivation training on May 26 to 28, 2016 with 34 participants, and (3) Vermiculture and composting training with 31 participants and 2 LGU technicians on May 30, 2016 (Figure 14).


**Figure 14.** Training conducted to the farmer beneficiaries, (a) S & T Updates on Rice Production, (b) Mushroom Production and Cultivation, and (c) Vermiculture and composting, Cabadbaran, Agusan del Norte. 2016.

**Table 8.** Rice production. Cabadbaran, Agusan del Norte. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | | 30 |
| Area Planted (ha) | | 40.8 |
| Varieties | | PSB Rc18, 122, 160, 218, 286, 300, 358 |
| Average Yield t/ha | | 4.90 |
| Baseline yield t/ha | | 3.87 |
| Gross Income P/ha | | P 89,064.00 |
| Production cost P/ha | | P 32,993.00 |
| Average Income P/ha | | P 56,071.00 |

## Development and Assessment of Palayamanan Plus Model for Quirino, Isabela

*ALCruz, Jr, JVE Adolfo,RG Corales, AM Corales, RB Malasa, DB Rebong*

**Activities:**

- Establishment and assessment of Palayamanan Plus model.
- Assist in processing and procurement of needed inputs and facilities.
- Conduct capacity enhancement activities.
- Monitoring and evaluation.

**Results:**

- Twenty-six farmers planted hybrid seeds in 31.50 hectares (Table 9). The average yield was 6.69t/ha with a net income of PhP43,409.39/ha. Additional income of PhP212,450.00 was obtained from the mungbean was also planted in the area with a total yield of 3,035kg.
- Twenty-six pigs were given to the farmer-beneficiaries. Most of the pigs were for fattening and two heads were for breeding. The pigs were sold after four months with an average live weight of 72.89 kg. The gross income range from PhP6,925 to PhP8,550/head. The two breeder sows gave birth to 9 and 11 litters. The gross income of the breeder farmers were Php22,500 and PhP27,500, respectively.



**Table 9.** Rice production. Quirino, Isabela. 2016.

| Rice Production | DS 2016 | WS 2016 |
|---|---|---|
| No. of Farmer Beneficiaries | 26 | |
| Area Planted (ha) | 31.50 | |
| Varieties | SL-8H | |
| Average Yield t/ha | 6.69 | |
| Baseline yield t/ha | 6.34 | |
| Gross Income P/ha | 88,409.39 | |
| Production cost P/ha | 45,000.00 | |
| Average Income P/ha | 43,409.39 | |

## Development and Assessment of Palayamanan Plus Model for Batac, Ilocos Norte

*BM Catudan, Benjamin A. Pajarill, Jr.FB Paleracio, JM Solero, NQ Abrogena and MAU Baradi*

**Activities:**

- Attended the project's Planning Workshop during the first week of March in Balanga, Bataan wherein the site's workplan for 2016 was presented.
- Implemented the plan of activities with the active participation of the City of Batac Agriculture Office (CAO) and identified Brgy Pimentel as the project site based on the selection criteria. The members of the Pimentel Federated Irrigators' Association (zanjera) were the farmer beneficiaries of the project.
- Conducted project briefing, needs assessment and quick survey to determine household labor sources, crops grown, poultry and livestock raised, and other farming enterprises they were involved in.
- Procurement of livestock and other inputs.
- Female goats and piglets were procured to serve as starter stocks of the farmer partners. Rice seeds were likewise offered to interested farmers. The cost of the rice seed and livestock availed by the farmers shall be paid back to the zanjera which will serve as seed money of the association in sustaining the farm enterprises intervened by the project.

**Results:**

- The briefing was attended by 36 farmers, 4 CAO personnel, the Sangguniang Panglungsod Chair for Agriculture, and staff of PhilRice involved in the project.
- The farmer beneficiaries enlisted for the livestock component were: 13 Boer mestizo goats and 17 piglets, for rice production, 140 kg inbred and 13 bags hybrid.

## Abbreviations and acronymns

ABA – Abscicic acid
Ac – anther culture
AC – amylose content
AESA – Agro-ecosystems Analysis
AEW – agricultural extension workers
AG – anaerobic germination
AIS – Agricultural Information System
ANOVA – analysis of variance
AON – advance observation nursery
AT – agricultural technologist
AYT – advanced yield trial
BCA – biological control agent
BLB – bacterial leaf blight
BLS – bacterial leaf streak
BPH – brown planthopper
Bo - boron
BR – brown rice
BSWM – Bureau of Soils and Water Management
Ca - Calcium
CARP – Comprehensive Agrarian Reform Program
cav – cavan, usually 50 kg
CBFM – community-based forestry management
CLSU – Central Luzon State University
cm – centimeter
CMS – cystoplasmic male sterile
CP – protein content
CRH – carbonized rice hull
CTRHC – continuous-type rice hull carbonizer
CT – conventional tillage
Cu – copper
DA – Department of Agriculture
DA-RFU – Department of Agriculture-Regional Field Units
DAE – days after emergence
DAS – days after seeding
DAT – days after transplanting
DBMS – database management system
DDTK – disease diagnostic tool kit
DENR – Department of Environment and Natural Resources
DH L– double haploid lines
DRR – drought recovery rate
DS – dry season
DSA - diversity and stress adaptation
DSR – direct seeded rice
DUST – distinctness, uniformity and stability trial
DWSR – direct wet-seeded rice
EGS – early generation screening
EH – early heading
EMBI – effective microorganism-based inoculant
EPI – early panicle initiation
ET – early tillering
FAO – Food and Agriculture Organization
Fe – Iron
FFA – free fatty acid
FFP – farmer's fertilizer practice
FFS – farmers' field school
FGD – focus group discussion
FI – farmer innovator
FSSP – Food Staples Self-sufficiency Plan
g – gram
GAS – golden apple snail
GC – gel consistency
GIS – geographic information system
GHG – greenhouse gas
GLH – green leafhopper
GPS – global positioning system
GQ – grain quality
GUI – graphical user interface
GWS – genomwide selection
GYT – general yield trial
h – hour
ha – hectare
HIP - high inorganic phosphate
HPL – hybrid parental line
I - intermediate
ICIS – International Crop Information System
ICT – information and communication technology
IMO – indigenous microorganism
IF – inorganic fertilizer
INGER - International Network for Genetic Evaluation of Rice
IP – insect pest
IPDTK – insect pest diagnostic tool kit
IPM – Integrated Pest Management
IRRI – International Rice Research Institute
IVC – in vitro culture
IVM – in vitro mutagenesis
IWM – integrated weed management
JICA – Japan International Cooperation Agency
K – potassium
kg – kilogram
KP – knowledge product
KSL – knowledge sharing and learning
LCC – leaf color chart
LDIS – low-cost drip irrigation system
LeD – leaf drying
LeR – leaf rolling
lpa – low phytic acid
LGU – local government unit
LSTD – location specific technology development
m – meter
MAS – marker-assisted selection
MAT – Multi-Adaption Trial
MC – moisture content
MDDST – modified dry direct seeding technique
MET – multi-environment trial
MFE – male fertile environment
MLM – mixed-effects linear model
Mg – magnesium
Mn – Manganese
MDDST – Modified Dry Direct Seeding Technique
MOET – minus one element technique
MR – moderately resistant
MRT – Mobile Rice TeknoKlinik
MSE – male-sterile environment
MT – minimum tillage
$mtha^{-1}$ - metric ton per hectare
MYT – multi-location yield trials
N – nitrogen
NAFC – National Agricultural and Fishery Council
NBS – narrow brown spot
NCT – National Cooperative Testing
NFA – National Food Authority
NGO – non-government organization
NE – natural enemies
NIL – near isogenic line
NM – Nutrient Manager
NOPT – Nutrient Omission Plot Technique
NR – new reagent
NSIC – National Seed Industry Council
NSQCS – National Seed Quality Control Services
OF – organic fertilizer
OFT – on-farm trial
OM – organic matter
ON – observational nursery
OPAg – Office of Provincial Agriculturist
OpAPA – Open Academy for Philippine Agriculture
P – phosphorus
PA – phytic acid
PCR – Polymerase chain reaction
PDW – plant dry weight
PF – participating farmer
PFS – PalayCheck field school
PhilRice – Philippine Rice Research Institute
PhilSCAT – Philippine-Sino Center for Agricultural Technology
PHilMech – Philippine Center for Postharvest Development and Mechanization
PCA – principal component analysis
PI – panicle initiation
PN – pedigree nursery
PRKB – Pinoy Rice Knowledge Bank
PTD – participatory technology development
PYT – preliminary yield trial
QTL – quantitative trait loci
R - resistant
RBB – rice black bug
RCBD – randomized complete block design
RDI – regulated deficit irrigation
RF – rainfed
RP – resource person
RPM – revolution per minute
RQCS – Rice Quality Classification Software
RS4D – Rice Science for Development
RSO – rice sufficiency officer
RFL – Rainfed lowland
RTV – rice tungro virus
RTWG – Rice Technical Working Group
S – sulfur
SACLOB – Sealed Storage Enclosure for Rice Seeds
SALT – Sloping Agricultural Land Technology
SB – sheath blight
SFR – small farm reservoir
SME – small-medium enterprise
SMS – short message service
SN – source nursery
SSNM – site-specific nutrient management
SSR – simple sequence repeat
STK – soil test kit
STR – sequence tandem repeat
SV – seedling vigor
t – ton
TCN – testcross nursery
TCP – technical cooperation project
TGMS – thermo-sensitive genetic male sterile
TN – testcross nursery
TOT – training of trainers
TPR – transplanted rice
TRV – traditional variety
TSS – total soluble solid
UEM – ultra-early maturing
UPLB – University of the Philippines Los Baños
VSU – Visayas State University
WBPH – white-backed planthopper
WEPP – water erosion prediction project
WHC – water holding capacity
WHO – World Health Organization
WS – wet season
WT – weed tolerance
YA – yield advantage
Zn – zinc
ZT – zero tillage

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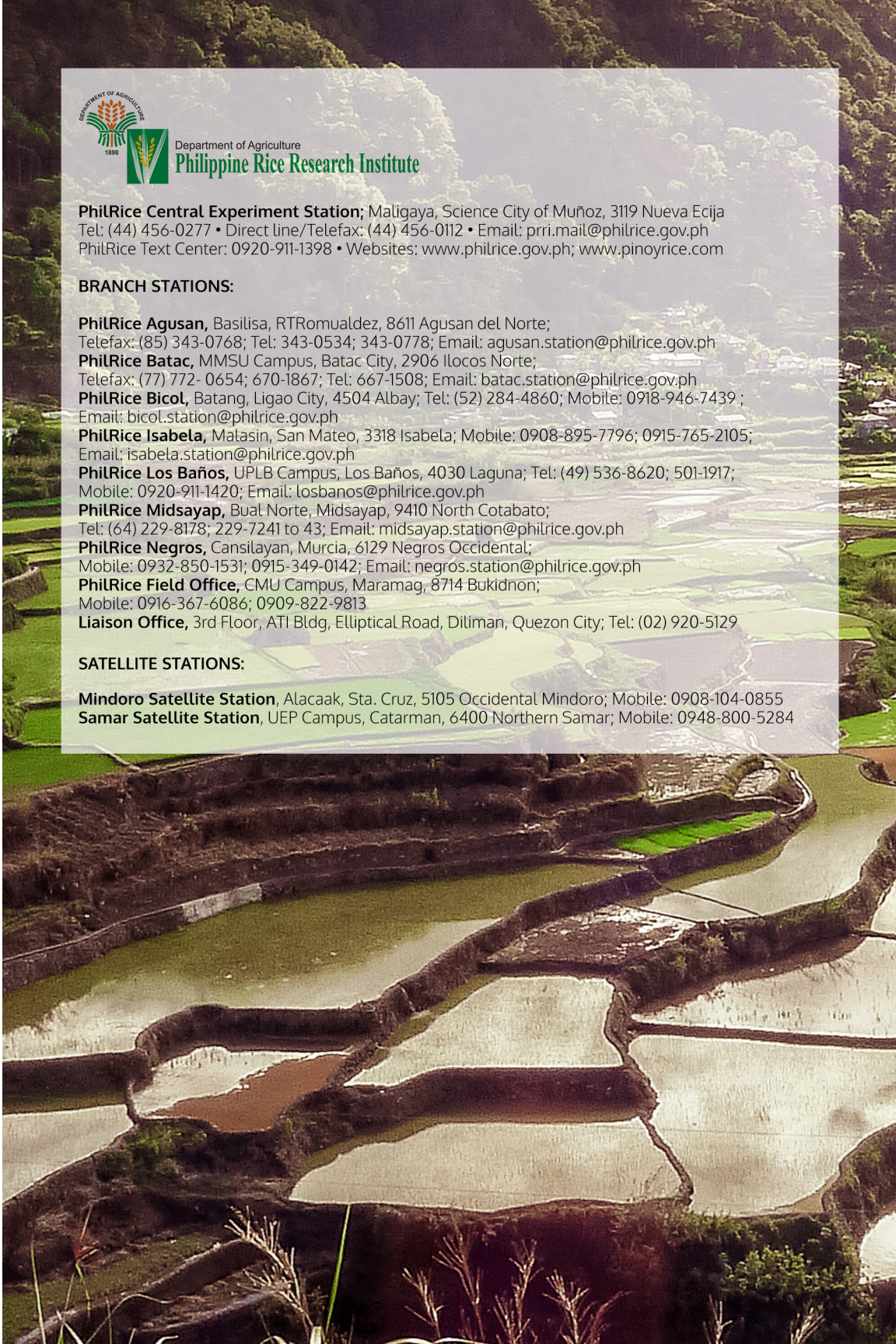

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