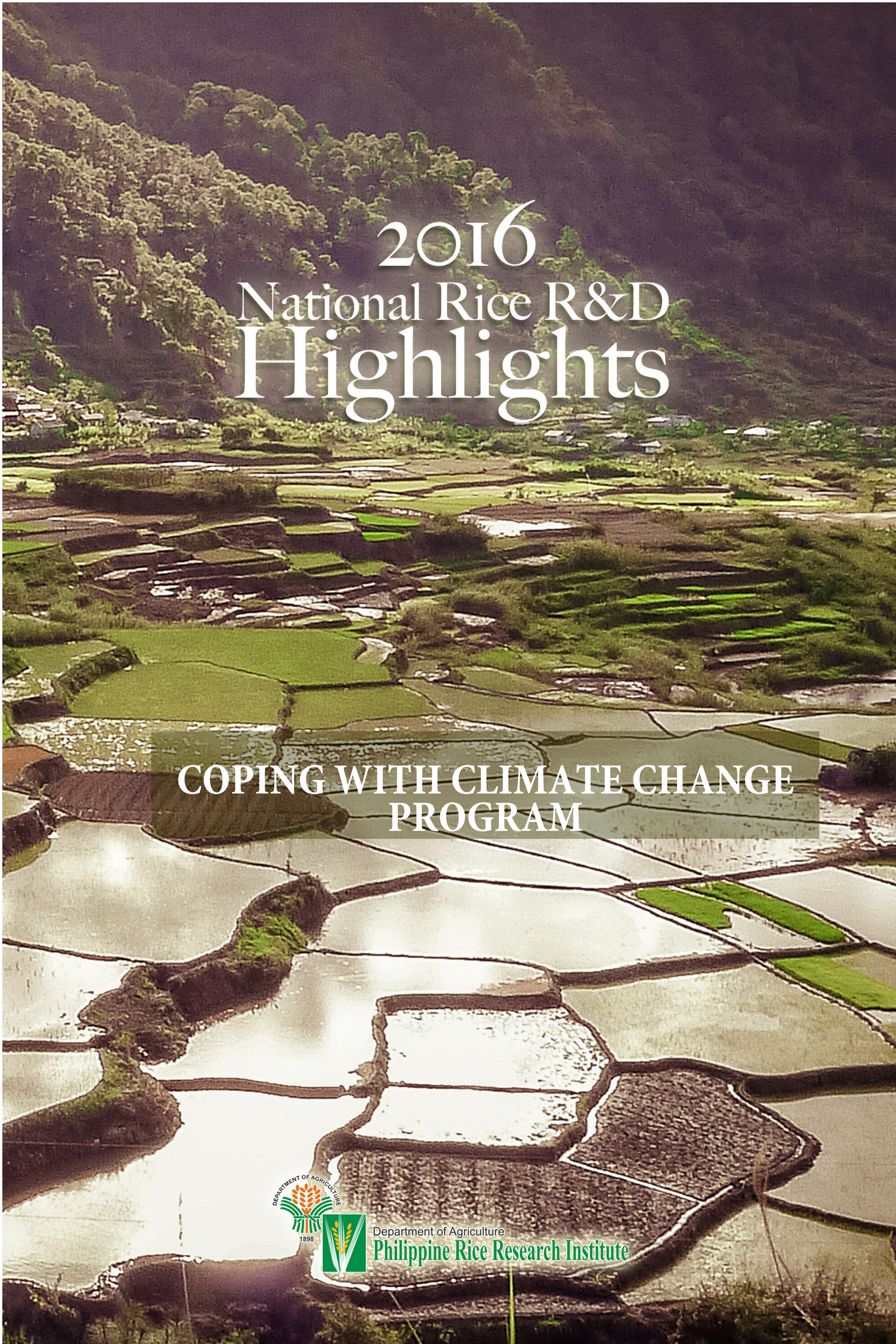

2016 National Rice R&D Highlights

COPING WITH CLIMATE CHANGE PROGRAM

Department of Agriculture
Philippine Rice Research Institute

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Coping with Climate Change Program

Program Leader – Ricardo F. Orge

Executive Summary

A total of eight studies under three projects were implemented in 2016. All of them, except one, will be in continued 2017. Although the program experienced budget deficiencies, some adjustments had been made so that generally the targeted outputs for the year 2016 were still delivered. Among the notable outputs of the program are the following:

1. An insect growth chamber had been locally developed which enabled the conduct of experiments on determining the behavior of white stem borers and their natural enemies at rising temperature (2oC higher than ambient). Initial results showed that increasing temperatures may have negative effects on beneficial insects such as hymenopterans and small predators. This however is still to be verified in the succeeding experiments to be conducted;

2. The growing degree-days (GDD) of a rice crop had been studied to see if it is an accurate basis of describing the phenological stages, now that climate change is being felt. Based from published maturity periods of the selected inbreds, some discrepancies were observed between the two bases of phenological stages;

3. Optimal planting dates for Ilocos Region based on recent agro climatic indices for rice and rice-based crops is near to be determined. A prototype planting schedule is currently under validation;

4. To protect farm investments against possible damage due to strong typhoons, another study attempts to lower down the cost and skill requirements of constructing a typhoon-resistant farm structure. The construction of the second prototype of the multi-purpose farm structure is on-going and is expected to be completed within the first quarter of 2017;

5. The capillarigation system, a do-it-yourself type of irrigation system for rice-based crops developed for small-holder farmers especially during incidence of El Niño is on its final stage of development. Results of field tests showed that the system works under actual operating conditions. Follow up field trials will be done in 2017 to compare the performance of the system with that of the commercially available drip irrigation system;

6. Under a study geared towards enhancing the climate change resilience of farmers in a flood-prone area in CARAGA Region through diversification of the source of income, weaned piglets were dispersed to 20 members of a community for fattening which will be returned to the sponsoring organization after 6 months. This intervention has shown signs of

sustainability as the results of the 9-month monitoring showed that 14 farmer-beneficiaries have paid back to the association PhP2,100.00 (weaned piglet price), totaling Php29,400.00. Currently, new set of 14 members of the association have availed the second rolling of weaned piglets;

7. For the same purpose of enhancing the climate change resilience of farmers by providing them additional income opportunities, a new and improved prototype of carbonizer-attached mushroom pasteurizer was fabricated, featuring a steam generator that is installed outside the pasteurization chamber which allows other uses of the heat for food processing activities when mushroom bag pasteurization is not to be carried out;

8. The technology on rice-duck farming was further enhanced through the integration of azolla. The yields of treatments with azolla and ducks were comparable with the yield obtained from the recommended fertilizer rate of 120-40-40kg NPK/ha during DS. The highest net income of P 95,625.50/ha was derived from Rice+Duck (PhP81,239.50 net income from rice and PhP14,386.00 from duck production). The income from the Rice+Duck+Azolla and Rice+Azolla was slighly lower than the Rice+Duck production system but comparable with the income derived from the RFR. The results of the study also suggests that the integration of azzolla could help solve the problem of increased GHG emission in rice+duck farming system.

I. Generation and management of local knowledge and information on climate change

Project Leader: AO Capistrano

This project houses all the basic researches conducted under the Program. Its outputs are information as well as technologies that would help contribute to the generation of new knowledge and understanding on the science of climate change. It is expected that these outputs would serve as inputs for researchers in generating sound research proposals geared towards helping farmers respond or adapt to the negative effects of climate change.

Impact of Increasing Temperature on Rice Insect Pests and Natural Enemies

GS Rillon, CCB Encarnacion, MJPS Ancheta, and JG Tallada

With climate change, it has been estimated that there will be an increase in temperature that could influence behavior, development and interaction of insect pests and natural enemies. It was estimated that some insect pests might increase while naturally-occurring biological control is expected to become a more important control tactic in the future because

natural enemies may have faster potential growth rate. Warming might also have a negative effect on some natural enemies such as hymenopterans and small predators. Understanding the impact of climate change to insects pests and their natural enemies is very important in preparing for and adapting management strategies against pests that may become established due to changes in the environment. This study aims to determine the effect of increasing temperature on biology and interaction of insect pests and natural enemies and suggests pest management strategies in preparing for and adapting to climate change.

Activities:

- Fabrication of the insect growth chamber (Figure 1) and conduct of preliminary testing

- Yellow stemborer egg masses were collected in the field and exposed to ambient temperature and inside growth chamber, +2°C above ambient temperature. Egg hatching and parasitoid emergence were observed and recorded.

Results:

- Results showed that when egg masses were exposed at additional 2°C temperature, egg hatching and parasitoid emergence decreased while egg masses that did not hatch increased (Figure 2). This indicates that an increase in temperature may have detrimental effect to stem borer and its parasitoids.

- It was also observed that stem borer egg hatching and emergence of parasitoids were prolonged with the rise in temperature.

- For next year, more trials will be conducted to verify these observations. Moreover, experiments on the influence of temperature on rice planthopper and its major predators will be conducted.

Figure 1. The locally fabricated insect growth chamber.

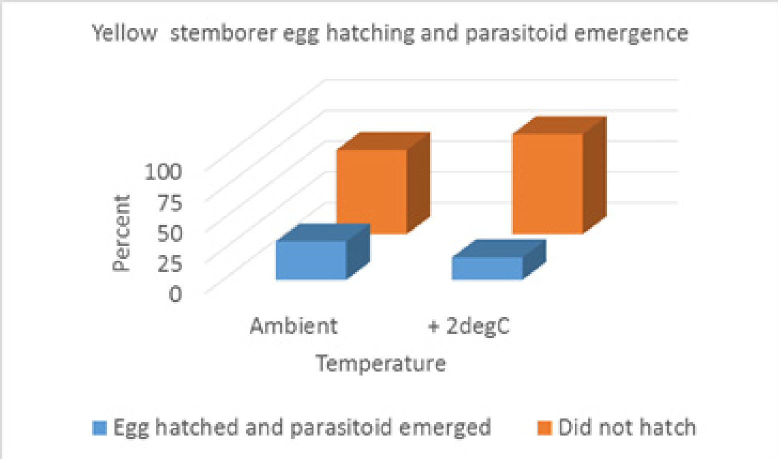


Figure 2. Yellow stem borer egg hatching and parasitoid emergence.

Identification of the Growing Degree-Day (GDD) Requirements at Different Phenological Stages of Public Hybrid Rice Parentals and Other Inbreds

AOV Capistrano, JJE Aungon, and JEG Hernandez

The growing degree-days (GDD) of a crop is a more specific basis of phenological stages than the number of departure days from the date of planting. Now that the earth is under a period of climate change, information of the GDD requirements and its optimization is particularly useful as surface temperatures become warmer and crop durations become shorter. Shorter physiological maturities also mean shorter phenological stages which could have serious implications in terms of farm management operations since execution of most farm operations are based on phenological stages of the crop. In rice, fertilizer management is one example of a farm operation dependent on the crop's phenology. Although, it can be argued that not-so-accurate schedules of fertilizer applications would only result in minimal yield losses however, the importance of knowing the accurate phenological duration cannot be undervalued in hybrid rice seed (F1) production. Synchronization of the flowering time is perhaps the best application of information regarding accurate phenological stages because unsynchronized flowering between hybrid rice parental spells disaster in hybrid rice seed production hence, the need to accurately identify the phonological stages of the rice crop.

Activities:

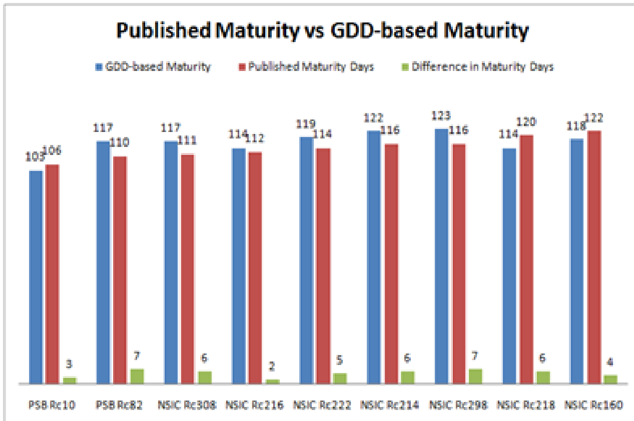
- Coordination with the Business Development Office (BDD) of PhilRice CES. Data from Selected cultivars planted by the BDD in 2015 and 2015 were used in this study.

- Agronomic and temperature data collection towards GDD identification.

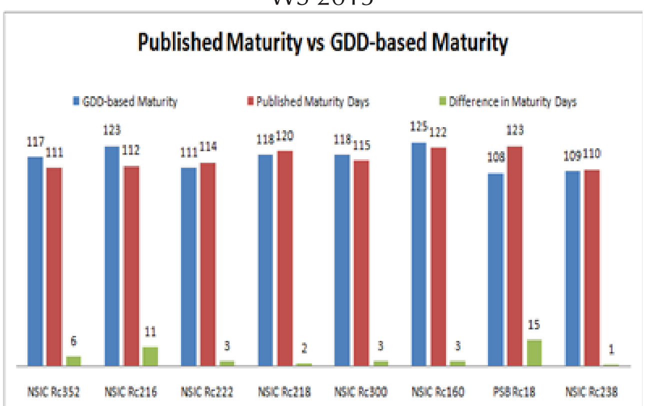
Results:

- Generated the GDD requirements per crop stage of selected inbred varieties and hybrid parentals from three sources of data:
  WS 2015 data: 9 inbreds & 4 A-line hybrid parentals
  DS 2016 data: 8 inbreds & 11 A-line hybrid parentals
  WS 2016 data: 9 inbreds &10 A-line hybrid parentals

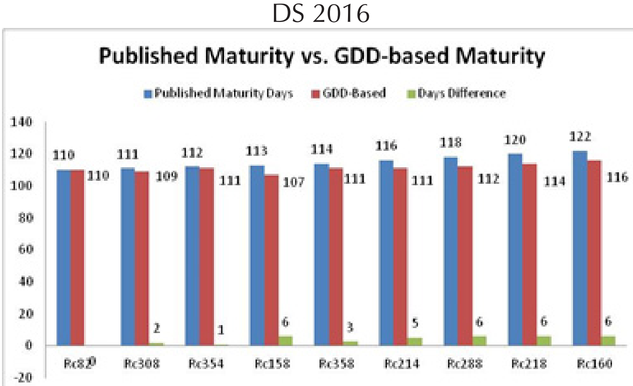
- Compared the published maturity against the GDD-based maturity of inbreds and found discrepancies between the two bases for maturities in the three data sources (Figure 3).



WS 2015



DS 2016



WS 2016

Figure 3. Comparison of maturity: published vs GDD-based.

II. Development of crop management strategies, decision support systems, and other technologies for climate change adaptation

Project Leader: ND Ganotisi

The onset of climate change brought added pressure to the country's agriculture sector, creating greater uncertainty and posing a serious threat especially to the country's goal for food security. Thus, the program prioritizes climate change adaptation-related interventions. This project aims to develop crop management strategies, new and innovative technologies, and decision support systems or tools for rice production that can be used by rice farmers to help them cope up with the negative impacts of climate change, particularly drought, strong typhoons, floods, rise in temperature, variability in rainfall patterns, and rise in sea water level.

Optimal planting dates based on recent agro climatic indices for rice and rice-based crops in Ilocos region

ND Ganotisi and HP Abando, Jr.

The study generally aims to determine the optimal planting date in the locality through rainfall analysis and by testing different planting dates on the agronomic and yield response of rice in the rainfed areas. Specifically the study aims: 1. To characterize the agro-climatic pattern of selected rice and rice-based areas in the Ilocos (Ilocos Norte, Ilocos Sur and La Union) based from available rainfall data; 2. To develop more precise planting calendars based from the agro-climatic characteristics of the rainfed rice and rice-based areas in Ilocos; 3. To validate updated planting dates in the rainfed areas in Ilocos. 4. To determine the agronomic and yield performances of rainfed rice as affected by different planting dates in Ilocos. The 28 years daily rainfall data from the data bank of PAGASA, Sinait, Ilocos Sur were analyzed for the rainfall probability, dry weather harvest reliability (DWHR), sunshine reliability, weekly rainfall, number of rainy days, drought and excessive rainfall hazard. Also, a field experiment on a typical rainfed was conducted using the strip plot design where the schedules of planting at the horizontal strip and the variety at the vertical strip with three replications to validate the recommended planting schedules. The planting schedule treatments were: first planting – 4th week of May (May 27); second planting – 2nd week of June (June 10); third planting – 4th week of June (June 24) ; and fourth planting – 2nd week of July (July 8) and 3 varieties (PSB Rc82, NSIC Rc9 and Rc192) in Batac City, Ilocos Norte.

Activities:

- Gathering, encoding and consolidation of rainfall data from PAGASA stations in Ilocos region.
- Analyzing and preparing updates of graphs of agro-climatic indices and planting calendar.
- Conduct validation of updated planting calendars.
- Conduct field experiment on rice with different planting dates.

Results:

- Daily rainfall data from 1988 to 2015 (28 years) copied from PAGASA-Sinait, Ilocos Sur were encoded, summarized and processed for the computation of probability values of the different agro-climatic indices. The computed values were inputted in excel format and plotted along with the weekly calendar the DWHR, sunshine reliability (SR), rainfall probability, average weekly rainfall, number of rainy days, drought and excessive rainfall hazard.
- Results showed that January to April and November to December has more than 80% probability of drought hazard which indicates avoiding planting during these periods. July to August has more than 60% probability of excessive rainfall hazard (Figure 4).
- Starting from the third week of May to fourth week of September, the DWHR has values below 70% probability. It indicates avoiding harvesting during these period because the weather is so wet and the SR is below 50% which means drying is a problem (Figure 5).
- The growth stages of the early, medium and late maturing rice varieties were superimposed in the graph and based from criteria such as avoiding harvesting at DWHR lower than 70%, and avoiding excessive rainfall hazard during vegetative stage, the recommended planting dates were pinpointed. In the province of Ilocos Sur, the recommended planting dates in the rainfed areas are: 1) third to last week of May for late maturing varieties (≥127 DAP); 2) first to second week of June for medium maturing varieties (111-126 DAS), and 3) third to fourth week of June for early maturing varieties (≤110 DAS).
- For the validation of planting schedule in Ilocos Norte, the field setup was established in a typical rainfed area in Brgy. Tabug, City of Batac, Ilocos Norte. The first planting was done in the 4th week of May (May 27); second planting – 2nd week of June (June 10); third planting – 4th week of June (June 24); and fourth planting – 2nd week of July (July 8). Three varieties (PSB Rc82, NSIC Rc9 and Rc192) were dibbled using string guide following 20 x 25cm planting distance laid-out using the strip plot design in 3 replications. The rainy season started in the third week of May with sporadic rainfall thereafter until an intense rainfall in the last week of August (Figure 6). However, at vegetative stage, the plants showed symptoms of browning and manifested drying followed by the dying of the plants and this was caused by bacterial pathogens attacking the roots of the plants. Bacterial pathogen slowly develop in continuously planted typical rainfed rice areas (IRRI). To compensate with the target loss, two validation setup will be conducted next season to validate the recommended planting dates in Ilocos Norte, in different site, and Ilocos Sur.

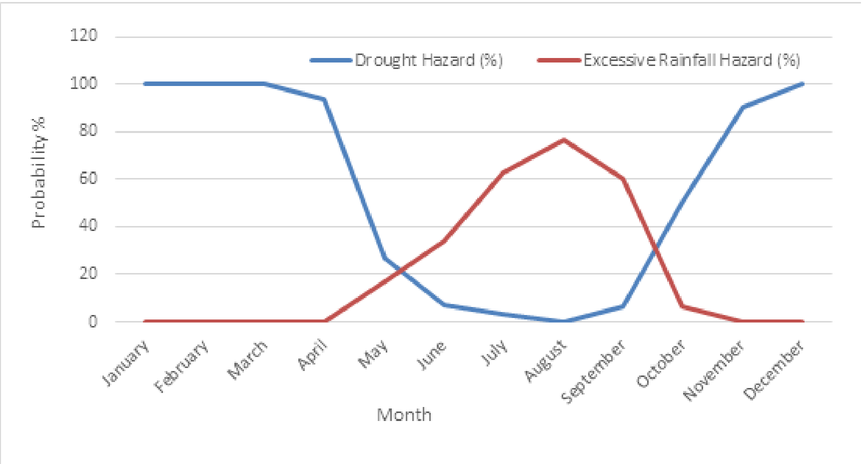


Figure 4. Drought and excessive rainfall hazard based from 28 years (1988-2015) monthly rainfall data from PAGASA, Sinait, Ilocos Sur.

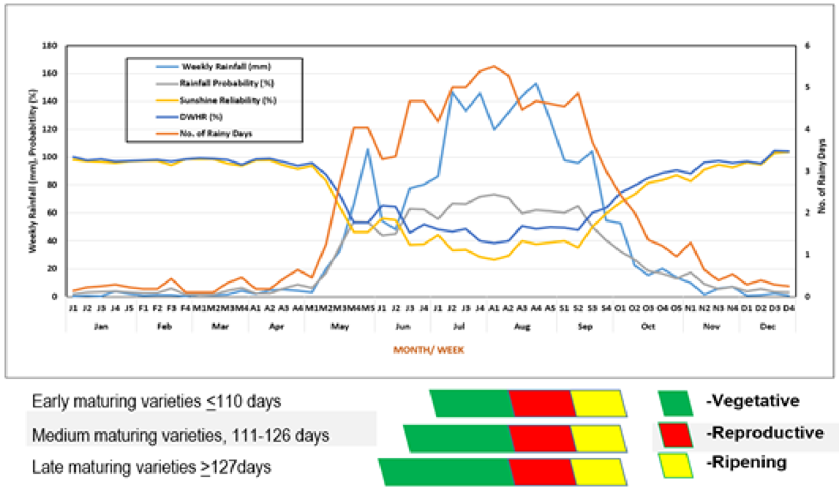


Figure 5. Agro-climatic indices derived from the daily rainfall data at PAGASA, Sinait, Ilocos Sur for the period 1988 to 2015 and recommended planting calendar for rice in the rainfed areas.

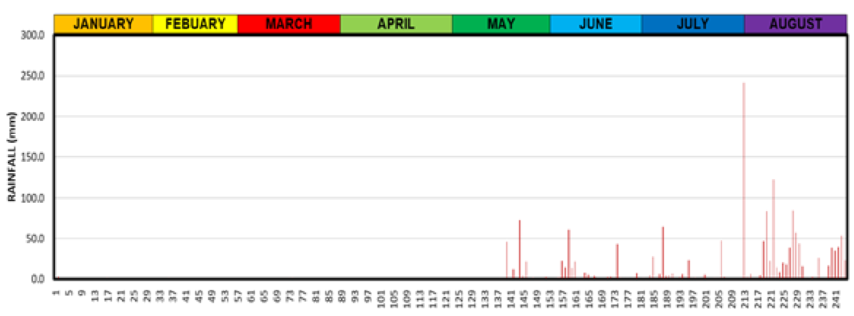


Figure 6. Daily rainfall amounts during the growth period of the rice crop.

Design and development of prefabricated components for a low cost, easy to build and typhoon-resistant multi-purpose farm structure
RF Orge, DA Sawey and LV Leal

Farm structures such as those that house poultry, swine and mushroom production play an important role in protecting the investments made in farming. Obviously, when a farm structure fails during strong typhoons, everything under or inside it (poultry, mushroom culture, etc.) would be exposed to high risk of damage or losses. Thus, one way of protecting farm investments is by making the accompanying farm structures able to withstand strong typhoons. Typhoon resistant farm structures are perceived as costly. One of the reasons is that farmers don't have access to inexpensive but typhoon-resistant designs. More often, farmers are the ones making their own farm structures and the science part of the structure's design and construction is often not given due consideration. This study aims to design, fabricate and test pre-fabricated components for a low-cost, easy-to-build, and typhoon resistant farm structure.

Activities:

- Design, fabrication and testing of basic fabrication units (BCUs).
- Construction and performance evaluation of a prototype of MuFS.

Results:

- The first prototype of the basic construction unit (BCU) was found to be too heavy, requiring 6 to 8 to carry it to the construction site during its installation. Thus, more designs of BCUs had been explored and generated. The latest improvement on the design of the BCU is a 6mm diameter concrete pole reinforced with bamboo strips and welded wire screen which could either be made straight or curved depending on its target use (Figure 7).
- A prototype farm structure that makes use of the straight and curved BCU types is under construction and about 80% completed. This structure was designed for resistance against super-typhoons. Although primarily designed to be used as shelter for a 4-ton capacity mechanical dryer, it can be used for other purposes during off-season periods such as, but not limited, machinery shed and storage of palay or farm inputs. It has a floor area of 20 m^2.

Figure 7. The improved prototypes of the basic construction unit: (a) the straight BCU (subjected to load using body weight), (b) the curved BCU.

Figure 8. The farm structure constructed from a combination of straight and curved BCUs.

Irrigation by Capillarity: Development of an Efficient Method of Irrigation During Extreme Drought

RF Orge and DA Sawey

Irrigation by capillarity, herein referred to as 'capillarigation', is a new concept of applying water and can be a practical and efficient way of irrigating crops especially if water supply is very limiting. In this concept of irrigation, the flow of water to the plants takes place by capillary action. This conserves a significant amount of water since, among other things, water discharge is made lower than the soil infiltration rate and water lost through evaporation, seepage, and percolation is minimized if not prevented. Moreover, the system can operate at atmospheric or near-atmospheric pressure hence it is expected that fabrication, operation and maintenance cost is reduced significantly as compared to other existing irrigation systems.

Activities:

- Design and development of irrigation system components.
- Development and performance testing of a capillarigation system under actual farming conditions.

Results:

- Results of preliminary field performance tests of the prototype capillarigation system using cotton yarn as wick and green pepper and tomato as test crops (Fig. 9) showed that the system can deliver water at an average rate of 38.4 mL/h per wick. A water use efficiency of 1.8g/L was obtained in the capillarigation system which was 30% higher than the control (manual watering). Because water was applied directly into the root zone (subsurface irrigation) weed problem was reduced by as much as 58%. For the test trial planted with tomato, a water use efficiency of 5.5g/L was obtained which was 121.46% higher than the control (Table 1).
- Using the system, the decision as to when to and not to irrigate the crops has been eliminated since the system, because of its very low water discharge, operates 24 hours a day, 7 days a week with no valve to close or open unlike the case of the drip or other conventional irrigation systems.
- The system still needs further refinements and field tests to address some problems (mold accumulation in the wicks) and to further evaluate its suitability to other crops and various field conditions as well as compare its performance with the commercially available drip irrigation system.

Figure 9. The field test setup of the prototype capillarigation system.

Table 1. Yield, weed density, and water use efficiency as affected by the two irrigation methods.

Parameter	Trial 1 (Green Pepper)		Trial 2 (Tomato)	
	Capillarigation	Control	*Capillarigation*	Control
Yield per plant, g	51.7	63.1	399.0	306.0
Weed density, $g\ m^{-2}$	47.2	111.7	--	--
Water use efficiency, $g\ L^{-1}$	1.8	1.2	5.5	2.5

III. Enhancing the adaptive capacity of rice farmers through diversification of household sources of food and income (CCP-006)

Project Leader: RF Orge

A lot of studies show that resilience to climate change can best be achieved through diversification of sources of income. Thus the growing of rice, being highly sensitive to extreme climate events, needs to be complemented with other income-generating activities that would maximize the income that can be generated from a limited piece of farm land tilled by the farmers. This project is therefore being implemented to enhance the adaptive capacity of rice farmers through diversification of household sources of food and income.

Enhancing Resiliency of rice - producing households of flood-prone areas in CARAGA Region

ST Rivas and GSM Tortola

The most vulnerable to shocks brought about by climate change, specifically flooding are the economically disadvantaged rice producing households in flood-prone communities in Caraga, such as in Sitio Antioquia, Kapatungan, Trento, Agusan del Sur. The negative circumstances brought about by climate change will definitely amplify socioeconomic problems which are already experienced by the region, making these farmers the most food unsecured.

Thus, the project implemented a livelihood program as a coping mechanism measure to support the needs of the affected community. This serves as their head start for generating additional farm income, in such a way that poor families were given opportunities to own and raise pigs at the least cost as possible. The selection of beneficiaries was prioritized those mostly deprived families but can sustain and act on the responsibilities expected from them. In the long run, these beneficiaries shall have the chance to alleviate their living condition expected from the economic benefits in swine production.

Activities:

- Generation of new income opportunities to pilot site.
- Determination of risk – transfer mechanisms possible to the area.
- Packaging of resiliency mechanism(s); and advocacy campaign to policy makers.

- Impact assessment to pilot site.

Results:

- Delivered the 20 piglets and 4.50 bags of Green Super Rice (GSR) Lines to 20 beneficiaries at Sitio Antoquia on February 15, 2016 (Figure 10 and 11).
- Results of 9-month showed that 14 farmer beneficiaries have paid back to the association PhP2,100.00 (weaned piglet price), totaling PhP29,400.00. Six farmer beneficiaries have retained the pigs for breeding purposes (4 sows and 2 boars). Currently, new set of 14 members of the association have availed the second rolling of weaned piglets.
- The GSR lines given were failure due to the presence of bacterial blight in the locality which resulted to severe drying of the leaves.

Figure 10. The 20 weaned piglets ready to be dispersed.

Figure 11. Farmers received weaned piglet of the project with the field technician of LGU-Trento.

Maximizing the Use of the Continuous Rice Hull (Ctrh) Carbonizer in Generating Additional Sources of Income for Enhanced Climate Change Resiliency of Rice-Based Farming Communities
RF Orge, LV Leal and DA Sawey

The production of rice hull into biochar using the PhilRice-developed CtRH carbonizer generates recoverable heat which could provide them additional income opportunities. Under the Palayamanan system of farming, biochar is popularly used as soil conditioner, animal bedding, and organic fertilizer ingredient, among other purposes. Thus while producing biochar which could be a regular activity in the farm, they can make use of this heat for additional income-generating activities, small scale power generation and other uses to enhance farm productivity.

Activities:

- Design and development of CtRH carbonizer's heat recovery attachments (HRA's) for processing value-adding products.
- Pilot testing of the CtRH carbonizer with HRAs.

Results:

- The design of the mushroom pasteurizer was further improved to address some operational concerns. A new and improced prototype was fabricated featuring a steam generator that is installed outside the pasteurization chamber. Unlike in the preceding prototype, the new prototype allows other uses of the heat when pasteurization is not to be carried out. Possible uses includes pumping water for domestic uses and steaming food products. Six units of these pasteurizers are being fabricated, together with the accompanying CtRH carbonizers (6 units), for use by selected collaborators of PhilRice under the Integrated Rice-based Agri-biosystems (IRBAS).
- A grassroots model of the CtRH carbonizer was also developed to come up with an affordable model for small holder farmers. This model is made mostly of concrete materials reinforced with bamboo and mesh wire. The design and method of fabrication is made as simple as possible so that most of the parts can be made and assembled by the farmers themselves;
- An additional attachment to the CtRH carbonizer was designed and fabricated (Figure 12). This attachment is intended to make use of the heat generated by the carbonizer to pyrolyze agricultural biomass residues to produce alternative source of fuel to run small internal combustion engines that may be used for household lighting or for charging batteries.
- Two units of the CtRH carbonizer with multi-purpose dryer attachment had been purchased by LGU-Laoac, Pangasinan for use in the income-generating activities of its farmer-beneficiaries.
- As part of the PhilRice-LGU (Alabat, Quezon) collaboration, one unit of the CtRH carbonizer with cooking attachment had been used in the project and was found to satisfactorily work in the production of coco-honey.

Figure 12. The carbonizer attachment for pyrolyzing biomass wastes for small scale power generation.

Rice-duck-based Farming System for Enhanced Climate Change Resiliency of Farming Households

RG Corales, JM Rivera, EM Valdez, and FS Grospe

Considering the rice areas as potential sites for duck raising and the significant number of households living below the poverty income threshold in these areas, this project can be adopted to respond to their food needs, assist in augmenting their household income, enhance economic activities that will create job opportunities for the people in the community, and hopefully resolve the issue of poverty. This study aims to: (a) determine the effect of Rice+duck+azolla-Mungbean-Rice+duck+azolla-Mungbean on arthropod population, soil quality, productivity and economics of rice-duck+ azolla-mungbean cropping system; (b) determine the effect of ducks (from vegetative to reproductive stage), azolla and mungbean in controlling the pest and diseases, and (c) determine the effect of azolla and mungbean on methane and nitrous oxide emission in a Rice+duck+azolla-Mungbean-Rice+duck+azolla-Mungbean cropping system.

Activities:

- Establishment of the rice crop and the duck component.

- Collection and analysis of data (crop and duck data).

Results:

- The highest rice grain yield was obtained from RFR + duck treatment with 6.50t/ha and the lowest was 0 – 40 – 40kg NPK/ha with 4.27 t/ha. All the treatments obtained significantly higher yield than the 0 – 40 – 40kg NPK/ha. On the other hand, the yields of treatments with azolla and ducks were comparable with the yield obtained from the recommended fertilizer rate of 120-40-40kg NPK/ha during DS (Table 2).

- During Wet Season all plots applied with NPK 90-40-40kg/ha have no significant yield difference with or without integration of 500 ducks/ha but signifcantly higher with 0-40-40kg/ha treatment (Table 2).

- The highest net income of PhP95,625.50/ha was derived from Rice+Duck (PhP81,239.50 net income from rice and PhP14,386.00 from duck production). The income from the Rice+Duck+Azolla and Rice+Azolla was slighly lower than the rice+duck production system but comparable with the income derived from the RFR. The lowest income was derived from 0-40-40kg NPK/ha treatment with PhP37,174.00.

- Arthropod population by visual count and sweep net method was lower in plots with ducks throughout the monitoring period. Pest damage incidence was also lower in both cropping seasons (Figure 13).

- Plots applied with NPK+ duck and NPK+ Azolla had significantly high methane emission compared to those plots with NPK alone, duck + Azolla and plots without N fertilizer application. About 50% high emission of plants was obtained in plots with NPK+ Duck compared to with NPK application alone and about 52% higher than those in plots with Duck and Azolla (Figure 14). These findings suggests that the integration of azolla in rice + duck farming system would help minimize methane emission.

Table 2. Effects of duck and azolla on rice grain yield of NSIC Rc160. PhilRice CES. 2016.

Treatment	DS (t/ha,14% MC)	WS (t/ha,14% MC	Mean
T1: 0-40-40 kg NPK/ha	4.27 b	4.52 b	4.40
T2: RFR (DS: 120-40-40 kg NPK/ha WS:90-40-40 kg NPK/ha)	5.70 a	6.11 a	5.90
T3: RFR + Azolla (1t/ha)	5.76 a	6.32 a	6.04
T4: RFR + Duck (500 heads)	6.50 a	6.41 a	6.45
T5: RFR + Azolla + Duck	5.74 a	6.53 a	6.13
Mean	5.59	5.98	

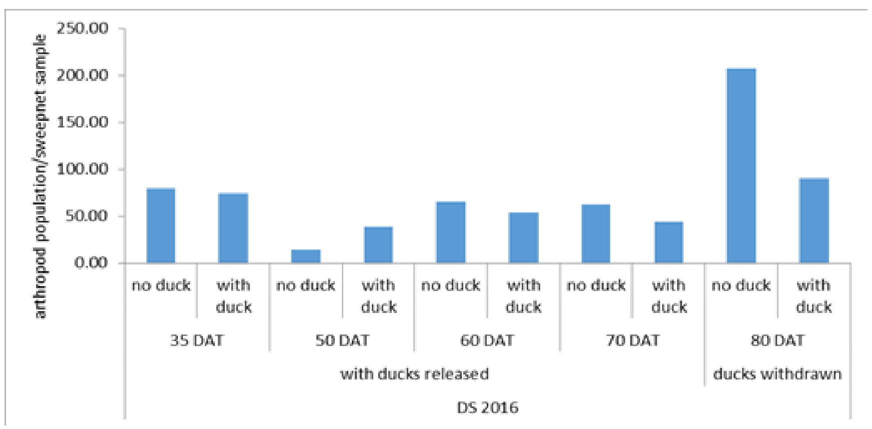


Figure 13. Arthropod population at different growth stages of the rice crop. 2016 DS.

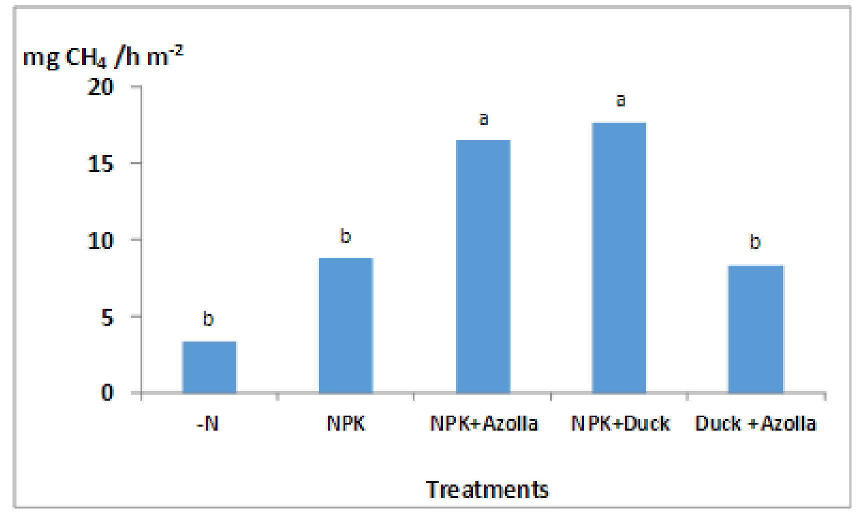


Figure 14. Seasonal mean emission rate as affected by different treatments in rice-duck farming system.

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

List of Tables

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