NOTABLE ACCOMPLISHMENTS
(FISCAL YEAR 2020)

PhilRice implemented 77 research for development (R4D) projects that produced varieties, machines, and crop management options. These technologies are being promoted through various strategies such as conduct of trainings, field days, exhibits and other information dissemination activities. Highlights of physical performance are as follows:

1. Variety Development

1.1 NSIC-approved varieties

- Five of the 15 new inbred rice varieties approved for commercial release are PhilRice-bred: two each for rainfed lowland dry-seeded areas (NSIC 2020 Rc 592 and Rc 594) and high temperature (heat)-prone irrigated areas (NSIC 2020 Rc 600 and Rc 602); and NSIC 2020 Rc 604 for saline-prone irrigated lowland areas.

1.2 Candidate varieties being tested

- Thirty (30) elite inbred lines for stressed environments are being tested in NCT while three lines for stress-free areas have completed NCT Phase II testing.
- One CMS-based three-line hybrid (PR48800H) is for seed production in preparation for NCT nomination in 2021WS while TGMS hybrid (PRUP 14/AYT 191) is now for NCT nomination.

1.3 Genetic resources conserved

- A total of 3,227 germplasm accessions (3,063 TRVs and 164 registered varieties) stored at the PhilRice Genebank were registered and uniquely identified. Some 1,342 germplasm were provided to various stakeholders for characterization, evaluation, reference, demonstration, direct use, and repatriation. More than 700 accessions exhibited desirable traits such as early maturity, short plant stature, long panicle, and heavy and long grains.
- The DNA of 2,082 TRVs are conserved in short-term (-20°) and long-term (-80°) for future reference.

2. Integrated / Smarter crop management

2.1 The LCC App, an android-based real-time nitrogen fertilizer management tool, and the MOET App, a pre-cropping and multi-element soil diagnostic tool, were both evaluated for field performance and are now available at Google Play Store.

2.2 The application of NPK fertilizer can be reduced to half the recommended rate using the developed Organic-Based Nutrient Management in organic rice production.

2.3 As a remote sensing-based rice production monitoring system with 85-95% accuracy, PRISM has regularly shared relevant and comprehensive outputs to DA-Central, DA-RFOs, and PhilRice ManCom for information and guidance. It also shows the synergistic integration of state-of-the-art technologies such as satellite image analysis, geographic information system, crop growth simulation modeling, and smartphone-based field data collection in agriculture modernization. PRISM data products can be accessed thru online sharing platforms such as the PRISM website and Infolib (prism.philrice.gov.ph).

2.4 To determine insect pest and disease resistance, 1,816 entries (463 inbreds, 614 hybrid parent lines, 696 germplasm accessions, and 43 varieties) were evaluated. Their reactions were summarized.

2.5 To develop fast and efficient method of resistance screening to sheath blight, the foil method was conducted in the screenhouse; the previously validated mist- and micro-chamber methods were optimized.

2.6 Alternative control techniques for major insect pests, diseases, weeds, and golden apple snails (GAS) were developed. The filter paper was identified as the best method for conserving fungal isolates.

2.7 A total of 1,082 samples composed of pre-NCT lines, germplasm collections/accessions, and cytoplasmic male sterility (CMS)-based parental lines and F1 hybrids were evaluated for grain quality.

2.8 Robust microplate reader- and NIRS-based assays were optimized for fast and reliable routine analysis of rice physicochemical properties. A microplate-based assay for amylose content determination had >92% accuracy for qualitative measurements and was 13-16 times faster than the conventional method. The NIRS models could simultaneously and non-destructively predict the moisture and protein content values of unknown samples with 97% and 94% accuracies, respectively, at 80-100 samples per day.

2.9 Instrumentation and actuator devices for automatic drip irrigation, irrigation gate control, and water and air quality, warehouse microclimate, insect, and rice paddy monitoring are being developed at the FutureRice Farm.

2.10 Two protocols for herbicide spraying using precision drone technology were tested and yielded promising results. Drone spraying is a considerable option since it proved to be time-efficient and used less water dilution ratio with effectivity comparable with manual spraying. Use of multi-rotor drones is viable for rice seeding, fertilizer application, and crop spraying.

2.11 The smartphone application tools for managing farm operations, weed management, and seed variety selection were enhanced with reported bugs fixed. As of December 2020, the *Binhing Palay* App has >10,000 active users while eDamuhan and AgRiDOC Apps have about 4,800 and 2,600 active users, respectively.

3. Machines and Mechanization

3.1 A guidebook on the establishment of a fully mechanized modern irrigated rice farm model and a manual for mechanizing rice production were reviewed and improved. A working prototype of the three-row portable motorized weeder with capacity of 1.5 ha/day and field efficiency of 71% with almost zero crop damage is now ready for piloting.

3.2 Economic analysis showed that owning and operating the multi-crop reduced-till planter (MCRTP) through custom hiring is viable and feasible. Investment cost can be recovered after 3.6 years at a machine utilization rate of 120 ha/yr. Break-even point is 240 ha and the benefit-cost ratio is 1.5.

3.3 With improved mobility and ease of usage, the gear-transmission with pivot mechanism power tiller had been developed in partnership with the Metal Industry Association of the Philippines (MIAP). The working prototype of the cutter-bar rice combine has harvesting capacity of 2.5 ha/day with field efficiency of 64-81%. Commercial prototypes are now being produced by accredited local manufacturers in Isabela and Davao City.

3.4 After modification, the rice hull gasifier engine-pump system now draws water at 6.3 li/s for a 6.7 m total delivery head continuously for 8 hours. A design and proof-of-concept prototype for single-cylinder 14 hp compression ignition engine had been developed with at least 65% fuel replacement for pumping water or generating 2kW electrical power.

3.5 The refined pedal-type brown rice machine prototype now has higher average output capacity.

3.6 The recently developed rice postharvest management protocol was validated. Regardless of cropping season, late harvesting results in much higher losses; combine harvesting reduces harvest losses. The use of combine harvester, flatbed dryer, and PhilRice SACLOB significantly lowers grain losses and improves milled rice quality.

4. Technologies for coping with climate change

4.1 *Palayamanan* technologies and practices on continuous multiple cropping (crop rotation, intercropping, mushroom spawn/production, and crop-animal system) in a confined area are being demonstrated. Testing of the prototype of the long-range sprinkler irrigation system in an aerobic rice field at the Palayamanan farm confirmed its potential in improving water productivity. An improved prototype of the mini-tractor Makisig (***Ma****kina para sa pabago-bagong* ***K****lima at* ***S****ari-saring* ***G****awain sa bukid*) is powered by a 9.7 kW (13 hp) gasoline engine equipped with an electronic ignition system for easy starting.

4.2 The *kwebo* and *capillarigation* systems were pilot-tested in Zaragoza, Nueva Ecija where selected farmers were trained on actual fabrication of component parts of the Kwebo. A field guide in installing and operating the *capillarigation* system for backyard gardening and small farms was drafted. Testing of the new prototype of the multi-purpose (MP) dryer showed that it can also function as an oven due to high heat recovery. The design of a multi-purpose steam generator was improved to generate pressurized steam for use in pressure cooking, small-scale power generation, and other applications. Another prototype of a small-scale water pumping system was designed and fabricated.

4.3 Processing of products from crops grown in *Palayamanan* farm was initiated - tomato, tomato leather, and eggplant flour - using a custom-designed heat recovery attachment for the carbonizer. The technoguide titled *"Pagsasagawa ng Sabayang Alternate Wetting and Drying Technology"* was developed and released online for extension workers, irrigation managers, and leaders of irrigators' associations. The packages of technologies based on manual and mechanical transplanting and on plastic drum seeding were further evaluated.

5. Safe and nutritious rice and rice-based food products

5.1 All six commercial rice samples collected from different NFA warehouses had comparable grain quality and were deemed safe for consumption as their pesticide and heavy metal levels were all below the maximum residue limits.

5.2 An *in vitro* method for measuring the glycemic index (GI) of rice was initially tested. Consumer knowledge on GI was determined through an online survey of 328 respondents. Results showed high awareness level on GI and high interest on rice with naturally low GI, brown rice, and low-GI rice-based products if these were available in the market.

5.3 In terms of color values, pH level, water activity, proximate composition, sensory properties, and general acceptability, samples of GABA rice produced from simulated field-soaked paddy rice were comparable with GABA rice prepared using standard protocol. A ready-to-drink GABA rice milk was developed using four commercially available powdered cow's milk, three of which obtained very high overall acceptability (80%).

5.4 The shelf life of complementary foods made from rice, soybean, and sweet potato packed in aluminum pouch and stored at ambient conditions was evaluated for eight months. Sensory evaluation of both the powdered and reconstituted forms showed no significant difference.

5.5 The three instant 'am' (boiled rice water) products enriched with carrot, sweet potato, and banana at 6% concentration and instant 'am' developed were evaluated and found to be shelf-stable up to four months. The instant enriched 'am' is a more convenient, nutritious, and shelf-stable alternative to traditional 'am' for older infants. IP application for instant 'am' was submitted to IPMO.

5.6 Healthy and nutritious biscuits with different levels of SRB were developed and analyzed for proximate composition, sensory properties, preference by ranking, and overall acceptability. SRB-based biscuit with 25% bran had significantly higher ash, fat, and crude fiber content than the wheat flour-based biscuit.

6. Socioeconomics, and policy analysis and advocacy

6.1 More than 10,000 farmers from different provinces were reached through the RCEF profile and baseline information, DS2020 and RiceBIS M&E, e-Binhi padala feedback, hybrid and inbred rice seed production, access to credit, business competency, and technology perception personal and phone surveys.

Fifty-five (55) provincial rice production profiles and baseline information for DS2019 were gathered from RCEF beneficiaries survey.

Monitoring and evaluation report of RCEF Seeds and Extension program for first season of implementation (DS2020) has been prepared.

6.2 The user-friendly *PalayStat* website containing updated primary and secondary (restructured) rice and rice-related datasets was improved with two additional features on search engine optimization and feedback system that can quickly assess the usefulness of downloaded data and references. It has 13,390 unique views and 2,840 unique sessions from within and outside the Philippines.

6.3 A handbook, PowerPoint briefer, and a module on understanding the Philippine rice industry were updated regularly.

Journal articles on rice value chain analysis and socioeconomic impact of adopting combine harvester were published.

6.4 A policy paper, "Analysis of the price of hybrid rice seed (F1) in the Philippines" was completed, which asserts that the current price of public F1 hybrid is just right as the key players are earning favorable returns. Also, the following key recommendations were forwarded: improve research, development, and extension (RDE) of hybrid seed production and supply of publicly bred hybrid varieties; increase government support to public hybrid especially for small seed cooperatives by limiting the involvement of private companies in the procurement program; and enhance marketing and trade promotion of public hybrid varieties by putting up more farm demonstration sites to showcase their performance.

6.5 Two policy fora on mobilizing local government units to support local farmers and on patronizing locally produced rice were held. The policy brief on truthful labeling was used as reference for this year's National Rice Awareness Month (NRAM) celebration to help promote locally produced rice to consumers. Lobbying for truthful labeling was executed thru an online policy forum. National, regional, and provincial rice supply, demand, and price situation outlooks were updated and maintained regularly.

7. Extension Support, Education, and Training Services (ESETS)

7.1 Rice and Rice-Based Business Innovations System (RiceBIS) communities

- Average yields improved from 4.37 t/ha in 2016 WS to 4.54 in 2019 WS, and from 4.67 t/ha in 2017 DS to 5.70 in 2020 DS owing to the adoption of recommended technologies and favorable environment. Cost of production also shrank from ₱13.73/kg to ₱11.24, and from ₱13.76/kg to ₱10.78 in the

respective seasons. Postharvest losses are being minimized through the adoption of the combine harvester.

- 21 agroenterprises were developed and implemented in Phase 1. In Phase 2 that began in 2020 WS, 23 RiceBIS communities were organized comprising 156 clusters of 2,946 farmers covering 3,176.83 ha of production area.

7.2 Trainings, field days, knowledge-sharing and learning, and other information dissemination activities

- 281 knowledge products (KPs) were produced featuring rice R4D works and outputs, RCEF seed and extension programs, PalayCheck system, Golden Rice, hybrid rice, riceponsible behavior, and truthful labelling policy. Two million copies of KPs were produced for RCEF; half of which were distributed to farmers during seed distribution in 57 covered provinces.
- Farmers and agricultural workers turned to the PhilRice Text Center (PTC) for queries during the lockdown. The PTC recorded 164,708 new registrants, a 494% increase year-on-year, majority of whom are RCEF beneficiaries.
- 86 SMS-checked articles were uploaded on the PhilRice and Pinoy Rice Knowledge Bank (PRKB) websites and rated as either excited, fascinated, or amused. Women were tapped as subject matter specialists. Eight of ten site visitors (83%) were satisfied with the articles published. More than ₱4.7 billion in PR value was generated with 739 news materials either printed or aired by 111 media companies.
- Our programs, technologies, and activities were featured in 67 radio segments broadcasted 226 times by six radio station-partners.

  The PhilRice Facebook page has 82,728 likers and 101,364 followers, a 30% increase from last year's. A digital campaign (FB post) promoting the National Rice Awareness Month with a theme 'Grow Local. Buy Local. Eat Local. #Support Our Rice Farmers' garnered 98% total reach and 196% total engagements against the target.
- On account of the global pandemic, the Rice Specialists' Training Course was repackaged into a blended learning approach with 21 of 22 enrollees completing the batch. Majority of the topics were delivered online through pre-recorded lectures. Participants included staff members of Luzon-based DA-regional field offices, ATI centers, and Offices of Provincial Agriculturists. Prior to the pandemic, three customized training courses were conducted for 78 extension workers, young farmers, and other extension professionals.
- A virtual wet season Lakbay Palay was executed through PhilRice's Facebook page livestream activities.

8. Seed Production

8.1 The DA leadership now supports the special accreditation of select seed growers to plant foundation seeds of inbred rice. Seeds produced during the DS have better viability and vigor. For effective distribution of high-quality seeds of preferred and adaptable varieties at the farm level, trials of newly released and popular varieties cum seed production were established in selected provinces nationwide, especially in areas where there are no or limited seed growers.

8.2 Seed targets for A- and R-lines of hybrid M1 and M20 parentals were exceeded by at least 343% and 422%, respectively.

9. PAG-AHON Project (Sa Palay at Gulay, may Ani, Hanapbuhay, Oportunidad at Nutrisyon). In support of the DA's Plant, Plant, Plant Program, the local government of Lupao in Nueva Ecija, Lupao Vegetable Growers Association, East-West Seed Company and PhilRice teamed up since May 11, 2020 to boost food production in Lupao. The team worked to produce and market quality rice and vegetables.

10. Budget and Infrastructure

- The 2021 Financial and Management Information System (FMIS) has been rolled out to all branch stations.
- Fifteen of 30 infrastructure and repair and maintenance projects worth ₱38,261,741.55 have been completed, largely at PhilRice Isabela, Midsayap, and in Nueva Ecija. The global pandemic and bad weather delayed the completion of other projects.
- We now have faster communications with internet connection for all branch stations. Proof is the conduct of several videoconferencing and webinar events that cushioned the lockdown restrictions. This is becoming the new normal for inter-branch and inter-agency meetings.

11. Human resources, including awards and recognitions

- Borne out of necessity, the revision of our organizational structure and staffing pattern is being pursued in response to the recommendations of our Board of Trustees and the Department of Budget and Management.
- Twelve personnel from our R&D pool have been conferred the Scientist rank (three Scientist II, nine Scientist I), the highest number of active career scientists among all government agencies.

  Of the 16 ongoing graduate scholars in local and foreign universities, three successfully completed and earned their degrees (1 PhD, and 2 MS) in 2020.
- In recognition of exemplary performance and outstanding contribution to the nation, we have 13 peer recognitions from national and international award-

giving bodies. Thirty-five (35) papers were published in international and national ISI and non-ISI journals while three books and book chapters were produced. Two technologies – pollen banking for synchronized pollination and brown rice-ice cream sandwich – were protected as utility models.

- Enjoying Magna Carta benefits in accordance with the provisions of RA 8439 are 127 technical personnel.

12. Quality, Health, and Safety Management, Good Governance, including Internal Control

- Surveillance audit for our QMS (ISO 9001:2015) and EMS (ISO 14001:2015) and migration audit for OH&S (ISO 45001:2018) certifications in November saw not even a minor non-conformity.
- Quarantine policies under the global pandemic were coordinated with the local RHU. Our own quarantine facility was calibrated by the city RHU.

Highlights from the Branch Stations

Agusan

- Resulting from improved operations, quality seeds were made available 32 days after harvest, very close to the ideal 30 days. Six very early-maturing lines with 8-20% yield advantage over the check varieties were selected and can be recommended as stopgap varieties or used as parents of new lines with desired traits for Caraga conditions.
- Two long-term conservation techniques using a dry formulation (cracked corn) and oil form (PDA overlaid with oil) were developed for biological control agents *Metarhizium anisopliae* and *Beauveria bassiana* against rice black bugs (RBB). The LGU-Esperanza included the maintenance of 31 RBB light traps in its 2021 annual budget for agriculture.

Batac

- An integrated crop management package of technologies for saline areas was developed composed of earlier planting, use of saline-tolerant varieties, older seedling age (25-35 DAS), planting distance (20 cm x 20 cm), nutrient management (80-30-60 kg NPK in three splits), and pest management.
- Several water-harvesting models with soil conservation features were established in Abra, Pangasinan, and Ilocos Norte. The models for upland and rolling rainfed lowlands are ready for scaling out; that for rainfed lowland is being improved by retrofitting it with solar pumping and drip irrigation. Seeds of the two most popular traditional varieties (Ballatinaw and Waray) in Abra were purified and rejuvenated to ensure their availability.
- Coarse- and medium-textured soils were determined as the most suitable for dry direct-seeded rice (DDSR) in the rainfed areas of Ilocos Norte due to better seedling

growth. The Climate-Agriculture Modeling and Decision Tool-Dynamic Cropping Calendar (CAMDT-DCC) is a powerful tool in simulating yield of rice for a given planting window.

Bicol

- High-quality seeds (HQS) of newly released irrigated and stress-adapted varieties (rainfed, upland, saline-prone, and multi-stress) were produced in seven *Binhing Palay* farms that also served as demonstration areas for the use of HQS and other technologies.

  Climate change-adapted crop management technologies were developed from on-station and on-farm trials. An integrated crop management technology package for saline-prone environments was developed. It uses Salinas varieties, 115-10-15 kg NPK rate, 80 kg/ha seeding rate, and drumseeder for direct seeding.
- Two new RiceBIS communities composed of 180 farmer-members were established in Masbate, where government programs/ interventions on rice are rarely implemented. Data on inbred rice seed production in Bicol that were benchmarked identified bottlenecks, gaps, and areas for improvement. Planting calendars and maps for seed production were developed.

Isabela

- The MarDag RiceBIS Association, organized by and composed of eight production clusters of 84 smallholder farmers in San Mateo, Isabela, operates four promising agro-enterprises (branded milled rice, brown rice, custom-hiring of farm machines, and KADIWA ni Ani at Kita).
- Community-level partnerships with five learning farm cooperators were established. Two newly established learning farms have been accredited as Farm Schools by TESDA. More than 530,000 next- and end-users were reached through various mass-based technology promotion platforms.

Los Baños

- A total of 3,445 rice germplasm materials were conserved and 260 *Azolla* species were properly turned over to the UPLB-National Plant Genetic Resources Laboratory for conservation and management.
- The applicability of the alkali digestibility test as a rapid method to assess genetic purity of hybrid parental lines of Mestizo 1 and Mestiso 20 was explored. Initial results show the good potentials of using ASV scores in determining genetic purity of parentals and F1 seed lots as well.
- Fourteen fixed lines were selected as potential new TGMS lines while seven pollen parent lines were identified with good combining ability. Two promising hybrids in the HPYT will be further advanced for 2021 evaluation.

- Evaluation of PRUP 14 (AYT 191) was completed and is now ready for NCT nomination. Five promising hybrids (3 CMS and 2 TGMS) were characterized and evaluated for their basic and F1 seed production capacities. Seed production protocols of two TGMS-based experimental hybrids were established.
- Two webinars conducted gathered 543 online participants across the country and Southeast Asia. Both achieved 100% overall satisfaction ratings as they were timely in understanding the role and sustainable future of agriculture in times of a pandemic.

Midsayap

- Correlation and path analyses of grain yield and agronomic and other yield-related traits of released hybrid rice varieties were completed. Results show parallel implications: total number of grains, spikelet fertility, panicle/m^2, and 1,000-grain weight directly affect grain yield.
- A total of 58 rice industry stakeholders were educated on the PalayCheck System and Palayamanan Plus. An integrated farming model including rice, vegetable, mushroom, and vermicompost production was established and yielded 6.59 t/ha at a production cost of only ₱8.70/kg palay.
- The DA's Plant, Plant, Plant Program was supported through the distribution of 24,477 vegetable seedlings and 1,602 seed packs to 1,139 households in 11 barangays of Midsayap and 2 barangays of Libungan, both in Cotabato.
- Yield in DS 2020 in a RiceBIS community in Midsayap was increased by 20% (0.88 t/ha from 4.4 t/ha baseline to 5.28 t/ha) while cost per unit of fresh palay was reduced by 26% (from ₱12.47 to ₱9.24). The use of drumseeder in crop establishment helped farmers in reducing the cost of labor and seeds.

Negros

- The last week of October through the whole of November, and the entirety of June were respectively identified as suitable planting /sowing schedules for DS and WS establishment of inbred rice crops.
- Three SUCs became partners as sites for varietal evaluation with student participation during establishment and other field activities. The universities helped promote performing varieties in their localities. Students appreciated rice research and farming more deeply. They can also serve as infomediaries.
- The nearby RiceBIS community covers 80-ha rice production clusters participated in by 80 rice farmers with agroenterprise development focusing on brown rice production of pigmented rice. The farmers generally benefited from the program. Adoption rate of yield-enhancing and cost-reducing technologies is high.

Research for Development Programs/Projects Implemented

	Number of Projects
R4D Programs	*23*
CREATE Rice	4
Hybrid Rice	5
Rice Farm Modernization and Mechanization	3
Science-Based Policies in Advancing Rice Communities	2
Rice Business Innovations System (RiceBIS) Community	5
Rice Seed Systems	4
Divisions and Center	*33*
Agronomy, Soils, and Plant Physiology	6
Crop Protection	4
Development Communication	1
Genetic Resources	4
Information Systems	2
Plant Breeding and Biotechnology	5
Rice Chemistry and Food Science	3
Rice Engineering and Mechanization	2
Socioeconomics	2
Technology Management and Services	3
Crops Biotech Center	1
Branch Stations	*21*
Batac	3
Isabela	3
Los Baños	3
Bicol	3
Negros	3
Agusan	3
Midsayap	3
Total	*77*