Department of Agriculture
PHILIPPINE RICE RESEARCH INSTITUTE (PhilRice)
Central Experiment Station
Maligaya, Science City of Muñoz, Nueva Ecija

2017

Highlights of Accomplishments

Highlights of Accomplishments, 2017

As the lead agency for rice R4D (Research for Development) initiatives, PhilRice develops rice science and technology, and generates information and other products through various programs, creating opportunities to improve the competitiveness of the Filipino rice farmer and the Philippine rice industry.

PhilRice executes strategies to create significant impacts on the lives of all our rice stakeholders. Provided products and services through developed technologies can expand rice yield growth over the medium term; sustain activities that will help narrow down the yield gaps; and create opportunities to increase farmers' income through intensified rice-based agri-biosystems, climate-resilient and cost-effective rice and rice-based farming systems, high- value products, and market linkages.

For FY 2017, PhilRice implemented 114 projects categorized into five R4D programs that are discipline-based, impact-oriented, and partnership-driven. Below are some of the significant highlights of accomplishments:

- Thirteen rice varieties approved by NSIC for commercial production;
- Value-adding technology products developed such as GABA rice for the functional food and pharmaceutical industries, dietary fiber and resistant starch from rice prebiotics, and nutrient-rich rice blends using local food crops;
- Integrated crop management practices established, improving the growth and development of rice;
- Four machines developed with promising performance (for pilot-testing by 2019) and three machines at pilot-testing level (for commercialization by the end of 2019);
- Technologies and strategies developed for coping with negative impacts of climate change;
- Operational PalayStat website, which contains primary and secondary rice data that clients can access;
- Reached a total of 10,002 farmers, students, and extension workers through Lakbay Palay (field days) conducted at PhilRice CES and its stations;
- Trained a total of 582 rice stakeholders through various training programs and S&T updates: farmers (382), students (56), agricultural extension workers (77), and legislators & private company personnel (67); and
- Produced a total of 88 knowledge products on rice and rice-related topics (magazines, handouts, bulletins, posters, videos, infographics, etc.).

1. Rice Varieties Developed and Approved by the NSIC

A total of 13 (3 inbred and 10 hybrid) rice varieties were developed and approved by the National Seed Industry Council (NSIC) for commercial production. These new varieties have higher yields, better grain quality and resistance against major pests and diseases than existing varieties as follows:

NSIC Name	Local Name	Breeding Institution	Ave Yield (t/ha)	Max. Yield (t/ha)	Recommended Domain
IRRIGATED LOWLAND (Special Purpose)					
NSIC 2017 Rc482SR	Japonica 5	PhilRice	3.5	6.8	National, Specialty Rice
NSIC 2017 Rc484SR	Japonica 6	IRRI	4.0	6.7	National, Specialty Rice
NSIC 2017 Rc31SR	Malagkit 6	PhilRice	4.7	10.8	National, Specialty Rice
IRRIGATED LOWLAND (Hybrid)					
NSIC 2017 Rc486H	Mestiso 80	Long Ping	6.5	13.9	Regional: Luzon
NSIC 2017 Rc488H	Mestiso 81	SL-Agritech	6.1	12.3	Regional: Visayas & Mindanao
NSIC 2017 Rc490H	Mestiso 82	PhilSCAT	6.2	11.9	Regional: Luzon and Visayas
NSIC 2017 Rc492H	Mestiso 83	Pioneer	6.2	12.5	Regional: Visayas
NSIC 2017 Rc494H	Mestiso 84	Bayer	6.0	12.6	Regional: Mindanao
NSIC 2017 Rc496H	Mestiso 85	Syngenta	6.5	10.0	Regional: Luzon
NSIC 2017 Rc498H	Mestiso 86	Syngenta	6.9	10.9	Regional: Visayas & Mindanao
NSIC 2017 Rc500H	Mestiso 87	Syngenta	6.7	10.5	Regional: Visayas
NSIC 2017 Rc502H	Mestiso 88	Bayer	6.2	12.5	Regional: Luzon
NSIC 2017 Rc504H	Mestiso 89	IRRI	6.4	10.1	Regional: Visayas

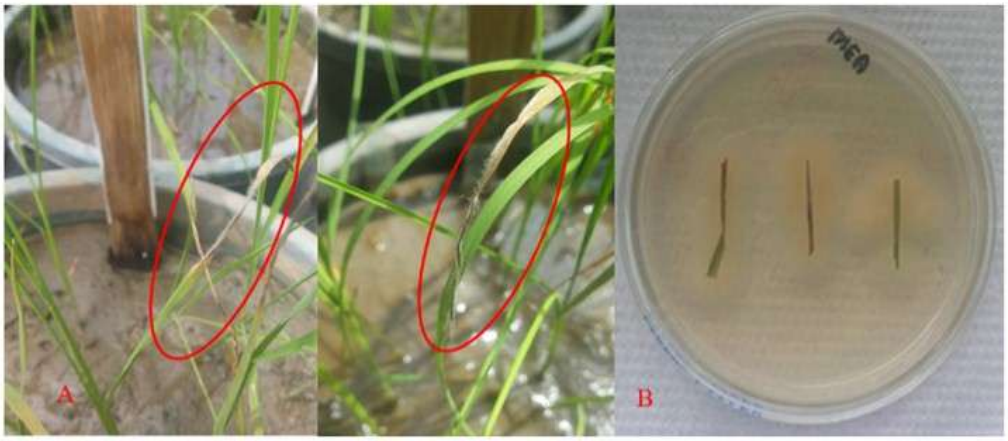
2. Integrated Crop Management Options Developed/Tested

Long-term Soil Fertility. In more than 15 years of continuous application of different organic materials mostly available in the farming system, a trend of getting similar yield from the pure organically grown rice plants to that of the inorganically fertilized plants was consistently observed only in wet season 2005, 2007, 2011, 2013, and 2016. Nutrient demand is not as high in the wet season as in the dry season, hence the comparativeness of organic and inorganic fertilizers. Dry season yields were lower from the organically applied rice plants than those plots with inorganic fertilizers with or without organic fertilizers combined.

Screening of Rice Materials for Insect Pest and Diseases Resistance. The evaluation of rice entries and the testing of 43 high-yielding varieties continued. The PhilRice Genebank evaluated 53 accessions for their spectrum of resistance against 20 differential blast isolates; 7 lines exhibited resistance against all isolates. Such disease resistance pattern is different from that of known broad-spectrum R genes included in the rice blast differential system. Thus, it is possible that novel gene/s for blast resistance are present in these rice

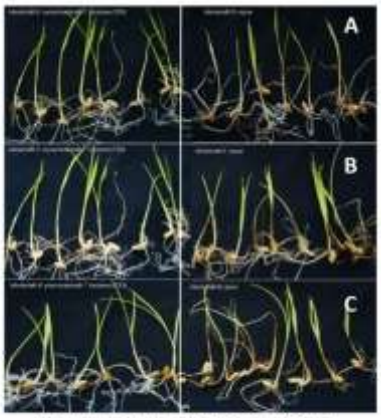
genotypes. These accessions are potential sources of novel broad-spectrum resistance genes.

Epiphytic Microbial Antagonists for Rice Blast Pathogen. Epiphytic microorganisms in the rice plant surface are potential biological control agents against *M. grisea*. However, some may pose potential threat to the rice plant. For instance, *Mucor sp.* LB2 caused considerable pathogenicity effects on rice seedlings on the 2nd trial of the tests that resulted in yellowing and browning of the leaves. Efforts at maximizing the potential benefits and reducing threats of epiphytes are crucial. Moreover, understanding and manipulating the natural associations between rice plants and their phyllospheric communities, in combination with current disease control strategies, would help reduce infection.



Symptom caused by *Mucor* sp. LB2 (A) yellowing and browning of 21-day-old rice seedlings, (B) isolated infected rice leaves in Malt Extract Agar (MEA).

***Trichoderma harzianum* Isolates for the Management of Blast, Sheath Rot, and Brown Spot Diseases of Rice.** Both *T. harzianum* isolates (T5Oi and TMDRi) showed good potentials in controlling brown spot, sheath rot, and blast of rice when applied as seed treatment and foliar spray. Seedlings from seeds soaked in both isolates did not rot or wilt; the healthy seedlings had less brown spot incidence at 72-89%, 42-84% (sheath rot); and 26-78% (blast). Applied as foliar spray, the isolates reduced brown spot incidence by 47-53%, 34-60% in sheath rot, and 15-25% in blast.



Incidence of seedling rot/wilt as affected by two *T. harzianum* isolates (5Oi and TMDRi) 7 days after inoculation of brown spot (*B. oryzae*), sheath rot (*S. oryzae*) and blast (*M. grisea*) pathogen spore suspension under laboratory condition.

3. Value-Adding Technologies Developed

Nutrient-Rich Rice Blends Using Local Food Crops. Results of the optimization process showed that both transparent polypropylene and aluminum-coated pouches withstood temperature and pressure during the retort-processing of rice-adlai and rice:corn meals. Both pouches also did not impart any residual off-odor and off-taste to the products. The use of 0.1% malic acid was found suitable as antimicrobial agent due to its subtle acidity. Moreover, three rice:*adlai* and/or rice:corn blend products, namely, energy bar, hopia, and soft cookies, were developed and characterized. Shelf-life evaluation of the rice:*adlai* energy

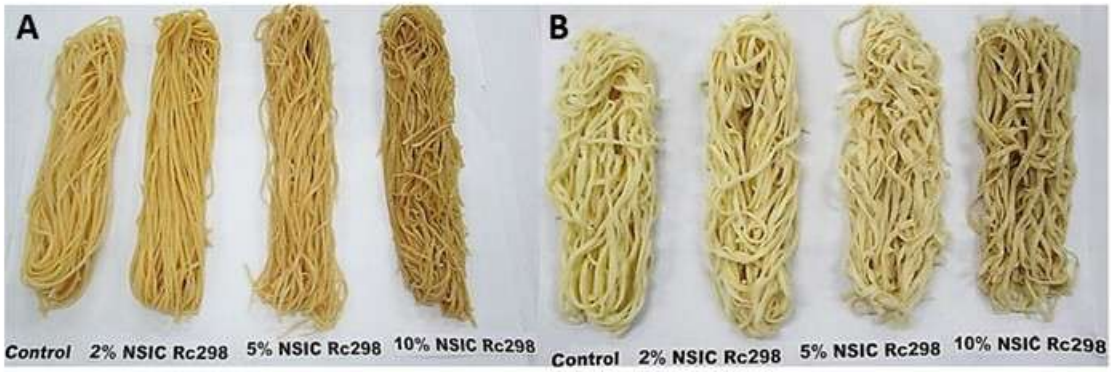
bar showed that the product remained acceptable up to eight weeks at room temperature in both pouches without the addition of preservative.

Rice:*adlai* energy bar packed in TPP (above) and ACP (above) stored at room temperature.

GABA Rice for the Functional Food and Pharmaceutical Industries. Two prototype products - instant GABA (gamma-amino butyric acid) rice congee and instant GABA rice chocolate drink - were developed. Their best formulations were further characterized in terms of proximate composition, microbial load, sensory properties, and consumer acceptability.

The developed GABA rice from NSIC Rc160 is a good source of protein, dietary fiber, carbohydrates, calcium, iron, and sodium. It also had high consumer acceptability in both raw and cooked forms; safe for consumption as shown by the acceptable microbial counts. Regardless of packaging materials and storage temperatures, GABA rice is still fit for consumption even after two months of storage.

Prebiotics from Rice: Dietary Fiber and Resistant Starch. Highly acceptable and nutritious fiber-enriched noodles could be supplemented with rice bran. Enriching the noodles with 10% of Minaangan and NSIC Rc298 increased the fiber content of 11.16% and 8.82%, respectively.



Uncooked (A) and cooked (B) noodles with different supplementation levels of NSIC Rc298 rice bran.

4. Farm Machines Developed

4.1 For pilot-testing by 2019

- **Stripper combine harvester.** Two field tests gave an average actual field capacity of 1.02 ha/day and an average field efficiency of 54.15%, with average grain losses at only 7.8%. These were affected by factors such as variety of rice, crop height, operating speed, width of cut, shape and size of the field, crop and field conditions, and the skill of the operator.

- **Riding boat tiller.** The overall weight of the 2nd prototype increased by 50 kg due to the added new features. Improvements are being made on the following parts: adjustable operator's seat, outrigger adjustment, positioning of lever controls, weight reduction of rotor and transmission, and inclusion of plastic floater.

4.2 For commercialization in 2019

- **Ricehull Gasifier-Engine Pump System.** Two models (RHGEPS-1 and RHGEPS-2) of the system were pilot-tested in one dry season cropping. Three units were fabricated by the accredited manufacturer. RHGEPS-2 was pilot-tested in PhilRice Mindoro; RHGEPS-1 in PhilRice Batac and PhilRice CES-FutureRice Farm. The design of the system was standard in all units pilot-tested.

- **MP Seeder and Reduced Planter** - Seven on-farm demonstrations have been established to observe differences between MP seeder (mechanized) and farmer's practice in terms of seeding rates, timing of fertilizer application, and fertilizer added.

- **Riding-type Transplanter.** A pilot-test unit was completed; a manufacturer has signified interest to fabricate and assemble it.

- **Brown rice machines** - Two prototypes developed - pedal-type and motor-driven - were tested for evaluation and improvement. The pedal-type prototype was more refined, produced 360g of brown rice from 500g paddy in 8 minutes of operation that gave about 72% recovery after two passes. The second prototype of the motor-driven model is being completed.

The prototype of pedal-type brown rice machine during testing

The 1st prototype of motor-driven brown rice machine during laboratory testing

5. Technologies/Strategies Developed for Coping with Negative Impacts of Climate Change

The second prototype of ***Kwebo*** had been completed. It is a multi-purpose farm structure designed to be typhoon-resistant and easy-to-construct so that farmers can build it by themselves. It is a dome-shaped structure primarily designed as shelter of a paddy dryer but can also be used as storage for seeds, machines, fertilizers, and other farm inputs for safekeeping especially during strong typhoons. A third prototype is being constructed.

The **capillarigation system**, a do-it-yourself-type irrigation system almost similar to the drip irrigation system, which makes use of capillary wicks as means of dispensing water to the plants (equivalent to the emitters in the drip system), was field-tested together with other existing irrigation methods (hose and drip). Three field trials at PhilRice CES showed that

the prototype outperformed the existing methods in terms of, among others, efficiently utilizing limited supply of water.

A new design of a **second-generation riding-type mini tractor** had been conceptualized and its first prototype is being fabricated. It features a screw-type traction mechanism which will hopefully make it more versatile than the existing hand tractors and small 4W tractors particularly in terms of traveling in adverse field/terrain conditions.

Six complete sets of the **CtRH carbonizer** with attachment for pasteurizing mushroom fruiting bags had been established in six farmer cooperatives/associations in Nueva Ecija, Bulacan, Aurora, Pampanga, and Pangasinan. Two of them are already operational.

To help enhance farmers' resilience to climate change through diversification of their sources of income, **the rice+duck farming system** was further studied, increasing the duck population from the conventional 125 to 500-1000 heads per hectare and integrating the use of azolla, as supplemental source of feeds for the ducks and nutrients for the plants. Results showed that higher income was obtained from the integration of ducks in rice with or without azolla.

6. Technology Promotion Activities Conducted

Knowledge Products. A total of 88 titles of knowledge products (e.g., magazines, handouts, bulletins, posters, videos, infographics, etc.) on rice and rice-related topics were produced and uploaded on Pinoy Rice Knowledge Bank (www.pinoyrice.com). From the 354,000 copies of KPs produced, 55,000 and 31,000 were distributed to farmers and extension workers, respectively. Moreover, multimedia resources had been well-managed for easy use and access for promotional work: some 15,418 photos were tagged in the database; 350 high-quality photos collected from the photo contest; and 106 rice graphic arts/illustrations produced.

To facilitate knowledge-sharing and learning (KSL), the following communication initiatives were carried out: media engagement, exhibit & KSL opportunities, campaigns (BeRiceponsible & Infomediary), web-based promotion, social media, SMS, and radio. A total of 108 media partners had been identified and mobilized to help in promoting rice technologies and services; 8 exhibits/trade fairs participated in with 8 exhibit collaterals designed; 129 KSL opportunities (e.g., seminars, forums, workshops, etc.); 7 farmer-coops mobilized for the establishment of Palaytambayan (rice knowledge corners); 2 national campaigns conducted; one facebook account well-maintained with an increase of page likes at 38% and an even more significant jump of posts reaching 1,213,748 (84.5%) unique users; one PhilRice website well-maintained with online stories picked up 615 times mainly by Business Mirror, Manila Bulletin, and the Philippine Star; 51 broadcast releases sent to

communication officers of DA, ATI, and private media partners and were broadcast 153 times; and 4 communication studies evaluating communication and initiatives.

Trainings and Field Days. A total of 582 rice stakeholders received various training programs and S&T updates: farmers (382), students (56), agricultural extension workers (77), and legislators & private company personnel (67); reached out to 10,002 farmers and AEWs through two Lakbay Palay events in CES and branch stations. An innovation on the use of musical plays to introduce the hybrid rice technology generated a very positive impact ; 135 former trainees were traced and they attested that the rice specialists' training course they participated in improved not only their knowledge in rice production, rice-based technologies, presentation and facilitation skills and decision-making but also boosted their confidence in performing their tasks as extension workers, facilitators, resource persons, and technical staff. On average, the former trainees were able to train and reach-out to 29,211 farmers, AEWs, and other rice stakeholders from 2008-2017.

In addition, 35 seed specialists and extension agronomists from Sub-Saharan countries including a breeder from Afghanistan and 18 Filipino AEWS were trained on rice seed production. This is a project funded by JICA through IRRI to support the rice sector of African countries.

- ✓ 64 PhilRice, BPI, ATI, DA-RFO, and 763 LFTs were trained to become trainers on hybrid rice seed production and certification
- ✓ 55 farmers/potential hybrid seed growers graduated from the Farmers' Field School season-long training on hybrid seed production
- ✓ Co-implemented training on F1 cultivation with the Agricultural Training Institute, producing 275 graduates
- ✓ Co-implemented training for seed inspectors (CMS/TGMS) with the Bureau of Plant Industry, producing 187 inspectors from Mindanao
- ✓ 20 Techno-Demo fields on adaptability trials on hybrid rice in Bataan, Bulacan, Tarlac, and Pangasinan established and maintained
- ✓ 8 Techno-Demo on Mechanized Hybrid Rice F1 cultivation were established and maintained in San Leonardo, Orani, Bataan; Lagare, Cabanatuan City; Calumpit and San Rafael, Bulacan.

Farmers' Field Day and Forum is a knowledge-sharing and learning platform used by PhilRice to increase awareness and to showcase latest rice and rice-based technologies. It is conducted twice a year in all PhilRice stations participated in by 10,000 farmers, students, agricultural extension workers, policy makers, and R&D workers, broken down as follows:

Station	Number of participants		TOTAL
	Dry Season (March-April)	Wet Season (Sept-October)	
PhilRice CES	2,323	2,584	4,907
PhilRice Isabela	925	817	1,742
PhilRice Bicol		366	366
PhilRice Negros	500	503	1,003
PhilRice Agusan	509	850	1,359
PhilRice Midsayap		625	625
TOTAL	**4,257**	**5,745**	**10,002**

ANNEX A. Research for Development Programs/Projects Implemented

The 114 R4D projects implemented nationwide in partnership with DA research centers, state colleges and universities, government and non-government organizations:

Program/Divisions/Centers/Stations	Number of Projects
R&D PROGRAMS	**22**
Coping with Climate Change	3
High Value-Added Products from Rice and Its Environment	3
Hybrid Rice	3
Palayamanayon Plus Program	4
FutureRice	4
Transforming Rice-Farming Communities into Rice-Based Enterprise Hubs for Inclusive and Sustainable Growth (RiceBIS)	5
DIVISIONS & CENTERS	**42**
Plant Breeding and Biotechnology	4
Genetic Resources	3
Agronomy, Soils and Plant Physiology	8
Crop Protection	4
Rice Chemistry and Food Science	2
Rice Engineering and Mechanization	3
Seed Technology	1
Crops Biotech Center	2
Information Systems	2
Development Communication	3
Technology Management and Services	4
Socioeconomics	4
Special Projects	2
BRANCH STATIONS	**50**
PhilRice Batac	7
PhilRice Isabela	8
PhilRice Los Baños	6
PhilRice Bicol	7
PhilRice Negros	7
PhilRice Agusan	7
PhilRice Midsayap	8
TOTAL	**114**