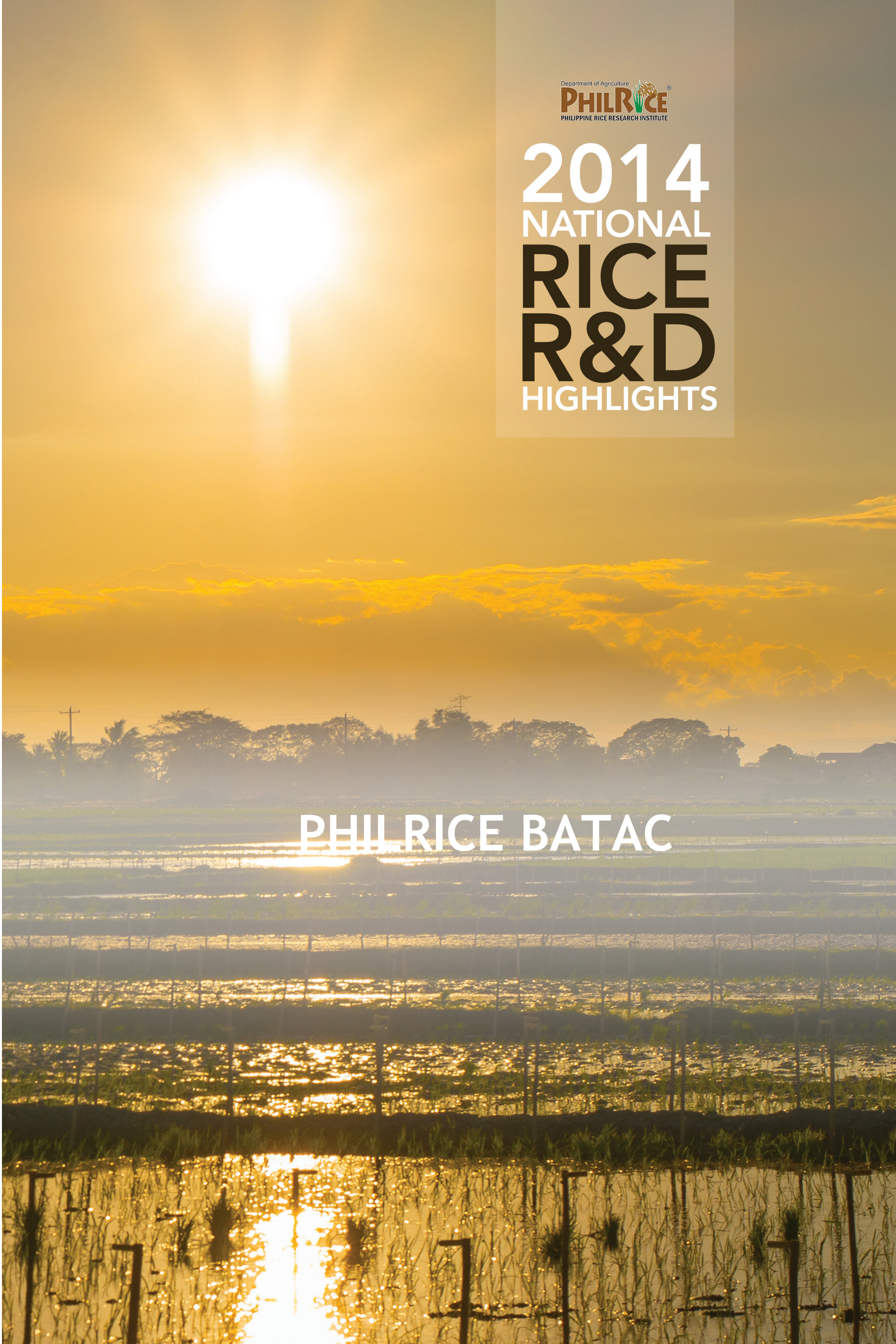
Department of Agriculture
PHILRICE
PHILIPPINE RICE RESEARCH INSTITUTE

2014 NATIONAL RICE R&D HIGHLIGHTS



PHILRICE BATAC

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PhilRice Batac

Acting Branch Director: Fidela P. Bongat

Executive Summary

PhilRice Batac is taking part in showcasing a nucleus-estate, self-propelling station working mostly for the rainfed areas with small landholdings. It integrated projects and activities for more holistic approach of generating and extending technologies to farmers and agricultural extension workers and other intermediaries and stakeholders.

The station implemented four researches and two development studies aside from those under the Programs and Divisions at PhilRice Central Experimental Station (CES). The three research studies were on agro-climatic profiling and analysis of key rice growing areas, development of postharvest technologies for traditional rice, and on water harvesting and soil and water conservation. These were funded by the Department of Agriculture Cordillera Administrative Region (CAR) Field Office (DA-CARFO) and DA-Regional Field Office 1. The station-based development studies were on development of hydroponics for growing vegetables using low-cost drip irrigation system and the operationalization of agrometeorological service. The station also implemented the Agricultural Support Component of the National Irrigation Sector Rehabilitation and Improvement Project (NISRIP) in Solsona and Madongan National Irrigation Systems and the Upland Rice Development Program along with other PhilRice CES-initiated projects such as Intensified Rice-Based Agri-Biosystem (IRBAS), Rice Learning Center, Rural Transformation Movement (RTM), National Cooperative Testing of promising lines, demonstration of newly released varieties, among others.

The study on profiling and analysis of key rice growing areas were focused on Abra and Apayao in collaboration with PhilRice CES. The development of postharvest technologies for traditional rice was able to generate information on indigenous practices as well as the willingness of the Cordillerans especially those in Kibungan, Benguet to adopt new technologies. It started testing the functionality of an adapted thresher from a previous study. Adaptation of thresher for traditional rice has great potential that can help solve difficulty of separating the panicle with the grains. Modifications on said thresher have yet to be done based on results of initial testing. The study on water harvesting and soil and water conservation geared on providing alternatives for farmers to grow crops other than rice after wet season by showcasing them water harvesting structure and lifting devices that can provide irrigation water to crops when rainfall is scarce. It continued to showcase high-value crops that may be grown through a farmers' field school.

The station had its start-up activities for IRBAS and RTM while pursuing its development projects. It pursued its information and communication technology (ICT)-based 4-month observation course to agricultural extension workers and farmer-leaders. It also responded quickly to clamors and requests of farmers, farmers' organizations, and local government units (LGUs) either on experts' dispatch or through PhilRice Batac Service Express. The PhilRice Batac Service Express is a new modality of extension whereby a whole team and package of technologies were brought to the municipalities for a day of practical lectures and hands-on exercises. It also started to provide technologies and information to far flung barangays using a mobile public address. These modalities brought PhilRice closer to farms and farmers generating curiosity and awareness. It also conducted a boot camp for 25 new agriculture and related sciences graduates which was a learning process that truly there is a need to capacitate also the new breeds of agriculturists who would become catalyst of change and transformation in the countryside.

Also evident was the growing number of students both secondary (both from Philippine Science High and Technical and Vocational School) and collegiate that want to come to PhilRice Batac for internship or on-the-job training. Those from Science High School were particularly interested in laboratory and field exposures while preparing them toward becoming rice or related science-inclined ones. Those from Technical and Vocational School were particular to acquiring a Technical Education Skills and Development Authority (TESDA) accreditation on National Certificate (NC II) on Crop Production. PhilRice Batac had been instrumental in the accreditation of the Bukig National Agricultural and Technical School, Aparri, Cagayan. Students from Mariano Marcos State University likewise came in for the OJT that helped them achieved commendable grades before their graduation.

A. Research Component

Water Harvesting and Soil and Water Conservation for the Uplands of Abra (CARFO 7)

RCCastro, DPDal-uyen, MJCVives, JMMaloom, FDJose, RARarangol and HJPAgngarayngay

Water has become the most limiting factor in food production. Many farms become unproductive during summer because of water scarcity, forgoing income opportunities for farmers and undermining the efforts for food sufficiency. To alleviate this, the government has been massively promoting small farm reservoirs (SFR). In many cases, however, the SFRs were ineffective in providing water especially during summer when water is needed most. Among the problems associated with SFRs are: 1.) they take a sizable area of the farm (a big problem in small farms), 2.) heavy losses due to evaporation, seepage and percolation, 3.) siltation which makes the SFR useless after several seasons, and 4.) the need for pumps to extract the stored water. For upland farms, For a water harvesting system to be effective, therefore, the above problems should be minimized, if not eliminated. Three additional water harvesting structure were constructed in Pidigan (2 units) and Bangued (1 unit), Abra as shown in Figure 1. Treadle pump was tested in Bangued and it worked.

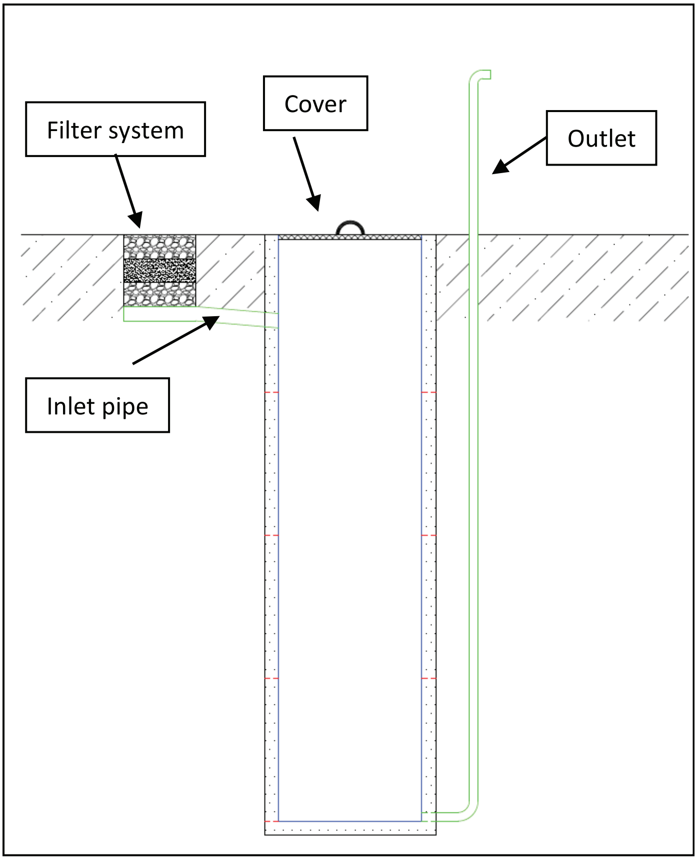

Figure 1. Schematic diagram of the constructed WHS in Pidigana and Bangued.

Agro-climatic Profiling and Analysis of Key Rice Growing Areas in Abra and Apayao (CARFO-10)
GC de Peralta, JM Maloom, MF Magno, R Bermudez and WB Collado

Soil characterization is important to characterize and identify areas which are suitable for rice production as well as expansion of rice areas. It will help resolve issues regarding soil and crop production of farmers. Rice farmers, even agricultural technicians and researchers, need a simple tool to evaluate the suitability of the land without having deeper knowledge on soil science. One of the important aims of soil/land evaluation is to help decide which areas are suitable for growing rice and the management practices suitable for its growth. This tool will use the basic principles and techniques known already in predicting and locating appropriate crop environments for sustainable productivity. This study aim to reassess the validated soil series for changes in the corresponding climatic profile as an effect of climate change and to characterize the current rice areas of key rice producing municipalities of Abra and Apayao based on soil series level

Highlights:

- Secondary data were taken from different agencies like the BSWM, UPLB and LGUs and were validated in the field. In the validation and documentation activities, pits were dug and morphological characterization was made; pictures of the soil profiles were taken; soil samples in each layer were gathered for future use. The soils with no secondary data were analysed in the laboratory to determine the physico-chemical characteristics. The landscape, slope and the present vegetation were also noted.

- From the soil survey report of Abra, there are 11 soil series in the province with 21 soil types (Table 1). Seven soil types are found in the plains and valleys, six in the intermediate uplands, and seven in hills and mountains. Figure 2 shows the location and extent of these soil types in the province of Abra. Bituin clay has the widest coverage in Abra with more than 40,000 hectares.

- From the soil survey report, there are 10 soil series in the province of Apayao with 15 different soil types (Table 2). Six soil types are found in the plains and valleys and nine in the hills and mountains. Figure 3 shows the location and extent of these soil types in the province of Apayao.

- Verified soils in Pidigan, Bangued, and San Juan, Abra and in Pudtol and Flora, Apayao. Three major soil series in Abra were validated: Bauang, San Manuel, and Alimodian.

- In Apayao, three major soil series were validated: San Manuel, Quingua, and Alaminos (major upland soil cultivated with upland rice).

Table 1. Soils and miscellaneous land types of Abra.

Soils of the Plains and Valleys	Soils of the Intermediate Uplands	Soils of the Hills and Mountains
Bigaa clay	1. Bantay sandy loam	. Alimodian clay
Bigaa sandy clay loam	2. Bauang clay	. Alimodian clay loam
Bigaasilty clay loam	3.Bauang clay loam	. Alimodian sandy clay loam
Maligaya clay	4. Bauangsilty clay loam	. Binangonan clay
Maligaya sandy clay loam	5. Sevilla clay	. Bituin clay
San Manuel sandy clay loam	6. Sevilla sandy clay loam	. Bolinao clay
San Manuel sandy loam	-	. Cervantes clay loam
-	-	. Cervantes sandy clay loam

Table 2. Soils and miscellaneous land types of Apayao.

Soils of the Plains and Valleys	Soils of the Hills and Mountains
Quingua silt loam	Alaminos clay loam
Quingua clay loam	Alaminos sandy clay loam
San Manuel silt loam	Alimodian sandy loam
San Manuel silty clay loam	Alimodian clay loam
San Manuel clay loam	Aroman clay loam
Toransilty clay	Bantay clay loam
-	Bauang clay loam
-	Faraon clay
-	San Juan clay

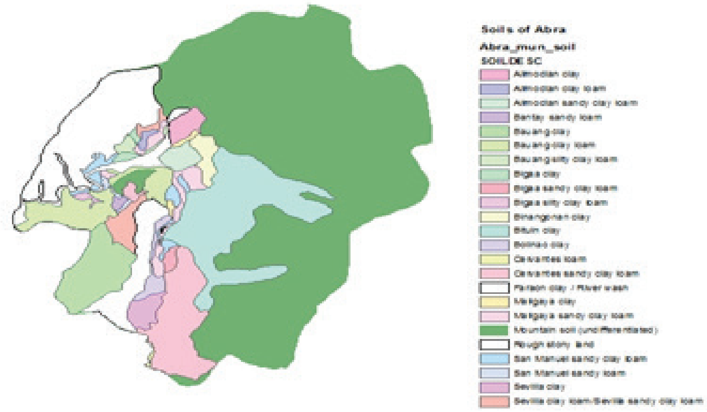

Figure 2. Soils map of Abra.

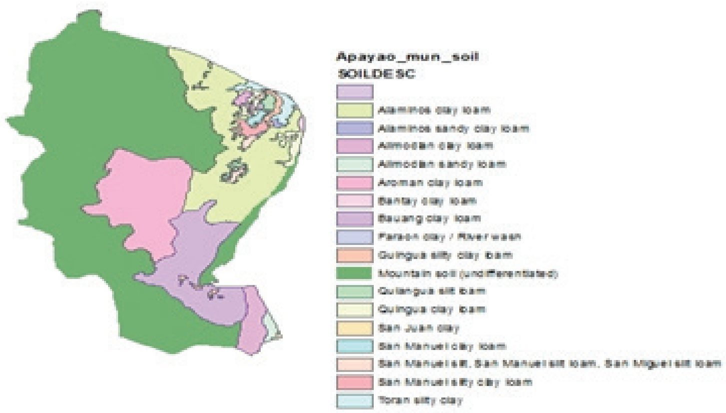

Figure 3. Soils map of Apayao.

I. Development of Postharvest Technologies for Traditional Rice (CARFO-11)

Project Leader: MAU Baradi

Traditional rice varieties are being preferred by some consumers due to their good taste and aroma. The Cordillera Region has a lot of these traditional varieties which include the Gal-ong, Palawan, Gobyerno, Maluit, among others. They are believed to be more nutrient-rich and tastier as they require little fertilizer and have no chemical inputs. Because of the increasing demand of premium quality traditional rice varieties in the market, there is a need to maintain their quality. Much of the harvest is lost not only quantitatively but also qualitatively due to improper postharvest operations. Total estimated losses, not counting later losses by retailers and consumers, run from 10–37% of all rice grown (De Padua, 1978). Not only could these but improper and incomplete postharvest operations also cause deterioration of quality. Thus, to minimize postharvest losses and produce premium quality rice, the development of postharvest technologies for traditional rice was conceived. This study on the development of appropriate postharvest technologies for traditional rice that could help minimize losses and preserve the quality of traditional rice will play a vital role in the rice industry. This will help the stakeholders, particularly the farmers and processors for the production of more and better quality traditional rice that would satisfy the consumers in their desire for better quality food. Eventually, this will help farmers to be more productive and competitive in the market, thus, giving them great opportunity to earn higher income. This will also help for the attainment of the country's food sufficiency.

Highlights:

- Development of TradVar Panicle Thresher. A prototype of the TradVar Panicle Thresher was fabricated particularly for traditional rice which are mostly non-shattering varieties and several with awns. It is being developed to suit the local conditions in the highlands. It has small capacity, portable and lightweight.

- Drying, Storage, and Milling Experiments. Experiments on the different postharvest operations such as drying, storage and milling were undertaken. The effects of various conditions or factors on the yield and quality of traditional rice were investigated.

  1) Drying
  The farmer's practice on drying was compared with that of PhilRice. Results showed that the samples, both bundled panicles and threshed grains, dried by the farmers were not completely dried. The final moisture content (MC) wet basis

(w.b.) ranged from 14.9 to 15.4% MC w.b. which was greater than the 14% MC w.b. recommendation for safe storage (Table 3).

2) Storage
The effects of the moisture content, storage time and temperature on the quality of traditional rice using farmer's practice and PhilRice intervention was investigated. Two storage huts or agamang"were used. For the farmer's practice, bundled panicles were stored at higher moisture content, heated or smoked once or twice a week (at least 1 hr day-1) through a wood-fed stove in the storage area to continue drying the grains. For PhilRice intervention, the moisture content was once heated during storage when the moisture content of the increased to 14.80% MCw.b. The Talukitok variety was used and storage duration was up to six months. The grains stored following farmer's practice had higher initial moisture content (15.3 %MC w.b.) while that of PhilRice was 12.86 %MC w.b. (Table 4). The air temperature in the drying area of the farmer's agamang was also higher than that of PhilRice. The higher temperature maybe due to the heating/ smoking of the grains conducted one to two times per week for six months (Table 5).

The Talukitok was characterized as short (5.3 to 5.4 mm) and bold grain (length/width=1.7).

The % brown rice, % total milled rice, and % head rice of the samples using PhilRice and farmer's practice were comparable with each other (Table 6).

Sensory evaluation showed that the raw samples of Talukitok stored at different conditions were not significantly different from each other in terms of aroma and translucency. They were non-aromatic and moderately translucent. However, in terms of the presence of off-odor, the farmer's practice was moderately perceptible. This is due to the smoking or heating practice. The PhilRice samples were observed to be slightly perceptible; this is due to the smoking or heating of the samples at one time. PhilRice samples were also whiter than the farmer's practice (Table 7).

For the cooked samples for Talukitok, there were no significant variations between the two different methods of storage in terms of aroma, whiteness, and taste. They were all non-aromatic, moderately white, and bland after six months of storage. However, the farmers' practice had moderately perceptible off-odor and off-taste while PhilRice samples only had slightly perceptible off-odor and off-taste. Moreover, samples obtained from the farmers' practice tend to be less cohesive and tender after five months of storage than the PhilRice samples (Table 8).

The physicochemical properties of the Talukitok rice during storage is shown in Table 9. The moisture contents of the milled rice of the different samples as affected by the two methods of storage were comparable with each other (<14%). This conforms to the checklist of grain quality test values in the National Cooperative Testing (NCT) rice breeding program (RTWG 1996) as cited by Juliano, 2010.

The protein contents of the samples ranged from 5.1 to 5.7% which do not conform to the recommendation of the NCT wherein the protein content of normal rice should not be less than 7% (Juliano, 2010). This may be due to the fact that the samples are organic (grown only with applied organic fertilizers and without treatment by pesticides) which is usually whiter and softer when cooked than normal rice because of its lower protein content. Protein content affects the gel consistency (GC) of rice. High protein content makes GC harder.

The crude ash contents of the different samples were comparable with each other (0.7). Juliano (2010) reported 0.3 to 0.8% crude ash in milled rice. The crude ash contents of the different samples did not decrease during the storage period of six months. This quality attribute may have not been affected as there was no significant lose in the moisture content of the samples during storage which may have not affected the mineral levels of the samples.

The samples were characterized as to have intermediate amylose contents (ACs) regardless of the storage method used.

The different samples from the two storage methods had intermediate GT with an alkali spreading value of 4 to 5.

Samples stored by PhilRice had higher % DPPH (an organic chemical compound 2, 2-diphenyl-1-picrylhydrazyl as defined in http://www.en.wikipedia.org/wiki/DPPH) scavenging activity than those of the farmers' practice (Table 10). The highest values were obtained during the 4th month of storage. It was at this period that the Talukitok rice had the highest % DPPH scavenging activity; when it had the greatest ability to prevent organ damage through scavenging free radicals (molecules that have single unpaired electrons in outer shells).

The total soluble phenolics of the samples obtained from PhilRice samples were higher than those of the farmers except on the 5th month (Table 11). This may be due to the higher temperature in the storage area agamang of the farmers' practice. The greater the phenolic compounds in rice, the better since these compounds may provide antioxidant protection against heart disease and cancer (http://www/en.wikipedia.org/wiki/phenols). The highest total soluble phenolics of the Talukitok were observed during the 3rd and 4th months (0.25 mg/g GAE). This observation confirmed with the report of Zhou, et al. (2004) wherein a significant increase in the concentration of free phenolic acids in white rice during the storage was observed, probably as a result of the enzymatic or nonenzymatic release of the bound phenolic acids. However, the values decreased again during the later stage.

- Pre-heating Before Milling. The % brown rice, % total milled rice, and % head rice of the samples significantly increased when it was sundried or pre-heated for around one hour before milling (Table 12).

- Effect of Milling Methods on the Milling Recovery of Traditional Rice. Different milling methods or machines (manual pounding, single-pass mill 1, single-pass mill 2, PhilRice micromill) significantly affected the milling recovery of traditional rice (Table 13). PhilRice micromill had the highest milling recoveries of the Gal-ong and Diket rice varieties among the different methods/machines used. However, in the case of Ballatinao, the highest milling recovery was obtained when manually pounded using mortar and pestle. Hence, the genotype or variety also affected the milling recovery of rice.

Table 3. Dying of bundled panicles and threshed grains of Talukitok rice.

Treatment	Bundled Panicles					Threshed Grains		
	First Batch		Second Batch		Hours of Drying	Second Batch		Hours of Drying
	Initial MC (%)	Final MC (%)	Initial MC (%)	Final MC (%)		Initial MC (%)	Final MC (%)	
Farmer's Practice (Control)	19.6	15.3	16.9	15.4	6	17.2	14.9	6
PhilRice	19.1	12.9	17.0	13.8	10	17.2	12.1	8

Table 4. Moisture content of bundled panicles of traditional variety Talukitok stored on farmers' practice and recommended practice.

Month	Moisture Content (% MCw.b.)	
	PhilRice	Farmers' Practice
0	12.86	15.30
1	14.06	14.71
2	14.80*	14.93
3	12.78	14.13
4	13.82	15.09
5	13.82	15.09
6	12.90	12.97

**The bundled panicles were heated or smoked until the moisture content reached 13.53 % MCw.b.*

Table 5. Mean temperatures of ambient, drying area and drying/storage area of PhilRice and farmers' agamang.

Location	Temperature (°C)	
	PhilRice *Agamang*	Farmers' *Agamang*
Storage/Drying area	22.71	22.21
Drying Area	21.92	23.21
Ambient	21.65	23.17

Table 6. Milling potentials of Talukitok as affected by different storage methods after six months.

Treatment	% Brown Rice	Class	% Total Milled Rice	Class	% Head Rice	Class
Farmers' Practice	78.3	Fair	71.8	Premium	66.3	Premium
PhilRice	78.6	Fair	71.5	Premium	68.4	Premium

Table 7. Sensory attributes of raw Talukitok 1 at different storage methods for six months.

Month	Aroma		Off-Odor		Whiteness	
	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice
1	no aroma	no aroma	slightly perceptible	slightly perceptible	slightly white	slightly white
2	no aroma	no aroma	slightly perceptible	slightly perceptible	slightly white	slightly white
3	no aroma	no aroma	slightly perceptible	slightly perceptible	slightly white	slightly white
4	no aroma	no aroma	slightly perceptible	slightly perceptible	slightly white	slightly white
5	no aroma	no aroma	moderately perceptible	slightly perceptible	slightly white	moderately white
6	no aroma	no aroma	moderately perceptible	slightly perceptible	slightly white	moderately white

Table 8. Sensory attributes of cooked Talukitok at different storage methods.

Month	Aroma		Off-Odor		Whiteness		Cohesiveness		Tenderness	
	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice
1	no aroma	no aroma	slightly perceptible	slightly perceptible	moderately white	moderately white	cohesive	cohesive	Tender	Tender
2	no aroma	no aroma	slightly perceptible	slightly perceptible	moderately white	moderately white	cohesive	cohesive	Tender	Tender
3	no aroma	no aroma	slightly perceptible	slightly perceptible	moderately white	moderately white	cohesive	cohesive	Tender	Tender
4	no aroma	no aroma	slightly perceptible	slightly perceptible	moderately white	moderately white	cohesive	cohesive	Tender	Tender
5	no aroma	no aroma	moderately perceptible	slightly perceptible	moderately white	moderately white	moderately cohesive	cohesive	moderately tender	Tender
6	no aroma	no aroma	moderately perceptible	slightly perceptible	moderately white	White	moderately cohesive	cohesive	moderately tender	Tender

Table 9. Sensory attributes of cooked Talukitok at different storage methods.

Month	Taste		Off-Taste	
	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice
1	Bland	Bland	slightly perceptible	slightly perceptible
2	Bland	Bland	slightly perceptible	slightly perceptible
3	Bland	Bland	slightly perceptible	slightly perceptible
4	Bland	Bland	moderately perceptible	slightly perceptible
5	Bland	Bland	moderately perceptible	slightly perceptible
6	Bland	Bland	moderately perceptible	slightly perceptible

Table 10. Physicochemical properties of Talukitok at different storage methods.

Month	Moisture Content (%)		Crude Protein (%)		Crude Ash (%)		Amylose (%)		GT ASV (%)	
	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice	Farmers' Practice	PhilRice
0	12.7	13.0	5.3	5.2	0.5	0.6	22.0	22.1	4.6	4.4
1	12.9	13.2	5.5	5.1	0.6	0.7	22.5	22.9	4.8	4.7
2	13.3	14.2	5.1	5.1	0.7	0.7	21.4	22.2	3.7	4.7
3	12.2	12.3	5.6	5.5	0.8	0.7	23.8	23.6	4.9	4.7
4	12.1	12.1	5.7	5.6	0.8	0.7	24.1	23.8	5.0	5.0
5	12.6	12.4	5.4	5.2	-	-	21.5	23.0	4.8	4.7
6	12.3	12.3	5.3	5.3	-	-	23.6	21.2	4.7	4.7
Mean	12.6	12.8	5.4	5.3	0.7	0.7	Intermediate	Intermedia te	Intermediate	Intermedia te

Table 11. DPPH scavenging activity of Talukitok at different storage methods.

Month	DPPH Scavenging Activity (%)	
	Farmer's Practice	PhilRice
0	14.4	16.2
1	15.8	19.2
2	17.5	20.0
3	23.3	25.5
4	24.9	26.8
5	17.1	17.6
6	19.3	19.4

Table 12. Total soluble phenolics of Talukitok at different storage methods.

Month	Total Soluble Phenolics (mg/g GAE)	
	Farmers' Practice	PhilRice
0	0.12	0.12
1	0.13	0.14
2	0.16	0.18
3	0.21	0.25
4	0.22	0.23
5	0.22	0.19
6	0.21	0.21

Table 13. Effect of pre-heating of samples on the milling potentials before milling.

Treatment/Method	% Brown Rice	% Total Milled Rice	% Head Rice
Control (Without sundrying)	80.72	74.14	67.25
Sundried	81.07	76.40	70.22

Table 14. Effect of milling methods on the milling recovery of traditional rice.

Treatment/Method	Milling Recovery (%)		
	Gal-Ong	Diket	Ballatinao
Manual (Pounding)	72.5	57.5	82.5
Rice Mill 1 (Farmer 1)	65.0	55.5	65.0
Rice Mill 2 (Farmer 2)	72.5	62.5	72.5
PhilRice Micromill	74.7	70.4	76.0

II. Water Harvesting for Rice Intensification and Crop Diversification in Region I (DA-RFO I)

Project Leader: RC Castro

Rice is a water-loving plant, hence, rice farming depends on the availability of water. In rainfed and upland areas, however, water scarcity is probably the gravest problem which is made even more profound by climate change. Dry spells become longer while rain which used to fall in six months is dumped in a matter of days. Hence, even during the rainy season, rainfall occurrence becomes erratic severely affecting rice production in rainfed areas. On the other hand, the production of dry season crops becomes limited. Under these conditions, the need to harvest, conserve and properly manage water becomes imperative to ensure that water is made available when needed by the crops. It will prevent potential yield losses and enhance productivity and eventually, to the improvement of the lives of the mostly marginalized farmers in the rainfed and upland farms as well as in the attainment of food self-sufficiency. This project aimed to increase rice production and enhannce crop diversification in rainfed and upland farms.

Development of Appropriate Water Harvesting Systems (WHS) for Small Farms

DP Dal-uyen, FD Jose, HP Agngarayngay, LC Taguda, JMMaloom, MC Vives, RA Rarangol, GB Agustin

A model on water harvesting structure (WHS) was developed for the rainfed lowland farm. Rather than the common small farm reservoirs (SFR), the structure uses underground storage tanks. The water storage tank was situated below the ground to minimize competition with crops for area and minimize losses from seepage, percolation, and evaporation.

The structure (Figure 4) is composed of a storage tank (5m x 3m x 3m), a catchment canal (1m x 10m), inlet pipe, manhole and an outlet. The catchment canal catches the rainwater surface run-off from the higher parts of the paddy to the storage tank. A filter system was installed in the inlet pipe to prevent silt from depositing into the storage tank. The structure was designed to harvest and store 45,000 L of rain water.

Highlights:

- The study sites are: Pagudpud, Ilocos Norte; Cabugao, Ilocos Sur; San Juan, La Union; and Pozorrubio, Pangasinan for rainfed lowland, and Sual, Pangasinan for the upland condition.

- In 2013-2014, one WHS was established each in the Ilocos Norte, Ilocos Sur and La Union sites.

Water lifting devices using renewable energy

LC Taguda,Dal-uyen, JMMaloom, MC Vives, GB Agustin

In pump irrigation, the source of water is always lower than the field. Even in rainwater harvesting, the impounding structures are commonly situated in the lowest portion of the field to collect the highest volume of water possible. Pumps are therefore necessary to bring the water to where it is needed. Motorized pumps are available in the market but small farmers cannot afford the high investment and fuel costs.

To lift the stored water from the water harvesting structure, water lifting devise is necessary. The treadle pump (Figure 5) was chosen because it is foot-operated, portable, low-cost, and does not need fuel to operate.

Highlights:

- The treadle pump model of Espino (2012) was tested in order to determine its effeciency and applicability in the sites. The delivery head and the discharge rate of the model was inversely proportional. Hence, improvement was made on its suctioning the water from the source and pushing this to the delivery area (Figure 5).

Optimizing crop-livestock-fish mixes for upland farms under limited water supply

MC Vives, EP Agres, GB Agustin, DP Dal-uyen

The project sites are characterized by a short rainy season and a long dry season. Limited water supply and the high cost of making it available for plant use are the common constraints for high yields. Under limited water, the optimum crop mixes for the farm in the study sites are being determined using multi-objective linear programming. The optimum crop mixes will serve as guide for the farmer to plant the right crop at the right time, when feasible, livestock or fish will be integrated in the farming systems.

Highlights:

- Production data (cost and return analysis) for the different crops as well as cropping pattern/combinations are being taken from the study areas. Farmer partners/respondents were provided with a Farm Record Book where they record the basic data of a particular crop that includes the production costs (material and labor costs), yield, selling price, and gross income.

- A linear programming (LP) model was formulated initially with income maximization as its objective function and the usual production factors as constraints. The varying levels of water availability was given special emphasis through a sensitivity analysis where available water was varied from 100% (available water in a normal year) to only 50% (simulated condition of severe drought).

- In Ilocos Norte, the farmer-partners were taught how to record accurately all activities, material and labor inputs, price and yield of their produce. There were 23 farmers who were given the skill of record keeping.

- The major crops in the area were identified. Majority of the farmers are planting cucurbits such as ridge gourd, bitter gourd, squash, melon and watermelon. A few are planting eggplant, and pole sitao. Each farmer was assigned to record for just one crop.

Community-based integration of water harvesting, conservation and management technologies.
EP Agres, DP Dal-uyen, LC Taguda, GB Agustin, MJC Vives, JM Maloom

A package of technology on water harvesting, conservation and management for rainfed lowland and upland farms is being developed in partnership with the farmers. General technologies are adapted to local conditions. Since this study is anchored on the technologies developed in study 1, 2 and 3, it is an adaptive research cum extension activity.

Highlights:

- This study was already established in Ilocos Norte, Ilocos Sur and La Union where the water harvesting structure was already constructed.

- The water collected and stored in the water harvesting structure in Ilocos Nortewas used to grow watermelon. Water conservation technologies were showcased with the use of a low-cost dripirrigation system (LDIS) and plastic mulch. The amount of water applied was measured to determine water use and conservation efficiency (Table 15).

- The recommended production technology of watermelon by PhilRice was compared with the Farmer's Practice. Sweet gold F1 was the variety used.

- A field day was conducted to showcase the water conservation and management technologies. It was actively participated in by the LGUpersonnel, farmers and PhilRice researchers. The field day included a field visit where the participants had the chance to compare the crop stand and yield of both treatments.

- A taste test of the watermelon from both treatments was also conducted. Economic analysis is shown in Table 16.

- Based on the cost and return analysis of the intervention on water conservation and management versus the farmer's practice, the farmer using the intervention can earn a net income of PhP11,500.00 per 1000 m^2 in just 70 days. The farmer partner needed Php7.00 to produce a kilogram of watermelon using his own technology, and PhP5.00 only using the intervention.

- To maximize the water conservation technologies such as the LDIS and plastic mulch, the farmer partner planted tomato during the rainy season.

Table 15. Water utilized in PhilRice demonstration setup (300 m^2) using LDIS.

Week	Water harvested (Liter)	Amount of water utilized (Liter)	Remaining water in WHS (Liter)
1	30,000	130	29,870
2		130	29,740
3		130	29,610
4		130	29,480
5		130	29,350
6		259	29,091
7		259	28,832
8		259	28,573
9		259	28,314
TOTAL	**30, 000**	**1, 686**	**28, 314**

lote: No rainfall during the establishment.

Table 16. Economic analysis of demonstration setup vs. farmers' practice.

Description	PhilRice Demo (1, 000 m^2)	Farmer's Practice (1, 000 m^2)
I. Production Cost, Php	10, 105	8, 793
a. Materials Cost	5, 386	3, 664
b. Labor Cost	1, 635	5, 128
c. Depreciation Cost (LDIS)	3, 084	-
II. Cost and Return		
A. Yield	1271	1,329
B. Selling Price (Php/kg)	17	15
C. Gross Income, Php	21,607	19,935
D. Production Cost, Php	10,105	8,793
E. Net Income, Php	11,502	11,142
F. Unit Cost of Production (Php/kg)	5	7

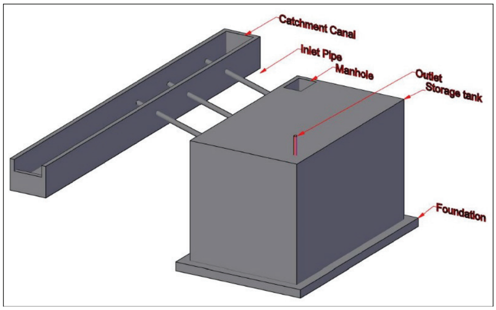

Figure 4. 3D perspective view of the WHS.

Figure 5. LDIS installed to as water conservation technology introduced.

Figure 6. The rainwater harvesting system in Bungro, Cabugao, Ilocos Sur.

Figure 7. The rainwater harvesting system in Caarusipan, San Juan, La Union.

Figure 8. The site validated in Nantangalan, Pozorrubio, Pangasinan.

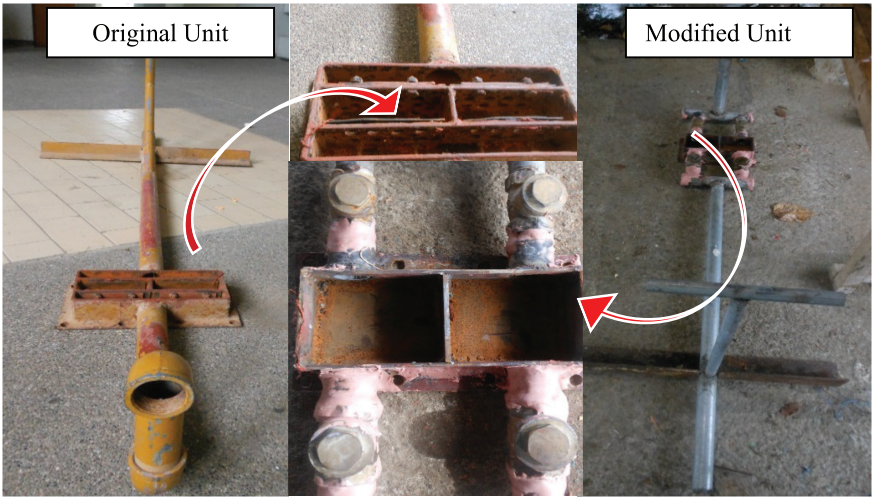

Figure 9. The modified treadle pump.

Figure 10. Treadle pump tested in Shallow Tube Well (STW).

Figure 11. Establishment of 2014 DS in Pagudpud, Ilocos Norte.

Figure 12. Field day in Pagudpud, Ilocos Norte.

Figure 13. Open forum during FFS in Pagudpud.

Figure 14. Establishment of off-season tomato re-using the LDIS installed and plastic mulch.

Effects of water management and fertilizer N levels on rice yield (PSB Rc82) and incidence of pests and diseases in the rainfed rice ecosystem.
AY Alibuyog, SV Pojas, ES Avellanoza

Water availability has a great influence on the time of planting and on fertilizer application. Irregular rainfall at the beginning of the wet season may delay planting, encourage weed growth and encourage build-up of insect pests, resulting in yield loss. Due to the unavailability of water, not only planting that is delayed but also the timing of fertilizer application. Farmers tend to apply top dress N only once if water is abundant but this results to a less efficient nutrient management and may also trigger pest and disease problems. Hence, this study was conducted to determine the most efficient fertilizer application and water management for rainfed areas based on rice yield performance and pest incidence.

Highlights:

- A field experiment was established at PhilRice Batac station to determine the effects of N fertilizer levels and water management on the yield of PSB Rc82 and on pest population and damages under rainfed condition. Fertilizer treatments assigned as horizontal factors were as follows: N1- no fertilizer applied, N2- 60kg N in two split applications, N3- 90kg N in two split applications, N4- 90kg N in three split applications, and, N5- 120kg N in three split applications. Water management was assigned as the vertical factors. W1 was purely dependent on rainfall, W2 was applied with supplemental irrigation during fertilizer application and W3 was irrigated during critical periods. Treatments were laid out on Strip-Strip Design, with three replications.

- Results showed that yield, tiller count, panicle length, seed weight, plant height, harvest index and LAI were significantly affected by fertilizer N level. On the other hand, water regime significantly differed on seed weight and harvest index but not on yield. N5 (120kg N/ha applied in 3 splits) outperformed all the other N treatments in yield (2728kg/ha), tillering ability (14 tiller/hill), panicle length (22.0cm) and seed weight (26.7g/1000 seeds).

- The N levels of 90kg/ha applied twice (N3) and thrice (N4) had a comparable yield of 2222kg/ha and 2284kg/ha, respectively. This implies that the application 30 kg N at basal and 60kg N at tillering is a more practical strategy than splitting N into three up to PI stage since it will require less labor. On the other hand, the application of lower N level (60kg N/ha) in two splits had significantly lower yield (1868kg/ha) than N3, N4 and N5. Furthermore, N5 had the highest LAI; N4, N3 and N2 were comparable with each other while N1, as expected, had the lowest.

At tillering stage, higher wasp population was observed from treatments with higher N levels. Same pattern was observed at booting stage where plant hoppers had higher population under N3 and N5 fertilizer treatments wherein N fertilizer levels at 2nd top dress was higher. Brown spot infection was more prevalent in treatments without supplemental irrigation while whorl maggot infestation was higher wherein water was more abundant in WR3.

III. Farming Without Fossil Energy Program

Program Leader: Eden C. Gagelonia

Harnessing Wind and Solar Energy for Crop Irrigation in Ilocos Region

MG Galera, ND Ganotisi, MLO Quigao, MU Baradi, MJC Regalado, AT Belonio

At present, the research for cheaper, environment-friendly and more efficient sources of renewable energies is actively being done. And with the increasing burden on natural oils and coal for production of energy, the promise of wind power and other sources of renewable energy offer an efficient alternative.

Wind and solar energy is unlimited, natural, and renewable energy that can be converted into other forms of energy like mechanical, heat, and electrical energy and many other forms. The largest advantage of these renewable energies is that they are free and unlimited. They are also environment-friendly energy source, which cannot aggravate global warming.

Combining the two renewable energy sources will ensure additional alternative way of irrigating crops, if not continuous. It can more or less charge a common battery which in turn runs an electric pump. Whenever there is no enough sunshine but have enough wind to charge the battery, drawing water is still possible and vice versa.

Highlights:

- The materials and equipment needed for the conduct of the study were already purchased and initial testing of the system has been conducted.

- The wind turbine of the hybrid system has a starting wind speed of 2.5ms^{-1} but during the initial testing it was found that it can run even at 2.15ms^{-1} at 2 m elevation head. Data on its capacity to charge the battery was not yet conducted since the wind turbine tower is still under construction.

- The testing of the pump system with solar energy as power source was initially conducted (Table 17).The initial water table during the testing was about 2m with 41m of discharge pipe. It produces an average pump discharge of 1.64 lps. However, the water table dropped down from 2.12 to 2.82m in just 10 min. The recharge of the well was not sufficient to sustain the discharge of the pump system. But with 86m length of discharge pipe, the pump discharge was reduced to 1.16 lps. With this discharge, the water table was maintained even after an hour of testing.

- The battery charge dropped down by 0.48V per hour (Vhr^{-1}) of operation when the average discharge of the pump was 1.64 lps. On the other hand, with 1.16 lps discharge, the battery voltage drop was only 0.32Vhr^{-1}.

- During the initial testing, the pump system using solar energy worked and allowed to operate for an hour. The 1.16 lps (4.18 $m3h^{-1}$) of water drawn can irrigate 880m^2 of eggplant or 860 m^2 of tomato or 300 m^2 of rice.

Table 17. Initial testing of the solar pump system, Nov. 25, 2014, 1:00-2:30 PM, 250 W solar panel.

A. Length of Discharge Pipe = 41.0 m			
Time (min)	Water table (m)	Charge of battery (V)	Pump Discharge (lps)
0	2.12	12.02	1.64
10	2.82	11.94	
B. Length of Discharge Pipe = 86.0 m			
20	2.71	11.88	1.16
30	2.70	11.86	
50	2.74	11.77	
70	2.73	11.66	
90	2.76	11.51	

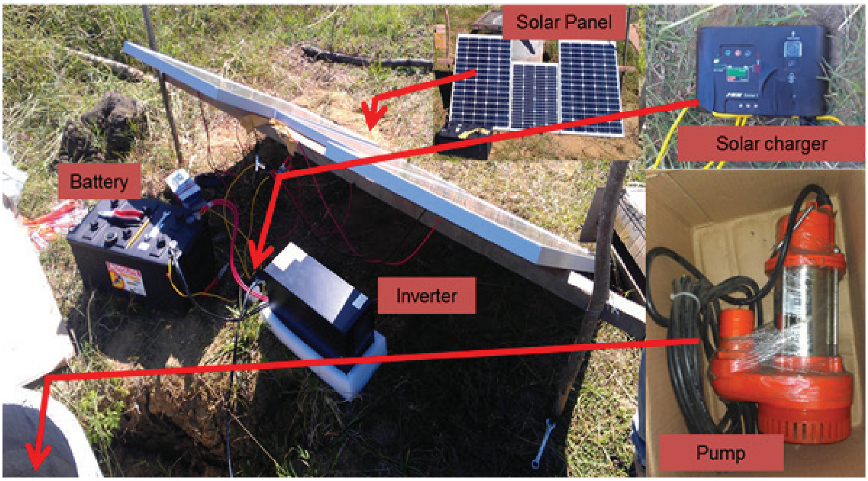

Figure 15. The pump system using solar energy as power source.

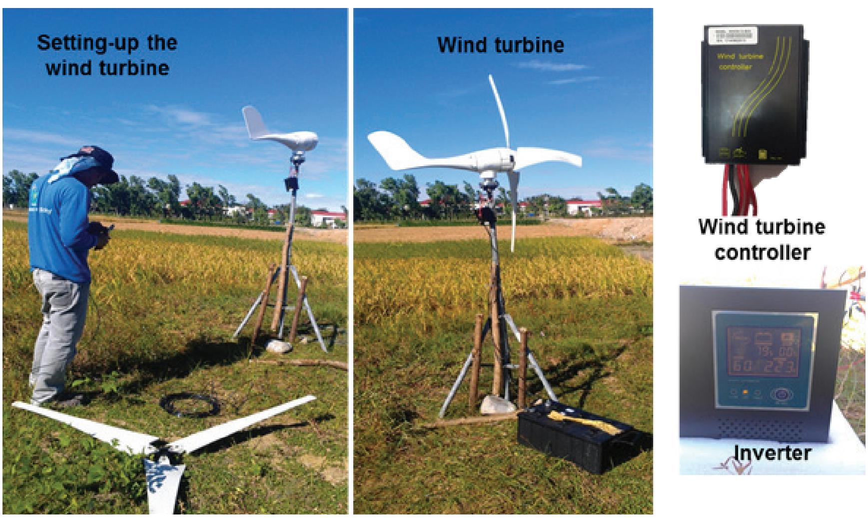

Figure 16. The installed wind turbine at 2 meter elevation for initial testing.

Germplasm collection and management in PhilRice Batac

AY Alibuyog, JM Solero, NI Martin, ES Avellanoza, GB Agustin, BM Catudan

The Philippines is still a very rich genetic source of traditional rice varieties (TRVs) which may serve as a valuable genetic resource in developing new varieties. However, these varieties are rapidly lost with the advent of modern agriculture. In December 2010, PhilRice Batac started its TRV collection and conservation activities.

Highlights:

- As of December 2014, PhilRice Batac has a total of 197 collections. These varieties were grown in uplands, highland and lowland irrigated; submerged and saline-submerged areas. New collections were recorded at the registration book, along with passport data.

- Nineteen new germplasms were collected from Pudtol and Conner Apayao; Currimao, Ilocos Norte, and; San Emilio, Ilocos Sur. These new germplasm collections were mainly grown in an upland ecosystem. A total of 197 germplasm had been collected from 2010 to 2014 in various provinces and ecosystems.

- From the total collections, 189 had seed files in coin envelopes, 76 were packed in foil packets at 20g each, 71 TRVs with seed samples in vials for display and lecture purposes and 65 with panicle samples vacuum sealed in clear polyethylene plastic

- Seeds of these collections were tested and among of 166 TRVs, 88 TRVs had good viability, 36 had poor and 39 had zero viability and candidate for embryo rescue at PhilRice CES. From the 0 viability, 24 were submitted to PhilRice CES for embryo rescue.

- The TRVs collected from saline-submerged ecosystem in Aparri, Cagayan were planted in lowland and highland irrigated ecosystem for regeneration and seed purification in lowland and highland irrigated ecosystem in Manabo, Abra and Batac City, Ilocos Norte. These TRVs were already lost in its origin due to flooding and flash flooding every after transplanting. Another 50 TRVs were planted in an upland ecosystem in Comcomloong, Currimao, Ilocos Norte, wherein only 16 TRVs survived the prolonged drought experienced by the crops from maximum tillering to maturity.

Table 18a. Summary of germplasm collections per province in PhilRice Batac, 2010 to 2014.

Collection Site	No. of Collection
Ilocos	
Ilocos Norte	52
Ilocos Sur	31
Sub-total	**83**
CAR	
Abra	12
Apayao	66
Benguet	5
Mt. Province	21
Sub-total	**104**
Cagayan	
Aparri	4
Sub-total	**4**
Others	
Agusan del Norte	2
Davao del Norte	1
Unidentified	3
Sub-total	6
Total	**197**

Table 18b. Summary of germplasm collections per ecosystem in PhilRice Batac, 2010 to 2014.

Ecosystem	No. of Collection
Upland	152
Submerged	6
Cool-elevated	26
Lowland Irrigated	6
Highland Irrigated	3
Saline-submerged	4
Total	**197**

Pre-Harvest and Post-Harvest Management for Aromatic and Organic Rice

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Aromatic and organic rice have become popular and continue to command higher price in local and international markets. Aromatic rice is preferred by consumers because of its distinctive pleasant scent that makes it more special than the ordinary rice. The scent of aromatic rice is inherent in the variety, but can be influenced by pre-harvest and post-harvest management practices. Literatures show that the quality of the grain is not only due to its genetic make-up but can be influenced by the environment and crop management like N fertilizer application.

On the other hand, organic rice or organically-grown rice has also become popular among consumers because of the belief that it has more nutritional benefits (Tafere et al. 2011). Organic rice is grown only with organic amendments/materials/fertilizers and bio-pesticide. Organic materials include crop residues, plant biomass, green manure, compost and other products from plants or animals. The benefit of organic material is that they may contain several essential nutrients (IRRI 2013). However, the organic fertilizer releases nutrients much slower than inorganic (mineral) fertilizers like ammonium sulphate and urea. Thus, the response of plants to organic fertilizer is likewise delayed because these materials have to be mineralized first before the nutrients can be taken up by the plant. In contrast,the nutrients in the inorganic fertilizers are readily available for plant use. Incorporation of organic materials into the soil can improve the soil physical properties, leading to better structure, aggregation, improved water-holding capacity and better drainage. However, these changes may not do much to the flooded rice soils where fields are typically flooded during land preparation by plowing or rotovating that eventually destroys soil structure. In contrast to organic farming, inorganic farming uses high-yielding rice varieties and large amounts of inorganic fertilizers and pesticides that can possibly erode the inherent productivity of the soils and produce crops that are of lower nutritional quality (Tafere et al. 2011).

This study on pre-harvest and post-harvest management for aromatic and organic rice will help the stakeholders, particularly the farmers and processors for the production of better quality aromatic and organic rice demanded by the market. Eventually, results of the studies will enable the farmers to be more competitive in the market, thus, giving them the opportunity to earn higher income from the sale of aromatic and organic rice.

Highlights:

A. Dry Season 2013-2014

Effect on Yield and Yield Components and Agronomic Characteristics

- The yield was determined by the interaction of the fertilizer treatment and variety used. Highest yields were obtained from those applied with inorganic fertilizers except the Omission Plot (-N) which was comparable with that of the control (no fertilizer applied) and those applied with organic fertilizers (chicken manure and rice straw). Gal-ong, which is a pigmented and aromatic traditional variety, gave the lowest yield among the three varieties (Table 19).

- Table 20 shows that the yield of the three varieties were not significantly different at T1 (Control) and T7 (Rice Straw). However, in the six remaining fertilizer treatments (T2–T6, T8) Gal-ong gave the lowest yield while Burdagol and PSB Rc82 were not significantly different except at T6 where Burdagol outyielded PSBRC 82.

Table 19. Grain yield of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate (kgha^{-1})	Grain Yield (tha^{-1})		
		Burdagol	PSB Rc 82	Gal-ong*
1. Control	0	1.91 b	1.64 b	1.56 a
2. Omission Plot (-N)	0-42-42	2.11 b	2.07 b	1.31 a
3. Omission Plot (-P)	112-0-42	4.85 a	4.44 a	2.21 a
4. Omission Plot (-K)	112-42-0	4.89 a	4.38 a	2.81 a
5. LCC-based 1	108-42-42	4.95 a	4.80 a	2.47 a
6. LCC-based 2	118-42-42	4.86 a	4.03 a	1.84 a
7. Rice straw	30-4-43 (4tha^{-1})	1.92 b	1.94 b	1.72 a
8. Chicken Manure	55-129-116 (3tha^{-1})	2.62 b	2.37 b	1.68 a
Significance				
Fertilizer	***			
Variety	***			
Fertilizer x Variety	***			

*** significant at 0.1% level of significance

*Means followed by different letter are significantly different from each other at 5% level of significance using LSD; *yield loss due to birds*

Table 20. Yield of the different fertilizer treatments as affected by variety (2014 DS), San Nicolas, Ilocos Norte.

VARIETY	Yield (t ha^{-1})						
	T1	T2	T3	T4	T5	T6	T7
Burdagol	1.91 a	2.11 a	4.85 a	4.89 a	4.95 a	4.86 a	1.91 a
Gal-ong	1.56 a	1.31 b	2.21 b	2.81 b	2.47 b	1.84 c	1.72 a
PSB Rc82	1.64 a	2.07 a	4.44 a	4.38 a	4.80 a	4.03 b	1.94 a

Means followed the same letter are not significantly different at 5% level of significance

Effect on Grain Quality Attributes

- The % brown rice of Burdagol and PSB Rc82 was not affected by the fertilizer treatments; both had fair brown rice recoveries (Table 21). However, for Gal-ong, the brown rice recoveries of the samples treated with T1 to T6 were all poor; only those applied with rice straw and chicken manure produced fair brown rice recoveries.

Table 21. Brown rice of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate (kgha^{-1})	Brown rice (%, Class)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	75.9	F	73.9	P	76.1	F
2. Omission Plot (-N)	0-42-42	76.5	F	-	-	76.7	F
3. Omission Plot (-P)	112-0-42	77.2	F	73.1	P	77.0	F
4. Omission Plot (-K)	112-42-0	76.9	F	74.9	P	78.0	F
5. LCC-based 1	108-42-42	77.2	F	73.5	P	78.3	F
6. LCC-based 2	118-42-42	76.0	F	74.4	P	77.9	F
7. Rice straw	30-4-43 (4tha^{-1})	75.5	F	76.6	F	77.2	F
8. Chicken Manure	55-129-116 (3tha^{-1})	76.4	F	75.2	F	77.7	F

F - Fair; P – Poor

- Only PSB Rc82 had premium milled rice recoveries, regardless of the fertilizer treatment (Table 22). For Burdagol, T2, T5 and T8 produced premium milled rice; the rest of the fertilizer treatments were all under Grade 1 class. For the case of Gal-ong, T3 and T7 were only the treatments that gave premium milled rice recoveries.

Table 22. Milled rice of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	Milled rice (%, Class)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	69.8	G1	66.8	G1	70.8	Pr
2. Omission Plot (-N)	0-42-42	70.5	Pr	-	-	71.4	Pr
3. Omission Plot (-P)	112-0-42	69.9	G1	71.1	Pr	71.3	Pr
4. Omission Plot (-K)	112-42-0	69.9	G1	69.9	G1	72.3	Pr
5. LCC-based 1	108-42-42	70.3	Pr	65.7	G1	71.5	Pr
6. LCC-based 2	118-42-42	69.1	G1	68.0	G1	71.4	Pr
7. Rice straw	30-4-43 ($4tha^{-1}$)	69.4	G1	70.4	Pr	70.1	Pr
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	70.6	Pr	67.9	G1	71.9	Pr

Pr - Premium; G1- Grade 1

- Of the three varieties, the head rice yield of PSB Rc82 was not affected by the fertilizer treatments (Table 23). All the samples belonged to Grade 1 class regardless of fertilizer treatment. However, for Burdagol, T3, T4 and T6 (inorganic treatments or higher N levels) had higher head rice yields (Grade 2) than T1, T2, T7 and T8 (Grade 3). For Gal-ong, T6 gave the premium head rice yield while Grade 3 was that of T7.

Table 23. Head rice of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	Head rice (%, Class)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	30.9	G3	46.0	G2	49.9	G1
2. Omission Plot (-N)	0-42-42	35.0	G3	-	-	48.5	G1
3. Omission Plot (-P)	112-0-42	39.9	G2	48.5	G1	55.2	G1
4. Omission Plot (-K)	112-42-0	40.0	G2	48.2	G1	54.2	G1
5. LCC-based 1	108-42-42	31.5	G3	50.8	G1	56.4	G1
6. LCC-based 2	118-42-42	40.0	G2	57.9	Pr	54.1	G1
7. Rice straw	30-4-43 ($4tha^{-1}$)	36.6	G3	38.7	G3	50.6	G1
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	33.0	G3	45.8	G2	53.5	G1

Pr - Premium; G1 - Grade 1; G2 - Grade 2; G3 - Grade 3

- Gal-ong had medium size grains while Burdagol and PSB Rc82 were long grains (Table 24).

Table 24. Grain length of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	Grain Length (mm)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	6.9	L	5.6	M	6.7	L
2. Omission Plot (-N)	0-42-42	6.7	L	-	-	6.7	L
3. Omission Plot (-P)	112-0-42	7.0	L	5.5	M	6.7	L
4. Omission Plot (-K)	112-42-0	6.8	L	5.6	M	6.9	L
5. LCC-based 1	108-42-42	6.7	L	5.7	M	6.9	L
6. LCC-based 2	118-42-42	6.8	L	5.7	M	6.8	L
7. Rice straw	30-4-43 ($4tha^{-1}$)	6.7	L	5.6	M	6.8	L
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	7.0	L	5.7	M	6.7	L

L - long; M - medium

- Burdagol has intermediate shape while Gal-ong is bold and PSB Rc82 is slender (Table 25).

Table 25. Grain shape of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate (kgha$^{-1)}$	Grain Shape (L/W)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	2.8	I	1.8	B	3.3	S
2. Omission Plot (-N)	0-42-42	2.7	I	-	-	3.2	S
3. Omission Plot (-P)	112-0-42	2.8	I	1.7	B	3.3	S
4. Omission Plot (-K)	112-42-0	2.7	I	1.7	B	3.3	S
5. LCC-based 1	108-42-42	2.6	I	1.8	B	3.3	S
6. LCC-based 2	118-42-42	2.7	I	1.7	B	3.3	S
7. Rice straw	30-4-43 ($4tha^{-1}$)	2.7	I	1.8	B	3.4	S
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	2.8	I	1.8	B	3.2	S

S - Slender; I - Intermediate; B - Bold

- The amylose contents of the different samples were not affected by the fertilizer treatments (Table 26). However, it was influenced by the rice variety. Burdagol had low amylose content, while Gal-ong and PSB Rc82 had both intermediate amylose contents.

Table 26. Amylose content of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	Amylose Content (%, Class)					
		Burdagol		Gal-ong		PSB Rc82	
1. Control	0	15.7	L	18.2	I	22.0	I
2. Omission Plot (-N)	0-42-42	16.8	L	-	-	22.2	I
3. Omission Plot (-P)	112-0-42	15.0	L	18.3	I	22.3	I
4. Omission Plot (-K)	112-42-0	16.0	L	18.9	I	23.1	I
5. LCC-based 1	108-42-42	16.2	L	18.2	I	21.2	I
6. LCC-based 2	118-42-42	17.2	L	18.7	I	22.8	I
7. Rice straw	30-4-43 ($4tha^{-1}$)	16.5	L	19.4	I	22.2	I
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	15.9	L	18.3	I	22.2	I

L - Low; I - Intermediate

Health-Promoting Phytochemicals

- There was a highly significant interaction effect of fertilizer treatment and variety on the DPPH scavenging activity in rice (Table 27). T5 (LCC-based 1) gave the highest DPPH scavenging activity in Burdagol and PSB Rc82. For Gal-ong, on the other hand, the T3 (-P) gave the highest DPPH scavenging activity.

- The effect of the variety on the DPPH scavenging activity was significant (Table 28). The DPPH scavenving activity of Gal-ong tripled that of the two other varieties. This is due to the red pigment of the variety which contains much anthocyanins.

Table 27. DPPH scavenging activity of the different varieties as influenced by fertilizer treatments, (2014 DS), San Nicolas, Ilocos Norte.

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	DPPH Scavenging Activity (%)		
		Burdagol	Gal-ong	PSB Rc82
1. Control	0	17.79 c	63.17 b	18.94 ab
2. Omission Plot (-N)	0-42-42	16.02 d	58.67 c	19.23 ab
3. Omission Plot (-P)	112-0-42	20.09 ab	65.30 a	18.42 bc
4. Omission Plot (-K)	112-42-0	17.86 c	55.62 d	19.86 ab
5. LCC-based 1	108-42-42	21.12 a	62.60 b	20.50 a
6. LCC-based 2	118-42-42	20.78 a	50.72 e	19.58 ab
7. Rice straw	30-4-43 ($4tha^{-1}$)	16.02 d	57.64 c	18.77 b
8. Chicken Manure	55-129-116 ($3tha^{-1}$)	18.54 bc	55.68 d	16.76 c
Significance				
Fertilizer	***			
Variety	***			
Fertilizer x Variety	***			

****significant at 0.1% level*
Means followed the same letter are not significantly different at 0.5% level of significance

Table 28. DPPH scavenging activity of the different fertilizer treatments as influenced by variety (2014 DS), San Nicolas, Ilocos Norte.

VARIETY	DPPH Scavenging Activity (%)							
	T1	T2	T3	T4	T5	T6	T7	T8
Burdagol	17.80 b	16.02 c	20.09 b	17.86 c	21.12 b	20.78 b	16.02 c	18.54 b
Gal-ong	63.17 a	58.67 a	65.31 a	55.62 a	62.60 a	50.72 a	57.64 a	55.68 a
PSB Rc82	18.94 b	19.23 b	18.42 b	19.86 b	20.50 b	19.56 b	18.77 b	16.76 b

Means followed by a common letter are not significantly different at 5% level using LSD

Validation of Postharvest Keychecks

- The improved keycheck 8 (harvest management) and proposed keycheck 9 (postharvest management) were validated by comparing the recommended technologies to that of the farmers' practice (Table 29). Some of the recommended technologies under the two keychecks were followed by the farmers but not on drying. The farmers dried their grains up to 9% MCw.b. which was lower than the recommended 12-14% MCw.b.

Table 29. Harvest and postharvest management following recommended technologies (PhilRice Batac) vs. farmers' practice.

PhilRice Batac	Farmers' Practice
Keycheck 8: Cut, piled, and threshed the crop at the right time; used laboratory mechanical thresher	Cut, piled, and threshed the crop at the right time; used motorized pedal-type thresher
Proposed Keycheck 9:Postharvest management	
9a. Paddy sorted according to variety type and quality	Paddy sorted according to variety type and quality
9b. Dried paddy with good quality (Dried paddy immediately after threshing; grains were spread 2-4 cm thick and stirred every 30 min)	Dried the paddy after 1-3 days after threshing. Sundried for 2-3 days; 3-6 times stirring per day. Overdried grains: 9% MCwb.
9c. Paddy with premium purity: cleaned paddy using blower	Cleaned paddy using electric fan
9d. Market quality preserved and losses to pests prevented during storage: used pallets and sacks that are free from residual infestation	Used sacks during storage
9e. Milling and eating quality preserved and losses to pests prevented: ensured that the area is secure; exposed or aerated newly-dried grains for about 4-5 hr before covering them.	Piled sacks after drying inside the house
9f. Maximized milling and headrice recovery: used machine that can produce at least 65% milling recovery and 80% head rice on milled rice basis	Single-pass milling machines owned by private rice millers

- The overdrying of paddy had significant effect on the final weight of the dried paddy (Table 30) and milling potentials of milled rice. PhilRice samples had higher brown rice, milling and headrice recoveries (Figures 17 to 19). The headrice of the rice samples of the farmers were even below the standards.

Table 30. Drying of paddy conducted by PhilRice Batac and farmer-cooperator.

TREATMENT	Moisture Content (%)		Grain Weight (kg)	
	Initial	Final	Initial	Final
PhilRice Batac	21	14	100	92
	21	12	100	90
Farmer's Practice (Control)	21	9	100	87

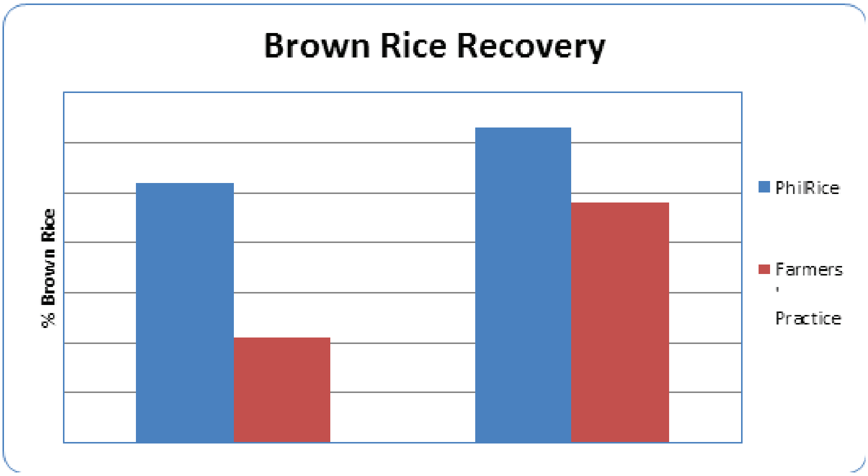

Figure 17. Brown rice recoveries of Burdagol and PSB Rc82 comparing PhilRice and farmers' practice.

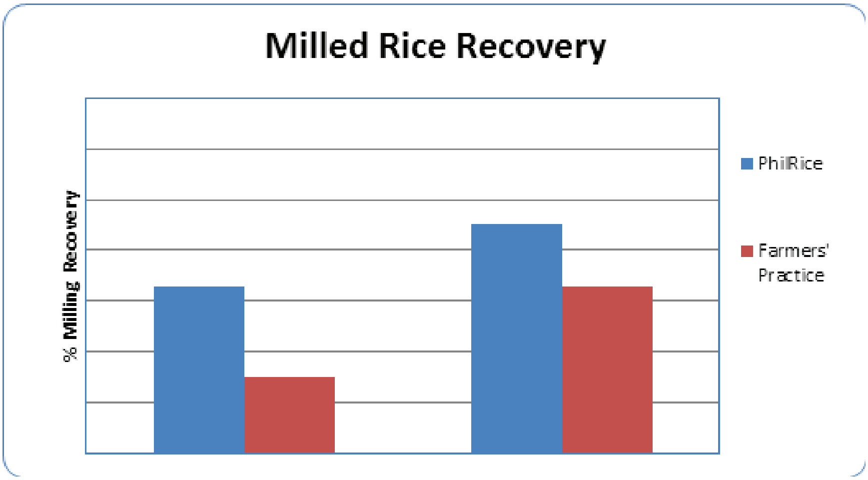

Figure 18. Milled rice recoveries of Burdagol and PSB Rc82 comparing PhilRice and farmers' practice.

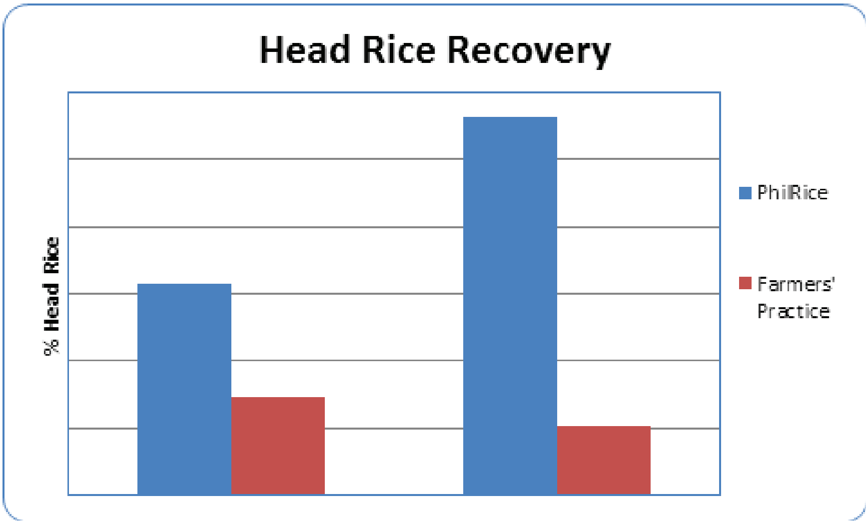

Figure 19. Head rice recoveries of Burdagol and PSB Rc82 comparing PhilRice and farmers' practice.

B. Wet Season 2014

The experiment was conducted in two sites: one in San Nicolas, Ilocos Norte and another one in Los Baños, Laguna.

Yield and Yield Component, and Agronomic Characteristic

- The yield was determined by the interaction of the fertilizer treatment and variety used (Table 31). Highest yields were obtained from those applied with the Omission Plot (-K). Lowest yields were obtained from those applied with the Control, -N, and organic fertilizers, except for the rice straw applied for Gal-ong. Gal-ong consistently gave the lowest yield among the three varieties (Table 32).

Table 31. Grain yield of the different varieties as influenced by fertilizer treatments, (2014 WS), San Nicolas, Ilocos Norte

FERTILIZER MANAGEMENT	Fertilizer Rate ($kgha^{-1}$)	Grain Yield (tha^{-1})		
		Burdagol	Gal-ong	PSB Rc82
1. Control	0	3.24 e	2.06 b	3.50 c
2. Omission Plot (-N)	0-28-28	3.27 e	2.20 b	3.41 c
3. Omission Plot (-P)	113-0-28	4.89 abc	2.62 ab	5.35 ab
4. Omission Plot (-K)	113-28-0	5.46 a	3.22 a	5.94 a
5. LCC-based 1	97-28-28	4.43 bc	2.81 ab	5.01 b
6. LCC-based 2	133-28-28	5.19 ab	2.67 ab	5.12 b
7. Rice straw	-	3.60 de	2.70 ab	4.12 c
8. Chicken Manure	30-240-28 (3t ha^{-1})	4.25 cd	2.11 b	3.84 c
Significance				
Fertilizer	***			
Variety	***			
Fertilizer x Variety	**			

*** significant at 0.1% level of significance; ** significant at 1% level of significance
Means followed by different letter are significantly different from each other at 5% level of significance using LSD

Table 32. Yield of the different fertilizer treatments as affected by variety (2014 WS), San Nicolas, Ilocos

VARIETY	Yield (tha^{-1})							
	T1	T2	T3	T4	T5	T6	T7	T8
Burdagol		3.26 a	4.89 a	5.46 a	4.43 a	5.20 a	3.60 a	4.25 a
Gal-ong	2.06 b	2.20 b	2.62 b	3.22 b	2.81 b	2.68 b	2.70 b	2.11 b
PSB Rc82	3.50 a	3.41 a	5.35 a	5.94 a	5.01 a	5.12 a	4.12 a	3.84 a

Means followed the same letter are not significantly different at 5% level of significance

Design and Development of Village-Type Rice Silo to Reduce Storage Losses

Delilah P. Dal-uyen, Lex C. Taguda, Mary Ann U. Baradi, and Fidela P. Bongat

Rice (Oryza sativa L.) is a staple food consumed by almost all of the population in the Philippines and can be produced twice a year in irrigated areas and once a year in rainfed areas. Losses from harvesting to storage were estimated by Castro (2003) to be roughly 15% on the average, ranging from 1 to 32%; 18% of which are incurred during storage. This translates to 2.7% contribution of storage to overall harvest and postharvest losses. With the 18.4 million metric ton (MT) paddy produced by the country in 2013 (BAS, 2015), this translates 0.5 million MT lost from storage. At 65% milling recovery, this loss from storage can feed 2.7 million Filipinos in a year.
This study generally aims to design and develop village-type rice silo appropriate for rice storage by small scale farmers.

Highlights:

Design of rice silo

- This silo was designed considering the storage parameters of milled rice and paddy rice (unmilled) including moisture content (MC). Also, some engineering properties such as the capacity/density of rice, loading and unloading were also considered. Therefore, the ease of the operation in the loading and unloading in the silo was given attention. Design of rice silo was prepared as shown in Figure 20.

- Cylindrical shape was selected for the design. The design of the body was double-walled with provision of an insulating material between the walls purposely to reduce the temperature fluctuation and relative humidity (RH) within and outside of the silo.

- Cover of the silo used an airtight material to enclose securely the stored grains to avoid penetration of air. The unloading was designed at the bottom portion for ease of unloading.

Fabrication of one-ton silo

- One-ton silo was fabricated to store and prolong the storability of unmilled rice as shown in Figure 20. Based from the result of the FGD, problems encountered by farmers, rice miller and fabricator was the basis in designing the silo therefore, interventions was made to address and consider the problems encountered as shown in Table 33.

- The space of the two cylinder is purposely for insulation to control the fluctuating temperature between the outside and inside of the inner cylinder. Carbonized Rice Hull (CRH) was chosen as insulating material and also purposely to prolong the storability of the silo and absorb moisture of the grains to be stored. Using CRH to prolong storability of crop was proven by a young farmer from Ilocos Sur that made him “Outstanding Young Farmer” (ATI, 2010). Biological control for weevil and molds was being emphasized as one of the enumerated problems of farmers during storage that could contribute high losses during storage. Frame was provided to hold the silo and ladder to ease loading of the grains to be stored.

Table 33. Problems encountered during storage using traditional storage ("garung") vs. intervention made.

PROBLEMS	EFFECT TO FARMERS	INTERVENTIONS MADE
Loading	Need ladder just to load the rice in their *garung.*	Attachment of two-step ladder exact for loading the grains.
Unloading	Difficulty in unloading the rice from the top of their *garung.*	Flexible unloading placed at the bottom of silo.
Dustiness (white powder) of the stored rice	Dusty grains show low quality of the grain.	Sealed the silo.
Birds and chicken	Losses during storage.	Sealed the silo.
Rodents	Losses during storage.	Sealed the silo.
Application of chemicals	Using chemicals such as Naptalene, Malathione, etc causing hazard to consumers.	Using biological control such as dry leaves of lagundi, eucalyptos and neem tree.
Weevil	Low quality resulting to low income.	Sealed the silo.
Decaying of the paddy during rainy seasons	Molding of grains	Insulation made to control the temperature fluctuation between inside and outside of the silo.
Spacious (inside location specially during rainy season)	Need space inside the house.	Can be placed outside even during rainy season.

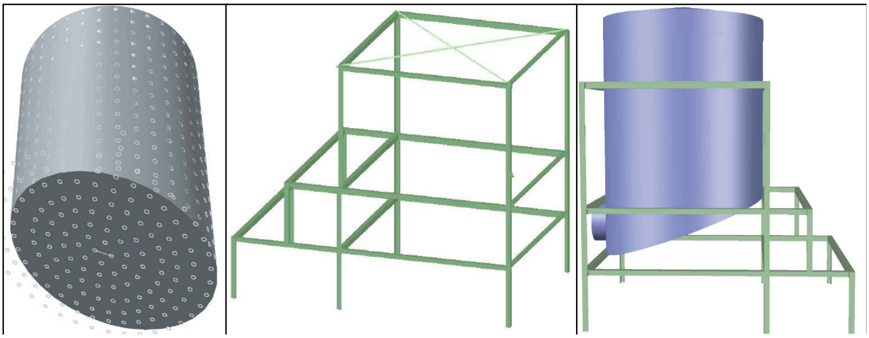

Figure 20. Schematic diagram vs fabricated rice silo.

Figure 21. Fabricated rice silo.

Design, Performance and Field Evaluation of a Downdraft Hydraulic Ram Pump for Irrigating Rice-based Crops in Ilocos: Survey of Existing Hydraulic Ram Pump (HRP) in the Country and Identification of Areas for Improvement

ND Ganotisi, MLO Quigao and MG Galera

Generally, internal combustion engine, electric pump and manual hauling are used to lift water from water source to their compound. Using internal combustion engines or electric motor to prime move water pumps is very expensive because of the escalating price of fossil fuels and electric power. Besides, fossil fuels when burned due to combustion, carbon dioxide is emitted which greatly add heat to the environment enhancing global warming.

Using renewable energy source for pumping water for irrigation like a hydraulic ram pump is deemed necessary, and may result to more productivity and production in arid and hilly areas of the region. A hydraulic ram pump is a pump that pushes water uphill using energy from falling water. It is a device with simple and conveniently applied mechanism by which the weight of water can be made for raising a portion of itself to a considerable height. It is inexpensive; virtually maintenance free; easy to install, parts are at any time available in the locality; self-acting; requires low water drop source but dependably and consistently pump a portion of that source uphill; and does not require outside source of energy to operate. The study aimed at identifying areas for improvement of the hydraulic ram pump for Northwest Luzon conditions was conducted. A survey of existing hydraulic ram pump (HRP) in the country particularly in Alaminos, Laguna and Nueva Era, Ilocos Norte were undertaken aside from scanning available HRPs from the internet.

Highlights:

- Based from profiling and characterization, the HRP installed in Laguna (Figure 22) has a body of the pump made of G.I. tee and elbow of 4 inches diameter welded together. The flanges are mild steel plates, with air chamber made of G.I pipe with 6″ diameter. It was fabricated using lathe machine made from iron plate. It has a discharge pump rate of 20,000 li per day with the elevation of the catchment from the pump of 8 m and lift the water to the storage tank at 30 m above the pump. The water is used for household and irrigation of crops. On the other hand, the HRP installed in Nueva Era, Ilocos Norte (Figure 23) has a drive pipe of 2″ with elevation of the catchment from the pump of 3-5 m. It has delivery pipe of 1″ and can lift the water 10-15 m directly to field crop. It was made of G.I pipes fittings, tee (2″ diameter), coupling (4″

and 2″ diameter), bushing (4″x2″ diameter) threaded together (Table 34).

- Through internet surfing, the AIDFI installed an HRP in Bacolod City, Negros Occidental. The pump can benefit 20 to 100 household or more, and it can pump water uphill to a maximum height of 200 meters. The HRP pump the water up to 30 to 40 times the height of the water source from the pump. AIDFI sells HRP in different sizes and flow rates.

- PASALI Philippine Foundation, Inc., an organization active in Mindanao, located in Brgy. Fatima, General Santos, Mindanao has completed a project on Spring Development and Installation of Level II Water System through HRP in eight sites of Brgy. Tungao, Butuan City from May to August 2014 in partnership with AIDFI. Another HRP was being installed by the PASALI in Brgy. Limulan Sitio Minurok, Kalamasig, Sultan Kudarat under the agos RAM Pump Project of AIDFI. Three Manobo (an indigenous group) villages with a total of 100 households located more than 500 meters above the sea level were given free flowing potable water through the pump.

- The problems encountered include leakage of water from the pump which reduced pressure and decreased pump discharge rate. The pump does not start by itself and the pressure gauge deteriorates.

- The future activities of the study include survey and identify areas in Ilocos Norte and Ilocos Sur where HRP is applicable; Adopt existing HRP and verify its performance and demonstrate in Ilocos Norte and Ilocos Sur; and to conduct on-farm evaluation of HRP in irrigating rice and rice-based crops.

Table 34. Profile and characteristics of HRP installed in Laguna and Ilocos Norte.

Parameters	Alaminos, Laguna	Nueva Era, Ilocos Norte
Background Information:		
Name of caretaker	Jovito de Mesa	Jimmy C. Soliven
Address	Brgy. San Gregoio, Alaminos, Laguna	Brgy. Bugayong, Nueva Era, I. N.
Date Installed	2006	-
Fabricator	Roberto, A. Alaban, Jr.	Dr. Arnold F. Dumaoal
Technical Parts:		
Ram pump design name	ET-2	Downdraft HRP, 2”
Source of water	River	Diversion canal
Materials of the catchment tank	Reservoir	Earth embankment
Elevation of the catchment tank from pump	8 m	3-5 m
Materials of the drive pipe	G. I. pipe	G. I. pipe
Drive pipe length	-	Approx. 10 m
Flow rate of the drive pipe	-	-
Delivery pipe diameter	2”	1”
Materials of the delivery pipe	Irrigation hose	Irrigation hose
Elevation of the storage tank from pump	30 m	Water was directed to the field (elevation was approx.. 10-15m from pump to field)
Diameter and materials of the pump body	The body of the pump was made of 4”G.I. tee and elbow welded together, the flanges are mild steel plates, the air chamber was 6” G.I pipe (Fig. 3).	It was made of 2” G.I pipe and tee fittings, 4” and 2” G.I. couplings, 4”x 2” bushing threaded together (Fig. 4).
Impulse, Delivery valve and snifter valve	It was fabricated using lathe machine made from iron plate.	It was made from 2” commercial check and spring valves. The snifter valve mas made from inner tube of tricycle wheels.
Discharge rate of the pump	Approx. 20,000 li/day	-
Usage of pumped water	Household and crop irrigation	Crop irrigation
Problem encountered/Action taken	Problem 1-Leakage of water from the pump reducing pressure Solution 1-repair the pump. Problem 2. Pump discharge rate decreased Solution 2- Repair the delivery valve or find leak and repair pipe.	Problem 1- Pump does not start by itself Solution 1- Close the check valve and open if the pressure reaches 10 psi. Problem 2-. The pressure gauge deteriorates Solution 2-Replace the pressure gauge.

Figure 22. HRP installed in Brgy. San Gregorio, Alaminos, Laguna.

Figure 23. HRP installed in Brgy. Bugayong, Nueva Era, Ilocos Norte.

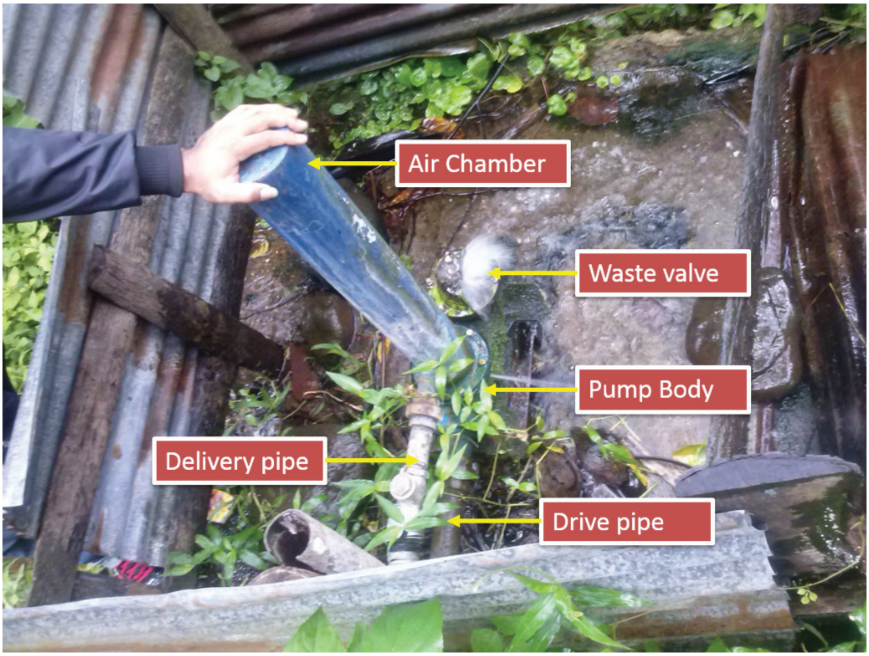

Figure 24. Different parts of the HRP installed in Brgy. San Gregorio, Alaminos Laguna.

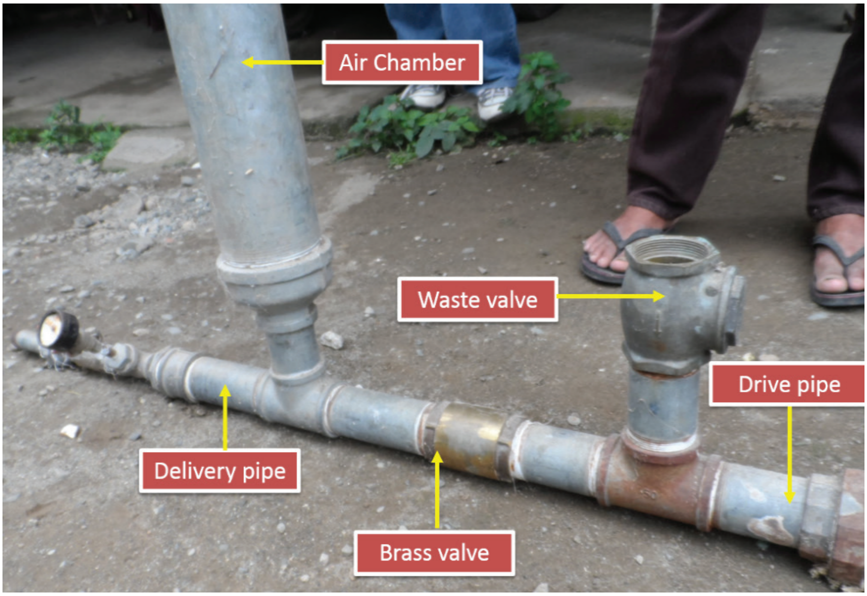

Figure 25. Different parts of the HRP installed in Brgy. Bugayong, Nueva Eva, Ilocos Norte.

Special purpose rice selection through the National Rice Cooperative Test (NCT) Project

AY Alibuyog, ES Avellanoza, EC Arrocena, JFParinas, TF Padolina

PhilRice Batac is one of the stations spearheading the selection and identification of special purpose rice. Special purpose rice such as the aromatic, glutinous, and japonica rice are gaining more attention from farmers and rice traders because of their good market potentials.

A total of forty entries were evaluated with ten entries each consisting of aromatic, glutinous, japonica and micronutrient-dense for special rice selections under the National Cooperative Test (NCT) in 2014WS at PhilRice Batac Experiment Station. Check varieties were: Burdagol and NSIC Rc128 for the aromatic group; NSIC Rc13 and Rc15 for the glutinous group; MS 11 and NSIC Rc220SR for the japonica group; MS13 and PSB Rc82 for the micro-nutrient group. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications.

Highlights:

- Results showed that aromatic and micronutrient groups had intermediate maturity, long maturity for the glutinous group, and early to intermediate maturity for the japonica group.

- Among the four groups, aromatic rice had the highest average yield (5116kg/ha), followed by the glutinous (4678kg/ha), micronutrient-dense with 3715kg/ha, andwith the lowest from the japonica group (3690kg/ha).

- Higher yields of the aromatic rice were attributed to its higher tiller counts, longer panicles, and heavier seed weight. The highest yielding entries for the aromatic group were: PR38949-B-29-2 (A,) PR36914-B-9-4-1-6-4-1 (NEW) and PR37343-B-6-3-2-2-2 (A); PR38948-B-51-1-1, PR34859-B-4-1-1-2-1 (G) for the glutinous group though not significantly different from the two check varieties; PR34131-B-20-1 (J) and (NEW) NIPPONBARE-(.6 EMS)-29-7 (J) for the japonica group; PR38963 (Fe)-B-7-1 (NEW) and IR10M300 (NEW) for the micronutrient-dense group.

- In terms of insect and disease damages, minimal whorl maggot infestation and rat damage were observed but with severe infection to brown spot and BLB in two aromatic entries (IR75483-385-3-3, GSR IR1-14-Y7-Y1-D2), one glutinous entry (PR38024-2B-2) and one micronutrient-dense entry (IR10M300).

Table 35. Summary of yield and yield components of forty entries under the National Cooperative Testing (NCT) Project. PhilRice Batac. WS 2014.

Entry No.	Designation	Days to 50% heading	Days to Maturity (DAS)	Plant Height (cm)	No. of Tillers/ Panicle	Panicle Length (cm)	Percent Filled Grains (%)	No. of Filled Grains/ Panicle	Seed Weigh (g/1000 seeds
				AROMATIC RICE					
1	PR36914-B-9-4-1-6-4-1 (NEW) (A)	94	124	98.6	16	27.07	61	88	25.3
2	GSR IR1-4-S5-Y2-Y1 (A)	94	124	81.7	17	21.87	64	101	22.7
3	BURDAGOL (CHECK)	97	127	83.9	13	22.04	69	95	33.7
4	PR38949-B-29-2 (A)	97	127	103.5	15	24.75	60	87	31.0
5	IR75483-385-3-3	89	119	88.5	15	27.08	79	81	28.0
6	IR914041-24-1-2-3 (A)	99	129	105.8	15	27.79	62	112	23.7
7	PR37343-B-6-3-2-2-2 (A)	107	137	91.5	14	24.60	58	102	29.3
8	NSIC Rc128 (CHECK)	95	125	96.6	18	24.24	65	89	24.0
9	PR34185-B-5-1-2-1-1-1-1-2-1-4-2-1 (A)	99	129	99.5	14	25.88	64	98	26.7
10	GSR IR1-14-Y7-Y1-D2 (A) (NEW)	91	121	75.3	17	22.24	46	74	23.3
				GLUTINOUS RICE					
11	PR40073-3B-2 (G)	105	135	91.1	9	24.00	79	97	32.3
12	Hangangchal 1 (G)	87	117	79.4	13	21.70	85	104	24.0
13	NSIC Rc13 (CHECK)	102	132	86.7	14	20.41	56	71	23.0
14	PR37046-B-3-3-1-2-1-2 (G)	94	124	93.4	12	28.15	65	104	29.0
15	PR34641-2B-15-1-1-1 (G)	106	136	87.2	11	25.56	59	105	21.7
16	PR38024-2B-2 (G)	105	135	87.7	12	25.31	62	111	22.3
17	PR38948-B-51-1-1 (G)	99	129	91.1	15	24.31	58	81	26.3
18	NSIC Rc15 (CHECK)	107	137	91.3	15	25.53	65	110	22.3
19	PR34859-B-4-1-1-2-1 (G)	99	129	101.3	11	23.05	80	107	28.7
20	PR37042-B-2-1-1-1-2-2-1-3 (G)	107	137	96.4	13	24.31	77	117	21.0
				JAPONICA RICE					
21	IR 68144-2B-2-2-3-1-166	77	107	79.6	13	18.04	73	74	26.3
22	IR91981-18-1-1-2-2 (J) (NEW)	77	107	82.8	15	19.15	73	79	26.3
23	MS 11 (CHECK)	80	110	73.0	19	16.92	84	58	27.0
24	NIPPONBARE-25kR-AC-29-1-1-1-1 (J)	87	117	86.0	11	16.81	79	71	28.7
25	IR89709-1-1-3-3 (J)	80	110	80.1	15	19.26	67	77	28.7
26	NIPPONBARE-AC-2-1-10-1-1 (J) (NEW)	91	121	92.5	12	19.40	79	69	31.3
27	PR34131-B-20-1 (J) (NEW)	87	117	108.6	12	18.75	78	84	29.7
28	NSIC Rc220SR (CHECK)	94	124	108.2	16	26.98	69	85	31.0
29	NIPPONBARE-(.6 EMS)-29-7 (J)	83	113	94.0	11	19.22	71	130	26.3
30	PR38697-11-80-2 (J) (NEW)	87	117	90.2	11	18.24	86	77	30.7
				MICRONUTRIENT-DENSE RICE					
31	IR10M300 (NEW)	94	124	91.9	13	26.38	62	97	26.3
32	IR10M210 (NEW)	91	121	88.2	13	22.15	72	78	24.7
33	IR84749-R1L 47-1-1-1-1 (NEW)	94	124	85.7	12	21.42	75	89	27.3
34	IR84842-87-3-1-2-2 (NEW)	101	131	109.7	7	23.52	84	128	26.0
35	MS 13 (CHECK)	91	121	64.3	16	21.14	88	82	22.3
36	IR83317-54-1-2-3 (NEW)	91	121	82.5	6	20.19	78	89	25.7
37	IR84841-17-3-1-2 (NEW)	100	130	84.7	13	22.07	83	97	23.7

Field performance trials of micronutrient-dense elite lines for the lowland irrigated (MNT)

SV Pojas, AY Alibuyog, EC Arocena, S Mallikarjuna

Breeding for mineral and vitamin enhancement of rice holds a great promise for making a significant, low-cost, and sustainable contribution to reducing micro-nutrient malnutrition in the country. With the thousands of rice selections with elevated mineral content generated by IRRI, evaluation of these materials for local consumption and utilization in the breeding program would be beneficial.

In 2014WS, 22 micronutrient-dense elite lines including two check varieties were evaluated under favourable rainfed condition at PhilRice Batac Experiment Station. The treatments were laid out in a Randomized Complete Block Design, with three replications.

Highlights:

- Results of the study revealed highly significant differences in all the parameters measured. PSB Rc82 (check variety) had the highest yield (5108 kg/ha) while the IR 68144 gave the lowest yield (3225kg/ha). Most of the entries gave comparable yields with that of the PSB check variety with average yields of more than 4 tons per hectare.

- Pre-NCT 21 gave the highest number of tillers (23) and highest percentage of filled grains (95.66%). The two Japonica entries exhibited low tillering ability and the lowest number of tillers was noted from this entries. Pre-NCT 16 produced the heaviest seeds while Pre-NCT 11 produced the tallest plants and the longest culm.

- Panicle lengths varied significantly in all the entries with Pre-NCT 16 producing the longest panicle.

- In terms of the agro-morphological characteristics, all the entries were very vigorous (18 entries), exhibited different abilities in terms of panicle exsertion, wherein majority of the entries have well-exserted panicles and only one entry having an enclosed panicle.

- Eleven entries showed yellowing of upper leaves during harvest and six entries have leaves that dried up early and fast, and five entries with excellent vigor and they remain green even during harvest. Almost all the entries have a very good phenotypic acceptability and four entries had an excellent rating.

Table 36. Yield and yield components of the entries evaluated in the MNT trial. WS 2014. PhilRice Batac.

Entry #	Yield(kg/ha)		Tiller count		Filled grains (%)		Weight of 1000 seeds (g)	
Pre-NCT 1	4095.49	abcd	18.63	abcd	90.27	abc	25.70	abcde
Pre-NCT 2	4766.44	abc	19.27	abc	82.54	cdef	28.47	abc
Pre-NCT 3	4271.03	abcd	10.53	hi	87.82	abc	28.70	qb
Pre-NCT 4	3816.66	bcd	18.77	abcd	89.54	abc	23.53	ef
Pre-NCT 5	3765.06	bcd	9.37	i	86.72	abcd	26.53	abcde
Pre-NCT 6	4445.69	abcd	17.00	bcdefg	86.71	abcd	28.06	abcd
Pre-NCT 7	4200.58	abcd	19.10	abc	93.01	ab	24.46	de
Pre-NCT 8	4541.93	abc	16.13	cdefg	85.16	bcd	26.87	abcde
Pre-NCT 9	4417.27	abcd	14.70	cdefghi	90.09	abc	23.57	ef
Pre-NCT 10	3892.56	abcd	21.77	ab	90.76	abc	26.20	abcde
Pre-NCT 11	4772.03	abc	13.53	defghi	85.36	bcd	25.00	cde
Pre-NCT 12	4335.88	abcd	18.47	abcdef	88.82	abc	27.13	abcde
Pre-NCT 13	4416.62	abc	14.40	cdefghi	82.10	cdef	25.93	bcde
Pre-NCT 14	3623.88	cd	15.70	cdefgh	82.59	cdef	24.67	de
Pre-NCT 15	4164.97	abcd	16.10	cdefg	87.60	abc	29.20	ab
Pre-NCT 16	4718.31	abc	13.26	efghi	84.35	bcde	29.76	a
Pre-NCT 17	4785.73	ab	16.70	bcdefg	74.79	ef	27.73	abcde
Pre-NCT 18	4409.18	abcd	12.60	ghi	73.26	f	28.67	ab
Pre-NCT 19	4140.36	abcd	13.20	fghi	77.46	def	26.87	abcde
Pre-NCT 20	5197.58	a	16.50	bcdefg	85.98	abcd	26.67	abcde
Pre-NCT 21	3224.75	d	22.53	a	95.66	a	20.53	f
Pre-NCT 22	3750.44	bcd	13.27	efghi	84.22	bcde	27.57	abcd
Mean	4261.94		16.29		85.65		26.45	
Significance	**		**		**		**	

Table 37. Yield and yield components of the 22 entries in the MNT trial. WS 2014. PhilRice Batac.

Entry #	Maturity (DAS)		Plant Height (cm)		Culm Length (cm)		Panicle Length (cm)	
Pre-NCT 1	107	h	82.53	cdef	62.60	fgh	19.84	hij
Pre-NCT 2	118	d	86.10	cdef	61.00	fgh	23.39	bcd
Pre-NCT 3	123	b	107.43	ab	83.00	a	24.17	bcd
Pre-NCT 4	117	e	75.73	abc	55.76	hi	20.22	ghij
Pre-NCT 5	123	b	96.57	abc	75.03	abc	21.90	defg
Pre-NCT 6	109	f	93.83	abcd	69.07	bcdefg	24.36	ab
Pre-NCT 7	105	j	82.06	cdef	63.07	efgh	19.37	hij
Pre-NCT 8	106	i	87.33	cdef	72.60	bcd	21.74	defg
Pre-NCT 9	117	e	80.97	cdef	60.83	gh	21.09	efgh
Pre-NCT 10	106	i	70.63	ef	51.53	f	19.34	hij
Pre-NCT 11	119	c	109.97	a	83.56	a	22.12	cdef
Pre-NCT 12	108	g	84.10	cdef	62.50	fgh	20.60	fghi
Pre-NCT 13	117	e	89.00	bcde	68.70	bcdefg	19.11	ij
Pre-NCT 14	125	a	88.73	bcde	65.86	defg	22.70	bcde
Pre-NCT 15	106	i	82.20	cdef	60.10	ghi	23.10	bcd
Pre-NCT 16	119	c	97.17	abc	71.76	bcde	26.03	ab
Pre-NCT 17	123	b	100.06	abc	76.73	abc	23.93	bc
Pre-NCT 18	123	b	93.43	abcd	67.73	bcdefg	24.44	bc
Pre-NCT 19	123	b	93.63	abcd	72.00	bcde	23.41	bcd
Pre-NCT 20	105	j	89.47	bcde	67.03	cdefg	23.15	bcd
Pre-NCT 21	107	h	67.60	f	41.47	i	18.51	i
Pre-NCT 22	119	c	91.03	abcd	83.00	g	19.21	ij
Mean	**115**		**89.98**		**63.96**		**21.90**	
Significance	**		**		**		**	

Multi-location Field Trials of Beta-Carotene Enriched "Golden Rice Event GR2-R in the Philippines.

AA Alfonso, AY Alibuyog, SV Pojas

Many people in the developing world do not get enough vitamin A or beta carotene from the food they eat, contributing to the public health problem of vitamin A deficiency (VAD). According to the World Health Organization, an estimated 190 million children and 19 million pregnant women are affected globally.

In the Philippines, VAD is still a public health problem among pre-school children (15.2% prevalence) and among pregnant (9.5% prevalence) and lactating women (6.4% prevalence).

Vitamin A deficiency is often severe in areas where people consume nutrient-poor staple foods and other nutritious food is scarce, unavailable, or too expensive. Rice, for example, is the staple food crop for more than half of the world's population, and is especially important in Asia. Rice is an affordable and filling food, yet it contains no source of vitamin A. More than 90 million children in Southeast Asia suffer from vitamin A deficiency, more than in any other region. A multi-location trial (seed bulk up) aimed to produce seeds which will be used for the grain production project and these grains shall be used for the bio-efficacy trial that will be conducted after a bio-safety approval by the Philippine government.

Highlights:

- In 2014, the area was not utilized for the trial however; it was properly maintained, frequently checked and kept closed to prevent the entry of any unauthorized personnel.

- Monitoring of volunteer plants and other weeds was done from time to time. Whenever there are emergence observed, rotavation inside the plots was done to eradicate any emerged volunteer plants and spraying of herbicide surrounding the plots was also done to prevent further growth.

- For the stored seeds, they were frequently checked to prevent the entry of rats and the storage room was cleaned to avoid any contamination.

- On June 26, 2014, the seeds of Entry 2 (GR2-R x IR64 BC3F7-148-10-10-10-12) and Entry 3 (GR2 R x IR64 BC3F7-148-10-10-10-59) with a total of 232.5kg were checked and inspected with the presence of the project leader from IRRI, Dr. Raul Boncodin, monitoring staff from DA-BPI together with the research team headed by Dr. Antonio A. Alfonso and the local IBC. After the inspection and inventory, the seeds were transported to the MLT site using the kuliglig. The seeds in sacks were placed in boiling water and were heat-killed for ten minutes. Afterwards, the seeds were placed inside the pit with a dimension of 2x2x3m (WxLxD). All seeds were heat-killed in batches and buried in the pit. After the disposal, all the equipments used were cleaned ensuring that these are all free from GR seed materials.

- For other activities, the seed storage area allocated for the grain production was renovated and provided with walls and window grills. The seed storage area was installed with outlets for the air-conditioning system.

Table 38. Inventory of GR2-R seeds for disposal.

Container ID	Line Description	Quantity (kg)
Bag #1	R2-R x IR64 BC3F7-148-10-10-10-12	17.0
Bag #2	GR2-R x IR64 BC3F7-148-10-10-10-12	45.0
Bag #3	GR2-R x IR64 BC3F7-148-10-10-10-12	10.5
Bag #4	GR2-R x IR64 BC3F7-148-10-10-10-12	35.0
Bag #5	GR2 R x IR64 BC3F7-148-10-10-10-59	13.0
Bag #6	GR2 R x IR64 BC3F7-148-10-10-10-59	35.5
Bag #7	GR2 R x IR64 BC3F7-148-10-10-10-59	37.5
Bag #8	GR2 R x IR64 BC3F7-148-10-10-10-59	39.0
	Total	

IV. PRiSM: Philippine Rice Information System - An operational system for rice monitoring to support decision making towards increased rice production in the Philippines (PhilRice, IRRI and sarmap)

JM Maloom

The Philippine Rice Information (PRiSM) aims to establish a nationwide information system on rice that will provide information on rice areas and yield at a particular location and time, and information on factors that are affecting the yield. That information are very important for the Department of Agriculture to aid them in their planning and decision making – to provide the most appropriate intervention to address production gaps. PRiSM will rely on data from remote sensing, crop models, crop health surveys, and other fieldwork to deliver actionable information on rice crop seasonality; area; yield; damage from flood, wind, or drought; and yield-reducing factors, such as diseases, animal pests, and weeds.

Highlights:

- PRiSM has been piloted in Region III, IV-B, V, VI, VII, VIII and CAR during 2014 wet season, the first cropping season of implementation. A total of 310 farmer's field (Table 39) were monitored and surveyed by Regional Field Offices (RFOs) and Local Government Units (LGUs).

- Synthetic Aperture Radar (SAR) images were acquired from InfoTerra GmbH of the TerraSAR-X satellites for Regions III, IV-B, V, VI, VII, and CAR, and COSMO-SkyMed satellites for Region VIII during the duration of cropping season. A total of 144 SAR images were delivered and processed for rice maps.

- The project generated field data, start of season maps with tabulated area, rice area maps with tabulated area, flood map, yield estimates, and pests and diseases incidence per region. These outputs were shared on-line through google drive for project partner's accessibility. The RFO could only access their regions data.

    - The field data collected from farmer's field (Table 40) were crop management metadata, leaf area index (LAI), yield, crop damaged during typhoon, and pests and diseases injuries. The GPS points from rice and non-rice within the footprint of images were also collected.

    - Start of season maps (Figures 26 to 29) was produced to determine the differences in crop establishments in each region. The municipal level estimated area showing the start of season captured in each images are also available. These maps were used as a prerequisite for yield estimation.

    - Rice maps (Figures 30-33) were produced to provide stakeholders the production during the season and the spatial location of the rice areas within the region. The municipal level estimated rice areas are also available. Results of accuracy assessment showed that most of the rice maps have high accuracy (Table 41).

    - Damage caused by Typhoon Glenda on July 15, 2014 was assessed using SAR images. Flooded rice area maps were produced and used to validate the reports from the LGUs. Result showed that many rice areas were not damaged, not yet planted, under land preparation, newly planted or under seedling stage in Bicol region (Figure 34). In Leyte, flooded areas were seen in the images but those areas were irrigated in preparation for planting because most areas have no standing crop during the typhoon similar with the DA report that damage to the province as a result of the typhoon is not significant (Figure 35).

- Flooded rice areas in Nueva Ecija as a result of Typhoon Mario on September 21, 2014 were determined using SAR images provided by InfoTerra GmbH from the TerraSAR-X satellites (Figure 36). The results were given to RFO III.

- Pests and diseases incidence at the monitoring sites per region were also determined.

• Several meetings and workshops, and project assessments shown in Tables 42 and 43, respectively, were conducted to develop and validate methods/protocols for field data collection, mapping rice area and estimating rice yields using combined remote sensing and crop modelling approaches.

• Conducted on-farm trials for developing the decision tool to reduce yield losses caused by pests and diseases in irrigated lowland rice at PhilRice CES, Negros, Agusan and IRRI.

• Developed first prototype of a web-based rice information system including a database management system of production situation, pest injuries, and yield in the pilot regions.

• Conducted capacity building on rice crop monitoring (Table 44) at PhilRice, RFOs, LGUs, and DA-BAS and disease, pest and injury identification (Table 45) using IRRI Crop Health Survey Portfolio at RFOs, LGUs and RCPC.

• Conducted communication and coordination activities for effective project management and product delivery.

Table 39. PRISM sites during 2014 wet season.

Region	Province	Municipality	No. of Monitoring Field
CAR	Kalinga	Rizal & Tabuk City	40
III	Bulacan	San Miguel	20
	Tarlac	Concepcion	20
	Pampanga	Floridablanca	20
	Bataan	Hermosa	20
IV-B	Occidental Mindoro	Sta Cruz (B only), Sablayan & Rizal	50
V	Camarines Sur	Pamplona & Minalabac	40
	Albay	Polangui	20
	Sorsogon	Castilla	20
VI	Iloilo	Dingle	20
VII	Bohol	Ubay, San Miguel, Dagohoy & Pilar	20
VIII	Leyte	Alang-alang	20
Total	***12***	***19***	***310***

Table 40. Summary of PRISM field data collected by RFOs and the LGU during WS 2014.

(i) Metadata	CAR		III				IVB			V				VI	VII	VIII
	Rizal	Tabuk City	Concepcion	Floridablanca	Hermosa	San Miguel	Rizal	Sablayan	Sta. Cruz*	Pamplona	Minalabac	Polaqui	Castilla			
Farmers name	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20
Boundary coordinates	15	17	20	20	20	20	20	20		13	20	19	19	20	20	20
Bund height	15	17	20	20	20	20	20	20		13	20	19	19	20	20	20
Method of crop establishment	15T	15T 2DS	19T 1DS	19T 1DS	19T 1DS	7T 13DS	19T 1DS	17T 3DS		4T 9DS	5T 15DS	19T	14T 5DS	10T 10 DS	20T	20T
Rice variety information	15	17	20	20	20	20	20	20		13	20	19	19	20	20	20
Date of crop establishment	15	17	20	20	20	20	20	20		13	20	19	19	20	20	20
Irrigation information	15	17	20	20	20	20	20	20		13	20	19	19	20	20	20
3_Metadata	17	1	20	20	20	20	20	20		13	20	20	16	20	20	20
(ii) Monitoring																
1st Monitoring	20	20	20	20	20	20	20	17		20	20	20	20	20	20	20
2nd Monitoring	20	20	20	20	20	20	20	20		20	20	20	12	20	20	20
3rd Monitoring	20	20	20	20	20	20	20	20		16	20	20	20	20	20	20
4th Monitoring	15	20					20	20						20	20	
5th Monitoring															20	
6th Monitoring															20	
(iii) RnR																
Points																
Non-rice	50		50				50			34		50	50	50	50	50
Rice	50		50				50			41		50	50	50	50	50
(iv) Component B																
Crop and Injuries																
1st Assessment	0	28	20	20	20	20	10	10	9	9	10	9	10	20	20	20
2nd Assessment	7	0	20	20	20	16	10	9	9	7	9	10	10	20	18	19
Fertilizer, Pesticide and Yield	3	0	20	20	20	0	0	20	4	3	2	0	8	20	20	19

*Component B only

Table 41. Accuracy of rice area maps during 2014 wet season.

Region	Number of Points	Accuracy (%)	Remarks
III	202	87.6	Good Accuracy
IV-B	96	86.5	Good Accuracy
V	345	86.7	Good Accuracy
VI	100	74.0	Too Low
VII	100	88.0	Good Accuracy
VIII	93	86.0	Good Accuracy
CAR			Not yet done

Table 42. Meeting and workshops conducted for the development of protocol.

Meeting/ Workshop	Duration	Venue	Number of Participants
Preparation for TOT Training	April 28-30, 2014	PhilRice/IRRI	
Website Workshop	May 20-21, 2014	IRRI	PhilRice – 5 IRRI – 6
Protocol Writeshop	May 22-23, 2014	IRRI	PhilRice – 4 IRRI – 2
PhilRice Meeting re: Workshop and Training	July 28, 2014	PhilRice CES	PhilRice – 7
PRISM Component A Monitoring and Evaluation cum Workshop	August 11-15, 2014	Eurotel, Naga City	PhilRice – 14 IRRI – 3
BAS Meeting	August 27, 2014	Quezon City	PhilRice – 5 BAS – 8
PRISM Component A&B Meeting	August 28-29, 2014	IRRI	PhilRice – 4 IRRI
PhilRice Component A&B Meeting	September 12, 2014	PhilRice CES	PhilRice – 12
Meeting for propose changes in ODK forms	October 30, 2014	Davao City	PhilRice – 8
Internal IT Meeting	November 11-13, 2014	PhilRice CES	PhilRice IRRI
Workshop PhilRice Component A	November 20-21, 2014	PhilRice CES	PhilRice

Table 43. Project assessments conducted at the regions.

Region	Duration	Venue	Number of Participants
CAR	October 9, 2014	Golden Berries Hotel and Convention Center, Tabuk City, Kalinga	17
III	October 16, 2014	PhilRice CES	12
IVB	October 24, 2014	Sikatuna Beach Hotel and Restaurant, San Jose, Mindoro	24
V	October 21, 2014	Kawa-kawa, Tuburan, Ligao City, Albay	18
VI	October 1, 2014	WESVIARC, Buntatala, Jaro, Iloilo City, Iloilo	20
VII	October 3, 2014	Bohol Experiment Station, Ubay, Bohol	7
VIII	October 9, 2014	Alang-alang Municipal Hall, Alang-alang Leyte	30

Table 44. Trainings-workshop conducted for Component A.

Title of Training/ Workshop	Duration	Venue	Number of Participants	Participants
Workshop and Executive Seminar for RFO heads and heads of agencies	March 19-21, 2014	IRRI		PhilRice, IRRI, RFOs, DA-OSEC
PRISM Training for PhilRice Branch Implementers	April 7-11, 2014	PhilRice CES	7	PhilRice Branch Staff
PRISM Training for Component A Implementers	May 5-9, 2014	PhilRice CES	DA RFO – 30 DA- 6 IRRI - 4 (observers)	RFO III, IV- B, V, VI, VII, VIII and CAR
Training-Workshop on Mapping Rice Areas SAR Images	May 26-30, 2014	PhilRice CES	PhilRice-14 IRRI-5	PhilRice and IRRI
Region III Training	June 3-5, 2014	Eurotel, Angeles City, Pampanga	25	RFOs and LGUs
Region VI Training	June 9-11, 2014	WESVIARC, Jaro, Iloilo City, Iloilo	31	RFOs and LGUs
CAR Training	June 10-13, 2014	Golden Berries Hotel and Convention Center, Tabuk City Kalinga	21	RFOs and LGUs

Title of Training/ Workshop	Duration	Venue	Number of Participants	Participants
Region V Training	June 16-20, 2014	Villa Caceres Hotel, Naga City, Camarines Sur	20	RFOs and LGUs
Region IV-B	July 7-11, 2014	Sikatuna Beach Hotel and Restaurant, San Jose Occidental Mindoro	18	RFOs and LGUs
PRISM Training for Component A Implementers (2nd Batch)	September 8-12, 2014	Training Rooms 1 and 2, PhilRice- CES, Muñoz, Nueva Ecija	DA RFO-27 PhilRice- 4	RFO I, IV-A, VII, VIII, IX, X, XI, XII, XIII AND ARMM
PRISM Training for BAS	September 15-19, 2014	Training Rooms 1 and 2, PhilRice- CES, Muñoz, Nueva Ecija	BAS – 30 RFO – 2 PhilRice – 1	BAS from CAR, III, IV-B, V, VI, VII, VIII and RFO II
Region XI Training	October 28-30, 2014	Mergrande Ocean Resort, Davao City	20	RFOs and LGUs

Table 45. Training workshops conducted for component B

Title of workshop	Duration	Venue	Participants
Training workshop for regional staff of DA-RFO (TOT)	March 25-28, 2014	IRRI	DA-RFO representatives
Region V Training	July 5-12, 2014	Naga City	RFOs and LGUs
Region VI Training	May 27-30, 2014	WESVIARC	RFOs and LGUs
Region III Training	Aug. 12-15, 2014	PhilRice	RFOs and LGUs
Region IV-B Training	August 12-15, 2014	Calapan, Mindoro	RFOs and LGUs
Region VII Training	August 5-8, 2014	Ubay, Bohol	RFOs and LGUs
Region VIII Training	August 11-15, 2014	Babatngon, Leyte	RFOs and LGUs
CAR Training	August 19-22, 2014	Tabuk, Kalinga	RFOs and LGUs

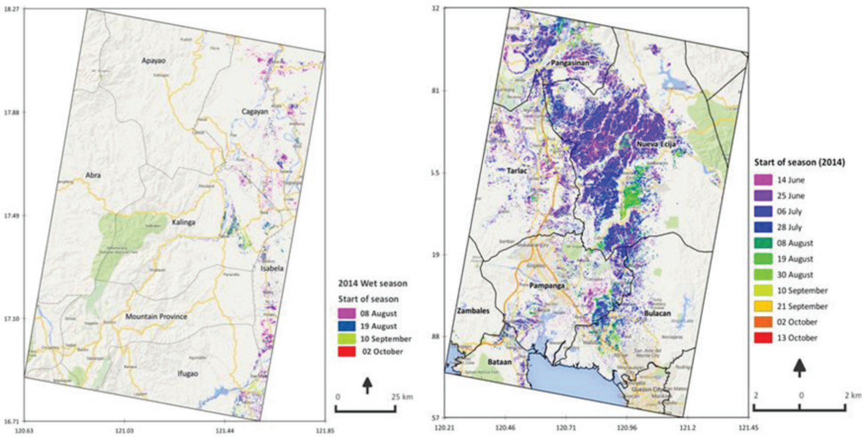

Figure 26. Start of season for CAR (left) and Region III (right) during 2014 wet season.

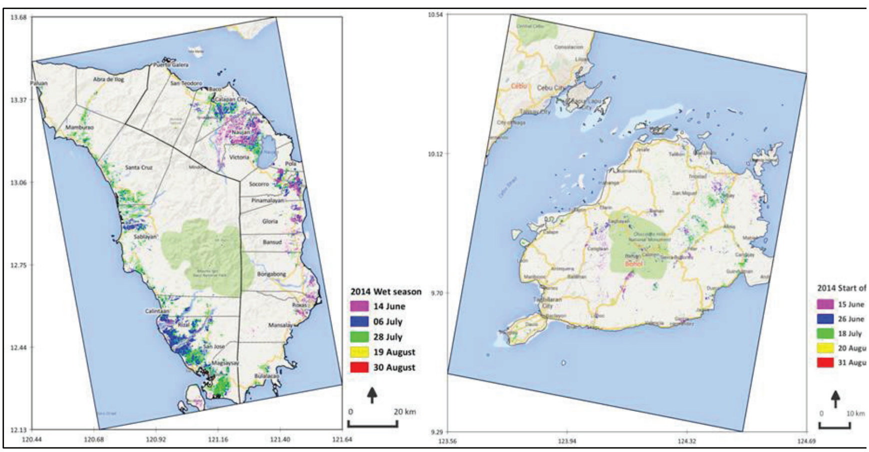

Figure 27. Start of season for Region IV-B (left) and Region VII (right) during 2014 wet season.

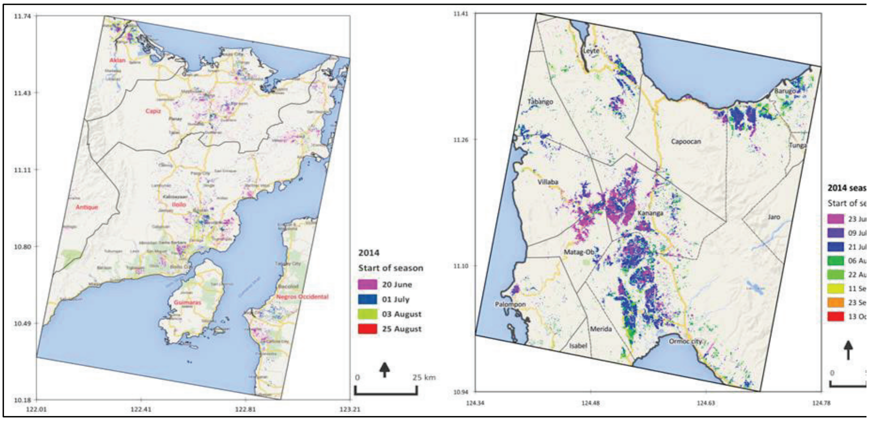

Figure 28. Start of season for Region VI (left) and Region VIII (right) during 2014 wet season.

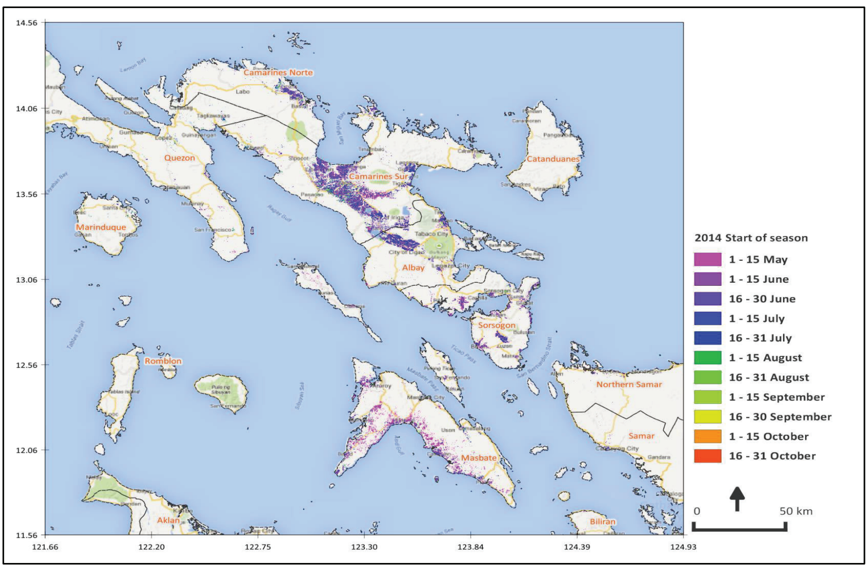

Figure 29. Start of season for Region V during 2014 wet season.

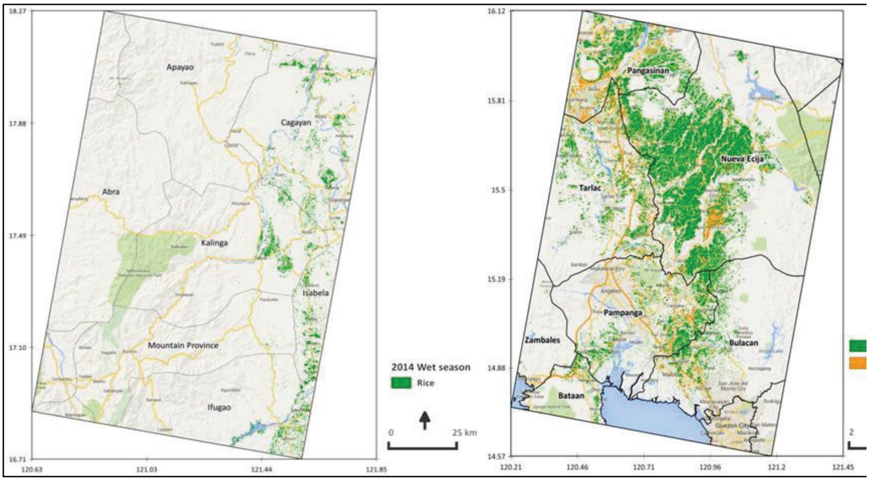

Figure 30. Rice area maps for CAR (left) and Region III (right) during 2014 wet season.

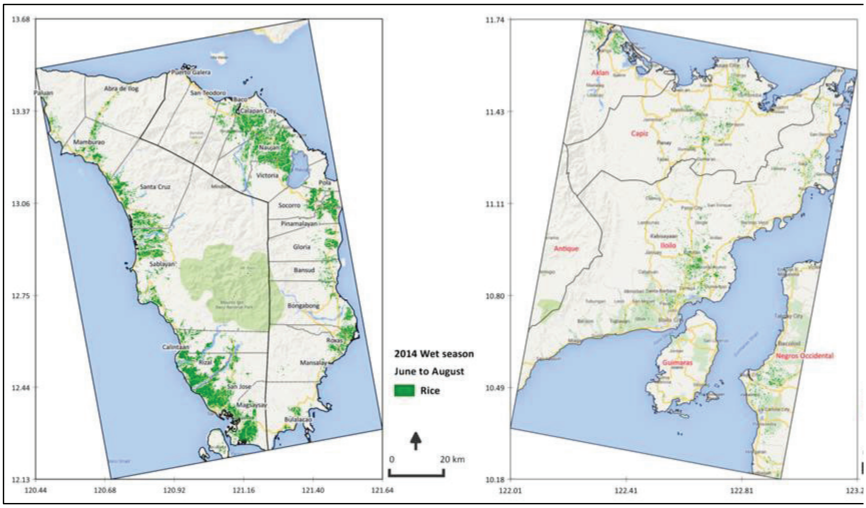

Figure 31. Rice area maps for Region IV-B (left) and Region VI (right) during 2014 wet season.

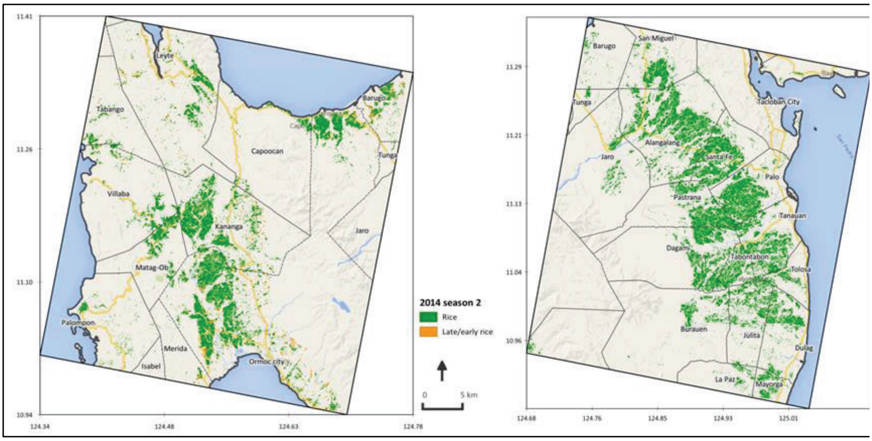

Figure 32. Rice area maps for Region VIII during 2014 wet season.

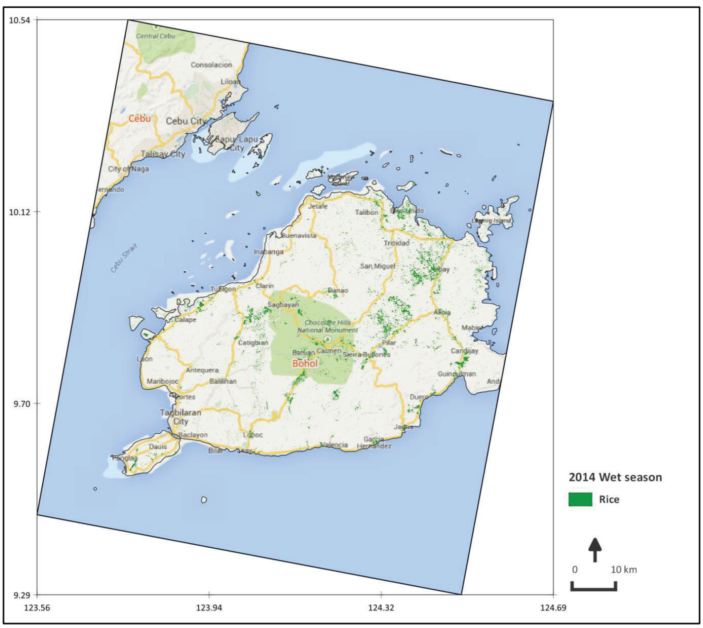

Figure 33. Rice area maps for Region VII during 2014 wet season.

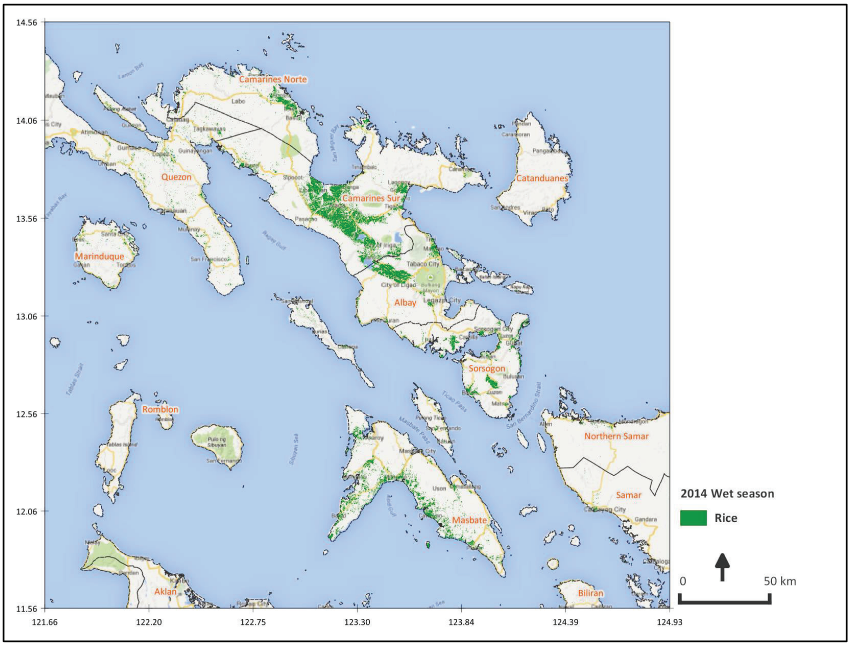

Figure 34. Rice area maps for Region V during 2014 wet season.

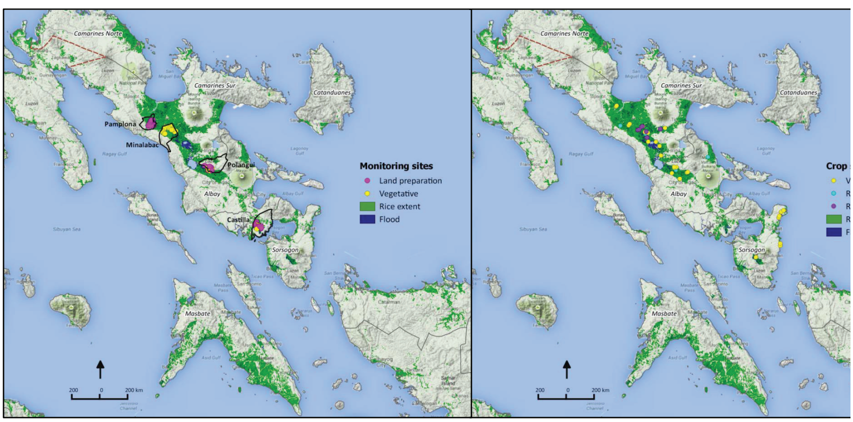

Figure 35. Field status during Typhoon Glenda on July 15, 2014 in Bicol Region.

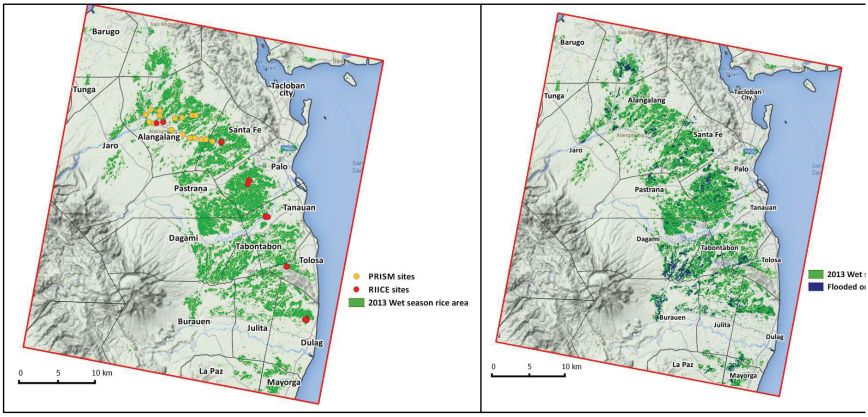

Figure 36. Field status during Typhoon Glenda on July 15, 2014 in Leyte.

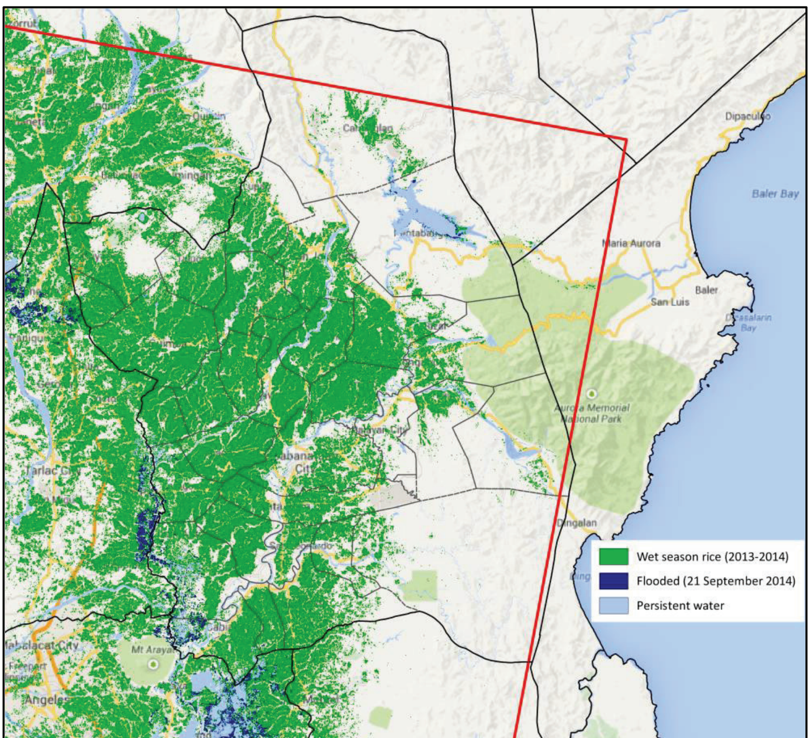

Figure 37. Flooded rice area during Typhoon Mario on September 21, 2014 in Nueva Ecija. II. Development

B. Development Component

Operationalization of Agrometeorological Service

JM Maloom, MJC Vives, MJ Ancheta, J Tallada and EJP Quilang

Agrometeorological services refers to all agro-meteorological and climatological information that can be directly applied to improve or protect agricultural production (yield quality, quantity, and income obtained from yields) while protecting the agricultural resource base from degradation (Stigter, 2004). In most of developing countries, agrometeorological advisory services and information products are seldom reaches smallholder farmers. For example in the Philippines, the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) is the official agency that provides weather and climate related information such as daily weather and seasonal climate forecast. However, farmers rarely get benefits from this information due to their low level of understanding to the terminology used and they are incapable to apply the information in support to their farming activities. There is still a need to translate the information in terms of rice farming operations in a language easily understood by the farmers. The challenges now are who will receives and interpret the routine flow of information with reference to available rice crop information and issues agronomic advisories, and most of all, how will farmers access these information. Development of effective method for communicating value-added agro-meteorological information to the farmers is very significant. This study aims to assist in strengthening the capacity of PhilRice Agromet Network (PhilAgromet) in agrometeorological data acquisition, transmission and analysis of the station data, and to develop value-added agrometeorological advisories and information products for rice farmers.

Highlights:

- A weather database from the Field Monitoring (FMON) System of PhilRice Batac was developed. This served as repository of all weather data gathered from the FMON and other available weather data from the on-line automatic weather stations (AWS) that were installed by the Department of Science and Technology (DOST) within the province of Ilocos Norte (Fig. 38). Also, weather data from MMSU Agromet station and PAGASA Laoag City are also available in the database.

- The FMON/AWS records/sends data in the database at DOST-ASTI every 15-minutes interval. Bi-monthly downloading/collecting of weather data from the internet was done from the said FMON/AWS. Also, to ensure accurate data, cleaning of the different sensors from dirt and other foreign object was done.

- Rainfall data for 2014 from the FMON and other AWS were used to compare the variability of rainfall in the province of Ilocos Norte (Figure 39). Based form the figure, rainfall pattern and amount in the western part (Batac) is different in Northern and Eastern part (Pagudpud and Banna, respectively). Pagudpud and Banna AWS had the same rainfall pattern but differ in the amount.

- Also, data from the MMSU Agromet station (1976 to 2012) was analyzed in terms of the amount of rainfall. Figure 40 shows the monthly average rainfall and Figure 41 on yearly rainfall amount in Batac City for 37 years. In terms of rainfall extremes, the longest wet spell averaged 11 days ranging from 7 to 24 days. On the other hand, the longest dry spell averaged 88 days ranging from 50 to 152 days. The highest 24-hr rainfall ranged from 98.3 to 498mm. Likewise, the highest monthly rainfall ranged from about 333 mm to 1407mm (Table 46).

Table 46. Rainfal extremes (1976-2006) in Batac City, Ilocos Norte.

Year	HIGHEST 24-hr (mm)	DATE	HIGHEST MONTHLY	DATE	LONGEST WET SPELL (a)	NO. OF DAYS	LONGEST DRY SPELL (b)	NO. OF DAYS
1976	128.3	25 May	333.1	Jul	21 Jul-03 Aug	14	01 Jan-25 Apr	115
1977	205.0	20 Sept	873.8	Sept	14 Aug-25 Aug	12	11 Feb-19 Apr	67
1978	98.3	23 Sept	326.3	Aug	30 Jul-13 Aug	15	01 Jan-13 Apr	103
1979	163.6	03 July	469.8	Aug	24 Jul-16 Aug	24	01 Jan-13 Apr	135
1980	221.4	09 July	467.4	July	10 Sept-20 Sept	11	31 Jan-15 May	97
1981	207.4	12 June	624.3	June	01 June-16 June	16	01 Jan-01 May	121
1982	152.4	13 Aug	739.2	July	28 June-06 July	9	01 Jan-03 May	123
1983	209.6	06 Sept	606.0	Aug	11 Aug-19 Aug	9	29 Oct-29 Dec	62
1984	220.0	28 Aug	827.4	Aug	14 Aug-20 Aug	7	01 Jan-28 Feb	59
1985	391	26 Aug	1022.6	Aug	16 Aug-29 Aug	14	01 Jan-05 May	125
1986	448.2	02 Sept	1407.4	Aug	27 May-04 June	9	02 Jan-26 Mar	84
1987	483.0	24 Oct	1046.3	Oct	12 Jul-19 Jul	8	01 Jan-01 June	152
1988	123.0	18 July	412.1	July	26 May-03 June	9	18 Feb-12 May	84
1989	221.8	06 Oct	864.8	Sept	07 Sept-14 Sept	8	01 Jan-24 Feb	55
1990	326.0	29 Aug	1176.0	Aug	23 May-04 June	13	18 Mar-16 May	60
1991	215.0	12 Aug	560.0	July	14 Sept-22 Sept	9	01 Jan-16 Mar	75
1992	358.4	21 Sept	826.0	Sept	14 Aug-20 Aug	7	27 Oct-31 Dec	66
1993	293.8	15 Sept	517.8	Sept	10 Jul-19 Jul	10	01 Jan-12 May	132
1994	418.4	10 Sept	804.4	July	29 June-13 Jul	16	13 Oct-31 Dec	79
1995	192.4	30 Aug	571.4	Aug	25 Aug-01 Sept	8	01 Jan-08 May	128
1996	498.0	25 Jul	1038.6	Jul	21 Jul-04 Aug	15	26 Jan-18 Apr	84
1997	175.0	06 Aug	545.6	Aug	29 May-05 June	7	25 Jan-17 May	113
1998	181.0	15 Oct	394.0	Sept	05 Sept-17 Sept	13	17 Jan-18 Apr	98
1999	293.0	05 June	527.8	June	10 sept-23 Sept	14	01 Jan-06 Mar	65
2000	224.2	22 Aug	1136.6	July	26 Aug-05 Sept	11	10 Mar-11 May	63
2001	330.0	04 July	752.1	Sept	01 Sept-10 Sept	10	01 Jan-21 Feb	52
2002	187.2	11 July	854.6	July	23 May-09 June	18	09 Nov-31 Dec	53
2003	172.4	16 Jun	522.5	Aug	02 Aug-09 Aug	8	23 Jan-21 Apr	89
2004	258.0	30 Jun	738.6	Aug	02 June-09 June	8	01 Jan-07 May	106
2005	344.8	21 Sept	586.1	Sept	22 June-01 Jul	10	01 Jan-09 May	129
2006	186.2	12 Jul	919.6	Jul	06 Jul-14 Jul	9	02 Mar-20 Apr	50

a = continuous period with at least 0.5 mm daily rainfall
b = continuous period with less than 0.5 mm rainfall

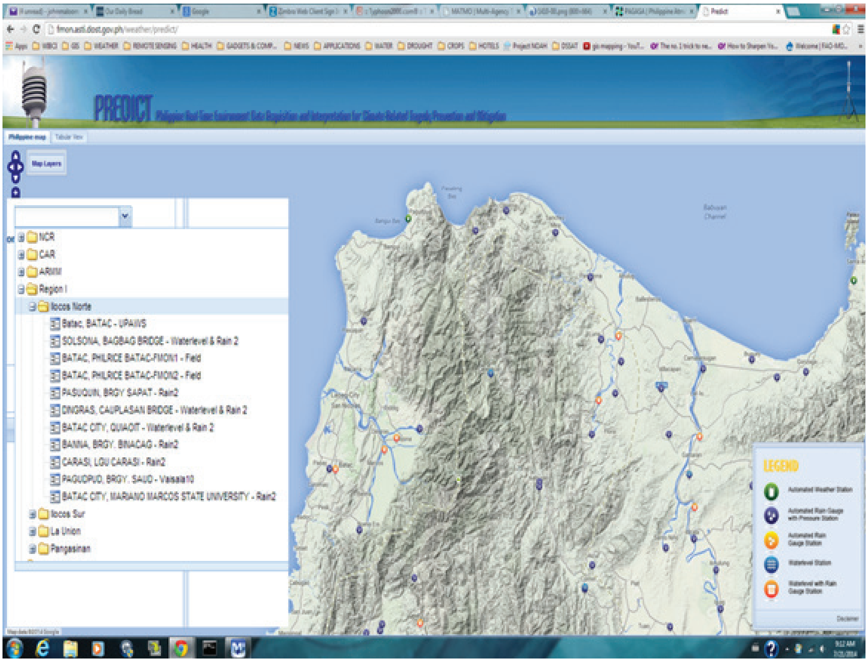

Figure 38. List and location of available on-line AWS installed by DOST in Ilocos Norte.

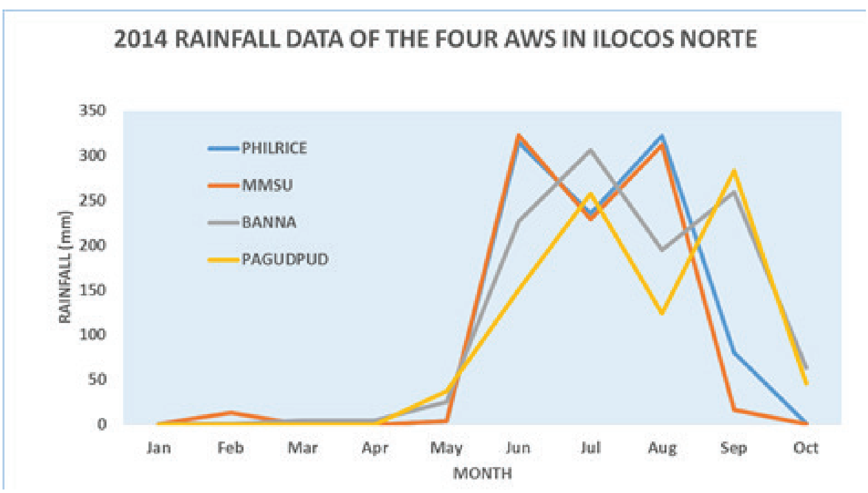

Figure 39. Rainfall data from the four AWS in Ilocos Norte.

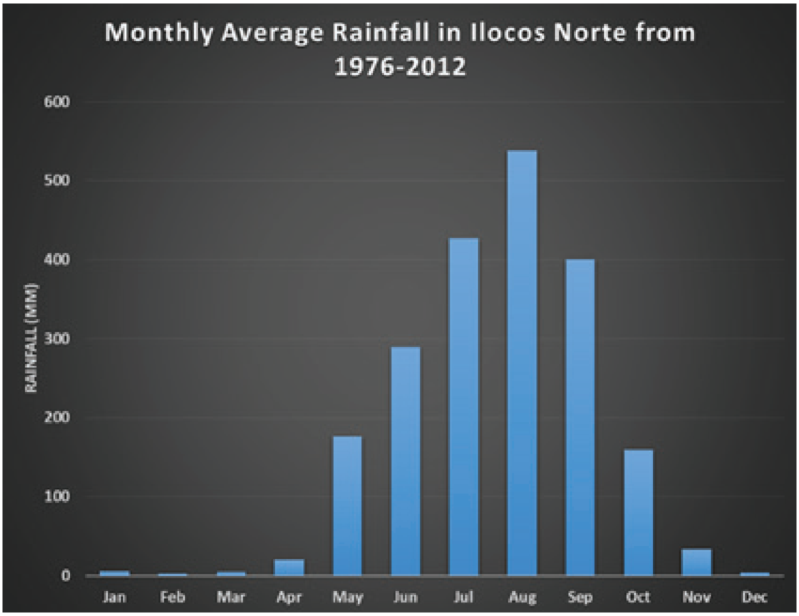

Figure 40. Monthly average rainfall in Ilocos Norte (1976-2012).

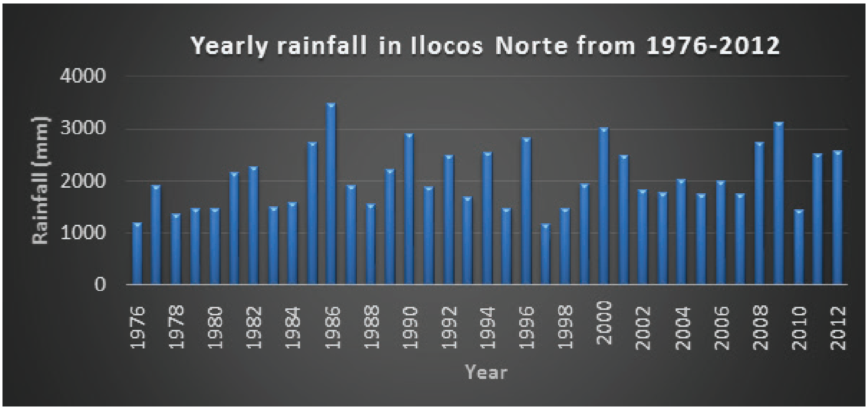

Figure 41. Yearly rainfall in Ilocos Norte (1976-2012).

Development of hydroponics for growing vegetables using LDIS (Low-cost Drip Irrigation System) for PhilRice Batac

ND Ganotisi, MLO Quigao, MG Galera and FP Bongat

Hydroponics simply means growing plants without soil. All required food nutrients for the plants are called hydroponic nutrients, which are dissolved in water and fed directly to the roots automatically. With rapid urbanization, industrialization and demographic which decreases agricultural area causes to shortage of supply in agriculture. Improvement of agricultural production is needed through the use of new technologies like hydroponics. The study aims to demonstrate the use of hydroponic system in raising vegetables and determining alternative nutrient solution for hydroponics system in Ilocos at PhilRice Batac station. Two methods of non-circulating hydroponics were designed as the planting structures such as (1) suspended pot using plastic pail and 1.5 li plastic bottle and (2) float support using PVC pipes and styrofoam boxes. First trial was set-up at the screen house and followed another trial in partial shading condition using pechay, mustard lettuce and kangkong. The crops were maintained by refilling with fresh nutrient solution (SNAP A&B mixed with water) if the water level has gone down by more than an inch below the bottom of the seedling plugs. Different nutrient solutions such as vermin tea, fermented plant juice and SFR water were identified as source of micronutrients mixed with different amount of organic fertilizers (14-14-14-11s, 46-0-0) as source of macronutrients. Data like yield, water conductivity, water temperature and total dissolve solids were gathered.

Highlights:

- Initial observation showed that the temperature inside the screen house was too high especially during the time 11:00 AM to 1:00 PM which may have suffered the plants (pechay, mustard and lettuce) to heat stress which cause wilting of seedlings, stunted growth and yellowing of leaves in both suspended pot and float support methods. It was also noted that kangkong was tolerant to heat and performed well in both suspended pot and float support using non-circulating hydroponics system.

- Non-circulating hydroponics established in partial shading condition showed the yield of pechay ranged from 43.80 to 50.28ghill^{-1} while lettuce ranged from 9.8 12.3g hill^{-1} (Table 47). On the other hand, styro box produced the highest yield of 35.6ghill^{-1}and the lowest was observed in plastic bottle with 15.7ghill-^{1} using mustard.

- In terms of water concentration data like electrical conductivity, temperature and total dissolve solids as affected by different nutrient solution formulated showed that only T5 (0g (complete), 0g (urea) : 1L SFR water) has on acceptable range of electrical conductivity according to Aranos which was 1.3mS/cm a medium low conductivity (Table 48). The other treatments had very high electrical conductivity which ranges from 8.2 to 91.0mS/cm. On the other hand, water temperatures were comparable with each other which ranged from 25.9 to 27.7°C.

- Water formulation using vermin tea, SFR water and fermented plant juice, the water concentration data as planted with pechay and mustard showed that all treatments has an acceptable range of electrical conductivity which ranged from 4.0 to 5.5mS/cm except for T13 (25 ml A&B SNAP solution: 10L water) which has a very high electrical conductivity of 8.3mS/cm. Also, this was related to TDS which T13 attained the highest (4,120ppm) and T5 (0 g (14-14-14-11s), 3g (46-0-0), 3.5g (0-0-60): 10 li SFR water) attained the lowest (1,580 ppm). The water temperature ranged from 28.1 to 29.0°C (Table 49).

- The study is still on-going and it is recommended to continue identifying and evaluating alternative nutrient solutions for hydroponics system of vegetable production, and to test hydroponics in the production of high value crops like tomato, eggplant, cucumber, bell pepper and others using LDIS in adding the nutrient solution.

Table 47. Average yield of crops planted at different planting structure established in partial shading condition using non-circulating hydroponics.

Crops	Yield, g/hill			
	PVC pipes	Styro box	Plastic bottle	Plastic pail
Pechay	47.3	50.3	43.8	45.5
Lettuce	12.3	10.1	11.2	9.8
Mustard	26.8	35.6	15.7	25.2
Kangkong	-	-	-	-

Table 48. Water concentration data as affected by different nutrient solution formulated.

Treatments	Description	Electrical Conductivity (EC), mS/cm	Water temperature, °C	TDS, ppm
N_1	0 g (complete), 0 g (urea) : 1L Vermitea	8.2	26.9	3,980
N_2	5 g (complete), 5 g (urea) : 1L Vermitea	35.0	26.9	17,000
N_3	10 g (complete), 10 g (urea) : 1L Vermitea	74.5	27.4	37,200
N_4	15 g (complete), 15 g (urea) : 1L Vermitea	91.0	27.3	45,500
N_5	0 g (complete), 0 g (urea) : 1L SFR water	1.3	27.7	641
N_6	5 g (complete), 5 g (urea) : 1L SFR water	21.4	26.5	10,700
N_7	10 g (complete), 10 g (urea) : 1L SFR water	60.4	26.0	30,800
N_8	15 g (complete), 15 g (urea) : 1L SFR water	62.6	25.9	32,400
N_9	25 ml A&B SNAP solution : 10L water	7.5	27.3	3,820

Table 49. Water concentration data as affected by different nutrient solution planted with pechay and mustard.

Treatments	Description	Electrical Conductivity (EC), mS/cm	Water Temperature, °C	TDS, ppm
T_1	0 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml Vermitea : 10 li water	4.0	28.1	1,980
T_2	2 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml Vermitea : 10 li water	4.5	28.4	2,240
T_3	4 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml Vermitea : 10 li water	5.2	28.6	2,600
T_4	6 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml Vermitea : 10 li water	5.5	28.2	2,730
T_5	0 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 10 li SFR water	3.1	28.1	1,580
T_6	2 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 10 li SFR water	4.0	28.2	2,000
T_7	4 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 10 li SFR water	4.8	28.2	2,410
T_8	6 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 10 li SFR water	5.1	28.4	2,530
T_9	0 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml FFJ : 10 li water	4.4	28.7	2,220
T_{10}	2 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml FFJ : 10 li water	4.8	28.9	2,360
T_{11}	4 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml FFJ : 10 li water	4.9	28.9	2,480
T_{12}	6 g (14-14-14-11s), 3 g (46-0-0), 3.5 g (0-0-60) : 50 ml FFJ : 10 li water	5.5	29.0	2,770
T_{13}	25 ml A&B SNAP solution : 10L water	8.3	29.0	4,120

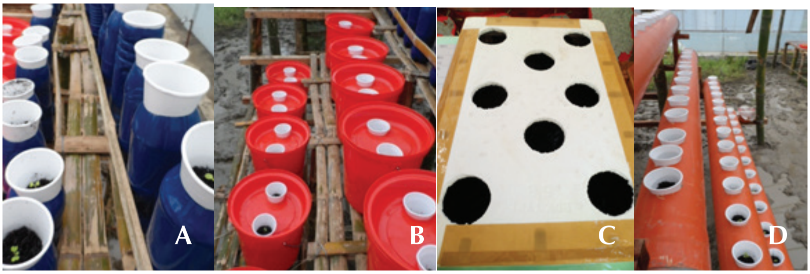

Figure 42. The different planting structures 1. Suspended pot: a. plastic bottle and b. pail 2. Float support: c. styro and d. PVC pipes.

Figure 43.Transplanted seedlings into seedling plugs.

Figure 44. Experimental set-up established in the screen house: a) suspended pot using plastic pail and b) float support using PVC pipes.

Figure 45. Experimental set-up established in partial shading condition: a) float support using PVC pipes and styro and b) suspended pot using plastic pail.

Figure 46. Measuring water concentration data using the Oaklon CON 400.

Figure 47. Circulating hydroponics system in screen house condition.

Figure 48. planted in styrofoam boxes using float support non-circulating hydroponics in partial shading condition.

Conservation of Indigenous Upland Rice Varieties in Abra and Apayao (CARFO 2)

BM Catudan, JM Solero, NI Martin, GB Agustin, AY Alibuyog

The Cordilleras is still a very rich genetic source of traditional rice varieties (TRVs) owing to its location and topography. Farmers in the uplands prefer to grow TRVs because of their low input requirement, resistance to pests and diseases, and adaptability. However, the yield and quality of the grains of TRVs are declining due to poor seed vitality and mixtures. Improving the productivity of upland rice production will consequently improve food security among disadvantaged subsistence upland farmers and can eventually provide additional income from surplus in their household requirements. Hence, this project aims to purify, characterize and increase seeds of the three most popular TRVs each for Abra and Apayao and eventually return purified seed samples to the farmers.

Highlights:

- The most popular TRVs in Abra (Baay/Binaay, Ballatinaw, and Waray) were characterized agro-morphologically using the standard form of PhilRice in in-situ setup (Table 50 and Figure 49).

- Nine (9) additional TRV seed samples were collected from CAR in 2014 and processed for safekeeping to help conserve the genepool of upland TRVs.

- A seminar on TRVs Seed Production and Harvest and Post-harvest Management was conducted in Pudtol, Apayao and Bucloc, Abra to help farmers maintain the purity and vigor of their seeds.

- A catalog of CAR TRVs consisting photos and agro-morphological characteristics was prepared for future reference.

Table 50. Agro-morphological quantitative characteristics of the top three most popular TRVs of Abra. 2014WS.

TRV	Culm Length (cm)	Maturity (DAS)	No. of Filled Grains	No. of Panicles/ Hill	100-Grain Weight (g)	Estimated Yield (kg/ha)
Ballatinaw (awned)	100.6	167	81	17	2.9	4, 911
Ballatinaw (awnless)	66.0	134	81	14	3.2	3, 706
Binaay (short & partly awned)	89.0	131	92	15	2.7	4, 456
Binaay (awnless)	88.6	139	109	17	2.4	5, 830
Binaay (fully awned)	117.4	134	101	22	2.9	7, 015
Waray	103.9	159	202	6	2.9	3, 767

Figure 49. In situ characterization of the most popular traditional rice varieties in Abra: (a) Ballatinaw TRV at milking stage; (b) Waray TRV at flowering stage; and (c) researcher measuring the width of the TRV leaf blade.

Documentation of Best Indigenous Upland Rice Production Practices in Abra & Apayao (CARFO-5a)

AC. Aguinaldo and LCS. De La Cruz

The activity was conducted to document the upland rice production practices of the upland farmers in Apayao and Abra, identify production gaps and propose possible courses of action to help attain rice sufficiency in the uplands. To document the technologies the following activities were accomplished:

Highlights:

- Edited and finalized lay-out of the coffee table books for Apayao and Abra.

- Printing of the book will be done by DA-CAR.

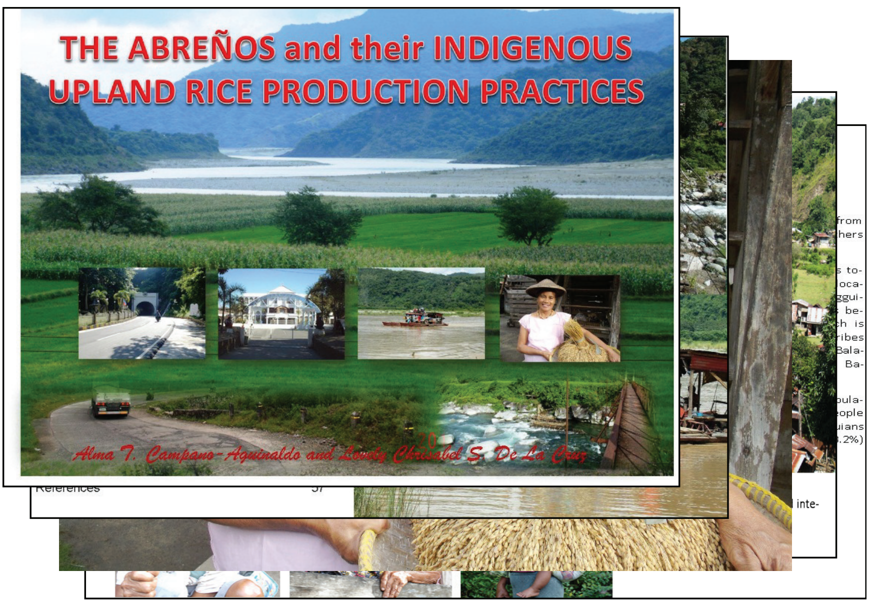

Figure 50. The coffee table book for Abra.

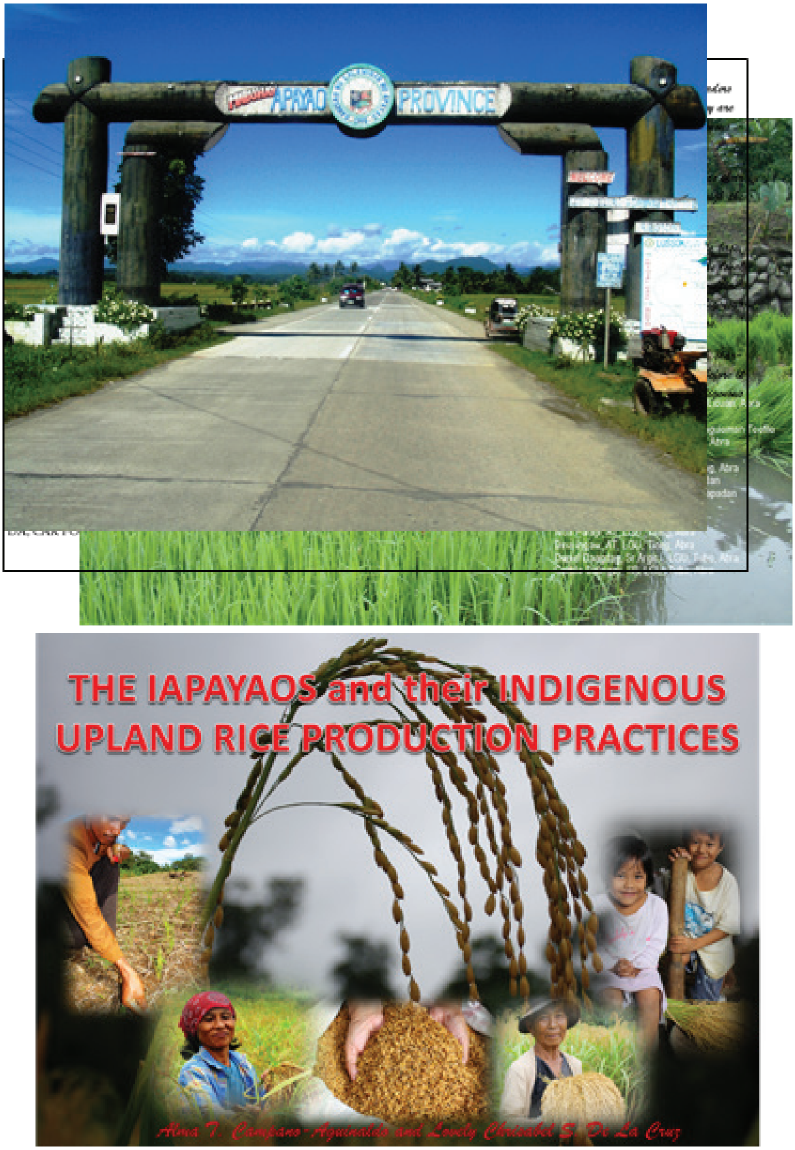

Figure 51. The coffee table book for Apayao.

Development of Appropriate Farming Systems in the Uplands of Abra through the Palayamanan (CARFO 06)

RC Castro, EP Agres, FC Diza, DP Dal-uyen

The Palayamanan project in the uplands is a collaborative undertaking of DA-CAR, upland LGUs of Abra and PhilRice Batac. The project aims to document the existing upland farming practices and package an upland farming system integrating good agricultural practices through Palayamanan, and, develop a linear programming model and generate optimum crop mixes under varying levels of water, labor and capital availability. Twelve upland municipalities were chosen as pilot sites in 2013 but trimmed down to six this year based on some set criteria.

Highlights:

- Collection of a one-year production data of different crops (cost and return) including the available labor and water were taken from each farmer partner in the flat uplands of Cabuloan, Bangued and Poblacion West in Pidigan, Abra in 2013.

- The data were entered into the linear programming model or Cropping Plan Advisory System (CPAS). Here, the available resources of the farmer such as capital for the season, and the crops he planted were entered into the software.

- The first run of CPAS indicated that during the first season, (Jun-Sept), if a farmer has 1.0 ha farm, with 300 mm total available water (50 mm/mo) in the farm and 180 man-days (30 man-days/mo) total labor available within the area, the system advised the farmer to plant 0.9 ha for rice and 0.1 ha for eggplant with a production cost of P40,000.00 to gain a profit of P162,500.00.

- A farmer can input as many crops as he is planting and let the system select the best crop for the season that will optimize his capital and his available resources of water and labor.

- The system selects the crop that does not jeopardize the rice season for the next year (temporal constraint).

- If the farmer continues farming for the second season (Oct to Jan) with only PhP30,000.00 capital, he must have to utilize only 0.5ha for ridgegourd, tomato and watermelon with a profit maximization of PhP203,000.00. No crop was recommended for the third cropping (Feb to May) apparently because of limiting water for irrigation that results to poor growth of plants, pests and diseases and low price of produce.

- This year, the one-year production data of different crops (cost and return) including the available labor and water were taken from each farmer partner in the flat uplands of San Diego, Pidigan; slightly sloping uplands of Silet and Culliong in San Juan and Sallapadan; and the steeply sloping uplands of Luba and Tubo, Abra.

- The data sets are being cleaned and just starting to encode.

Municipal-Level Database of the Rice Industry Statistics of the Cordillera Administrative Region (CARFO-8)

BM Catudan, NI Martin, CT Dangcil

The success of implementing the National Rice Program depends on properly identifying and timely delivery. The planning of proper interventions necessary to boost domestic production requires to each region and provinces. An in-depth knowledge and information about the socioeconomic characteristics of each region's rice industry. There are many existing sources of information and databases of the Philippine rice industry but they are scattered and may not be available when needed.

The Philippine Rice Research Institute and the Department of Agriculture collaborated in a project in 2011 to 2012 that came up with a regional rice industry primer series and municipal-level rice database system of the top two rice-producing provinces of the 16 regions in the country linked to the website of DA-RFOs. In 2013, PhilRice Batac, together with DA-CARFO, consolidated and processed the same data for the provinces of Abra, Benguet, Ifugao and Mt. Province.

Highlights:

- Consolidation of the municipal-level data was accomplished in 2013. The data sets were submitted to the database programmer for uploading in early 2014.

- Reprinting of the regional rice industry primer was on process and will be delivered this 2nd quarter 2015.

- The provincial rice primer for the 5 provinces of the region was prepared in 2014. Since the 1993 to 2012 data series of the provincial primer has been prepared in late 2013, the coverage years were adjusted to 1995 to 2014 to make the analysis more recent. Printing of the provincial primer is expected to be accomplished by the end of the second half of 2015.

Needs Assessment for Low-Yielding Farmers in Abra and Apayao (CARFO-9) (Enhancing Rice Productivity by Searching the Lost Farmers)
NQ Abrogena, LMdC Tapec and JQ Polipol

Promising technologies had been developed and promoted to increase yield and income of farmers. However, agriculture sector is reported to be still with lots of limitations especially in marginal areas and also to marginal farmers. This study documented the farmers' present rice production practices; identified the available resources and their specific farm needs; determined the constraints in adopting new production technologies; described the social networks of farmers and other stakeholders; and identified technology promotion strategies that suit the farmers' resources to improve their production management.

Highlights:

- A total of 124 sample respondents were surveyed through stratified sampling in Abra and Apayao.

- Rice production practices of farmers are affected by internal and external factors. Internal factors are the farmers' knowledge, attitudes and behaviors towards a given production technologies. These factors are considered to be under the farmers' control. The external factors which are not under the farmers' control like physical factors, biological and socio economic factor had greatly influenced productivity.

- Majority (72%) of the farmers in Abra used recycled seeds with extremely high seeding rate of 159 kg/ha. Drought is the major factor why most of the farmers have high seeding rate.

- It was noted that only few of the farmers in both sites applied basal fertilizers. The farmers usually applied fertilizer once as topdress. The farmers claimed insufficient capital to buy fertilizers as reason why they only applied once.

- Farmers mostly sprayed chemicals during heading to grain filling stage. It was noted that some Abra farmers sprayed before the 30 DAT. This implies the inadequate knowledge of farmers in rice production technology.

- Aside from farming, majority of the farmers were beneficiaries of the Pantawid Pamilyang Pilipino Program (4Ps) of the government. This means that most of the sample-farmers belong to the "poor" considered households.

- It was also noted that only few of the farmers have tractor or hand tractor. This implies that most of them still used animal drawn implements which affect their efficiency in producing palay.

- The farmers were also constraints with water especially in Abra. More than half (66%) of the farmers were under rainfed areas. Meanwhile both sites have sandy type of soil which requires more water during rice production. Thus, contribute to low yield of farmers.

- Poor farm-to-market-road was also noted as problem in Abra. Most of the farmers need to pass-by the wide river through raft (balsa) to buy inputs and to market their produce. This is also one of the reasons why farmers are contented with their recycled seeds and do not use high quality seeds because they could hardly transport the seeds from the market to their farms.

- Only 55% of the farmers were members to farmers' organization. This suggests the need to entice farmers to be organized into farmers' associations to be fully benefitted of government programs which are channeled through organization.

- It is very unfortunate to note that 80% sample farmers of Abra have not yet attended any trainings or capability enhancement on rice production. More training on rice production must be conducted to enhance capability of rice farmers to increase their yield and put them in the stream of high yielding farmers especially those in Abra.

- Interestingly, however, the farmers wanted to be updated on the latest rice technologies to improve their yield and income. And they preferred interaction with fellow farmers as mode of acquiring new technologies.

- Majority of the farmers in both sites claimed that AEWs rarely visited them on their farms for the past season. This is due to the limited number of AEWs in some municipalities. Among the surveyed municipalities in Abra, there are municipalities which have only one or two AEWs.

- Yield of Abra (2.23t/ha) is 40% lower than yield of Apayao (3.70t/ha). The yield of the farmers ranged from 0.70 to 6.3t/ha or 2.86t/ha on the average which is 36% lower than the national average rice yield level of 3.8 t/ha (BAS 2013).

- Harvesting/threshing contributed to the biggest chunk of labor cost of farmers in both sites. This is because farmers used manual labor during harvesting. Fertilizer cost contributed the highest expense for both sites. This is because of the continuous increase in fertilizer cost.

- Total production cost of farmers totaled to PhP25,710/ha in Abra and PhP27,900/ha in Apayao. The average price of PhP18.00/kg gave a gross income of PhP40,000 to PhP60,000/ha of farmers. The low yield of the Abra farmers resulted to high cost per unit output of PhP11.51/kg. The Apayao farmers incurred only PhP7.57/kg of palay.

Table 51. Percentage distribution of seed class of variety planted by the respondents in Abra and Apayao.

Quality of Seeds	Abra	Apayao	ALL
RS	2	5	3
CS	24	65	36
FS	1	-	1
hybrid	-	27	8
GS/ recycled seeds	72	3	52

Table 52. Seeding rate per hectare (kg/ha) by the respondents in Abra and Apayao.

Seeding rate	Abra	Apayao	Both
Max	550	160	550
Min	20	9	9
Average	159	51	127

Table 53. Percentage distribution of membership to organization by the respondent in Abra and Apayao

Items	Abra	Apayao	Both
Membership to Organization			
Yes	24	46	55
No	76	54	45
Members of Organizations			
Irrigators' association	14	59	34
Cooperative	10		5
Farmers Association	76	41	61

Table 54. Percentage distribution of trainings attended by the respondents in Abra and Apayao.

Items	Abra	Apayao	Both
Attended Rice trainings			
Yes	20	51	67
No	80	49	33
Rice trainings attended			
season-long training	0	21	3
short training	88	74	21
briefing	12	5	77

Table 55. Comparative production cost (P/ha) and net income (P/ha) between Abra and Apayao.

Items	Abra	Apayao	Both
Yield	2,234	3,699	2,857
Gross Income	40,896	61,933	49,842
Material Cost	8,339	10,482	9,250
Labor Cost	17,368	17,500	17,424
Total Production cost (P/ha)	25,706	27,982	26,674
Net Income (P/ha)	15,190	33,950	23,168
Cost/kg of palay (P/kg)	11.51	7.5	9.34

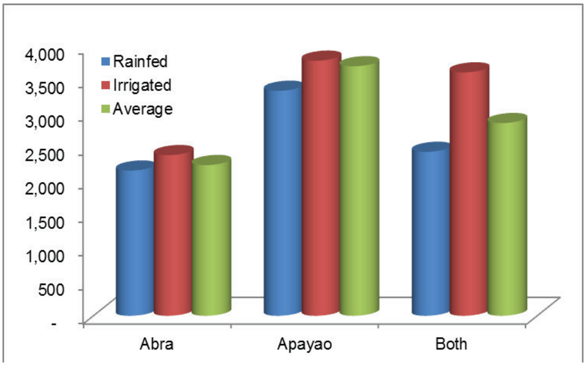

Figure 52. Average yield by ecosystem in Abra and Apayao.

Figure 53. Farm-to-market road in some marginal areas of Abra and Apayao.

Figure 54. Farmers in Abra and Apayao are still using animal-drawn farm implement in rice production.

Figure 55. Data gathering through focus group discussions and individual interview of farmer-respondents.

Gusto Namin, Milyonaryo Kayo: A Rural Transformation Movement
ACAguinaldo, LMdC Tapec, MJC Vives, RI Sibucao Jr and SV Briones

The Rural Transformation Movement (RTM) is an initiative that mobilizes various expertise, organizations, and resources to rally and catalyze rural transformation with PhilRice as the lead agency. The movement's goal is to improve farmers' economic as well as social and environmental well-being. Carrying a tagline Gusto Namin, Milyonaryo Kayo, RTM particularly takes a challenge of achieving 1-M gross income per hectare per year through a combination of best practices in rice-based agriculture. It will not only intend to make farmers economically well-off but it will also nurture them with good values, such as community sharing, working for a common good, and respect for the environment. But unlike the conventional agricultural development programs, this campaign is behavioral change driven rather than a mere technology transfer. It also uses 'change intervention' over 'technological intervention' to encompass its holistic approach aimed at addressing both technical/technological and psychological constraints of the target population towards rural transformation. The campaign specifically aims to enhance farmers' perceptions, attitudes, practices, and life chances with rice-based agriculture as a driver for inclusive and sustainable growth in rural farming communities.

Highlights:

- A briefing on RTM was held at the PhilRice Auditorium on December 12, 2014.
- The briefing was participated by 120 LGUs, farmers, researchers, professors and media personnel of Ilocos Norte and few from Ilocos Sur.
- Two (2) farmers (Mr Rafael Abaya of Candon City, Ilocos Sur and Mr Romeo Ganiron of Batac City, Ilocos Norte) were also invited to share their experiences on how to possibly to attain 1 million per hectare per year. They thus, challenge their co-farmers to take the risk in venturing on different farm enterprise to attain the goal.
- The briefing also included the acceptance of the challenge "Kaya Natin Maging Milyonaryo" by a group of farmers in Brgy. Nagbacalan, City of Batac, Ilocos Norte.
- A commitment wall was signed the participants to strengthen the pledge of "Kaya Natin Maging Milyonaryo
- RTM collaterals like T-shirts were also distributed to the

participants as part of the social awareness campaign of the movement.

One-Stop Information Shop (Promotion of Rice and Rice-based Knowledge Products)
AC. Aguinaldo, MB. Alupay, LCS. De La Cruz

Highlights:

The promotion of rice and rice-based knowledge products and services was carried out in five activities this year. These activities conducted were as follows:

1. Usapang Milyonaryo" Broadcast and other Media
2. Responsive Provision of PhilRice Knowledge Products
3. Mobilizing Knowledge for Increased Awareness and Adoption
4. PhilRice Batac Service Express
5. Maintenance and Improvement of the PhilRice Batac Museum

- "Usapang Milyonaryo" Broadcast and other Media

- 1317 farmers enrolled
- 16 broadcasts aired over Bombo Radyo DVR Laoag from June 29-October 19, 2014
- 9 LGU partners and 6 LGU broadcast focal persons
- Broadcast content:
    a. 7 episodes of the dramatized and Iluko version of the "Adventures of Gabby Ghas"
    b. 3 outstanding farmer-leaders featured
    c. 6 LGUs aired their projects and accomplishments
    d. 16 different rice production technologies/topics were discussed by 9 experts who were invited to the broadcast
    e. Immediately responded to queries.
- Outstanding broadcast enrollees recognized during the Stations' field day
- As to feedbacks based from text messages received, 30% were queries while 70% were in answer to aired question of the day. Submitted news articles to different media outlets.

- Responsive Provision of PhilRice Knowledge Products
- 2 exhibits attended (Batac City Farmers' Festival and Cordillera Month Celebration);
- 14 students underwent On-the-Job Training,

- 86 ATs, MAOs and farmers trained (establishment of demonstration farms, data gathering and analyzing data, mushroom production);
- 51 visitors of the station coordinated their visit and provided briefing;
- 214 farmers and other stakeholders served in 5 requested briefings 1 training module for a months' OJT written, ready for critiquing;
- organized a quick response team to conduct requested briefings and trainings;
- started cataloguing the books at the PhilRice library based from the program provided by CES;
- POT for Upland Rice Production written;
- Translated to Iluko dialect the book, "Adventures of Gabby Ghas", published; produced and distributed different production technology and PhilRice services leaflets.

• Mobilizing Knowledge for Increased Awareness and Adoption
- 3 activity sites: Brgys Tamdagan, Esperanza and Bago, Vintar, Ilocos Norte.
- 132 farmers attended the briefing, and baseline survey (Brgy. Tamdagan (90), Bago (19), Esperanza (23)
- 1 rice production technology roving and briefing conducted

• PhilRice Batac Service Express
- 574 farmers and other stakeholders from various locations in Region 1 and CAR served through the activity
- 10 PhilRice Express briefings conducted
- Modified Dry Direct Seeding technology demonstrated as requested by farmers who attended the activity;
- Paved the way for the selling LCC and quality seeds;
- Renewed linkage with LGU Flora, Apayao
- About P58,200 saved funds for implementing the activity as LGUs paid for the snacks and meals of participants and other logistics

• Maintenance and Improvement of the PhilRice Batac Museum
- Constructed a traditional "bangsal" storage of home and farm tools depicting the traditional farm family and the collection of traditional farm tools of the station are emphasized. Additional farming tools collected included "kuribot", tabas and sangol.

- Technology flipcharts on Good Agriculture Practices (GAP) were also displayed for easier access of clients
- 64 students and other clients visited the museum and library.

Feedback Mechanisms for the Services Provided by the One-Stop Information Shop of PhilRice Batac
BM Catudan, NI Martin, CT Dangcil

PhilRice as a research and development entity continually promotes a wide range of knowledge products, information and services to its clients. Measures have to be performed, however, to ensure that the modalities used are effective strategies in transferring information, technology, and skills to recipients. Assessment of these modalities helps identify strengths and weaknesses of each, elements that can be immediately discarded, areas that can be further improved, and strategies that passed standards and can be fully employed. In this context, this study intends to assess and evaluate the performance of research and development projects and activities set up in the station.

Highlights:

- The study assessed effectiveness of the "Usapang Milyonaryo" radio broadcast as a modality in technology promotion and information dissemination on rice production.

- From the 363 enrolled listeners from 6 municipalities of Ilocos Norte, 55 who both took the pre- and post-test served as respondents.

- Overall, the radio broadcast resulted to gained knowledge among 74% of the respondents based on the raw scores from the tests.

- The topics where knowledge was most improved were on golden apple snail management, identification of insect pests, recommended fertilizer application and land preparation.

- Topics that require more focus in succeeding similar techno promo activities include: difference between a disease and nutrient deficiency, recommended number of seedlings hill-1 for inbred varieties, recommended age of seedlings for transplanting, and recycling of own seeds.

- Some topics need modification on the delivery that caused decreased in knowledge of respondents. Modality used in the campaign must be reviewed to attain a higher impact of technology transfer to the farmers.

Table 56. Number of enrolled respondents per municipality who took the examination on rice production of the 'Usapang Milyonaryo Radio Broadcast', 2014.

Municipality	Pre-Test	Post-Test	Both
Bacarra	36	32	-
Currimao	-	19	-
Dingras	87	34	32
Paoay	39	8	6
San Nicolas	177	20	17
Vintar	24	-	-
Total	363	113	55

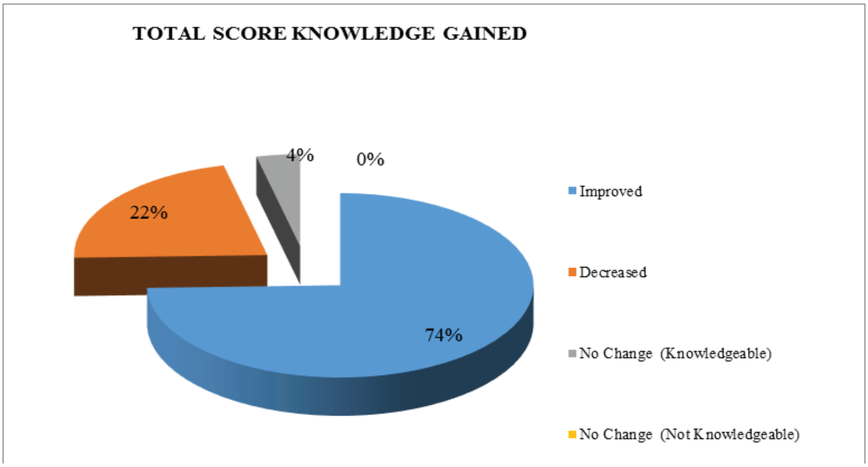

Figure 56. Total knowledge change on the score of 55 enrolled respondents at Usapang Milyonaryo radio broadcast, October 2014.

Database Management of R&D Outputs of PhilRice Batac

BM Catudan and LMdC Tapec

PhilRice Batac, after more than a decade of operation, has generated voluminous R&D outputs, information, and photographs. These are scattered, however, as they are stored and maintained by the concerned staff in their respective computers. This existing file retrieval system caused inefficiency as so much time is spent in seeking the needed files, especially if the files being sought had been maintained by staff that already left PhilRice. Hence, this activity was conceived to consolidate all R&D outputs and documents of the station since the start of its operation, and systematize and improve the efficiency to increase efficiency of file storage and retrieval. The PhilRice Batac Information System (PBIS) database program was constructed specially to store R&D data and documents. Official photos of the station were separately stored in the Adobe Lightroom software.

Highlights:

- A total of 332 technical reports of studies conducted by the station including papers presented in local and national forum, branch accomplishment reports and annual field day reports from 2001 to 2013 can now be accessed in the PBIS.

- Details of the 118 trainings, 59 briefings, 31 field days, 31 cross visits, and 10 workshops conducted by the station from 1999 to 2031 were also uploaded in PBIS. The database record of each techno promo activity also includes the name and profile of participants.

- Publications uploaded include 20 brochures, 41 coursewares, 2 flipcharts, 11 matured technologies, 6 news articles, and 38 posters.

- The 577 e-copy of research literature downloaded from the internet by station researchers were pooled and included in the PBIS. This will allow sharing technical references among researchers and save efforts from searching duplicate documents from the internet.

- The catalogue of the station's library materials was also uploaded in the PBIS to ease searching of references from the PhilRice Batac Library. The index of 1,276 reference material can now be accessed in the PBIS.

- Research data of 48 studies conducted at the station were already uploaded in the PBIS.

- The Adobe Lightroom photo database contains 46,330 photos of R&D studies and station activities. Each photo was properly tagged to facilitate searching of picture files of interest. The tags also acknowledge the owner of each whenever possible.

- The e-file of the PBIS user's manual has already been finalized. It will be included in the PBIS database system as a clickable button by 2015.

Assessment of the Financial Performance of the Integrated Rice-based Agri-bio Systems Project of PhilRice Stations
BM Catudan and LMdC Tapec

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 an efficient farming system that can be later duplicated by farmers in actual realm.

Measures have to be performed, however, to ensure that these R&D outputs are viable before they reach their eventual users. Profitability has always been the ultimate element whether a particular technology, enterprise, or farming system will be accepted by the target client. A farmer is willing to change his existing practice only when the expected monetary benefit exceeds that of his current one.

In this context, this project intends to assess and evaluate the financial performance of the IRBAS project of each PhilRice station. Profitability indicators used in the financial analysis of the station business plans include gross profit, net income, gross margin, and breakeven price and production (for single product enterprise only). Gross Profit is obtained by deducting material and labor costs from revenues. Net Income is gross profit less overhead cost. Gross Margin is the ratio of net income and revenues. Breakeven Price is the cost of producing one unit of output, or the minimum selling price of the product to be able to cover the cost of production. Breakeven Production is the minimum output level to be able to cover the cost of production.

Highlights:

- The business plans of PhilRice stations for their respective IRBAS projects in 2014 were consolidated and analyzed. The core component enterprises of IRBAS project in each station are rice production, mushroom production and vermicomposting. Nevertheless, some stations included other crops, livestock and fish depending on the suitability of the enterprise in their locality. The rice component in some stations was likewise integrated with duck production. A few stations had more than one type of mushroom (Table 1).

- The aggregate target gross income of the stations for 2014 (Table 2) varied according to their effective area.

V. Intensified Rice-Based Agri-Bio Systems

Project Leader: Fidela P. Bongat

PhilRice Batac is evolving into a self-propelling nucleus-estate type whereby an integrated, intensified, and diversified (or dynamic) farming had started to showcase. This Intensified Rice-based Agri-biosystem (IRBAS) Program integrates different technologies from rice and rice-based crops, and from waste utilization into food and fertilizer production which are necessary for maximizing the contributions to overall rice productivity of the limited landholdings. Income optimizations with crop mixes were considered key points in implementing this through improved cropping system and management practices, reduced farming costs, increased value of produce, recycling and adding value to rice and rice-based by-products, thus providing additional employment and sources of income from the rice environment.

The IRBAS Project at PhilRice Batac ventured in three enterprises namely: Rice-Corn-Mungbean Cropping System, Oyster Mushroom Production, and Vermicompost Production. The project aimed to develop a model or models that can increase farm productivity and profitability of the rice environment.

Enterprise 1 – Rice-Corn-Mungbean Cropping System

LG Inocencio, JA Orcino, NQ Abrogena

In rainfed areas such as the Ilocos water scarcity is probably the gravest problem. Dry spells become longer while rainfall is dumped in only a matter of days. Hence, the need to identify crops and varieties that can provide profit despite limited water for irrigation. This study aimed to develop and assess the profitability of rice-corn-mungbean cropping system.

Highlights:

- The enterprise was established in a 2.0ha farm that ventured in four sub-components: (1) rice seed production; (2) glutinous corn seed production; (3) glutinous green and grain corn production; and (4) mungbean seed production.

- The rice seed production enterprise produced 7,415kg registered seeds of PSB Rc82 and NSIC Rc160 sold at PhP42.50/kg.

- The glutinous corn seed production enterprise produced 845kg glutinous corn seeds (IES Glut 4) sold at PhP50.00kg, 3,532 ears of corn sold as green corn at P3.00/ear on "pakyaw" basis where buyers do the harvesting, and 2,486kg of glutinous corn grain sold at PhP15.50/kg.

- The mungbean seed production enterprise produced 175kg of mungbean seeds sold at PhP80.00/kg.

- The rice-corn-mungbean enterprise produced a gross income of PhP420,500.00, the production cost incurred was PhP183,670.00 and an overhead cost of PhP116,130.00, thus,earning a net income of PhP130,700.00.

Enterprise 2 – Oyster Mushroom Production
EP Agres, LG Inocencio, CS Cabanog, FC Diza

Oyster mushroom (Pleurotus sp.) is an excellent substitute for animal protein of farm families. Production of oyster mushroom utilizes and adds value to farm wastes such as rice straw and corn stover. These farm wastes are presently disposed of by majority of farmers through burning which pose hazard to environment. Thus, using these as substrate for mushroom production can provide livelihood or can generate employment. It takes 67 man-days to complete the production cycle from collection and preparation of farm wastes into bagging, pasteurization, inoculation, incubation until harvesting and marketing the produce. Approximately, 128 fruiting bags can be made produce mushrooms in a span of three months. Farmers with small landholdings or even the landless can grow the mushroom. This enterprise aims to increase income and improve nutrition of farm families from the rice environment, and showcase oyster mushroom as a viable enterprise.

Highlights:

- The PhilRice Batac mushroom center was established early this year by converting several rooms at the basement of the NTA-PhilRice building into a laboratory, preparation area, and temporary fruiting rooms.

- The mushroom enterprise produced 6 products of which the first 3 were not sold but was vital in the production of the succeeding 4 products which were usually for sale:
  - Tissue culture or pure culture of oyster mushroom was produced using the potato sucrose gulaman (PSG) media. Four liters of PSG was prepared and successfully produced 20 flat bottles of pure culture and 25 bottles of sub-culture which were used to inoculate 7 kilograms of grain spawn.
  - Grain spawn is the "seed" or planting material for oyster mushroom production. Palay grains were used as base of the grain spawn. In 2014, 7kg of grain spawn were produced that were able to inoculate 4,000 fruiting bags.
  - A total of 5,000 fruiting bags using rice straw, corn cobs and sawdust were produced. Each bag contained 1.2 to 1.4 kg substrate and was sold at P40.00 each.
  - Fresh oyster mushroom is the reproductive stage of the mushroom that is edible and sold to consumers immediately after harvesting. The project produced 258kg fresh oyster mushroom.
  - Air-dried/sun-dried oyster mushrooms are the mushrooms that were not harvested on time particularly those during weekends and the total production was three kilograms. A kilogram of fresh mushroom when dried weighed 200 grams only.

- The mushroom enterprise that started in April attained three cycles of production.

- The first and second cycles of production utilized rice straw + sawdust (70:30) as substrates, while the third utilized corn cobs + sawdust (70:30). There was 8% contamination with Trichoderma in substrates containing corn cobs + sawdust, and 59% in corn cobs alone when pasteurized at the conventional 80 to 85^{0}C temperature inside the pasteurization chamber or in our case, the steel drum. This observation led us to increase the temperature from 85 to 95^{0}C for 6 hours when using corn cobs as substrate.

- The cost of the expendable materials to produce the outputs totaled to PhP7,463.00. More than 50% of the material cost was used to purchase the polypropylene plastic bags.

To lessen the cost for the next cycle of production, the recommendation is for other brands, thickness and/or size of plastic bags that can be pasteurized may be procured.

- The enterprise needed a total of 41 mandays to operate the three cycles of production. It needed the skills of a laboratory aide to produce planting materials or grain spawn and an experienced and efficient laborer to prepare the farm wastes as the substrates for oyster mushroom. Activities that needed the longest mandays included bagging of substrates (16 mandays), pasteurization (6.5 mandays), and inoculation (6 mandays). The total cost for manpower was PhP9,500.00

- The length of harvesting period in the first cycle was shorter (two months), compared to six months in the second cycle. Contributory factors may include the increased volume of substrate per bag, and the effect of the CRH placed under the fruiting bags that absorbed the moisture during mist application which in turn maintained higher humidity required for fruiting.

- Total production for the three cycles as of December 8, 2014 totaled to 258kg fresh and 3.25 kg dried oyster mushroom from the 3,917kg substrate, giving an average of only 13% biomass conversion, although this will still increase pending the additional harvests from the third cycle. A kilo of fresh oyster mushroom was sold at PhP200.00 from May up to the second week of August. The price was lowered to P150.00/kg starting August to the present time due to the increased supply. The present volume of production is just enough for demand of the employees of NTA and PhilRice and some local restaurants on occasional basis.

- All fruiting bags that were not harvested on time particularly those that matured during weekends were harvested the next Mondays and were either sundried or air-dried depending on the weather. A kilo of fresh oyster mushroom when dried weighed 225g.

- Matured fruiting bags (144 bags) were sold at PhP40.00 each to walk-in clients and visitors of the station. Grain spawn (40 bottles at 250g) were used by the project and sold at PhP100.00/250g bottle to local producers trained by the station.

- The mushroom enterprise produced a gross income of PhP52,165.00 but incurred a production cost of PhP16,940.00 and an overhead cost/annual depreciation of fixed assets amounting to PhP5,770.00, hence, a net income of PhP29,450.00.

Enterprise 3 –Vermicomposting
CS Cabanog, EP Agres, FC Diza

Rice straw does not easily decompose. The widespread burning of crop residues such as rice straw, corn cob, corn husk, and corn stalk increase carbon dioxide emission and aggravate global warming, and the improper discharge of livestock wastes into water bodies causes pollution.

Chemical fertilizers contribute largely to the deterioration of the environment through depletion of fossil fuels, generation of carbon dioxide (CO2), and contamination of water resources.

To fully harness the benefits of vermicomposting, this enterprise aimed to enhance resource-use efficiency in the rice environment through making farm wastes and other trashes into cash instead of burning them, thereby increasing farm income; help supply organic fertilizer needs of the station and nearby farmers; and showcase vermicomposting as a viable enterprise that can help increase employment in the community.

Highlights:

- The vermiculture and vermicomposting enterprise used the African Night Crawler, Eudrilus eugeniae as the vermicomposter. It produced organic fertilizer from partially decomposed organic materials that are available in the locality such as rice straw, corn stover (corn cobs and husks) and animal manure.

- The organic materials and animal manure were piled and predecomposed (30:70) prior to providing these as bedding to the vermiworms. The temperature of the pile was monitored regularly and upon reaching 25^{0}C and below, the substrate was filled into the vermibins.

- The enterprise produced 4,180kg vermicast and 66kg vermiworms. The vermicast was packed at 50kg/bag and sold at PhP400.00/bag. The increase in volume of the vermiworms from the original stock was valued at PhP300.00/kg.

- The 4,180kg vermicast was produced from 1,791kg farm wastes and 4,180kg manure. The vermicast and vermiworm productionhad a biological efficiency of 70% and 400%, respectively.

- The vermicast was used mainly as organic fertilizer for rice, corn, garlic, and vegetable production of the station's BDD and on-station Palayamanan. It was also used on experiments particularly in mineralization, seedling media, and vermitea for hydrophonics.

- Vermicomposting has low capital investment since the production materials are mainly agricultural wastes. The initial stocks of 15kg of vermiworms and 100 pcs of plastic sacks used as packaging materials were the only production materials used with a total value of PhP5,300.00.

- The labor requirement for the three cycles of production was only 33 days. Activities included the collection of agricultural wastes, harvesting and packing of vermicast with a total value of PhP7,600.00. With the labor requirement, we can say that the production of organic fertilizer using vermiworms is easy, thus, can be a joint activity of family members.

- The vermicomposting enterprise produced a gross income of PhP53,258.00, incurred a total production cost of PhP12,867.00 and overhead cost/depreciation of fixed assets amounting to PhP2,675.00, thus, gaining a net income of PhP37,716.00.

Assessment of Mature Technologies Developed by PhilRice Batac
BM Catudan, NI Martin, CT Dangcil

PhilRice as a research and development entity continually develops and improves technologies, techniques, and technology promotion modalities. Although some technologies are technically feasible, measures have to be performed, however, to ensure that these R&D outputs are viable before they reach their eventual users. This study aims to operationalize the said protocol so that eventually PhilRice can form its own technology assessment team to evaluate whether a technology is ready for wide-scale promotion and commercialization.

Highlights:

- The mature technologies developed and promoted by PhilRice Batac that were prioritized for technology assessment were the following: bamboo bin dryer, brush cutter harvester, Low-cost Drip Irrigation System (LDIS), Modified Dry Direct Seeding

Technology (MDDST) or Dry Direct Seeded Rice (DDSR), panicle thresher – corn sheller, and saline rice varieties.

- Technical reports of these mature technologies were obtained from the database system of the station, the PhilRice Batac Information System (PBIS). Likewise, information on the year, location, and recipients of promotion of these mature technologies were consolidated. These documents shall serve as secondary references materials when the assessment shall be performed.

- During the mid-year reporting, however, it was agreed among PhilRice management, project leader and branch stations that mature technologies to be evaluated are synchronized institute-wide. Hence, the technology assessment activities of PhilRice Batac were limited to consolidation of all available pertinent documents of the technologies planned to be evaluated.

Figure 57. The mature technologies developed and promoted by PhilRice Batac; (a) Low-cost drip irrigation system (LDIS); (b) bamboo bin dryer; (c) brush cutter harvester.

Clean, Green, Practical and Smart On-Farm Learning Center
AC. Aguinaldo, SV. Briones, JM. Santiago, RI. Sibucao Jr.

Ensuring more food output from the same unit of land, and at the same time protect the soil and the environment from further degradation due to intensive crop cultivation is one of the main concern in researcn and development (R&D). Similarly, the burgeoning population and continuing conversion of prime rice lands for other purposes pose an enormously difficult challenge of producing more food from shrinking and less fertile lands. This scenario is doubled by dwindling supply and rising cost of petroleum – based products from farm fuel, pesticides, and fertilizers. The escalating production costs at the farm level is eroding the potential income and profit of farmers.

A paradigm shift is needed in our agricultural efforts to help achieve the food security and sufficiency. Our common ways of rice farming should be revolutionized, transformed, and metamorphosed to alleviate the bottlenecks in food production and delivery. Furthermore, to address these problems and create opportunities for economic growth and development in the countryside, Philippine rice-based farms must be transformed into competitive, sustainable, and resilient agri-biological production systems. One key element to realize this is through integrated and diversified rice-based production systems wherein demonstrations and deployment of these technologies and systems will be carried out in an on-farm learning center or area.

Field demonstrations, aptly named on-farm demonstrations, of new or innovative practices carried out on actual farms have long been a key hallmark of program delivery and teaching in extension work. These on-farm demonstrations gained the confidence of farmers who toured the farms, and has led to successful growth and development of the extension system. Such farm based demonstrations are being used extensively in extension work in other countries as a means of showing and telling farmers exactly what a new or innovative practice is and showing how it will fit under local conditions. Soil types, fertility levels, climatic conditions such as frequency, amounts and periods of rainfall, availability of inputs or their applications, knowledge levels of the farmers and extension workers, available infrastructure and many other factors all come into play when on-farm demonstrations are considered as a program delivery method.

The Philippine Rice Research Institute , Central Experiment Station launched a Clean, Green, Practical, and Smart On-farm Learning Center (Clean GPS On-farm Learning Center) for farmers, student-trainees, AEWs, partners / stakeholders and even to local, national, and international farming communities, to more intensive learning experiences in the field of sustainable and resilient agriculture.

The Clean GPS On-farm Learning Center, which is primarily used to demonstrate integrated and diversified rice-based production systems, will provide experiential learning opportunities to learners or trainees (i.e. farmers, student-trainees, others) to various on-farm options or components. The farm options or components refer to the fundamentals / elements or composition of the whole production system as envisioned in the Clean GPS On-farm Learning Center. It aims to achieve a holistic and comprehensive technology packages and developing alternative inputs to come up with sustainable and cost-effective rice and rice-based farming systems while preserving our natural resources.

Highlights:

- Under the Rice Relay set-up, the six stages of the rice crop was established and became the learning field of 42 boot campers, 12 OJTs, and the home learning field of 21 participants to the Four-Month Observation Course for Rice and Rice-based Farming Systems for AEWs and Farmers in Region 1 and CAR. Hence, a total of 75 trainees had their hands-on experience at the Learning Center.

- A total of 789 field day participants and 51 visitors also had a chance to observe the stand of the crops in the Learning Center.

- The Rice-Garlic-Corn-Mungbean Relay set-up is still ongoing. However, the transplanted rice was a better yielder compared to the rice established through the Modified Dry Direct Seeding Technology.

- On the tilapia pond refuge, 10 kilos were harvested from a 10 square meter pond, giving a farmer a net income of 105.00.

- A total of 75 trainees had their hands on farm machineries also to include the four wheels, the riding type tractor, the hand tractor and the brush cutter harvester.

- Twelve AEWs, 8 farmers and 1 student of ASIST participated in the Four-Month Observation Course which utilized ICT as major modality. From the 21 trainees, 4 were able to establish their demonstration farm, 3 were able to conduct a FFS. Hence, the study is directly and indirectly helping 54 farmers in their respective localities.

- A total of 32 new graduates in agriculture and related sciences in Region I, Abra and BNATS in Aparri, Cagayan together with 10 farmer-leaders and barangay officials of Lidlidda, Ilocos

Sur attended the Rice Boot Camp. The farmers of Lidlidda were able to put up a project "Lidlidda Farmer University – Adal Para iti Amin" where 52 farmers participated in a Season Long Rice Production Training. The Field Day was attended by 224 farmers from the municipality and nearby Burgos and San Emilio. The project is supported by the LGU and is now starting with Vegetable Production.

- On the Gulay Check Learning Center, a total of 75 farmers, AEWs and OJTs had their hands on training. A cucurbit and solanaeceous crop showcase was established. Fruit trees and medicinal plants are also maintained.

Enhancing Knowledge Exchange and Decision-Making among Rice Stakeholders through the Development and Promotion of Location-Specific Rice Knowledge Products and Delivery Systems (CVP Phase 2)

AC Aguinaldo, BM Catudan, LJ Barroga, SV Briones, A C Bondoc, MA Sibucao, BA Pajarillo, HJ Agngarayngay, RValdez,RDacones, ERiñen, B Daculan, M Gappi, N Atuan, R Opelac, OPastor & N N Rigonan

The use information and communication technology (ICT) is found to be an effective modality in transferring new and relevant rice knowledge and production technologies to farmers and other rice stakeholders. This was proven with the implementation of an ICT-based technology delivery system called the Open Academy for Philippine Agriculture (OPAPA) in 2003.
To further validate the effectiveness of the project, this was tested at the municipal level. The project provided a more realistic picture on the effects of ICT tools in improving the transfer of technologies that provided impact on farm yield.

The project aimed to further test and develop approaches in solving with the range of problems faced by farmers and identify how best to make these options more widely known at the village and municipal levels through the use of ICT. And more specifically, the project further studied the effectiveness of computer-based information and knowledge dissemination to rural farmers and extension workers at the whole municipal level.

The project was implemented in 4 barangays of Batac City, namely, Brgys. Rayuray, Quiling Sur, Baay and Baligat.

Highlights:

- 40 farmers were trained on Vermi Composting last March 27 and April 3, 2014 and each of the four barangays established their own vermin composting facilities.

- During the Farmers' Festival on May 1 to 7, 2014, the CVP farmers showcased their knowledge on computer operations and surfing the net in the conducted "Cybervillage Olympics". The activity featured competition among the cybervillages from dismantling the computer to bringing out recommendation from the Crop Manager for Rice and shown to other farmers the benefits of using ICT in solving farm problems. A total of 120 CVP farmers, non-CVP farmers, City Agriculture Office, IRRI and PhilRice Batac, City Government of Batac officials and SPES students joined the Cyber Olympics. Baligat emerged the Olympics champion during the activity.

- CVP participants can now assist local AEWs in downloading technologies in the internet especially in using the Rice Crop Manager for fertilizer recommendation, coaching other farmers in their rice production by assisting them derive information for ICT materials and had also experienced talking to world renowned scientist through web conferencing.

- Before the project ended, to ensure project sustainability, all the 4 barangays submitted their plans for its continued implementation.

National Irrigation Sector Rehabilitation Improvement Project Highlights of Accomplishment (2014)

BA. Pajarillo, Jr, DP. Ligayo, Jr.

Highlights:

- Conducted PFFS meeting in MADONGAN RIS and SOLSONA RIS.

- Established and supervised Participatory Demonstration Farm (PDF) cum Seed Production Area.

- Attended the End Season Review and Workshop.

- Attended the Training on PalayCheck System in PhilRice CES.

- Attended System Management Committee meeting of NIA.

- Accomplished monthly reports and other requirements needed.

Primer of the Rice Industry of CALABARZON Provinces
BM Catudan, NI Martin, CT Dangcil

The CALABARZON Primer is intended as a reference for planners and policymakers from the region down to the municipalities to find suitable ways to help rice farmers. This primer offers a standard analysis among the five provinces for unbiased comparison and provides a single reference that covers all the provinces in the region. The study aims to analyze the trends and growth in rice production parameters in the last two decades in each of the five provinces in CALABARZON and to provide probable reasons that influenced change that occurred over the years.

Highlights:

- An initial 850 copies of the regional primer was delivered to DA-RFO4a in 2014. The 250 copies balance was at the awarded printing press ready for delivery by the 2nd quarter 2015.

- The provincial rice primer for the 6 provinces of the region was prepared in 2014. Since the 1993 to 2012 data series of the provincial primer has been prepared in late 2013, the coverage years were adjusted to 1995 to 2014 to make the analysis more recent. Printing of the provincial primer is expected to be accomplished by the end of the second half of 2015.

VI. Upland Rice Development Program
Program leader: Ruben B. Miranda

Upland Rice Development Program in Ilocos Norte and Apayao (URDP)
Meljoy R. Gappi

The Department of Agriculture undertake an upland rice development program that will establish a community-based seeds system for traditional upland rice varieties and promote a “farming systems approach” anchored on sustainable agricultural practices. Thus it aimed to: promote sustainable farming systems and practices in the upland farming communities that will help farmers increase their yields and income; develop a sustainable models of locally organized Community-based Seed Banks (CSB) and a viable seed production system; capacitate the LGUs and Upland

Farmer Organizations in the implementation of Upland Rice Development Program; develop sustainable institutional collaboration and support in the planning and implementation of development program and interventions; Create and manage a data-based system in upland rice production in support to program planning and formulation of interventions and strategies

Highlights:
Component 1. Social Mobilization

- Consolidated the files of Upland Rice Development Program for Luna, Apayao and Pasuquin, Ilocos Norte from 2012-2014 and submitted to Ms. Hanah Mavi Manalo for the development of program document.

- There were three upland farmers organized, one in Cagandungan, Luna, Apayao which had 41 farmer members, and 2 in Pasuquin Ilocos Norte which has 77 upland farmers; while in Marag, Luna Apayao there was no upland farmer organization but had a 52 upland farmers.

Component 2. Rice Seed Assistance of Traditional and Modern upland Varieties

- A total volume of 300kg of upland rice was distributed in Pasuquin, Ilocos Norte as starter seed for the upland farmers' organization. Most preferred traditional variety in Pasuquin, Ilocos Norte were purified and seed produced for procurement as rice seed assistance of upland rice development program for 2015 wet season establishment.

- Two upland seed producers was identified from Ilocos Norte and Apayao, in Luna, Apayao, Mr. Gin-awa Agpuldo was chosen, while Mr. Genaro Maneja in Pasuquin, Ilocos Norte.

Component 3. Community-based Palayamanan in the Upland for Increased Productivity and Food Sufficiency

- Community-based upland Palayamanan were established in Apayao and Ilocos Norte, during the dry season. A small portion of the upland palayamanan was utilized in Marag, Luna, Apayao with seven kinds of vegetables were planted. In Pasuquin Ilocos Norte, three kinds of vegetables were planted in Santa Matilde and San Juan. Among the vegetables planted in Luna, Apayao, pole sitao gained the highest yield with 150 kilograms, while in Pasuquin, Ilocos Norte, only the garlic and onion yielded. Garlic provided high income to the community.

- During the wet season, rice was the main crop for the two province whole, vegetables and other crop were just planted within the perimeter of the area as additional source of food or income. Only in Apayao has a volume of harvest for other crop, corn gave high income of PhP15, 000.00.

- Conducted of modified season-long training in upland rice production and other Palayamanan components. Three farmers field school was conducted in Ilocos Norte and Apayao, with a total of 112 farmers who graduated from the FFS. Among of the site, San Juan, Pasuquin, Ilocos Norte has more female than male participants.

- Varietal trial of upland rice were established on May 15, 2014 in Marag, Luna, Apayao, while in San Juan, Pasuquin, Ilocos Norte was June 20 and June 24, 2014 in Sta. Matilde. In Luna, Apayao, three modern and two traditional varieties were tested, while in Pasuquin, Ilocos Norte, two modern and three traditional varieties were tested. Plant height and number of tillers of the varieties tested were different across location. Among of the five varieties tested, NSIC Rc9 consistently produce a higher yield. However in San Juan, Pasuquin Ilocos Norte, traditional upland varieties yield were numerically comparable to the modern varieties.

Component 4. Development and Packaging Sustainable Models of Locally Organized Community Seed Banking in the Upland

- There were two established community seed bank in Pasuquin, Ilocsos Norte with a total number of 72 farmer beneficiaries. Seed re-payment from the seed assistance were collected upon all the farmers finished harvesting their crop. The organization/association were kept safe the seeds and then distribute it again for the next season to other farmers who would like to avail. In all sites, there was no upland CSB mini-warehouse.

Component 5. Information and Communication Support

- Distribution of leaflets and other techno bulletins are of great help in the awareness campaign for the program. Thirty Technology bulletin of PalayCheck for upland rice farming were distributed in the covered site.
- There were 10 Placards and three billboards were installed in all sites. Name of cooperators and varieties tested in the

area with the Community-based Palayamanan billboards were strategically installed.

Component 6. Data-based creation and management

- Upland farmers and area planted were gathered from the first implementation of the project. During the pre-implementation of the project in 2012, there were 1,163ha of potential upland areas of Ilocos Norte. Only two municipality have validated upland farmers and upland areas, these are Nueva Era and Pasuquin, Ilocos Norte.

- In Apayao, Luna was the only area that is validated because it was the project site. It has a 582 upland farmers and has 380ha of upland area. The 2014 data gathered from the Ofice of Agriculture Services of Apayao has 6,778ha of upland rice production areas (OAS, Apayao). In Pudtol, Apayao alone, there were 738 upland farmers and 1,522 upland rice areas validated by Municipal Agriculture Office.

Component 7. Field Monitoring and Evaluation

- Documentation of field problems and best practices of upland rice farming were also done. Among the field problems that were documented, white grub infestation was emerging as one of the serious problems for upland rice cultivation.

Upland Rice Development Program in Ilocos Sur and Abra (URDP)
Jayson S. Baldoz

Highlights:
Component 1. Social Mobilization

- Organized upland farmers in each site but we only registered one upland farmer's organization in DOLE, which is the Tiagan Upland Farmer's Organization and Community Seed Bank Inc. With this, we will be able to facilitate CSB lightly with the help of MAO and Upland Technologist as monitoring team.

Component 2. Rice Seed Assistance of Traditional and Modern Upland Varieties

- Delivery and distribution seeds from CES and technical briefing was done in accordance to the URDP protocol of organizing CSB in Brgy. Tiagan, San Emilio, Ilocos Sur.

- A total of 482kg of assorted seeds from CES such as NSIC Rc11, NSIC Rc23, Dinorado and red rice was given to one of the LFTs (Armando Malangay) stored at his storage house. The seeds were distributed after the conduct of 1st meeting and orientation about the scheme of CSB of upland FFS (2014 WS). With the seeds distributed, those who availed the seeds and other FFS participants were encouraged to form an upland farmer's organization. Tiagan Upland Farmer's Organization and Community Seed Bank Inc. was formed through the support and supervision of San Emilio-Municipal Agriculture Office.

Seed Production and Procurement of Most Preferred Traditional Upland varieties

- Seed production and procurement of most preferred traditional rice variety was done in Ilocos Sur. Kinamuros and red rice were preferred. A total of 1500kg of the said varieties will be purchased from the supervised upland seed producer located at Tiagan, San Emilio, and Baringcucurong, Suyo, Ilocos Sur.

- Potential upland rice seed producer was identified but does not have training on seed production except on the topics included in the FFS and the supervision of UpTech.

Table 57. List of potential upland seed producer.

Region	Potential Upland Seed Producer	Farm Location	Area (ha)	Varieties
1	Gallardo Cultong	Tiagan, San Emilio, Ilocos Sur	1	Kinamuros

Component 3. Community-based Palayamanan in the Upland for Increased Productivity and Food Sufficiency

- Palayamanan is a very interesting component of URDP wherein you can see the participating farmers enjoy the new knowledge of farming integration and diversification they got from the FFS
- People understood the difference between mono-cropping and integrated farming. They are now starting to practice the

integration of different Palayamanan components such as utilization of organic inputs made from their farm by-products to their plants.

- Also Palayamanan allows them to showcase their farms to their fellow farmers. They do not want to be left behind, that's one reason, that's why they are now focused on keeping their own farm develops into an integrated farm.

- A total of 4 upland Palayamanan sites plus 1 under establishment (ATI-led) were made in San Emilio, Ilocos Sur while 2 in Abra from 2012-2014. Each site was partially funded by the ATI-RTC1 and was continually developed by the farmer-innovator/LFT.

Conduct of modified season-long training in upland rice production and other Palayamanan components

- This year, a total of 3 upland FFS was conducted. One of those were rice production, while the remaining three was about vegetable and other Palayamanan components. Of all FFS, 2 field days was conducted during the 2013 dry season and 2014 wet season.

Establishment of farmer-managed Palayamanan Model Farms

- In the establishment of farmer-managed upland Palayamanan, the three farmers (Armando Malangay, Julay Unggay, and Gallardo Cultong) at sites in San Emilio were convinced to continue the development of their farms even without the help of other funding agency. They are all LFTs aiming for a demo farm wherein they can showcase different upland farming technologies to their fellow farmers.

Development and packaging location- specific technology in Upland rice production

- In 2014 WS, a study on contour planting was conducted at San Emilio, Ilocos Sur. It was demonstrated to show a different type of upland rice planting that could help on reduce soil erosion for sustainable upland rice production in sloping areas.

Component 4. Development and Packaging Sustainable Models of Locally Organized Community Seed Banking in the Upland

- Establishment of Community Seed Bank has just started last 2014 WS and the collection of seed repayment is good. They still do not have their warehouse so the seeds were temporarily stored at Mr. Malangay's (LFT) storage house. CSB is managed by the upland farmer organization (TUFOCSB Inc.) led by the President Mr. Sabino Pambalan.

Component 5. Information and Communication Support

- Distribution of URDP bulletins was done during the implementation of the program in Ilocos Sur.

- Billboards and placards strategically installed at the Provincial level and Palayamanan sites.

- Billboards and placards were put up in the Palayamanan sites near the roads.

Component 6. Data-based Creation and management

- Data-based some basic Information on Upland Rice Development Program

Component 7. Field Monitoring and Evaluation

- The implementation of the program was monitored by the stakeholders such as ATI and RFO.

- During FFS sessions, experts from MAO and PhilRice were able to give technical assistance

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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