Department of Agriculture

PHILRICE®

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DA-PHILRICE R&D HIGHLIGHTS

STRATEGICALLY MODERNIZED AND ROBUST TECHNOLOGIES FOR COMPETITIVE AND SECURE RICE INDUSTRY

Content

PROGRAM

Strategically Modernized and Robust Technologies for Competitive and Secure Rice Industry

Jasper G. Tallada

EXECUTIVE SUMMARY

The Strategically Modernized and Robust Technologies for Competitive and Secure Rice Industry (SMARTerRice or SMT) aimed to achieve rice-based farming systems that are resilient and modern to increase the productivity, efficiency, and profitability of farmers.

Specifically, the program determined the productivity, efficiency, and profitability of different packages of technologies (POTs) for the irrigated and favorable rainfed rice environments; evaluated and developed modern rice-based farming models and value-adding technologies for enhanced multiple streams of income and resiliency; and enhanced the application of digital technologies for the transformation of rice-based farming systems.

Emerged as the sole program in the PhilRice Research Sector after a high-level streamlining process in 2020, it still works under the purview of the current corporate strategic plan for 2017-2022 following an even more multi-disciplinary and comprehensive approach. There are four component projects operating under the program.

Project 1 compared the POTs and the local farmers› practices (FP) under irrigated rice environment. It showed that POTs did not produce a higher yield; however, these resulted in a better unit income due to lower seed costs, increase in fertilization efficiency, and expanded use of good variety.

Project 2 compared the POTs and the local FP under a favorable rainfed rice environment in Talugtug, Cuyapo, and San Jose City. Configuration of fertilization levels resulted in higher grain yields based on target yields.

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Project 3 evaluated the different rice-based farming systems and value-adding technologies in enhancing multiple channels of food access, income sources, and resiliency. It also identified viable products that rice-based farmers can adopt. The Sorjan method, net tunnels, and capillarigation system were also studied for substantial yields and income.

The project also established new vertical farming systems for high-value crops such as lettuce and sweet basil. These systems feature frequent nutrient solution recirculation using a mist spray and a ground-based cooling system for better crop growth. Mushroom production was also found to be a potential good source of supplementary income.

The project evaluated a pair of machines for mechanical bagging of growing media and solar drying of excess mushrooms. The gamma-aminobutyric acid (GABA) rice technology was also validated. A crop diversification app was also evaluated with the Mariano Marcos State University and PhilRice Batac.

Project 4 features the integration of electronic digital technologies in rice farming. A new and improved AgriDoc App was developed that includes information on input suppliers, machinery service providers, available traders, and price. It also developed Internet of things (IoT) devices for environmental monitoring, irrigation gate control, and flatbed operation monitoring and control.

Moreover, the project conducted several field tests to reduce seeding rates using agricultural drones for inbred and hybrid rice varieties. Results showed that agricultural drones obtained similar yields with manual broadcasting and mechanical transplanter. The project also conducted limited herbicide trials.

PROJECT 1

Modernized Rice Production Technologies for Irrigated Lowland Ecosystem

Elmer G. Bautista and Kristine S. Pascual

Most data on the package of the technologies (POTs) to increase grain yield and farmers' income are well-established, albeit limited and conducted only in small plots or field experiments under controlled conditions. As a result, the effects and impacts of these POTs have not been shown and validated in farmers' fields. Thus, this project validated, integrated, and demonstrated POTs in the farmers' irrigated fields from seed to post-harvest management during dry (DS) and wet seasons (WS). The Project mainly aimed to enhance grain yield, increase farmers' income, and showcase the best rice management practices and technologies for farmers' adoption.

In the Tarlac research site, the unit cost of palay production under POTs was lower by 29.50% in DS (PhP7.4/kg) and 30.7% in WS (PhP9/kg) than farmers' practice (PhP10.50/kg in DS and PhP13/kg in WS). The reduced production cost was attributed to the use of mechanical transplanting, inbred variety, and fertilization application guided by the Minus-one Element Technique (MOET).

However, the grain yields under FP were higher by 10.80% in DS and 9% in WS than in the POTs. Late crop establishment resulted in lower yields under POTs.

In the Isabela site, grain yields cultivated through FPs were higher by 25% in DS (7.10t/ha) but lower by 6% in WS (5t/ha) compared with POTs (5.30t/ha). The low yields under POTs in DS were attributed to challenges encountered during field trials.

PROJECT 2

Modernized Rice Production Technologies for Rainfed Lowland Ecosystem

Dindo King M. Donayre and Ailon Oliver V. Capistrano

Abiotic and biotic factors beset rainfed lowland rice farming in the country. Among the biotic factors is water scarcity, which rainfed farmers consider a major problem in rice production. Water scarcity is directly related to poor land preparation and transplanting of much older seedlings. It also affects weed infestation, fertilizer application, production cost, and yield.

The project worked on a different package of technologies (POTs) to address problems in the rainfed areas, particularly in Cuyapo, Talugtug, and San Jose City in Nueva Ecija and Batac City in Ilocos Norte. The POTs employed in the trials include the use of certified inbred rice varieties such as NSIC Rc 402, Rc 222, and Rc 218; use of the MOET for proper fertilizer recommendation; and proper pest management strategies. It also included using machines for land preparation, crop establishment (transplanter), and harvesting (combine harvester). In addition, the project used the targeted yields approach for nutrient management.

Five of 10 transplanted POT rice fields of Brgy. Cabatuan, Cuyapo and Brgy. Alula, Talugtug, Nueva Ecija hit 5t/ha target yield (5-6.33t/ha). One POT rice field hit the 7t/ha (8.02t/ha) but none for the 6t/ha. For rice fields under farmers' practices (FP), three hit the 5t/ha (5.34-5.66t/ha) but none achieved the 6 and 7t/ha target yields.

In Batac, Ilocos Norte, three out of six transplanted POT rice fields hit the 5t/ha target yield (5.37-6.01t/ha); 2 in the 6t/ha (6.28-6.55t/ha). No POT fields hit the 7t/ha. For rice fields under FP, three hit the 5t/ha but none on 6 and 7t/ha.

Dry direct-seeded rice fields under POT and FP in San Jose, Nueva Ecija did not hit the three target yields.

PROJECT 3

Modernized Rice-based Farming Systems and Value-adding Technologies

Marissa V. Romero and Myrna D. Malabayabas

The world's food demand will continue to rise due to exponential population growth. Complicating this concern is the major challenge of the devastating effects of extreme weather conditions, in which farming communities are at the receiving end.

Crop diversification is an essential strategy for farmers to improve productivity, increase income, and address the adverse effects of climate change. Another way of diversifying and increasing farmers' income is by adding value to the products or by-products they generate from their farms. Processing raw products will produce a higher market value resulting in added income.

The project developed and evaluated modernized rice-based farming system models and value-adding technologies for enhanced multiple channels of food access, income sources, and resiliency.

The project evaluated assorted vegetables, rice varieties, and the addition of Nile tilapia in the Sorjan cropping system composed of alternate sinks and raised beds, pond refuge, trellis for vine vegetables, and perimeter crops. It exceeded its target of PhP30/m2 and resulted in a unit income of as much as PhP41.43/m^2.

Growing plants without using soil through hydroponics and aquaponics as vertical gardening methods was also a significant development. This activity was in partnership with the College of Engineering of Central Luzon State University (CLSU). The project used 100 units of white-painted PVC vertical towers installed with a drainage and cooling system of nutrient-enriched recirculating solution in a 100m^2 greenhouse space. As a result, high-value crops such as lettuce and basil yielded 163.80kg and 2.44kg in a single cycle. It translated to an estimated gross income of PhP30,884.

With machines from the DA-BAR-funded project, Rice StrawPH improved mushroom production. Its growing medium bagger machine was evaluated to be needing further refinements in the

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design. The solar tunnel dryer also needs more components to operationalize the unit.

To digitalize rice-based farming systems, PhilRice Batac developed the Cropping Plan Advisory System (CPAS) application, which is being updated by Mariano Marcos State University.
Meanwhile, 115 rice- and 86 Palayamanan crops-based products were identified through a scanning of available value-adding technologies for rice and other rice-based farming system commodities. Two PhilRice-developed technologies (GABA rice and rice-adlay blend) were also validated and characterized comprehensively for important quality and nutrition parameters.

Three attachments were also developed to recover the heat generated in the continuous rice hull (CtRH) carbonizer: cylindrical- and cubical-type ovens and multi-purpose heat recovery attachments. The ovens were utilized in processing tilapia subjected to various treatments.

PROJECT 4

Rice Farming 4.0

Jasper G. Tallada and Nehemiah L. Caballong

The SMT-214, Rice Farming 4.0, is the application of information and communication technologies, including electronic digital technologies leading to the realization of Agriculture 4.0.

While there is an abundance of technologies at different maturity levels, available materials and skill sets must be developed for locally adapted developments. The project worked on a select set of technology development that applies information and communication technologies, digital electronics, and mechatronics. While the project targeted new initiatives, IoT, app development, and robotics activities are still being conducted.

A project component investigated crop establishment procedures using an agricultural drone at different seeding rates for inbred (40kg/ha and 60 kg/ha) and hybrid rice (10kg/ha and 18kg/ha).

AgriDOM Inc., one of the project partners based in Davao City, provided DJI Agras T16 and was used by the local subsidiary FarmTech of Cabanatuan City. As a result, a similar range of yields was achieved for the drone-established, hand-broadcasted, and mechanical transplanted rice.

Another project component developed a new and improved AgriDOC app to include more features such as input supplier, services provider, and trader information.

The project also created IoT devices for environmental monitoring and irrigation gate control. A prototype flatbed monitor and control was also fabricated.

A seeding robot was fabricated using 350W motors and was found unsuitable after a field test. As a result, the robot had to be modified to use 1000W motors.