DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL RESEARCH

2018
Annual Report

Complementing R&D Efforts to Strengthen the Agri-Fishery Sector

About the Cover

Relevant contributions to the agriculture and fishery sectors become most effective through complementation. The Bureau of Agricultural Research (BAR), as the Department of Agriculture's research arm in charge of funding and coordinating all R&D initiatives in the agri-fishery sector, complementation efforts are but necessary to reach optimum research results. Real change and sustainable progress do not exist in a vacuum, they take place through teamwork, collaboration, and complementation of activities—much like two independent hands working together to serve the same body. To complement is to complete something, making up a whole, and bringing them to an end goal. As BAR reflects on three decades of accomplishments in agri-fishery R&D, it moves forward with even greater promise knowing that all its supported research projects are implemented to satisfy what is needed and lacking, and at the same time, build on future endeavours.

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MESSAGE

I consider 2018 as a challenging but rewarding year for the Bureau of Agricultural Research (BAR). We were able to surmount the pressing demands and challenges confronting the sector by initiating bolder steps in the pursuit of leading and providing excellent leadership and coordination in the national agri-fishery Research and Development (R&D) system.

The year was marked with a simultaneous coordination between and among agencies of the government, non-government organizations, state universities and colleges, and other research institutions on matters pertaining to the empowerment of the agri-fishery sector. Such coordinating function is in line with our mandate as the Department of Agriculture's central coordinating body for agriculture and fisheries R&D.

The 2018 accomplishment of BAR is characterized by putting forward a comprehensive R&D and Extension (RDE) plans across all spectrum of society. By institutionalizing the Research and Development, and Extension Agenda Program (RDEAP), we were able to address the seemingly gap between the prioritization of the sub-sectors: crops, high value crops, livestock and poultry, and fisheries, and address them according to the needs and demands. RDEAP serves as the basis in prioritizing what researches are to be funded and will complement with BAR's banner programs: Community-based Participatory Action Research (CPAR) and the National Technology Commercialization Program (NTCP). The bureau was able to match the demands of the R&D programs and its thematic thrusts based on the researchable areas identified in the RDEAP.

As the agency navigates its way, glaring insights come to the attention of the management. The focus of this year's report gravitated toward the need to expand the reach of R&D through various complementation endeavors. Realizing the merits of such move, BAR has calendared several activities and initiatives with various stakeholders to establish the foundation of these complementation efforts.

To ensure a seamless flow between R&D and Extension, along the line of ensuring that relevant technologies reach the end users, BAR and the Agricultural Training Institute (ATI) convened during the early part of the year and discussed possible parameters that would effectively cascade R&D information further to farmers and fisherfolk.

As a result, among the common grounds that both agencies can embanked on included provision of relevant information materials from funded research, strengthened collaboration in the conduct of free seminars all over the country featuring urban farming technologies, and training services and other inputs

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in the conduct of demonstration activities of BAR-supported research in the regions, including CPAR. Another noteworthy complementation achievement was the revitalization of the Regional Research and Development Extension Network (RRDEN) with the Department of Agriculture-Regional Field Offices (DA-RFOs) as the front liners. Having the RFOs at the lead, we are setting the standards to further strengthen their institutional capability and their human resource capacity as the conduits for agri-fishery growth and development.

By virtue of the Agricultural Competitiveness Enhancement Fund (ACEF) Extension Law, in terms of funding complement, BAR was tasked to take effect the implementation of the Technical Criteria for Technology Commercialization and Technical Criteria for Research Facilities Development. In 2018, BAR endorsed to the ACEF Management Committee eight project proposals for ACEF funding amounting to Php 40 million. The committee approved the endorsed project proposals.

The end-points of all of these endeavors are just some of the pivotal measures that BAR has undertaken in 2018. We are humbled and grateful for these accomplishments.

Dr. Nicomedes P. Eleazar, CESO IV
BAR Director

Complementing R&D efforts to Strengthen the Agri-Fishery Sector

Complementation of efforts and synergies between and among agencies in the field of research and development (R&D) is crucial in effectively addressing the various challenges facing the sector. It's through these complementation efforts that research problems are resolved in the most effective and cost-efficient ways.

Bringing together initiatives among agencies for complementation increase the quality of output while avoiding duplication of efforts and resources.

For the Bureau of Agricultural Research (BAR), the year 2018 was highlighted by various complementation efforts between and among its R&D partner-agencies. Among these activities included: 1) Harmonization Meeting with the State Universities and Colleges and Orientation/ Proposal Conceptualization on the Agricultural Competitiveness Enhancement Fund (ACEF) R&D Grants; 2) BAR-PCAARRD Complementation Meeting on R&D Initiatives; 3) Revitalization of the Regional Research Development and Extension Network (RRDEN) on Agriculture and Fisheries; 4) Inter-agency Collaboration through the Global Innovation Policy Accelerator (GIPA) Programme; and 5) BAR-ATI Research and Development and Extension (RDE) Complementation Workshop.

Harmonization Meeting with SUCs for ACEF Grants

The national and regional state universities and colleges (SUCs) are key partners of BAR in planning and implementing the Research, Development, and Extension Agenda and Programs (RDEAP) at the national and local levels.

Having recognized SUCs as the seat of expertise particularly, in the field of basic research and technology generation/ information generation, SUCs are the main recipients of the BAR's grants for its various R&D programs.

In line with the R&D complementation efforts of BAR, a harmonization meeting among SUCs was conducted to establish a holistic and integrated partnership, facilitate effective and efficient use of expertise and resources, and maximize dissemination, extension and utilization of research outputs for the agri-fishery sector. This is also part of the bureau's mandate to strengthen the R&D network to jointly and actively participate in the harmonization of regional R&D programs.

BAR was tasked by DA to lead the screening and evaluation of proposals for the R&D Grant component of the ACEF program for SUCs. The grant aimed to increase productivity and competitiveness of farmers and fisherfolk through the services and technologies derived from funded agri-fishery R&D activities of the SUCs.

The focus of the research must be on increasing productivity, profitability, and competitiveness of various priority agricultural and fishery ventures through commercialization of appropriate technologies, and further upgrading of their research facilities.

BAR-PCAARRD Complementation on R&D

A complementation meeting between BAR and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) was set to discuss various R&D initiatives and to come up with strategies that will harmonize all their R&D efforts.

Specifically, the focus of complementation efforts were on the areas of: 1) on-going initiatives on the biotechnology database developed jointly by DA-Biotech Program and PCAARRD; 2) convergence initiatives on R&D program packaging/ formulation, monitoring, and technology transfer; and 3) as complementation of R&D initiatives on high value crops including garlic among others.

The meeting was attended by officials from BAR and PCAARRD with the hope that both agencies will come up with implementing strategies and have a better complementation in their R&D efforts and avoid duplication of researches.

Among the strategies identified were: harmonizing the R&D agenda based on priority commodities, crafting roadmaps, indetifying research projects and implementing agencies, and sharing of information between two agencies.

Inter-agency Collaboration through GIPA Program

The Global Innovation Policy Accelerator (GIPA) Program aimed for the creation of specific innovation policy while working with United Kingdom (UK) mentors and institutions. It is supported by the Newton Fund, known in the Philippines as Newton Agham. Newton Fund uses science and innovation partnerships to promote economic development and social welfare of partner countries.

The British Council has partnered with the Department of Science and Technology (DOST), the Commission on Higher Education (CHED), and the Department of Agriculture (DA). Through these agencies, the UK government co-develops and implements programs to strengthen science and innovation capacity, as well as create solutions to development challenges in the country.

In view of this initiative, a forum was conducted to discuss the process of inclusive and open approaches in innovation policy development while building a deeper and effective connection between UK and Southeast Asia countries on inclusive innovation policymaking. Included in the Philippine Team was BAR that spearheaded the coordination works among the participating government agencies including DOST, Department of Trade and Industry (DTI), Department of Information and Communications Technology (DICT), and National Economic Development Authority (NEDA).

Revitalization of the Regional RDE Network

To ensure the smooth and effective delivery of Research Development and Extension (RDE) and to strengthen the cooperation among the regional networks, BAR revitalized the establishment of the Regional Research Development and Extension Network (RRDEN).

RRDEN, an existing network of regional and provincial collaborators, is intended to strengthen the RDE priority setting and implementation of programs on the agriculture and fishery sector. This is in harmony with the current goals and priorities of the national government.

RRDEN was created for each region pursuant to the Agriculture and Fisheries Modernization Act (AFMA) under Rule 81.14.3 mandating DA-Regional Integrated Agricultural Research Centers (RIARCs) of the Regional Field Offices (RFOs) to develop and maintain a network of regional and provincial collaborators in undertaking the regional RDE programs.

BAR was tasked to oversee and coordinate the activities of the network to ensure the efficient delivery of the RDE system, and at the same time, strengthen the cooperation among network members.

Through the established network, a systematic implementation of RDE agenda and complementation of programs for agriculture and fisheries is achieved.

BAR and ATI for Stronger RDE Complementation

Realizing the importance of a seamless connection between R&D and Extension to better serve the farmers and fisherfolk, BAR, as the lead R&D coordinating agency; and ATI, as the lead training and extension arm, convened in a meeting to come up with interventions to strengthen the complementation of the RDE functions in the agriculture and fishery sector.

The activity sought to strengthen the complementation efforts of the two agencies of DA, and to identify gaps and opportunities in relation to ensuring a consistent flow of information along the RDE continuum.

Representatives from BAR and ATI presented their respective Knowledge Management (KM) frameworks and various initiatives and activities along the line of managing their own KM within the organizations. Other areas of possible complementation and collaborations were also thoroughly discussed based on the identified gaps and constraints.

A panel of experts was tapped by BAR and ATI to assist the two agencies in the complementation efforts by providing a workable KM framework that will serve as a basis for operationalizing the RDE continuum.

Banner Program

As the DA's research coordinating agency, BAR has always been at the forefront of ensuring that short- and long-term R&D innovations and interventions are deeply felt by the farmers, fishers, academe, and stakeholders. The drivers of responsive R&D are anchored on the two banner programs of BAR: the Community-based Participatory Action Research (CPAR) and the National Technology Commercialization Program (NTCP).

Food security and sufficiency are some of the many challenges faced by the agriculture and fisheries sector are faced with. Cost-effective decision leading to stronger community relations and generating technologies from R&D are imperatives in attaining a highly-competitive agriculture and fisheries sector.

CPAR

Community-based Participatory Action Research

CPAR was institutionalized to ensure the transfer and adoption of technologies from research to farmers' utilization. The program is focused towards attaining a harmonized RDE linkage by promoting technological interventions at the community level. It is also a location-specific research cum extension that deals with improved farming systems technologies for specific micro agro-climatic environment within a province or municipality.

The banner program is designed to implement an integrated production and post-production management system in the community.

Since CPAR was established, BAR, through its Program Monitoring and Evaluation Division (PMED), has coordinated a total of 286 CPAR projects (71 are on-going, 215 completed) benefiting 13,930 farmers and fishers nationwide. Out of the 286 CPAR projects, 253 projects are focused on agriculture, while 33 are on fisheries (*Table 1*).

For 2018, 14 projects were funded amounting to Php 11,185,765.00.

CPAR is being implemented throughout the 16 regions through the DA-RFO's Research Divisions and DA-BFAR's Regional Fisheries Integrated Research and Development Centers (RFRDCs). This is in close coordination with the local government units, scientists, researchers, extensionists, and other experts in the fields of agriculture and fisheries.

PMED coordinates, monitors, and evaluates the implementation of agriculture and fisheries RDE activities under the national/regional RDE networks agenda and programs. The division conducted periodic reviews, workshops, and meetings and assisted in the identification and assessment of technologies for adaptation, verification, commercialization, disseminations, and patenting. PMED also maintains and updates the inventory of agriculture and fisheries R&D/E projects of the bureau.

Table 1. Number of BAR-funded CPAR projects.

Region	No. of Projects	No. of Sites	No. of FC	Farmer Org	Other Adoptors	Total Beneficiaries
CAR	19	41	583	12	180	763
I	19	60	271	27	900	1171
II	35	65	417	6	1581	1998
III	13	26	294	16	275	569
IVA	15	45	336	18	302	638
IVB	19	31	188	6	72	260
V	24	50	1345	33	241	1586
VI	24	40	582	26	0	582
VII	17	27	351	20	268	619
VIII	14	31	528	31	261	789
IX	4	9	46	9	278	324
X	23	63	765	26	696	1461
XI	21	34	480	21	538	1018
XII	11	23	254	12	516	770
CARAGA	11	54	451	50	216	667
ARMM	17	36	337	23	378	715
TOTAL	**286**	**635**	**7228**	**336**	**6702**	**13930**

Notable CPAR Projects

CPAR on Breeder Goat Production in Sta. Maria, Ilocos Sur

Implementing agency: DA-RFO 11

To improve the goat stock of the community, the project introduced the Goat Enterprise Management (GEM). Interventions included in the GEM were: 1) breeding management through upgrading and controlled breeding; 2) feeding management thru stall feeding, urea treated rice straw, intensified use of multipurpose tree species (MPTS), and multi-nutrient mineral block (MNMB); 3) health management through improved housing, rapid rotational grazing, and strategic worm control; and 4) farm waste management using the food-feed system. Through the project, three goat multiplier farms were established. These multiplier farms were being managed by the three farmers' group, namely: 1) Ag-agrao CPAR farmers association; 2) Gusing CPAR farmers association, and; 3) Baballasioan CPAR farmers association. These associations were merged and federated into AGBAGU (Ag-agrao Baballasioan Gusing).

CPAR on Sugar Apple+Vegetable+Legume Farming System in Lobo, Batangas

Implementing agency: DA-RFO CALABARZON

The package of technology (POT) introduced were fertilization, pruning, weeding, net bagging, and irrigation. Planting of legumes and other vegetables and production of vermicompost were also introduced as part of the interventions. The occurrence of mealy bug infestation was resolved through irrigation. As a result, there was an observed increase in the productivity and income (87 percent) of the CPAR farmer-cooperators. Institutionalization strategies used in the project led to the organization and registration of the "Samahan ng Mag-Aatis ng Lobo." Adoptors of the technology also increased from original 18 farmer-cooperators to 51 farmers.

CPAR on SCoPSA in Corn-based Hilly Areas in Maddela, Quirino

Implementing agency: DA-RFO 2

Cagayan Valley is consistently the top corn-producing region in the country. Prior to CPAR, the farmers were using hybrid corn with the hope of increasing their harvest. However, the average grain yield from the beneficiaries was only 50 percent below the optimum yield of 8 mt/ha for corn. The CPAR project titled, "CPAR on SCoPSA in Corn-based Hilly Areas in Maddela, Quirino" aimed to address issues on soil degradation while improving the municipality's existing farming system to optimize moisture availability thus increased production, particularly in the province's sloping areas. The results of the CPAR intervention reflected a positive increase both in yield and income. The CPAR farmer-cooperators likewise acquired higher yield compared to their old practice, with an increase translating from 8.18 to 104.49 percent.

Enhancing White/Purple Corn Productivity under River Flood and Drought-Prone Areas of Enrile, Cagayan

Implementing agency: DA-RFO 2

The project attained a yield of 4,196 kg/ha and 2,933 kg/ha for dry season and wet season, respectively. During drought condition, the improved cropping pattern under white corn intercropped with mungbean provided an income of Php 27,990 (corn) and Php 18,082 (mungbean) versus the farmer's practice of Php 19, 645 (corn) and Php 1,852 (mungbean). Another improved cropping pattern introduced under white corn and peanut intercropping provided a higher income of Php 8,785 compared to farmer's practice of Php 362.50 during the dry season.

CPAR on Cacao Production in Calinan District, Davao City

Implementing agency: DA-RFO 11

Cacao is one of the major crops being grown in the Calinan District. However, one problem observed during the site validation was that the old cacao trees (more than 20 yrs old), have been producing less pods and yet the farmers wanted to sustain them because according to them, they were good varieties and high-yielding too. With the introduction of CPAR in Calinan District, 30 farmers have become interested and became co-operators of the project. One of them was Mang Fermin, chair of the Sirib Active Group of Individual Growers Cooperative (SAGING Coop). He owns 0.6 hectare allotted to CPAR cacao. During peak season, he can harvest every other week (twice in a month) with an average of 70-80 kilos cacao from his 0.6-hectare land.

Corn-based Farming Systems in Kadingilan, Bukidnon

Implementing agency: DA-RFO 10

The technology interventions included the use of organic + inorganic fertilizer application, Integrated Nutrient Management (INM), and Integrated Pest Management (IPM) using appropriate and improved corn varieties (Pioneer 30B80). The farmer-cooperators positively responded to the technology introduced to them. The INM in combination with organic and inorganic fertilizer was highly appreciated by the farmers considering its results in crop yields while reducing the use of inorganic fertilizer and the benefit derived in using organic fertilizer.

CPAR on Site Specific Nutrient Management

Implementing agency: DA-RFO MIMAROPA

Occidental Mindoro thrives on two major crops: rice and corn. Yet 80% of the region's smallhold farmers suffer from low income due to the decreasing production with only five tons per hectare. During the project's PRA, it was concluded that most farmers do not have enough capital to supply proper fertilization for yellow corn production. According to the International Plant Nutrition Institute (IPNI), Site-specific Nutrient Management (SSNM) is an approach that promotes the timely application of fertilizers at optimal rates to fill the deficit between the nutrient needs of a high-yielding crop and the nutrient supply from naturally occurring indigenous resources that includes soil, crop residues, manures, and irrigation water. Using the published "Quick Guide for Yellow Corn," resulting from a collaborative project of IPNI and BAR, the CPAR farmer-cooperators made use of the fertilizer application based on the SSNM rates.

Banner Program

NTCP

National Technology Commercialization Program

Another banner program of the bureau is the National Technology Commercialization Program or the NTCP which highlights technologies generated from R&D. The NTCP serves as a vehicle for the development of enterprises and the improvement of agriculture and fisheries related industries anchored on appropriate activities emphasizing technology transfer, promotion, adoption, utilization, and commercialization. The NTCP advocates the transformation of agriculture and fisheries from a resource-based to technology-based interventions.

The concept of technology commercialization is a process of marketing and promoting a particular technology designed to stimulate the development and entrepreneurial capabilities of the individual and the agribusiness community as a whole. It also justifies the need to initiate the transfer, to commercialize and to diffuse identified technologies that will spur agriculture and fisheries growth.

Since NTCP was established, BAR, through its Technology Commercialization Division (TCD), has coordinated a total of 516 projects.

For 2018, 27 new projects were funded; 59 are on-going; and 39 are completed (*Table 2*). Also, BAR-TCD received 134 proposals for funding from various agencies of government and other R&D institutions, of which 25 projects were funded.

Tasked to transform the agriculture sector from resource-based to technology-based sector using technologies and other related interventions, BAR, through TCD, by virtue of the Agricultural Competitiveness Enhancement Fund (ACEF) Extension Law, embodied in the Joint Memorandum No. 01 Series of 2017, under R&D Grant, was tasked to implement the Technical Criteria for Technology Commercialization and Technical Criteria for Research Facilities Development.

Under this scheme, BAR endorsed eight project proposals to the ACEF Management Committee for funding amounting to Php 40 million. The committee approved the endorsed project proposals.

Table 2: NTCP Projects funded according to commodity.

Commodity (AFMA)	NTCP Projects Funded		
	New	***On-going***	***Completed***
Crops	22	45	27
Livestock	3	11	8
Fisheries	0	3	0
Others	2	0	4
Total	**27**	**59**	**39**

Notable NTCP Projects

Adoption and Commercialization of Green Corn, Green Corn-based Silage, Haylage, and UMMB Production for Dairy Cattle in Cagayan Valley

Implementing agency: ISU

Raising dairy cattle is one of the primary sources of income among the farmers of Isabela, Cagayan. Despite the vastness of areas, dairy farmers are still faced with quality feeds especially during dry season. The supply of feeds/forage is very low during the dry season while in the wet season, supply of feeds is high. To address feed quality and scarcity concerns, the Isabela State University (ISU) implemented the project.

It was recommended that quality feed and roughages be made available all-year-round since small and large ruminants depend on forages and roughages for milk and meat production. According ISU, green corn silage production, nutrient-enriched rice straw (as haylage) and the use of Urea Molasses Mineral Block (UMMB) have been proven to improve nutrition among dairy animals, and thus improving milk and meat production.

The project is being piloted by the Malaya Development Cooperative (MDC) and the Quezon Dairy Farmers Cooperative. The farmers tapped in the piloted areas will plant corn that will be cut down at 70-85 days old. The harvested corn plants will be chopped and packed in a 30-40 kgs capacity sacks with polyethylene bag, air removed from the bags using vacuum pump, sealed, and stored in a place safe of rats.

Pilot-Testing of Integrated Soybean Production-Processing Technologies towards Accelerating the Development of the Local Soybean Industry in the Philippines

Implementing agency: PhilMech

Among the main objectives of this partnership is to assess the technical and financial viability of an integrated production, postharvest, and processing systems of soybean; and to capacitate farmers to engage in soybean processing for added value and income while creating a demand for locally-produced soybeans.

The project team, led by Ma. Cecilia Antolin of the Philippine Center for Postharvest Development and Mechanization (PhilMech), deemed it best to provide support to soybean farmers through the adaptation and application of commercially-available mechanical planter, weeder, and harvester for soybean.

Donald Esguerra, a farmer-entrepreneur and owner of D'Soya, was one of the cooperators in the implementation of the two-year project of PhilMech. Carrying the brand name D'Soya, the soybean products including soymilk, *taho*, and okara cookies, as well as rice meals such as tofu steak, tofu teriyaki, and sizzling tofu, have now reached the mainstream market, particularly in a popular mall in Angeles City, Pampanga.

From then on, Esguerra started selling soymilk drinks within his community. He would also have costumers at a local church he attends to. "*Nagustuhan naman nila ang* products *namin. Hindi rin kami nahirapang ibenta* because I am a vegetarian. *Nagpapasalamat kami talaga sa* PhilMech *at sa* BAR because they are the right agencies, and they provided the right technologies," he concluded.

Product Development and Commercialization for Guyabano for the Farmers' Association of Tagkawayan and San Antonio, Quezon

Implementing agency: DA-RFO CALABARZON

Guyabano or *guayabano* (*Annona muricata* Linn.) is rich in vitamin C, phosphorus, and calcium. Its 70-percent edible portion contains 63 calories and sugar content ranges from 4-14 percent. It used to be an underutilized crop before it was included in the Department of Agriculture-Regional Field Office-CALABARZON's R&D Agenda.

The Quezon Agricultural Research and Experiment Station (QARES) implemented the project to develop and commercialize products from *guayabano* for the farmers' associations of Dolores, and San Antonio, Quezon. QARES provided a nursery for the production of *guayabano* seedlings for sale and distribution to the project beneficiaries and other clients of the station. Around 5,000 seedlings from the nursery were planted at the two project sites covering a total area of 23.5 hectares.

The beneficiaries of the project, the San Antonio FBS and the Rural Improvement Club of Dolores, Quezon, were trained on the production of the crop and on value-adding technologies so they can continue implementing even after the project has been completed. Through the project, four products were developed from *guayabano*: wine, nectar, juice, and soap. Aside from selling the products to trade fairs and exhibits, QARES was able to link the farmers' associations to various end-users and tied-up with local tourism offices to market the products.

Collection, Evaluation, and Identification of Apali Cultivars Suitable for Food Processing

Implementing agency: DA-RFO 11

Apali (*Dioscorea esculenta* Lour. Burkill) or commonly known as the "lesser yam" is a tuber crop that is rich in carbohydrates and is a good addition to the usual rice and corn staples. It is highly-nutritious and has medicinal properties that even the early Filipinos and their ancestors have been consuming this crop. But due to the introduction of other crops in the country, the crop has been taken for granted and, therefore, has not been cultivated as widely in many areas of the country.

With the aim of promoting and increasing the cultivation of Apali, the Research Division of DA-RFO 11 has been studying this crop, specifically on its production, so that more farmers will be encouraged to grow this indigenous crop. DA-RFO 11 has developed appropriate culture and management for *Apali* including soil and planting requirements, harvesting, and postharvest handling. In their study, it was found out that a hectare of *Apali* can yield from 25 to 70 tons following the production management that they have developed.

The project resulted to the development of various products from *Apali*. Due to its potato-like characteristics, *Apali* can be processed into cue, boiled, sweetened, jams, ice cream, candies, or as vegetable mixed or stewed with meat.

National Commodity Programs

In responding to the needs of the agriculture and fisheries sector, R&D initiatives must be attuned to the major challenges of the time. A unified effort is important in achieving a level wherein the potential economic gains are within reach and the impact are evenly felt at the grassroot, the farming and fishing communities.

This section highlights the accomplishments of BAR particularly on the R&D aspects of the various national commodity programs as prioritized by the Department.

Rice

In support to the goal of the Philippine Rice Industry Roadmap's "Rice Secure Philippines" which aims to improve competitiveness, increase farm income, to enhance resiliency to disasters and climate risks, and to ensure access to safe and nutritious rice for the rice farmers, various R&D projects were set in motion with focus on information and technologies on varietal development and improvement, integrated crop management, crop protection and health, water resources management, and rice-based farming systems.

In 2018, 74 new and on-going projects were supported under BAR's Rice R&D program. These comprised of projects carried out through the DA and International Rice Research Institute (IRRI) R&D partnerships and the Strategic RDE program.

Among the newly-funded projects were on: sustainable rice straw management practices and technologies for bioenergy, food, and feed; brown rice R&D with focus areas on improving quality, shelf life, and engineering technologies and on market segmentation study; hybrid rice R&D; utilization of entomopathogens and endophytic bacteria for rice pest and disease management; and regional assessment of the level of mechanization of the rice production and postproduction systems.

Operationalization phase of Philippine Rice Information System (PRISM) Unit at PhilRice with DA-RFOs

Accomplishment: *Finalized the strategic and operational plan, developed the operation's manual and disseminated to DA and DA-RFOs, and improved ICT infrastructure at PhilRice*

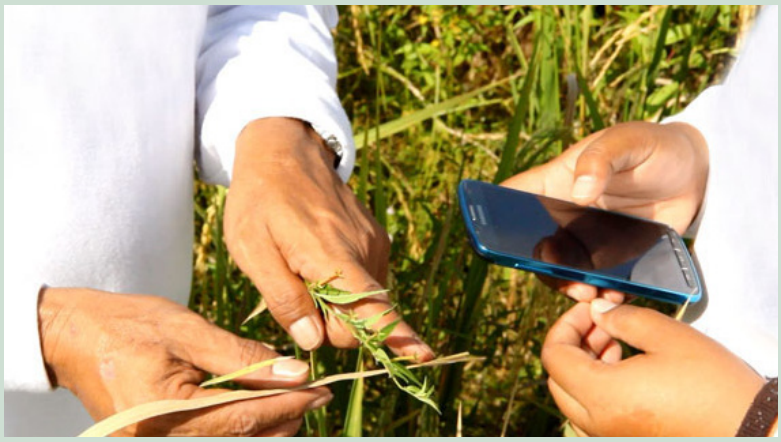


PHOTO: IRRI

PRISM is an online system that aims to consolidate and present accurate, timely, and location-specific information on the status of the rice crop in the country to support the DA in: decision-making and planning interventions, and disaster preparedness and rapid response to emergency situations (e.g., flood or drought). PRISM generates and provides seasonal rice information to DA and supports its planning, operations, and policies towards an increased and sufficient rice production in the Philippines. The PRISM R&D started in 2014 and was completed in December 2018. Pursuant to the DA Administrative Order No. 09 released on 10 August 2017, PRISM is operational and is on its first year under the core program of PhilRice with the DA-RFOs as co-implementers.

Harmonizing, standardizing, and testing of rice crop health monitoring protocols

Accomplishment: *Through PRIME project the latest crop health monitoring protocols have been compiled by DA-RFOs, BPI, PhilRice, and IRRI.*

The project, "Pest Risk Identification and Management Efficiency" or PRIME generally aimed to understand risk factors for pest outbreaks and identify appropriate management strategies and tactics to reduce crop losses. Five pests, which cause major losses in the Philippines, were studied under the project: 1) blast (leaf blast [LB] and neck blast [NB]), 2) bacterial blight (BLB), 3) rice tungro disease and its vector the green leafhopper (GLH), 4) brown plant hopper (BPH), and 5) rats. PRIME builds on the existing platform of PRISM and integrates field-based pest surveillance and information derived from satellite and drone images, such as cropping intensity, planting synchrony, and crop health indicators to identify risk factors of pest outbreaks, map potential outbreak risk, and formulate integrated pest management (IPM) strategies. The standard crop health assessment protocol to be developed is envisioned to serve as the official protocol that will be used by DA in the monitoring and surveillance of pest population and pest injuries in farmers' fields.

Continuous development, fine tuning, and field testing of automation of water monitoring and irrigation scheduling for Safe AWD (AutoMonPH of WateRice project)

The project "Water Efficient and Risk Mitigation Technologies for Enhancing Rice Production in Irrigated and Rainfed Environments" or WateRice aimed to increase production efficiency and water-productivity and reduce production risks through the development, dissemination, and adoption of appropriate crop management technologies in irrigated and rainfed environments. It develops Information and Communication Technology (ICT) tools for improving decision-making on water and weed management and recommending best management practices for irrigated and rainfed environments. The project also focuses on investigating mechanization as an enabling means for the adoption of innovations.

PHOTO: PhilRice

One of the key features of the project is the development of a cheap sensor to measure the water level, logging the water-level data, and transmitting the data via SMS to a server or to the water user in support to the automation of water monitoring and irrigation scheduling for safe alternate wetting and drying (AWD). The work package has been built on IRRI's work on AutoMon (beta version) since 2014. For the Philippines, the beta version has been further fine-tuned, strengthened, and continuously being field tested to match with water governance and other policies in the Philippines and is named as AutoMonPH.

B. Strategic RDE Projects

Development of an integrated Crop Management Package for Rice in Saline-Prone Areas for Increased Productivity

The nationwide demographics, farming profile, management practices, and coping mechanisms of farmers in saline-affected areas served as bases in the development of appropriate and effective interventions that increase productivity in saline-prone areas. The integrated crop management developed through this project focused on rice varieties, fertilizer management, planting distance/density, and pest and disease management. At least three location-specific integrated crop management packages for the seven major saline areas in the Philippines will be produced.

B. Strategic RDE Projects

Nationwide coverage of the implementation of GIS-based Water Resources Assessment R&D for Identifying Suitable Sites for Small Scale Irrigation Projects

In support to the R&D component of the DA's Small Scale Irrigation Program (SSIP) Masterplan, BAR, BSWM, and National Rice Program initiated and supported the regional R&D projects on "Identifying Suitable Sites for Small Scale Irrigation Projects in the Regions through GIS-based Water Resources Assessment" implemented by the SUCs. The output of this R&D initiative will serve as a guide for future allocation of SSIPs nationwide.

These R&D projects have developed and adopted a GIS-based model as a decision support framework to optimize and identify location to implement SSIP effectively and efficiently; generate regional and provincial water resources assessment maps for SSIPs in the Philippines; and enhance the capacities of the region's SSIP implementers, researchers, and extensionists on the use of developed protocols and enhanced science tools for SSIP planning and development.

In 2018, all the regions and provinces were already covered for implementation by the different SUCs partnered for the project. These regional projects are targeted to be completed in 2019 until 2020. Outputs are aimed to be turned over, utilized, and sustained at BSWM and DA-RFOs for SSIP Planning, Targeting, and Implementation.

On 10-13 April 2018, the Review and Planning Workshop for the SSIP R&D Projects and Workshop for the SSIP Suitability Protocols/Criteria, Outputs and Map Design/Layout Standardization was conducted. In the workshop, the suitability criteria and factor weights for the different SSIPs were discussed and agreed upon by all partners and members of the R&D program and a manual on the Suitability Mapping of Small Scale Irrigation Projects is to be developed with CLSU as the lead agency.

Community-based Participatory Action Researches on Rice-based Farming Systems (DA-RFOs)

As one of the banner programs of the bureau, CPAR projects on rice-based farming systems were also pursued under the rice program and were aligned on the commodity integration and diversification initiatives of the rice roadmap. This initiative aimed to provide additional sources of farm income for rice farmers and strengthen their individual and organizational capacities.

The following are the new and on-going DA-RFO-led CPAR rice-based projects supported in 2018:

New projects:

1. CPAR on Rice+Rice+Mungbean Cropping System in Brgy Ongol Ilaya and Brgy. Tinaytayan, Dumarao, Capiz
2. CPAR on Rainfed Lowland Rice-based Integrated Farming Systems in Brgys. Gov. E. Jaro and Bagong Silang, Babatngon, Leyte
3. CPAR on Integrated Rice-based (Rice+Corn+Vegetable+Livestock) Farming System in the Rainfed Areas of Brgy. Sinense and Suaverdez, Anao, Tarlac
4. CPAR on Integrated Rice Farming System in Irrigated Areas in Solano, Nueva Vizcaya

On-going projects:

1. CPAR on Water Management of Rice-based Cropping System in Lucban SWIP in Barangay Lucban, Benito Soliven, Isabela
2. CPAR Model Showcasing Mungbean GAP-based for Improved Rice Productivity in Lowland Rice-based Areas of Culing Cluster, Cabatuan, Isabela
3. CPAR on Integrated Crop-Livestock Production in Lowland Rainfed Rice Growing Areas in Napilihan and Calangcawan Sur, Vinzons, Camarines Norte
4. CPAR on Rice+Gabi+Sili Farming Systems in Camalig, Albay
5. CPAR on Rainfed Rice-based Farming System (Rice+Mungbean+Vegetable) in San Miguel, Iloilo
6. CPAR on Rainfed Rice-based Farming System and Utilization of Upland Areas in Pande Azucar Island, Concepcion, Iloilo
7. CPAR on Rice-based Farming System in the Municipality of Ubay, Bohol
8. CPAR on Rice-based Farming Systems in the Lowland Areas of Brgy. Marquez and Numo, Esperanza, Sultan Kudarat
9. CPAR on Rice-based Integrated Farming System in Datu Paglas, Maguindanao
10. CPAR on Integrated Rice Production System (Organic Rice + Native Chicken) in Mamasapano, Maguindanao

The National Corn and Cassava Program is one of the major programs of DA that aims to increase the production of quality corn and cassava for human consumption, feeds, and industrial uses.

As the agriculture sector intensifies the call to promote these two major crops as 'other' staples next to rice, the program focuses on pest resistance and stress tolerance, varietal conservation and development, and site-specific nutrient management to achieve sustainable corn and cassava production.

In 2018, BAR supported 56 projects under its Corn and Cassava R&D program.

Corn

Projects with Significant Results

Corn Germplasm Utilization through Advanced Research and Development (CGUARD)

In 2018, there were 2,291 maize collections collected by 16 regions. The biggest collection came from Region 6 with 576 collections; followed by Region 7 with 339 collections; and Region 5 with 249 collections. The 16 DA-RFOs submitted 2 kgs per maize collection to IPB-UPLB for screening to disease and insect pest resistance, abiotic stress tolerance, and quality traits-nutritional, development, and improvement for resistance/tolerance traits.

The 2,291 collections were stored at the National Plant Genetic Resources Laboratory of IPB-UPLB and were also kept in South Korea's seed depository for safekeeping.

The CGUARD-IPB team evaluated 300 collections out of which 4 maize populations exhibited resistance to downy mildew; 2 maize populations exhibited resistance to bacterial stalk rot; 1 variety exhibited resistance to Fusarium ear rot; 6 maize populations exhibited resistance to Asian Corn Borer; 2 varieties exhibited resistance to corn weevil; and 11 varieties exhibited tolerance to drought. The UPLB team continues to characterize and evaluate maize collections coming from the regions.

The CGUARD IPB-UPLB team submitted the list of traditional corn varieties with detailed description, including morphological and agronomic characteristics to NSIC-BPI. Agriculture Secretary Emmanuel Piñol approved the Memorandum Order No. 32 Series of 2018 pertaining to the "Guidelines on the Collection, Characterization, Conservation, and Utilization of Traditional Corn Varieties" to support and operationalize the collection and conservation of traditional corn varieties in the regions.

Projects with Significant Results

Nationwide Survey and Early-warning on Cassava Arthropod Pests and Diseases in the Philippines

The top three most prevailing arthropod pests are red spider mites, whiteflies, and mealybugs. Peak incidence for spider mites was recorded in February with 18.5 percent; whitefly with 7.65 percent in May; and mealybugs with 8.54 percent in February.

The highest incidence of spider mites was observed in CALABARZON with 38.35 percent and Region 7 for Whitefly with 24.81 percent and mealybugs with 15.79 percent.

The top three most prevailing diseases are brown leaf spot, blight leaf spot, and bacterial blight. Peak incidence for these diseases was recorded in February with incidence of 54.39 percent, 23.59 percent and 10.53 percent, respectively.

The highest incidence of brown leaf spot and blight leaf spot was observed in Region 10 with 78.47 percent and 66.45 percent incidence. For bacterial blight the highest incidence was observed in Region 9 with 52.47 percent incidence.

Phytoplasma incidence was observed highest in Region 7 followed by ARMM with and MIMAROPA with 14.92 percent, 5.71 percent and 5.21 percent incidence, respectively.

Cassava

Sustaining Soil Characteristics and Nutrients through Site-Specific Nutrient Management (SSNM) in Cassava Production Areas for Higher Yields in the Philippines

Optimization of SSNM can be made by adjusting the fertilizer recommendation based on the following factors: variety, soil fertility, cassava management practices (variety, crop residue management, crop rotation, and organic nutrient inputs), climate, water availability, fertilizer source, and price.

The data obtained from this project are being utilized in optimizing the beta version of Nutrient Expert™ for Cassava, a software decision tool for generating SSNM-based fertilizer recommendations.

Optimizing the SSNM prototype 180-70-250 based on variety and site characteristics can be done by conducting additional cropping seasons of farmers' participatory evaluation (FPE) throughout the country. This will further establish and disseminate the use of SSNM for nationwide cassava production.

The HVCDP is one of the banner programs of DA in support to food security, poverty alleviation, and sustainable growth. The program mainly promotes the production, processing, marketing, and distribution of high-value crops while increasing farmers' income, creating livelihood opportunities, and contributing to national agricultural development of the Philippines. In response to this, BAR funded several R&D projects on industrial crops, vegetables, alternative staple food crops, and legumes.

In 2018, 158 projects were funded of which 79 are applied researches and technology commercialization, 28 are new projects, and 51 are on-going.

BAR also participated in major activities in support to the strategic R&D of HVCDP which included the First Southeast Asian Coffee Education Congress; First Luzon Legumes (Mungbean, Peanut, Soybean) Summit; HVCDP Quarterly Performance Review and Assessment; HVCDP FY 2019 Budget Execution Documents (BED'S) 1,2, and 3 and Cash Planning Report (CPR) FORMS; TWG Meetings on Priority Commodities; Malunggay Industry Development Act; Crafting and Enhancement of the Malunggay, Legumes, Potato, Mango, and Garlic Roadmaps; and several PCAF Committee Meetings.

HVCDP

PROGRAM UPDATES

Adlay

- Adlay seed production in all regions is continuously being expanded. All HVCDP focals were requested to expand their seed production to 10 hectares per region while the Adlay research focals in Regions 11, 13, and 2 were requested to expand their seed production to 20-50 hectares.

- A national review of Adlay on-going and completed projects was conducted on 17-20 July 2018 at Kimberly Hotel, Tagaytay City.

- The Adlay Technical Working Group met to finalize plans of establishing Adlay processing centers in Regions 2, 4A, 9, and 10. Among the agreements made during the meeting were: 1) The building will follow the standard space requirement for farm structure developed by Regional Agriculture Engineering Division (RAED) and will follow the Modular Approach; and 2) Adlay CPAR proposals will be submitted by the four regions to support and sustain the availability of Adlay seeds.

- Adlay seed production areas in Region 9 were monitored wherein DA-RFO 9 is actively partnering with the Dapitan LGU Cassava Growers and Processors to provide technical assistance and purchase the Adlay produce of 73 farmers (113 hectares).

PROGRAM UPDATES

Soybean

- Despite the challenges of low local production and low consumption as food, the soybean industry has significantly increased in terms of areas planted to soybean thus, increased in production. There is also a growing awareness of Filipinos on the benefits of planting and consuming soybean. As of 2018, a cumulative total area of 4,601 hectares were planted with soybean, and more than 200 tons of soybean were distributed benefiting more than 20,000 farmers.

- NSIC-recommended multi-purpose varieties for seed production namely: *Tiwala 8* (PSB Sy 6), *Tiwala 6* (PSB Sy 2), and *Tiwala 10* (PSB Sy 7) were developed.

- Soybean varieties for food such as the *Manchuria* variety (originated from Mindanao), I*PB Sy 96-27-23* from IPB, and *CLSoy 1* from CLSU were developed.

- Commercial production areas in Regions 2, 9, 10, 11, and Caraga were established.

- There is a growing partnership with 37 various groups from the private sector comprising of cooperatives, processors, and business individuals who are engaged in soybean food processing. These groups are now being supplied by farmer-R&D partners all over the country, requiring as much as 800-1,500 metric tons per month.

- The first leg of the Soybean Cooking Contest was conducted on 24 January 2018 at DAF-ARMM, Cotabato City while the second leg was held on 6-7 March 2018 in Bacolod City.

- A national review and planning workshop for Soybean R&D Projects was conducted on 15-18 May 2018.

A. Utilization of Waste Onion Leaves

Three newly BAR-funded projects for the utilization of onion leaves for the development of products from onion leaves, utilization of waste onion leaves for various applications, and development and promotion of cost effective seed production technology for onion are as follows:

1. CLSU: Development and Promotion of Cost-Effective Seed Production Technology for Onion *(on-going)*

- The protocol for the storage of onions and shallots was optimized.
- Gibberellic acid did not induce flowering in the four varieties of onion and shallots.
- There is a continuous experiment on planting onion varieties in the greenhouse after they were subjected to cold storage conditions.

2.*CLSU: Development of Products from Onion Leaves Towards Increased Farmers' Income *(on-going)

- Biomass assessment was conducted.
- High resolution digitized maps of onion growing areas were generated.
- Evaluations of the fabricated machines and produced briquettes are still on-going.

3. CLSU: Increasing Farmers' Income Through the Utilization of Waste Onion Leaves for Various Applications *(completed)*

- Several products were developed. These were: 1) powdered leaves for various applications, i.e., *kropek*/chips flavoring, as condiments and flavoring for pastries; 2) vacuum-fried onion leaves; 3) onion leaves juice extract; and 4) pickled onion leaves.

B. Comprehensive R&D on the IPM for Onion Armyworm

1. CLSU: "Detection, Spatial Tracking, Damage, and Yield Assessment and Mapping of Armyworm Infestation and Diseases of Onion Using Remote Sensing Technology" *(on-going)*

- Global Positioning System (GPS) points of the alternate hosts of onion armyworm was gathered.
- Shapefiles of onion areas in different onion growing areas in Nueva Ecija, Tarlac, and Pangasinan were updated.
- Mapping of the alternate hosts of onion armyworm in the field is on-going.
- Status of onion growing areas in Nueva Ecija, Tarlac, and Pangasinan is continuously being monitored.

2. UPLB: "Early Detection and Warning: Surveillance and Monitoring of Different Crops/Areas Affected by Onion Armyworm" *(on-going)*

- Continuous surveillance of onion armyworm in different sites in Nueva Ecija and Pangasinan is being conducted.
- Onion armyworm population dynamics model is continuously being developed.
- Proliferation of armyworm population is significantly affected by temperature based on the STELLA® model simulation.

3. UPLB: "Biological Studies of Onion Armyworm" *(on-going)*

- 6,500 copies of leaflet, "*Harabas ng Sibuyas,*" were printed and distributed to 18 municipalities of Nueva Ecija.
- Onion armyworm manual, "*Harabas ng Sibuyas: Pag-aalaga, Pagpaparami, at Pag-iimbak ng Bayrus* (NPV)," was drafted.
- Collected onion armyworm was reared until F17 for molecular identification.

4. UPLB: "Efficacy Test of Bio-pesticides and Microbials Against Onion Armyworm" *(on-going)*

- 46 tubes containing Nucleo polyhedronvirus (NPV) infected onion armyworm were distributed to farmers and other stakeholders.
- 167 brochures were distributed to farmers and stakeholders during training and seminars participated.
- Molecular works to determine the molecular identification of the microbials collected by the project are continuously being conducted.

5. UPLB: "Insecticide Management and Resistance Studies from Onion Armyworm" *(on-going)*

- 6,500 copies of the leaflet, "*Gabay sa Paggamit ng Pestisidyo sa Pangangalaga ng Sibuyas Laban sa Harabas,*" were printed and distributed to 18 municipalities in Nueva Ecija.
- Survey was conducted among leek growers to validate the increase in the use of the effective insecticide spinetoram (Exalt®) to control the armyworm.
- Aside from vegetable oil (Superkote®), additional insecticide, diafenthiuron (Pegasus®), was found effective against eggs of onion armyworm.

6. CLSU: "Enhancing Cultural Management Practices in Reducing the Infestation and Damage of Onion Armyworm" *(on-going)*

- Baseline information on the existing onion farmer's cultural management practices were collected and validated.
- Varietal evaluation of onion bulb for resistance to onion armyworm is on going.
- Selected trap and companion crops are continuously being propagated.
- Experiment on the effects of planting date and row spacing on the population density of armyworm started on 20 November 2018.

7. UPLB: "Quality and Safety Assessment and Postharvest Behavior of Onion Grown Under Integrated Pest Management Program Against Armyworm" *(on-going)*

- Quality profiling and safety evaluation of *Red Pinoy* and yellow onion bulbs were subjected to Integrated Pest Management (IPM) strategies in cold storage.
- Determination of the effect of pre-harvest ethephon application and postharvest treatment of 1-MCP (methylcyclopropene) in preventing sprouting during storage is on going.

C. Spanish Red Pineapple

1. DA-RFO 5: "Fruit Size and Quality Enhancement of Spanish Red Pineapple through Cultural Management Practices" ***(on-going)***

- Matured leaves have been harvested.
- Recommended spacing for Spanish Red Pineapple under treatment P2 has higher plant height; and leaf length, wider leaves were observed in P3 and higher number of leaves was observed in P4.
- Fertilizer treatment F3 has relatively higher values for plant height, leaf length, and width compared to other treatments.

2. ASU: "Fruit Size and Quality Enhancement of Spanish Red Pineapple through Cultural Management Practices in Region 6" ***(on-going)***

- The Spanish Red Pineapple is already on its eleventh month.
- The development of new leaves starts to slow down in preparation for flower bud formation.
- Vigorous growth of Spanish Red Pineapple reduces weed growth.
- Some plants were affected with scale insects due to erratic change in temperature.
- Insecticide application was conducted to lessen the damage of the scale insect.

TECHNOLOGIES GENERATED

1.VSU: "*Chitin* and *Chitosan* Extractions from Crustacean Exoskeleton: Evaluation of their Potential together with *Chitin*-Containing Indigenous Materials for the Control of Phytophthora Disease of Jackfruit"

- *Chitin* and *chitosan* extracted from shrimp and crab exoskeletons were found comparable with standards and both were effective in controlling the disease in inoculated jackfruit seedling.
- Monthly stem injection was the most cost-effective method of chitosan application followed by weekly spraying.
- *Chitosan* was more effective in reducing lesion length when applied before pathogen inoculation or as preventive treatment.

2. BSU: "Development of Agro-Forestry Model for Oak-based Forest with Shiitake and Arabica Coffee Production"

- Tree species, besides oak, was found as log substrate for shiitake production.
- Shiitake strains were tested as high-yielding on logs of certain tree species.
- Log diameter was found highly biologically-efficient.
- Tree density was determined as appropriate for Arabica coffee production as determined during the experimental sites including farmer-cooperators' areas.
- Good agricultural practice was integrated with shiitake and coffee under forest.

3. ViFARD, Inc.: "Improvement of Yam Production System through Tissue Culture-Derived Plantlets and Microtubers and Breaking Tuber Dormancy for Continuous Production of Planting Materials"

- Viable tissue culture-based technology of producing clean planting materials are being conducted for seed growers and farmers' use.
- Reliable protocol for breaking tuber dormancy for more efficient production programming are being conducted.
- New production system that utilizes microtubers and tuber microslices are being conducted from in vitro-derived materials.

4. DA-RFO 9: "Ceylon Tea (*Camella sinensis*) Research and Development Program in Zamboanga Peninsula"

- Appropriate technologies through research and development for the establishment of Ceylon tea industry in Zamboanga Peninsula were identified.
- The project has been recommended for technology commercialization.

TECHNOLOGIES GENERATED

5. MSC: "Establishment of Rapid Propagation Techniques for Seedless Breadfruit in Marinduque"

- Vegetative propagation techniques in propagating seedless breadfruit were established.
- Media for *in vitro* propagation of seedless breadfruit in Marinduque was optimized.
- Nursery containing readily available quality plant materials of breadfruit was established.

6. DA-RFO 4A: "Utilization of Wood Vinegar 'Mokusaku' Technology as Pesticide and Fertilizer for Selected High Value Fruit-Bearing Trees and Plantation Crops in CALABARZON"

- Bio-pesticide using wood vinegar for high value and plantation crops was developed.

7. DA-RFO 2: "Traditional Seed Storage Practices of Vegetable Growing Communities in Cagayan Valley: An Assessment"

- Effective and economical seed storage system was documented.

8. DA-RFO 10: "Development and Production, Post Production and Utilization Technologies of *Roselle* (*Hibiscus sabdariffa* L.) in Region 10"

- Package of technology on recommended fertilization and spacing on *Roselle* production was developed.
- Crop mixes on specific types of plantation crops in various provinces in the region were recommended.
- Ideal harvest index for harvesting *Roselle* flowers and seeds was developed.
- Value-adding technologies for *Roselle* were developed.

9. UPLB: "Formulation and Application of Multi-Strain Inoculant for Agroforestry Production"

- A model of a sustainable agroforestry farm using multi-inoculant (*Pinakbet* crops grown with coffee and cacao using multi inoculant in Rizal, Laguna and Batangas) was established.

10. MSC: "Enhancing Productivity and Viability of Arrowroot Industry in Marinduque"

- Profile of arrowroot industry in Marinduque was established.
- Varietal identification and naming was conducted.
- New varieties in BPI were registestered.
- Cultural management practices to improve production efficiency were developed.
- Increased starch recovery and utilization of by-products into other useful products were developed.

Amid the slow increase in the local production, the livestock and poultry industry is seen to contribute to the steady growth of the agriculture sector, with the R&D priorities in place focusing on animal health, feed resources, breeding, and product development.

In 2018, BAR supported 9 projects under the livestock and poultry program (*Table 3*). These focused on various technologies from production and management practices to post-production and value-adding processes on native pig, native and free-range chicken, cattle, and goat.

Livestock & Poultry

Table 3. Livestock and poultry R&D projects funded in 2018.

TITLE OF THE PROJECT	IMPLEMENTING AGENCY
1. Utilization of Epididymal Sperm of Slaughtered Livestock for Basic Research using Assisted Reproductive Techniques (ARTs)	PCC
2. Development of a Strategic Approach to Identifying and Combating Porcine Reproductive and Respiratory Syndrome Virus Outbreaks and Other Porcine Viral Disease in the Philippines	CLSU
3. Utilization of Soybean (*Glycine max L.*) to Enhance Growth, Health, and Estrus among Native Pigs in Pampanga	PSAU
4. Rapid Diagnostics and Control Strategies for Enteric Bacterial Pathogens in Backyard Poultry Production in the Philippines	UPLB
5. Volume and Availability of Banana and Water Lily and their Utilization as Feed Ingredients for Goats in Luzon	PSAU
6. Volume and Availability of Banana and Water Lily and their Utilization as Feed Ingredients for Goats	USM
7. Nutritive Value, Digestibility, and Performance of Buffaloes using Banana by-Products and Water Lily as Alternative Feed Sources	PCC
8. Feeding Value of Banana (*Musa sapientum*) Stalk and Water Lily (*Eichhornia crassipes*) (Mart.) in Dairy Cattle	UPLBFI
9. Mitigating Greenhouse Gases in Livestock (Cattle) through Different Feeding Formula, Methods, and Practices for Efficient Cattle Production	CSU

Projects with Significant Findings

1. PCC: "Epididymal Sperm Cryopreservation as a Tool for the Conservation *In vitro* of Indigenous Livestock and/or Endangered Wildlife in the Country: Prospects for Animal Genetic Resources (AnGR) Cryobanking"

- A cryopreservation procedure for epididymal sperm (ES) was established utilizing the non-descript goat as the animal research model.
- Initial sperm recovery from past mortem testicles at ambient temperature revealed that motile and viable sperm can be isolated within 30 minutes up to two hours upon death using the sperm swim-up method in a Tris-citrate based semen extender. Processed ES remain alive for up to three days in a refrigerator in a suitable semen extender.
- Interventions using cold packs or ice to prevent tissue decomposition of the testicles beyond two hours after death can equally yield viable epididymal sperm. Such intervention facilitates a method of 'ES rescue' from valuable animals that die unexpectedly from a remote area.

2. CLSU: "Phylogenetic Characterization and Detection Using Dry Format RT-LAMP of the Emergent Newcastle Disease Virus (NDV) in the Philippines"

- A protocol was established for DRY FORMAT RT-LAMP to detect NDV which provides a quick, simple, sensitive yet affordable alternative diagnostic test for surveillance and monitoring of the disease.
- Evidence on the genetic character of the NDV strain in the Philippines was acquired. This could serve as genetic information for developing new vaccine tailor fit to the virulent NDV strain in the country.

3. PCC-CLSU "Nutritive Value, Digestibility, and Performance of Buffaloes using Banana by-products and Water Lily as Alternative Feed Sources"

- Based on the initial results of the different banana varieties studied, *Tampuhin* has the highest dry matter and crude protein content. This could be the best banana variety to be used as feed ingredient for buffaloes. As for dry matter basis, use of banana stalks as feed ingredient was comparable to Napier which is the conventional feed source to buffaloes which could support up to 50 percent energy requirement of the animal.
- Simple and rapid preferential study to check whether the feeds (banana stalk and water lily) were found acceptable to the dairy cattle, buffaloes, and goats. Feed given to the test animals were combined with salt and molasses. Results showed that the dairy cattle consumed water lily more in whole form. On the other hand, the test animals consumed more banana stalks especially when added with molasses.

Philippine Native Animals Development (PNAD) Program

PNAD recognizes the opportunities in providing income and in alleviating rural poverty through the conservation and utilization of domesticated native food animals. BAR, through its partner agencies, supported projects to develop good farming practices and promote enterprises from native animals.

In 2018, there are two new projects supported by BAR under the PNAD:

1. Enterprise Development and Commercialization of Meat Processing from Native Pig in Quezon Province (DA-RFO 4A)

- The project carried out native pig production and processing, and is now assisting members of the CARITAS SAC Gumaca, Inc. in terms of technology transfer and commercialization of native pig the project sites.

2. Dissemination of Technology Information Materials in Support to the Philippine Native Animals Development Program (CELPA)

- The project aimed to come up with information on native pig production in English, Filipino, and Bisaya dialects.

National Thematic Programs

Agricultural R&D is continuously changing with new fields of study and emerging markets reshaping the landscape of the sector. Throughout the years, BAR has added new programs aside from significant commodities such as rice, corn, and high-value crops. These new tracks are BAR's response to the nation's changing needs: organic agriculture, biotechnology, and climate change.

Organic Agriculture

One of the most significant shifts in the sector is attributed to the rise of organic agriculture. To further establish a beneficial and sustainable support system for this emerging farming scheme, the Organic Agriculture Act was passed into law in 2010. Among the provisions indicated in the act mandates BAR to coordinate, develop, enhance, support, and consolidate activities and related technologies for the formulation and implementation of a unified and integrated organic agriculture RDE plans and programs.

Since the start of the program, 191 OA projects have been funded, of which 123 are completed and 68 are on-going. In 2018, BAR supported 22 projects, 8 new and 14 on-going. From the 8 new projects, 2 are on applied research, 3 on technology commercialization, and 3 on establishment of R&D facilities.

Also, in 2018, six technologies have been developed from the completed applied research projects (*Table 4*).

Table 4. Organic agriculture applied research projects that generated technologies.

Organic Agriculture Project	Implementing Agency
1. Development of Package of Chemical Free Production Technologies using Animal Manures with Biofertilizer *cum* Biopesticide Properties for Tomato and Garlic	MMSU
2. Validation and Documentation of Organic Production System for Lowland Rice and Eggplant-Mungbean in Pangasinan	DA-RFO 1
3. Validation and Documentation of Organic Production System for Lowland Rice and Mungbean-Okra in Tarlac	DA-RFO 3
4. Validation and Documentation of Organic Production Systems for Rice and Bitter gourd-Squash in Zamboanga Sibugay	DA-RFO 9
5. Validation and Documentation of Organic Production System for Lowland Rice and Squash in Buenavista, Agusan Norte	DA-RFO CAR
6. Organic Okra Production Pest Management Technologies Development for Local and Export Markets	TAC

In addition, three technologies have been developed and commercialized from the completed technology commercialization projects. These are:

1. Integrated RDE Program on Commercial Production of Free-Range Chicken among Women in Santa Ignacia, Tarlac (TAC)

2. Promotion of Organic Farming Technologies for High Value Vegetables and Native Pigs Production in Kalayaan, Laguna (CELPA, Inc.)

3. Expansion of Native Pig Production and Commercialization of Developed Processing Technologies in Tagkawayan, Quezon (SLSU-JGE)

BAR also facilitated the documentation of eight OA projects, through the Applied Communication Division and in collaboration with Mag-Agri Tayo—an agricultural television program aired every Saturday at 9:30-10:30 AM aired over PTV Channel 4. From these documentation, segments were produced on OA technologies promoted through this media format *(Table 5)*.

Table 5. Organic agriculture projects documented for tv segments.

Organic Agriculture Project	Implementing Agency
1. Protocol Improvement and Product Development of Liquid Organic Fertilizers from Fermented Plant Extract	BIOTECH-UPLB
2. Development of Organic Seed Production Systems for Field Legumes and Lowland Vegetables (RFU 4A, 4B, and 5)	BPI-LBNCRDPSC
3. Documentation and Evaluation of Microbials and Botanicals for Organic Agriculture in Support to Organic Stakeholders in CALABARZON, MIMAROPA, and Bicol Region	BPI-LBNCRDPSC
4. Management of Eggplant Fruit and Shoot Borer, *Leucinodes orbonalis* Guenee (*Lepidopera pyralidae*) and Other Major Insect Pest of Organically-Grown Eggplant with Emphasis on Biological Control Agents and Botanical Insecticides in Quezon, Laguna, and Batangas	CPU
5. Development of Natural Source as Alternative to Synthetic Methionine for Native Chicken Organic Supplemental Feed Production	CPU
6. Development of Effective Management Strategies for Low-cost Organic Production Systems through the Identification and Analysis of the Microbial Flora and Parasite Fauna of the Philippine Native Swine	BIOTECH-UPLB
7. Participatory Breeding and Seed Production on Organic Vegetables	UPLB
8. Identification of Indigenous Entomopathogenic Nematodes (EPNs) as Effective Biocontrol Agent against Common Insect Pests of Selected Organically-grown Salad Vegetables in Cebu	CTU

BAR also launched the OA Research, Development, and Extension Agenda and Program (2018-2023) during the 15th National Organic Agriculture Congress on 15 November 2018 in Cebu City. The OA RDEAP is a guide for the organic agriculture stakeholders on the priority researchable areas for the promotion and enhancement of organic agriculture in the country.

Climate Change

BAR's role in the implementation of Climate Change R&D Program is focused on the development of technologies geared towards climate change adaptation and mitigation. In previous years, BAR has funded extensive research in provinces across the country that is considered highly vulnerable to climate change. Through the conduct of Climate Resiliency and Vulnerability Assessment (CRVA), BAR laid out foundational data for identifying farming communities that need climate change resilient technologies.

R&D initiatives on climate-resilient technologies are continuously being supported by BAR in accordance to the Climate Change Research, Development, and Extension Agenda and Program (CC RDEAP) for Agriculture and Fisheries.

Since the program started, BAR has funded 81 CC R&D projects of 57 are completed and 24 are on-going. In 2018, 13 on-going projects were funded and 7 were completed (*Table 6*).

To ensure the smooth implementation of these projects, reviews were conducted and facilitated by BAR-Program Monitoring and Evaluation Division. There were 15 projects reviewed for 2018.

Table 6. Climate Change R&D Projects completed in 2018.

	Climate Change R&D Project	Implementing Agency
1	Climate Change Impacts on the Value Chains of *Siganid* and *Tilapia* in Vulnerable Regions in Luzon, Philippines	WORLDFISH
2	Climate-Resilient Agri-Fisheries (CRA) Assessment, Targeting, and Prioritization for the Adaptation and Mitigation Initiative (AMIA) in CAR and MIMAROPA	UPLBFI
3	Climate-Resilient Agri-Fisheries (CRA), Assessment, Targeting, and Prioritization for the Adaption and Mitigation Initiative (AMIA) in Samar Province Region 8	VSU
4	Climate-Resilient Agri-Fisheries (CRA), Assessment, Targeting, and Prioritization for the Adaption and Mitigation Initiative (AMIA) Phase 2 in Cebu Province (Central Visayas Region)	VSU
5	Climate-Resilient Agri-Fisheries (CRA) Assessment, Targeting, and Prioritization for the Adaptation and Mitigation Initiative (AMIA) in ARMM and Region 9	MSU-Marawi
6	Climate-Resilient Agri-Fisheries (CRA), Assessment, Targeting, and Prioritization for the Adaption and Mitigation Initiative (AMIA) in Caraga Region	CSU
7	Policy Study towards the Institutionalization of the Climate Change Information System Agri-Fishery High-Risk Communities: Documentation and Assessment of Current Efforts	UPLBFI

Biotech

Globally, biotechnology is one of the technology options geared towards achieving food security, sector competitiveness, and resilience to climate change. For almost two decades of its adoption locally, advances of this modern technology continue to grow rapidly. Filipino farmers have continuously been reaping the benefits from its applications for having improved farm productivity and increased profitability.

With the Agriculture and Fisheries Modernization Act (AFMA) of 1997 (RA 8435), the DA-Biotechnology Program was established to help the agriculture sector move from resource-based to technology-based through the development and application of a wide range of biotechnology techniques and tools while ensuring biosafety.

BAR handles and manages the biotech program's fund for R&D. The DA Biotech Program Office (BPO), on the other hand, facilitates the coordination, monitoring, and evaluation of biotech projects under its Biotechnology Research and Development; Institutional Capacity Enhancement; Policy Research and Advocacy; and Information, Communication, and Education components.

Since BAR started managing the biotech R&D funds in 2011, it has supported 178 projects.

For 2018, 45 biotech projects were funded, of which 17 are new and 28 are on-going. A majority of the new projects funded were on the improvement of disease resistance in swine, poultry and livestock. The DA-Biotechnology Program and BAR were able to complete 15 projects in 2018 (*Table 7*).

Table 7. Biotechnology R&D projects completed in 2018.

	Biotechnology R&D	Implementing Agency
1.	DABIOTECH-R1112: Establishment of Core Collection of Tall Coconut Accessions Using Microsatellite Marker Technology	PCA-ZRC
2.	DABIOTECH-R1119: Development of Philippine Rice Cultivars with Elevated Levels of the Provitamin A Betacarotene (Golden Rice 2) and Resistance to *Tungro* and Bacterial Blight through Marker-Assisted Breeding	PhilRice
3.	DABIOTECH-R1128: Development of a PCR-based Detection Method for *Xanthomonas oryzae* pv. *Oryzicola*, the Rice Bacterial Leaf Streak Pathogen	UPLB
4.	DABIOTECH-R1132: Genetic Diversity Analysis and Fingerprinting of Philippine *Musa balbisiana* Genotypes	UPLB
5.	DABIOTECH-R1403: Development of Molecular Detection for *Phospholipase* C-zeta 1 (PLCZ1) as Screening Tool for Water Buffalo Bull Fertility	PCC
6.	DABIOTECH-R1405: Evaluation of the Ovicidal Action of Nematode Predacious Fungus *Pochonia chlamydosporia* Against *Fasciola sp*. in Water Buffaloes (*Bubalus bubalis*)	UP-MSI
7.	DABIOTECH-R1510: SNP Marker Development for Genetic Traceability of Farmed Sandfish, *Holothuria scabra* (Holothuridae)	UP-MSI
8.	DABIOTECH-R1603: Development of Candidate Gene Sequence-Specific DNA Markers to Fast-Track Bacterial Wilt Resistance Breeding in Tomato	UPLB
	Policy Research and Advocacy	**Implementing Agency**
9.	DABIOTECH-P1502: The Socio-economic, Environmental, and Intersectoral Impacts of GM Corn in the Philippines	SIKAP/STRIVE, Inc.
10	DABIOTECH-P1302: Economic Assessment of Adoption of Microbial Rennet	UPLB
11	DABIOTECH-P1201: Incidence and Determination of Food-borne Pathogens in Vegetables: Towards the Development of Microbiological Standards for Produce	UP-NSRI
12	DABIOTECH-P1101: Development of Philippine National Standards and Codes of Practice for Selected Natural Ingredients	BCP and BAFS
	Institutional Capacity Enhancement	**Implementing Agency**
13	DABIOTECH-C1501: Support to the Implementation of BPI Regulation of GM Crops in the Philippines 2015-2017	BCP
14	DABIOTECH-C1503: Research Capacity Building for Agricultural Biotechnology at Cavite State University (CvSU)	CvSU
15	DABIOTECH-C1206: Capacity Building for Agricultural Biotechnology Advancement	ISAAA-SEA

DA-Biotech Scholarship Undergraduate Program

The DA-Biotech Scholarship Undergraduate Program was established in 2004 to promote the field of Agricultural Biotechnology, and assist in multiplying the succeeding champions in this field by supporting students with interest to undertake career paths in Biotechnology.

The Scholarship Program has awarded 61 scholarship grants to college students enrolled in five partner SUCs, which include Central Luzon State University, UP Los Baños, UP Visayas, Visayas State University, and University of Southern Mindanao.

To date, there are already 30 graduates, of which 18 scholars graduated in 2018.

R&D GRANTS AND SUPPORT SERVICES

1. Support to Basic and Strategic Research

BAR continuously supports basic and strategic R&D to enhance the generation of appropriate technologies. In 2018, 25 applied research projects were funded or 89 percent of the physical target for the year. Of the 25, 7 are new and 18 are continuing projects.

For crops-related research and livestock/poultry research there are 8 projects supported, of which 4 are new projects and 4 are continuing. The rest of the projects were distributed under fisheries and aquaculture research (1 new and 3 continuing) and crosscutting research (2 new projects and 11 continuing).

2. Human Resource Development

In its effort to contribute to the country's workforce responsible in mobilizing the agriculture and fisheries sector, the Human Resource Development Program (HRDP) offers the members of NaRDSAF network of R&D institutions financial assistance to students, employees, and researchers qualified for pursuing undergraduate, graduate, or post-graduate degree courses.

HRDP consists of the Degree and Non-degree Scholarship Program. The Degree Scholarship is open to the staff from members of NaRDSAF network of R&D institutions who are pursuing MS or PhD degree.

In 2018, BAR supported 11 scholars through this grant (*Table 8*).

Table 8. Grantees under the Degree Scholarship Program.

Name	Agency	Degree/University
1. Arlyn A. Abdulla	BFAR-ARMM	MS Ocean Sciences/UP Visayas
2. Charles A. Castro	DA-RFO 13	MS Plant Pathology/UPLB
3. Adley L. Masnar	MSU-Marawi	PhD Crop Production Management/USM
4. Charlie T. Panlilio	DA-BAFS	MS Soil Science/UPLB
5. Reychence D. Toto	DA-RFO 9	MS Agricultural Economics/UPLB
6. Wilmer S. Faylon	DA-RFO CALABARZON	MS Animal Science/UPLB
7. Kevin G. Biol	DA-RFO 8	MS Development Communication/UPLB
8. Ramon T. Maulit, Jr.	DA-RFO 11	MS Entomology/UPLB
9. Elijah M. Avante	BAI	MS Genetics/UPLB
10. Saudi D. Mangindara	DAF-ARMM	PhD Agricultural Sciences/USM
11. Gany A. Gaspar	DA-RFO 1	MS Veterinary Studies/CLSU

Meanwhile, the Non-degree Scholarship covers assistance to the conduct of thesis/dissertation studies and funding support for attendance or participation of NaRDSAF-member institutions in agriculture-related R&D trainings, conferences, symposia and seminars.

In 2018, BAR supported six scholars through the Thesis and Dissertation Assistance Program (*Table 9*).

Table 9. Assisted through the Thesis and Dissertation Assistance Program.

Name	Agency	Degree/University	Title
1. Francia D. Octeza	BU - Gubat Campus	PhD Development Management/ BU Graduate School	Rice Hull Liquid Smoke Production Process Standardization and Efficacy Testing as Bio Insecticide
2. Cynthia L. Payonga	SLSU	PhD Animal Science/UPLB	Bio-Economic Model of Native Chicken (*Gallus gallus domesticus* L.) Production in a Coconut-based Farming System in Catanauan, Quezon
3. Julienne Marie Undine Paz H. Quimio	UPLB	MS Animal Science/UPLB	Evaluation of Subtherapeutic and Therapeutic Chlortetracycline Levels on Meat and Antimicrobial Resistance Profile of *Escherichia coli* Micoflora in Broiler Chickens
4. Mary Arnel D. Garcia	BSU	PhD Animal Science/UPLB	Energy and Nutrient Digestibility and Requirements for Minerals in Growing Philippine Native Pigs (*Susscrofa domesticus*) Raised under Intensive Farming Conditions
5. Marcos E. Bollido	NwSSU-San Jorge Campus	Master in Agricultural Sciences/ESU	Growth Performance and Profitability of Broilers with Fermented Ration Under Two Management Systems
6. Dennis C. Ramo	LGU-Monkayo	PhD Entomology/UPLB	Reproductive Cycles and Behavior of Rice Black Bug, *Scotinophara coarcta*ta (Fab.) (Hemiptera: Pentatomidae) Population as Influenced by Rice Cropping System: Implication to its Flight and Aggregation Behavior

Since 2012, BAR has been implementing an Undergraduate Scholarship Program in partnership with UPLB through the Office of the Vice Chancellor for Academic Affairs and UPLBFI. The program was initially for students taking up BS Agriculture and BS Agricultural Biotechnology.

In 2015, the scholarship was made available to students taking other agriculture-related courses: BS Food Technology and BS Development Communication.

For 2017-2018, 22 undergraduate scholars graduated during the 46th UPLB Commencement Exercises held on 23 June 2018. Five of these scholars graduated *cum laude*: Roy R. Boten (BS Agriculture), Ericka Joy U. Ancayan (BS Agricultural Biotechnology), Lawrence Gabriel C. Ignacio (BS Food Technology), Patricia Mae A. Lara (BS Food Technology), and Clarisse Mae N. Abao (BS Development Communication).

Gawad Saka

BAR facilitated the screening, evaluation, and field validation of the eight nominees for DA's Gawad Saka Search for Outstanding Agricultural Research (OAR) and Outstanding Agricultural Scientist (OAS). Gawad Saka is an annual activity that recognizes the outstanding work done by of farmers, fisherfolk, institutions, scientists, and researchers in the agriculture and fisheries sector.

Dr. Irene Adion, manager of the Central Luzon Integrated Agricultural Research Center (CLIARC) and focal person of Organic Agriculture Program, DA-RFO 3, was named as the finalist of the 2018 Gawad Saka Search under OAR category.

Dr. Irene Adion of DA-RFO 3

3. R&D Facilities Development

The R&D Facilities Development Program supports the acquisition of scientific and information technology equipment; construction and renovation of R&D facilities (office buildings, laboratories, and experimental farms); and basic R&D support facilities of NaRDSAF member institutions. In 2018, BAR funded 15 new R&D facilities.

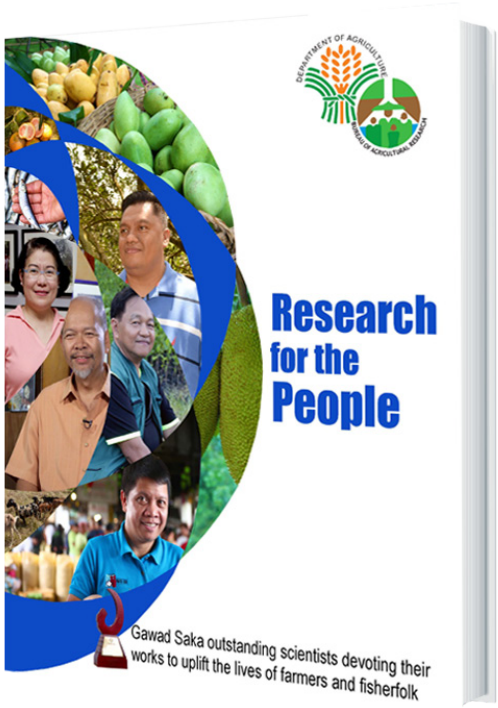
BAR participated in the inauguration of 11 R&D facilities. These were: Organic Agriculture R&D Center and Storage Facility for Garlic at DA-Ilocos Norte Research and Experiment Center; Fish Processing and Marine Products Research and Development Center at Bataan Peninsula State University; Organic Agriculture R&D Center at Palawan Agricultural Center (PAC); Research and Development Building at DA-Palawan Research and Experiment Station; Food Product Development Center DAF-Autonomous Region in Muslim Mindanao Integrated Agricultural Research Center (ARMMIARC); Organic Agriculture R&D Center at DA-Nueva Vizcaya Experiment Station; Plant Genetic Resources Center in Cagayan Valley at DA-Cagayan Valley Research Center; Mushroom Development Center in DA-Regional Crop Protection Center, Ilagan, Isabela; BPI-LBNCRDPSC R&D Facilities; and R&D Multipurpose Facility at Baguio Stock Farm.

BAR also participated in the groundbreaking ceremonies of 9 R&D facilities. These include: Multipurpose Facility in support to CC at ISU-Echague; Organic RDE Center at UPLB; Plant Genetic Resources Center at PAC; R&D Multipurpose Facility at ARMMIARC; Davao Commercial Agriculture Research Station R&D Center at Davao Commercial Agriculture Research Station; Modern Academic Research Greenhouse at UPLB-Institute of Crop Science; Artificial Insemination Center for Dairy and Cacao Processing Center at ISU-Echague.

4. Scientific Publication Grant

BAR supported 41 R&D undertakings of institutions, organizations, and scientific/ professional societies under the Scientific Publication Grant (SPG). These includes: 25 conferences, symposia, workshops; 9 knowledge management (KM) projects; and 7 book projects.

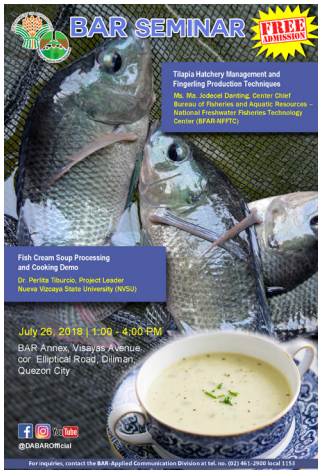
Among the KM projects that received fund support through SPG were the following: audiovisual presentation (AVP) of NOAP Projects funded by BAR, production of video guides on mature R&D generated agriculture and fisheries technologies, documentation and telecast of CPAR and NTCP-inspired success stories and other BAR R&D projects, and Information and Knowledge Management (IKM) Mentorship Program: Communicating Agriculture and Fisheries Research for Inclusive and Sustainable Development.

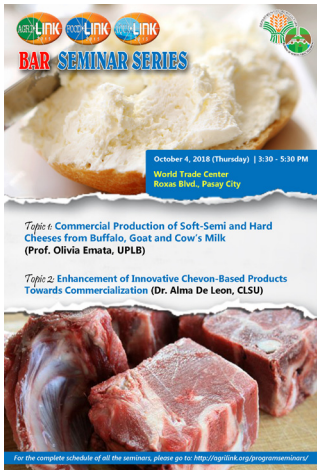


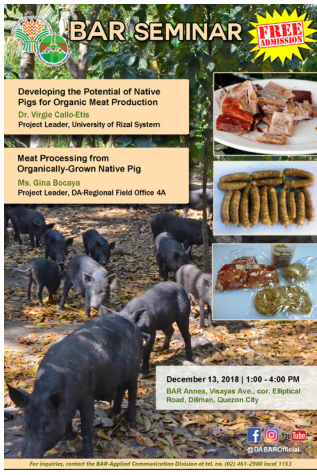
5. Knowledge Management

The bureau's KM program focuses on technology and information dissemination from technology generators to users. To ensure that information and knowledge generated from supported researchers reach the intended users and stakeholders, BAR produces and packages knowledge products in different media forms. It also capacitates its workforce through trainings and mentorship program.

Seminar Series





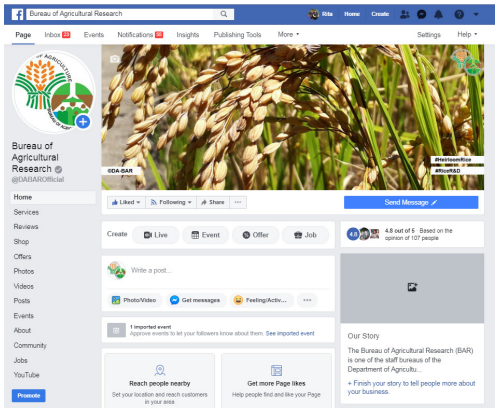


In 2018, BAR, in collaboration with Agricultural Training Institute and Manila Bulletin, conducted four AgriTalk Free Seminars held in Iloilo, Cabanatuan, Manila, and Davao. Attended by more than 2,000 people, AgriTalk is a free seminar featuring the latest and practical technologies and trends in agriculture. Specifically, it aims to showcase technologies and farming practices that farmers can adopt in their own farms for increased production and income.

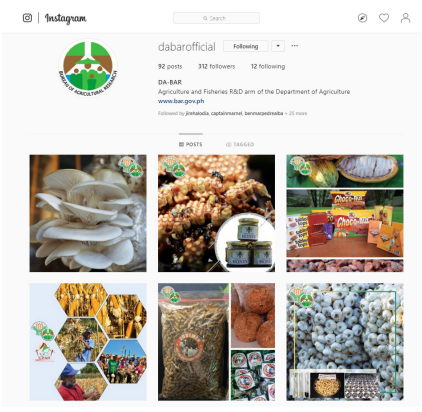
BAR continued to conduct its in-house and regional seminars. In 2018, BAR conducted nine in-house seminars and six regional seminars. The seminars were livestreamed in BAR's Facebook Page for those who could not go to the venue. Further, BAR uploads the livestreamed video on its official YouTube account to further disseminate the featured technology to interested individuals.

In 2018, more than 900 individuals attended the in-house seminars. Among the featured seminar topics were: Lending Facility for Farmhands and Fisherfolk, Agriculture and Fishery Financing Program, Cacao Production and Marketing Opportunities, Cacao Bean Processing, Organic Seed Production Systems for Legumes and Lowland Vegetables, Management of Other Major Insect Pest of Organically-grown Eggplant, Nutraceutical and Cosmeceutical Products from Saluyot and Okra: Protective and Preventive Alternatives for Health and Wellness, and Do-It-Yourself: A Homemade Virgin Coconut Soap Enhanced with Plant Extract.

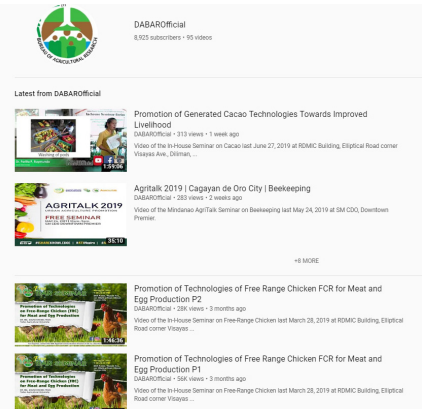
Social Media



Facebook Page



Instagram



YouTube Channel

BAR maintains three official social media accounts (Facebook, Instagram, and Youtube: @dabarofficial) for wider audience reach. The bureau continuously utilizes its Facebook Page to announce and promote its seminars and other activities such as the Agriculture and Fisheries Technology Forum and Product Exhibition and the National Research Symposium. It also serves as a platform to post and upload press releases and post-activity events and provides a venue to address inquiries and feedback from clients. BAR also broadcasts its seminars through Facebook Live to reach more audience and accommodate those who could not go to the venue.

In 2018, 179 photo releases, 4,127 photos, 50 articles, 17 technologies, 49 videos, and 25 announcements were posted and uploaded on the BAR's social media accounts.

Publication and IEC Materials

The bureau's regular publications, BAR Chronicle, official monthly newsletter; and BAR R&D Digest, quarterly magazine, continue to feature and highlight R&D activities and research-generated technologies.

For the 3rd quarter of 2018, BAR R&D Digest featured the Seamen in Agriculture (SIA). The group has been adopting BAR-supported technologies. SIA has more than 4,000 members from all over the country.

In partnership with AFACI, BAR continued its distribution of IEC materials. Brochures, magazines, newsletters, and other publications reproduced by BAR were distributed during seminars, trade fairs, and exhibits.

In 2018, BAR packaged 19 regular and 274 special publications and reproduced 329,003 IEC materials of various kinds (e.g. flyers, CDs, brochures). As for the 52 press releases sent to media outfits, 49 articles and 5 photo stories were published in dailies. For this year, BAR was also able to publish 91 media release through broadcasts/radio, livecasts, online publication, etc.

Books

BAR assisted in the launching of four books:

1. Science-based Management and Upland Community Development: The Case of Mount Makiling Forest Reserve

Launched on 18 April 2018 in UPLB, the book compiles and synthesizes findings of scientific studies undertaken in Mount Makiling Forest Reserve (MMFR) since the early 1900s and put together into a sustainable management, conservation, and development program for forest reserve and the upland community.

2. Financial Viability and Profitability Analysis of New Technologies and Enterprises

Launched during the 14th Agriculture and Fisheries Technology Forum and Product Exhibition on 30 August 2018 in Mandaluyong City, the training manual aimed to equip the would-be users including research personnel from various academic and research institutions with the knowledge and skills in conducting financial viability and profitability analysis of new technologies and enterprises.

3. The Way Forward: Modernization and Industrialization of Philippine Agriculture

Launched during the 14th Agriculture and Fisheries Technology Forum and Product Exhibition on 30 August 2018 in Mandaluyong City, the 322-page compiled book was organized into six chapters with the hope of providing answers on what must the stakeholders and players in the agriculture sector do to modernize and industrialize the country's agriculture sector.

4. Research for the People: Gawad Saka Outstanding Scientists Devoting their Works to Uplift the Lives of Farmers and Fisherfolk

Launched during the closing ceremony of the 30th National Research Symposium on 8 November 2018 in Manila, the book features five Gawad Saka Outstanding Scientists who unquestionably deserve being awarded for their selfless and patriotic efforts in helping farmers and fishers through proven R&D solutions.

Information and Knowledge Management (IKM) Mentorship Program

The IKM Mentorship Program is a first-of-its-kind course program that aims to facilitate improved agricultural and fisheries research reporting and knowledge management in the agri-fishery sector. On 25-26 September 2018, the 16 learners of the first batch graduated from the program. Kevin Biol of DA-RFO 8 was awarded the most outstanding learner-participant of this batch.

Following the success of the first batch, SEARCA and BAR launched its second batch of course learners on 19-21 November 2018 at SEARCA, Los Baños, Laguna. Eighteen learner-participants from BFAR regional offices and DA attached agencies and staff bureaus are included in the IKM program which will run for eight months.

6. R&D Technology Commercialization Center

R&D Technology Commercialization Center (Tech Com Center), located at the ground floor of the BAR Building, is a showcase area of research results, innovations, and products developed under the BAR's banner programs: NTCP and CPAR.

Among the products displayed at the Tech Com Center are the winners of best product in NTF over the years. These include: DA-QARES' cacao wine (2018 Best Product), DA-RFO 11's Apali flour-based products (2017 Best Product) UPLB's Cream Cheese (2016 Best Product), and FREEDOM Inc.'s Nipa Palm Sugar (2015 Best Product), and DA-NMACLRC's Adlay breakfast cereal (2013 Best Product).

Since April 2018, the Tech Com Center also features a "Technology of the Month." The poster highlights the technologies featured during the BAR's monthly in-house seminar. It contains brief and concise rationale and information on the featured technology.

The Tech Com Center is open to all interested individuals. Among the key personalities who visited the Tech Com Center were: Dr. Kim Min-kyeong, AFACI deputy secretary general, and Kim Eun-ji, AFACI coordinator for ATIN project; Dr. Christine Tait-Burkard, Dr. Tanja Opriessnig, and Dr. Samantha Lycett of the University of Edinburgh-Roslin Institute, together with Dr. Clarissa Yvonne Domingo of CLSU and Dr. Daphne Jorca of BAI, researchers under the Newton Fund Partnership between UK-Biotechnology and Biological Sciences Research Council and DA-BAR; and, officials from Komite Ekonomi dan Industri Nasional (KEIN) of Republic of Indonesia which include Dr. Benny Pasaribu, Agriculture and Agroindustry Development working group head, Hendri Saparini, Macroeconomics, Trade and Investment working group head, Mohamad Fadhil Hasan, Labour Force and Employment working group head, Aries Muftie, Rural Economic Development working group head, and Fachru Nofrian, member of the working group on Macroeconomics, Trade and Investment.

7. Intellectual Property Management

BAR continuously provides assistance to its clients through the intellectual property (IP) applications such as trademark, patent, and utility model. Apart from this, IP management is also a continuing activity of the bureau. It includes novelty spotting, evaluation of projects found with IP potential, drafting of applications conforming to the Intellectual Property Office requirements, compliance with the IPO findings, and corrections of findings to meet the examiner's preferences.

In 2018, 12 intellectual property rights (IPR) application were facilitated, 9 trademarks and 5 utility models. During the 14th Agriculture and Fisheries Technology Forum and Product Exhibition, five IPR were awarded:

MakGum – PCA-Albay Research Center (Trademark)
The brand is used for all products made from *makapuno* coconut, one of which is galactomannan.

UMART – CLSU (Trademark)
The trademark would be the brand for all products produced, manufactured, and sold by CLSU.

K-zser – CLSU (Trademark)
The logo and the brand would be used for the mango liquor and other mango products produced by CLSU.

Technology Commercialization on Wheels – UPLB (Trademark)
The trademark would be used to identify products and services offered through UPLB's Technology Commercializatoin on Wheels.

Cozy Coast – Evelyn Rimando (Trademark)
The brand would be used primarily as the name of the establishment together with the agricultural and aquacultural products and services they offer.

Institutional Updates

ABOUT BAR

BAR is an attached agency of DA tasked to coordinate agriculture and fisheries research and development and ensure the application of its full potential to improving the sector. It was created in 1987 through Executive Order 116 to ensure that agricultural research is coordinated and undertaken for maximum utility to agriculture. It is mandated to tap farmers, farmers' organizations, and research institutions, including state universities and colleges in the conduct of research for the use of the DA particularly, the farmers and fisherfolk.

Vision

"A better life for Filipinos through excellence in agriculture and fisheries research and development."

Mission

"To attain food security and reduce poverty through technology-based agriculture and fisheries sector."

R&D Thrusts

1. Food security
2. Increased productivity and profitability
3. Poverty eradication and people empowerment
4. Sustainable agricultural development
5. Global competitiveness

Strategic Approaches

1. Relevant and innovative technology and information generation
2. Community-based technology development and validation
3. Responsive technology commercialization
4. Agribusiness development
5. Public-private partnership
6. Institutional development
7. Local and international linkaging
8. Information communication technology management
9. Knowledge management
10. Provision of favorable research policy environment

For the last three years, the annual budget allotment for R&D has gradually declined. In 2018, the allotment decreased by 5.80 percent, from Php 1.24 billion in 2017 to Php 1.17 billion.

Table 10. BAR's Annual allotment from 2014-2018

YEAR	ALLOTMENT ('000)
2014	1,004,593
2015	1,117,202
2016	1,330,979
2017	1,247,399
2018	1,175,085

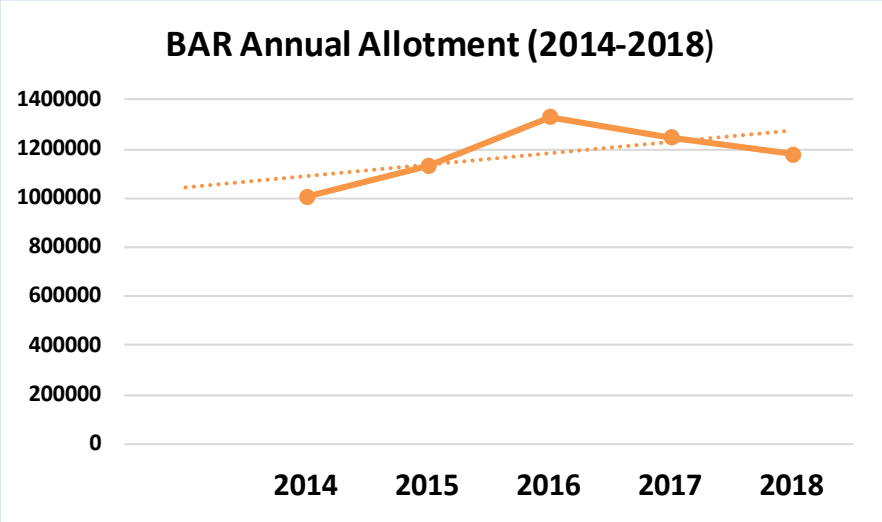


Figure 1. BAR's Annual Allotment for the last 5 years

A major portion of the 2018 R&D allotment went to R&D Programs of BAR (37 percent) and National Rice Program (37 percent). The R&D Programs include implementation of various research activities under Biotechnology, Climate Change, CPAR, NTCP, and IDG.

Table 11. BAR's Annual Allotment for 2018 by programs

Programs	Allotment	Percent
Rice	417,833	37%
Corn	112,335	10%
High Value Crops	126,624	11%
Organic Agriculture	50,000	5%
Other R&D Programs	417,833	37%

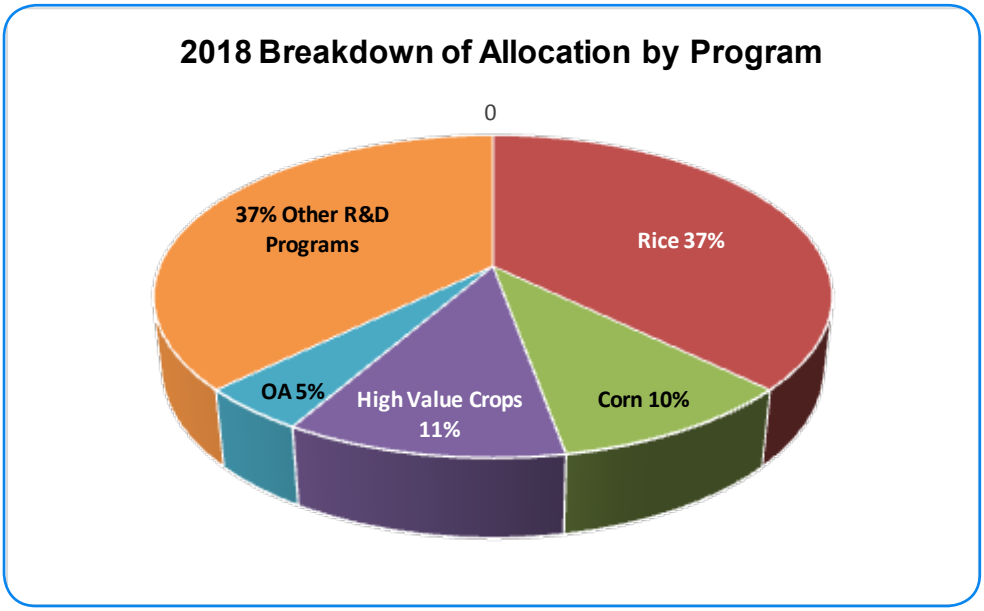


Figure 2. BAR's Annual Allotment for 2018 by programs

INTERNATIONAL PARTNERSHIP

An important strategy that BAR continues to exhaust in addressing effective and sustainable solutions to address issues besetting agri-fishery R&D is through partnership with international research organizations. When pursued effectively, international collaboration can improve productivity and create impact at the grassroot far more than conducting the research alone. It can combine for optimal results in terms of research collaboration.

BAR establishes new partnership as well as maintains existing linkages with international institutions to allow knowledge exchange and resource sharing. These collaborations also support the vision of Philippines towards a progressive agriculture and fisheries industry.

1. BAR and FAO collaborative project on agro-biodiversity

The Department of Agriculture (DA), through BAR, in partnership with the Food and Agriculture Organization (FAO) of the United Nations, held the 2nd Project Steering Committee (PSC) Meeting for the implemented project titled, "Dynamic Conservation and Sustainable Use of Agrobiodiversity in Traditional Agro-Ecosystems of the Philippines (Rice Plus)," on 24 January 2018 in Quezon City.

The project aimed to address the challenges on food production and accessibility in rural communities through innovative and traditional practices. Initiated in 2016, The DA-FAO partnership was initiated with BAR serving as the lead coordinating government agency for the project.

Since its implementation, the team has coordinated and visited different sites to orient various stakeholders on the project. The orientation aimed to demonstrate the true value and importance of agrobiodiversity resources in the country. Provision of policy and capacity building support in the participatory conservation and sustainable use of agrobiodiversity resources were also accounted.

The FAO-DA-BAR project aims to conserve globally-important crops like rice, mungbean, taro, yam, banana, abaca, among others, in traditional agro-ecosystems of the Philippines. Among its components include mainstreaming the agro-biodiversity conservation into policy and legal frameworks, enhancing and expanding dynamic conservation practices for agro-biodiversity in three pilot communities in Hungduan and Hingyon, Ifugao; and in Lake Sebu, South Cotabato, and disseminating the documented good practices to other areas.

2. BAR and AFACI collaborative projects on food crops and networking

The Department of Agriculture (DA), through BAR, in partnership with Korea's Asian Food and Agriculture Cooperation Initiative (AFACI) conducted review and evaluation of its on-going projects that are being implemented in the Philippines on 14 June 2018 in Quezon City.

Highlights of the review included the presentations of the accomplishments of four on-going projects funded by AFACI. Among the projects presented include: 1) "AFACI-GAP Project: Development of Locally-Appropriate GAP Programs and Agricultural Produce Safety Information System in the Philippines" by Mary Grace Mandigma, Principal Investigator (PI) of GAP and officer-in-charge division chief from Bureau of Agriculture and Fisheries Standards; 2) "Assessment of Brown Planthopper, Whitebacked Planthopper Populations and Virus Diseases in Rice and Selected Solaneceous Crops" by Genaro Rillon, PI of IPM and research division head of crop protection from Philippine Rice Research Institute; 3) "Collection, Characterization and Distribution of Vigna sp. and Pigeon pea Germplasm to Promote Use in the Philippines (Phase 2)" by Maria Lea Villavicencio, PI of PGR and university researcher from Institute of Plant Breeding, College of Agriculture and Food Science (CAFS), UPLB; and, 4) "Application of improved Postharvest Handling Techniques of Crops grown by Farmers in the Philippines (Phase II)" by Jennelyn Resorez, in behalf of Dr. Perlita Nuevo, PI of Postharvest and research assistant professor from Postharvest Horticulture Training and Research Center, CAFS, UPLB.

AFACI is an intergovernmental and multilateral cooperation body aiming to improve food production, realize sustainable agriculture and enhance extension service of Asian countries by sharing knowledge and information on agricultural technology. Since its inception in 2010, BAR serves as the lead coordinating agency of the AFACI-funded projects in the Philippines.

ANNUAL MAJOR EVENTS

Annually, BAR spearheads the conduct of two major events: the Agriculture and Fisheries Technology Forum and Product Exhibition (NTF) every August; and the National Research Symposium (NRS) every October.

The NTF aimed to identify, disseminate and promote mature technologies in the fields of agriculture and fisheries, and to establish and strengthen linkages and networks between and among the public and private sectors in terms of product marketing. It also serves as a venue to bring together manufacturers, distributors, dealers and buyers for market matching and business ventures.

Meanwhile, NRS features completed R&D papers from different R&D institutions throughout the country. It aims to recognize the vital role of researchers as catalyst for developing R&D that matters to the sector.

1. 14th Agriculture and Fisheries Technology Forum and Product Exhibition

BAR staged the NTF on August 30-September 2, 2018 at SM Megamall, Mandaluyong City with the theme, "Agripreneurship: Mainstreaming Agriculture and Fisheries R&D by Delivering Technology Breakthroughs to Farmers and Fisherfolk."

Since 2005, the NTF showcases technology and product innovations developed by national and regional offices, international organizations, SUCs, and other R&D partners with the goal of developing and strengthening technology-based agri-entrepreneurial linkages and providing commercial opportunities.

The guest of honor for the event was chair of the Senate Committee on Agriculture and Food, Senator Cynthia Villar, who underscored the role of R&D and commended BAR for choosing "agripreneurship" as its theme this year. She also acknowledged the bureau's commitment to consolidate, strengthen, and develop the agriculture and fisheries R&D system for the purpose of improving its effectiveness and efficiency.

Also present during the opening was Agriculture Assistant Secretary Roldan G. Gorgonio, who represented Secretary Emmanuel F. Piñol. Gorgonio also commended the bureau for showcasing to the public the results of R&D and stressed the importance of mainstreaming food, non-food products, and generated technologies to the market through technology commercialization.

There were 92 exhibits that showcased technologies, services, and products that drew 6,613 visitors and guest from both public and private sectors. Key officials who visited the forum including Rep. Evelina Escudero of the first district of Sorsogon; Cecilia Barbara Reyes, committee secretary of the Special Committee on East ASEAN Growth Area, House of Representatives; Angel Enriquez, director of the Bureau of Soils and Water Management; and Dr. Jiweon Lee, director-general of Korea's Rural Development Administration-Technology Cooperation Bureau.

Other known personalities who visited the forum were Dr. William Dar, president of Inang Lupa Movement, Inc. and former secretary of DA; Ramon Magsaysay, Jr., former senator; Dr. Luis Rey Velasco, former chancellor of UPLB; and Felicidad Tan-Sy, wife of the owner of SM Malls.

Among the highlights of the event were the launch of the revitalized Regional Research, Development and Extension Network for

Agriculture and Fisheries (RRDEN); book launching; re-launch of the EL music video, "Tara! Mag Edible Landscaping Na!"; and conduct of seminar series.

Five Intellectual Property Rights (IPR) protection certificates of trademark registration were awarded to BAR's partner institutions. Also highlighted during the closing ceremony were the awarding of loyalty award to BAR employees who rendered 15 years above of government service in the bureau and the awarding of NTF best booths and best products.

Launch of revitalized RRDEN

Research partners from 16 regions signify their support and commitment to the implementation of the revitalized Regional Research, Development and Extension Network for Agriculture and Fisheries (RRDEN) which was launched during the opening of the NTF.

During the launch, each representative composed of regional technical directors and research division chiefs, from the 16 regions showcased the RRDEN official logo which carries the original design proposed by the Mindanao group, with modifications and improvements done by BAR's Applied Communication Division embodying the network's identity and purpose.

Regional representatives, along with BAR officials also signed the "RRDEN Commitment Wall" to show their support. This also reinforces the bureau's partnership with the regions.

RRDEN was created for each region pursuant to the Agriculture and Fisheries Modernization Act (AFMA) under Rule 81.14.3 mandating DA Regional Integrated Agricultural Research Centers (RIARCs) to develop and maintain a network of regional and provincial collaborators in undertaking the regional RDE programs. BAR was tasked to oversee and coordinate the activities of the network to ensure the efficient delivery of the RDE system, and at the same time strengthen the cooperation among network members.

Through the established network, a systematic implementation of RDE agenda and complementation of programs for agriculture and fisheries has been achieved.

Book launch

Two books supported by BAR were launched during the opening program of the NTF on 30 August 2018 at SM Megamall, Mandaluyong City.

The two books launched were: 1) "Financial Viability and Profitability Analysis of New Technologies and Enterprises" and 2) "The Way Forward: Modernization and Industrialization of Philippine Agriculture."

The training manual is an in-depth discussion on the different analytical

tools, including exercises focused on computer applications of these are outlined in this book. It consisted of five chapters: 1) Cost and Returns Analysis, 2) Break-Even Analysis, 3) Partial Budget Analysis, 4) Break-Even Budgeting, and 5) Financial and Sensitivity Analyses. The training manual aimed to equip the would-be users including research personnel from various academic and research institutions with the knowledge and skills in conducting financial viability and profitability analysis of new technologies and enterprises.

Meanwhile, Dr. Dar's 322-page compiled book was organized into six chapters with the hope of providing answers on what must the stakeholders and players in the agriculture sector do to modernize and industrialize the country's agriculture sector. The six topics in the book included: 1) Modernizing and Industrializing the Philippine Agriculture Sector, 2) Inclusive Growth, 3) Science and Technology for Farming, 4) Climate Change, 5) Agripreneurship and Agribusiness, and) The Youth and Farming.

Re-Launch of EL Music Video

BAR, together with Edible Landscaping (EL) team of UPLB, re-launched the music video, "Tara! Mag Edible Landscaping Na!"

Created to promote and disseminate information on EL technology to a wider audience, the music video features the EL techno-demo garden located at the UPLB campus and the different adopters of the technology. The song was composed by Jascha Emmanuel A. Dadap, Von Jelmar P. Herbosa, and Maria Charito E. Balladares.

Since 2010, BAR and UPLB have been working together to promote the EL technology. EL is a new and innovative way of creating attractive and functional spaces while producing safe and nutritious food. This means that vegetables, herbs, medicinal plants, and fruit trees are used to decorate landscapes and garden instead of ornamentals.

Present during the music video re-launch were Dr. Nicomedes P. Eleazar, BAR director; Digna L. Sandoval, BAR OIC-assistant director; Dr. Glenn S. Lubuguin, UPLB assistant to the vice chancellor for research and extension; and Angel C. Enriquez, OIC-director of the Bureau of Soils and Water Management. The EL theme song was performed live by Kyle John Echarri, millennial ambassador of the EL project.

Seminar Series on Financial Viability

The second day of the NTF highlighted on the agribusiness potentials and financial viabilities of various technologies supported and funded by BAR under NTCP.

The seminar topics focused on the innovative and relevant technologies that the public may want to engage on for its agribusiness and profit potentials (*Table 12*). Among the topics discussed were on Nipa palm, *batuan*, mushroom, coffee, cacao, Queen pineapple, mango, and abaca.

Aside from financial viability on the agri-commodities, other seminar topics that were featured in the seminar included: 1) innovative products from corn, 2) corn silage production, 3) chevon-based products, 4) commercial production of native chicken, 5) soybean value-adding technologies, 6) *guayabano* product development, 7) algal paste in aquaculture, and 8) microbial inoculant for pests and diseases.

Table 12. Seminar topics during the 14th NTF.

SEMINAR TOPIC	RESOURCE PERSON
DAY 2| 31 August 2018	
Financial Viability of Processing Nipa Palm Sugar	Antonio Peralta *FREEDOM, Inc.*
Fianancial Viability of Batuan Value Added Products	Dr. Erlinda Dizon and Reifrey Lascana *UPLB*
Financial Viability of Mushroom Products	Salvo Salvacion *SLSU-Lucban*
Financial *Viability* of Coffee Processing Technologies	Dr. Helen Martinez *PhilMech*
Financial Viability of Cacao Production and Developed Products	Rambie Malangen *ISU*
Financial Viability of Queen Pineapple Products	Ulysses Rey Dimaano *LPMPC*
Financial Viability of Mangifera Liqueur	Geraldine Gantioque *CLSU*
Financial Viability of Abaca Products	Dr. Feliciano Sinon *VSU*
Commercial Production of Native Chicken for Market (Dressed)	Dr. Jaime Cabarles *CPU*
DAY 3| 01 September 2018	
Innovative Chevon-based products	Alma De Leon *CLSU*
Corn Silage Production for Dairy Cattle	Nilo Padilla *ISU*
Local Production of Texturized Soy Protein	Elmer Enicola *UPLB-IPB*
Innovative Products from Corn	Rose Mary Aquino *DA-RFO 2*
Guyabano Product Development	Dennis Bihis *DA-RFO 4A QARES*
Application of Algal Paste Technology in Aquaculture	Dr. Soledad S. Garibay *UP Visayas*
Microbial Innoculant for Pest and Diseases	Dr. Virginia Cuevas *UPLB*
Soybean Cooking Demonstration	Ceferina De Guzman *Golden Beans and Grains Cooperative*

Best Products and Best Booths Awards

Besting 80 product entries for the year's Best Product was the cacao wine from the Department of Agriculture-Quezon Agricultural Research Experiment Station (DA-QARES).

Made from the seed pulp–a part of the fruit that is often regarded as waste, the cacao wine's sleek packaging and labelling, exceptional product quality, and most especially its local and international market potential and competitiveness impressed the judges paving for its win at the forum's annual product competition.

DA-Regional Field Office (DA-RFO) 2's MangBean soup product landed on second place, while DA-RFO 11's adlay products came third. MangBean soup is one of the region's product lines made from soybean. It is considered a highly-nutritious instant soup as soybean contains healthy amounts of protein, fiber, and ash, and has lower phytic acid than most legume crops. Meanwhile, adlay-based products instant mami is packed with adlay grains in native chicken flavor while the Adlay Pao is made from adlay flour with asado-flavored mushroom filling.

Finishing as fourth and fifth placers were the NutriConvy and Veggie Chips products developed by DA-RFO Caraga and DA-RFO 5, respectively. The NutriConvy products include muffin mix, adlay caldo, and pancake mix packed with adlay, squash, *malunggay*, and soybean as the main ingredients, with no preservatives, artificial flavors, and colors. The Veggie Chips, on the other hand, are a healthy alternative to junk food snacks such as chips or *chichirya*. These nutritious chips come in five flavors: *ampalaya*, squash, *malunggay*, tomato, and carrots.

Special awards were also given to various products that may have failed to meet the criteria but their ingenuity and uniqueness, one can't just set aside. Sheep wool products and fossilized cacao leaves from DA-RFO CALABARZON; *Malunggay* pods decorations and cyperus grass products from DA-MIMAROPA; raffia grass products from DA-RFO 5; and the aloe vera-based products from Rescue Environment through Greening Outreaches, a non-government organization based in Quezon province bagged this year's special awards.

Meanwhile, the NTF's Best Booth competition also gives recognition to participating exhibitors who displayed creativity, originality, and uniqueness in designing their respective booths. The winners were: Department of Agriculture and Fisheries – Autonomous Region of Muslim Mindanao (DAF-ARMM), first place; DA-MIMAROPA, second place; DA-RFO 1, third place; DA-RFO 5, fourth place; and DA-Caraga, fifth place. DA-RFO 2 and the Bureau of Fisheries and Aquatic Resources (BFAR) Regional Office 2 also received special awards for the Best Booth category.

All entries for the Best Product category were evaluated based on: creativity and uniqueness; relevance to food security; health and wellness; good product attributes; packaging and labeling; and market potential and competitiveness.

For the Best Booth category, the criteria were: booth design (originality, uniqueness, creativity, use of indigenous materials, organization of display); booth contents (showcase of BAR-funded projects and presence of knowledge materials); and staff presentation (fully knowledgeable about the projects and products being showcased).

All winners received R&D grants and a plaque.

Awarding of IPR Trademark Registration

In support to the promotion of innovation and creation through Intellectual Property Rights (IPR) protection, BAR awarded five certificates of trademark registration to agencies and private individuals during the closing ceremony of the 14th NTF.

The IPR certificates of trademark registration were awarded to BAR's partner institutions, namely: Philippine Coconut Authority-Albay Research Center (Mak Gum), Central Luzon State University (UMART and K-Zser), University of the Philippines Los Baños (Technology Commercialization on Wheels); and private individual, Evelyn Rimando (Cozy Coast).

The IPR protection is given by the International Property Office of the Philippines (IPOPhil) through the assistance of the bureau's Intellectual Property Section, which is under the Technology Commercialization Division.

Awarding of Loyalty Awards

Pursuant to the Civil Service Commission (CSC) Resolution No. 02-0295, series of 2002, BAR, conferred a loyalty award to its 20 employees during the closing ceremonies of NTF.

Recipients of the loyalty award for 30 years of government service were: BAR Director Dr. Nicomedes Eleazar; BAR OIC-Assistant Director Digna Sandoval; Dr. Andrea Agillon, Victoriano Guiam, Ricarte Castro, Rosalia Maranan, Melissa Resma, Ludivina Pelayo, Julieta Yonzon, Elec Yadao, Alfonso Nidoy, Ronnie Rosales, and Merlinda Martinez.

Loyalty awardees for 20 years of service included Ma. Louella Dejelo, Rodolfo Galang, Christopher Lazaro, and Elvira Rapada; while those the loyalty award for 15 years of service were given to Francisco Grettchin, Ricardo Bernardo, and Roberto Quing, Jr.

The continuous and satisfactory service rendered by an employee in the government for a period of 10-40 years will be awarded with loyalty memorabilia such as a bronze service pin (for 10 and 15 years of service), a silver service ring (for 20 and 35 years of service), and a gold service medallion (for 30, 35, and 40 years of service). In addition, a cash gift for every year of service is given to qualified officials and employees.

2. 30th National Research Symposium

Eight Gold winners were announced as AFMA Best R&D Paper and Poster during the awarding ceremony of the 30th National Research Symposium (NRS) held on 7 November 2018 at the Philippine International Convention Center Complex, Roxas Blvd., Manila. Leading the awarding of winners were Department of Agriculture Undersecretary for Operations Ariel T. Cayanan; Atty. Rod H. Pino, representing Rep. Evelina G. Escudero of the 1st District of Sorsogon; BAR Director Nicomedes P. Eleazar; and BAR OIC-Asst. Director Digna L. Sandoval.

From the 176 research entries received by BAR this year, the 31 R&D papers and 3 posters were hailed and emerged victorious. The winners were selected from seven competing categories: 1) Basic Research, 2) Socio-Economic Research, 3) Development Research-Agriculture, 4) Applied Research (Technology Generation/Information Generation)-Agriculture, 5) Applied Research (Technology Adaptation/Technology Verification)-Agriculture, 6) Applied Research (Technology Generation/Information Generation)-Fisheries, and 7) Applied Research (Technology Adaptation/Technology Verification)-Fisheries.

The AFMA Best R&D Papers Gold award received a cash prize amounting to Php 100,000. Silver award received a cash prize of Php 75,000 and for Bronze award a cash prize of Php 50,000. For AFMA Best R&D Posters Gold award a cash prize of Php 50,000; Silver award Php 35,000 and Bronze award Php 25,000 respectively. Aside from the cash prize given, all the winners were received a proposal-based research grant from BAR.

Table 13. Winners of AFMA Best R&D Paper (by category)

R&D PAPERS	AUTHOR/S	AGENCY	AWARD
A. BASIC RESEARCH CATEGORY			
Somatic Embryogenesis, Regeneration, Phenotypic, and Cytological Evaluation of Selected Philippine Papaya (*Carica papaya* L.) Genotypes	Pablito M. Magdalita Alangelico O. San Pascual	UPLB	Silver
B. SOCIO-ECONOMIC CATEGORY			
Livelihood Vulnerability Index of the Informal Food Sector to Climate Extremes in Camarines Sur	Hanilyn A. Hidalgo	CBSUA	Silver
Knowledge Gains of Farmers from the Climate Field School and Changes in their Practices	Ruth Anne T. Ruelos, Merlyne M. Paunlagui Macrina G. Umali, Agnes R. Chupungco Dhanicca Armor M. Domingo Therese R. Oliviga Agnes C. Rola	UPLB	Bronze
Participatory Approaches in Analyzing Best Practices in Promoting Organic Agriculture in Selected Municipalities in the Philippines	Marianne R. De Luna Edna Luisa A. Matienzo	UPLB	Bronze
C. DEVELOPMENT AGRICULTURE CATEGORY			
CPAR on Integrated Rice-Based Farming System: An Approach Towards Community Driven Agricultural Development in Ilocos Norte	Mark Ariel L. Agresor Melinda G. Calumpit Evelyn De Los Reyes Eliemar Ragadi Joi Labii Justina Sacro	DA-RFO 1	Gold
Development of Five Variants of Cassava Chips	Cynthia DT. Leycano Aurora F. Consulta Avelita M. Rosales	DA-RFO 4A (CALABARZON)	Silver
Development, Product Quality Assessment, and Promotion of Rice Value-Added Products in Department of Agriculture - Northern Mindanao Agricultural Crops and Livestock Research Complex (NMACLRC), Dalwangan, Malaybalay City	Maridith A. Flores Juanita B. Salvani Antonieta S. Tumapon Dafni C. Carreon Danie E. Pelayo	DA RFO 10	Silver
CPAR on the Utilization of Organic Fertilizer under Coconut-based Faming Systems in Placer, Surigao del Norte	Ailene P. Bahia Charles A. Castro Reynan P. Mamalis Florites J. Rosales, Wilfreda M. Manos	DA-RFO Caraga	Bronze
Technology Commercialization of Mungbean Production in Bicol Region	Luz R. Marcelino Hemilyn R. Yamson Nessie Pasion Danilo Bordon Edgar R. Madrid	DA-RFO 5	Bronze

Table 13. *Cont.*

R&D PAPERS	AUTHOR/S	AGENCY	AWARD
D. APPLIED RESEARCH (TG/IG) - FISHERIES			
Development of Maliputo (*Caranx ignobilis*) Seed Production Technology: A First in Philippine Aquaculture	Maria Theresa M. Mutia Drusila Esther E. Bayate Frederick B. Muyot Myleen L. Magistrado Janet L. Baral Ma. Lourdes D. Merilles	BFAR-NFFRDC	Gold
Resource Assessment, Biological Evaluation, and Phytochemical Screening of Economically-Important Seaweeds of Ilocos Provinces	Andres Y. Tungpalan Joyce R. Tolentino Rhea R. Espiritu	MMSU	Silver
Status of Ornamental Fish in the Philippines: Prospects for Industry Development	Frederick B. Muyot Maria Theresa M. Mutia Arvie Joy A. Manejar Gency L. Guirhem Margielyn J. Muñez	NFRDI	Bronze
E. APPLIED RESEARCH (TA/TV) - FISHERIES			
Formulation and Standardization of Seaweed Flakes' Food Products	Ida C. Junio	DMMMSU	Bronze
F. APPLIED RESEARCH (TG/IG) – CROP SCIENCE/CROP PROTECTION			
Comprehensive Phenotypic and Genotypic Profiling of Economically-Important Traditional Rice Varieties in the Philippines through Participatory Research	Marissa V. Romero Henry F. Mamucod Teodora E. Mananghaya Loida M. Perez John Oscar S. Enriquez Renneth A. Millas	PhilRice	Silver
Appropriate Log Substrate Source, Diameter, Pruning Period, and Soaking Cycle for Increased Shiitake Yield	Bernard S. Tad-awan	BSU	Bronze
"PhenoFera"- A Natural Phenolics Powder from Mango Seed Waste for Cosmetics Industry	Arsenia B. Sapin Maria Katrina N. Alaon Teresita J. Ramirez	UPLB	Bronze

Table 13. *Cont.*

R&D PAPERS	AUTHOR/S	AGENCY	AWARD
G. APPLIED RESEARCH (TA/TV) – CROP SCIENCE/CROP PROTECTION			
Enhancing Soybean Productivity and Local Availability in Region 2	Rose Mary G. Aquino Vanessa Joy F. Calderon, Cristy G. Dela Cruz Vilma U. Atalin Kristina Manaligod Elimario F. Batang, Jr. Sheryl A. De Guzman	DA-RFO 2	Silver
Commercialization of Cacao Production Systems and Processing Technologies in Laguna and Quezon Provinces	Daisynette D. Manalo	DA-RFO 4A (CALABARZON)	Bronze
Verification of the Effectiveness of Developed Organic Pest Management Technology Against Eggplant Fruit and Shoot Borer, *Leucinoides orbanalis* Guenee (Lepidoptera: Pyralidae)"	Pio A. Javier Evangeline G. Punzalan	UPLB	Bronze
H. APPLIED RESEARCH (TA/TV) – ANIMAL SCIENCE			
Development of Loop Mediated Isothermal Amplification Assay-based Test Kit for the Detection/Screening of Caprine Arthritis Encephalitis Virus (CAEV)"	Claro N. Mingala Michelle M. Balbin Daryl G. dela Cruz Joram J. Gautana	PCC-NHQGP	Gold
I. APPLIED RESEARCH (TG/IG) – ENGINEERING AND POSTHARVEST			
Development of Non-Destructive Moisture Meter for Coffee Beans	Arlene C. Joaquin Richard P. Avila Maria Elizabeth V. Ramos Romualdo C. Martinez	PhilMech	Gold
J. APPLIED RESEARCH (TA/TV) – ENGINEERING AND POSTHARVEST			
Development of Postharvest and Processing Technologies for Locally-Produced Soybeans in the Philippines	Ma. Cecilia R. Antolin Renita SM. dela Cruz Cesar F. Neric, Jr. Kathlene A. Corpuz	PhilMech	Gold
Edible Machine: Pilot Testing, Promotion and Commercialization of Adlay (*Coix lacryma-jobi* L.) Milling Machine to Major Production Areas in the Philippines	Roynic Y. Aquino Rose Mary G. Aquino Samuel D. Barut, Jr. Rolando D. Pedro	DA-RFO 2	Silver
Pilot Testing of Mechanized Onion Planting Systems Using 10-row Tractor-driven Mechanical Seeder	Ma. Cecilia R. Antolin Renita SM. dela Cruz Cesar F. Neric, Jr. Kathlene A. Corpuz	PhilMech	Bronze

Table 13. *Cont.*

R&D PAPERS	AUTHOR/S	AGENCY	AWARD
K. APPLIED RESEARCH (TG/IG) – SOIL AND WATER SCIENCE			
Microbial-Induced Micronutrient Mobilization in Soil: Innovation for Increasing Yield and Improving Nutritional Quality of Sweet potato	Edgardo E. Tulin Anabella B. Tulin Zenaida T. Ecleo Mark Christian O. Moreno	VSU	Gold
Synthesis and Characterization of Nanozeolite from Sugarcane Bagasse Ash and its Potential as Controlled-Release N, P, and K Fertilizer	Quincy E. Ybañez Pearl B. Sanchez Marcial S. Buladaco II Joy Eloiza S. Rosales	UPLB	Silver
L. APPLIED RESEARCH (TA/TV) – SOIL AND WATER SCIENCE			
Adoptation of Bhoochetana (*Yamang Lupa* Program) Principles and Approaches in Boosting Agricultural Productivity in Region 9	Roger O. Bagaforo Rictibert C. Pamunag John Paul F. Guadalupe Genevieve P. Hassan Ronnie R. Gonzales Cherry Mae P. Jumao-As	DA-RFO 9	Gold
Performance Evaluation of Selected Rice Varieties Coated with Mycorrhizae in Lahar-Laden Soil of Zambales	Janice M. Baysa Dinah E. Abugho Angelo C. Fermil	PRMSU	Bronze

Table 14. Winners of AFMA Best R&D Poster.

R&D POSTER	AUTHOR/S	AGENCY	AWARD
AFMA Best R&D Posters			
Comprehensive Phenotypic and Genotypic Profiling of Economically-Important Traditional Rice Varieties in the Philippines through Participatory Research	Marissa V. Romero Henry F. Mamucod Teodora E. Mananghaya, Loida M. Perez John Oscar S. Enriquez Renneth A. Millas	PhilRice	Gold
Development of Non-Destructive Moisture Meter for Coffee Beans	Arlene C. Joaquin Richard P. Avila Maria Elizabeth V. Ramos Romualdo C. Martinez	PhilMech	Silver
Development of Loop Mediated Isothermal Amplification Assay-based Test Kit for the Detection/Screening of Caprine Arthritis Encephalitis Virus (CAEV)	Claro N. Mingala Michelle M. Balbin Daryl G. dela Cruz Joram J. Gautana	PCC	Bronze

Book Launch of "Research for the People: Gawad Saka Outstanding Scientists"

During the NRS closing ceremony, a book titled, "Research for the People: Gawad Saka Outstanding Scientists Devoting Their Works to Uplift the Lives of Farmers and Fisherfolk," was launched. The book, which BAR co-published with the Foundation for Agriculture-Related Missions (FARM), Inc., features five Gawad Saka Outstanding Scientists who unquestionably deserve being awarded for their selfless and patriotic efforts in helping farmers and fishers through proven R&D solutions.

The five scientists represent the three subsectors of agriculture: crops, livestock, and fishery, capturing a wider perspective and describing the diversity in fields of expertise. Likewise, the five scientists represent the major island groups of the Philippines since three of them are from Luzon, one from Visayas, and one from Mindanao.

Table 15. Five outstanding scientists featured in "Research for the People".

AWARDEE	DESIGNATION/AGENCY	AWARD	CONTRIBUTION
Dr. Louella D. Lorenzana	OIC-RTD for Research and Regulations of DA-RFO 4B (MIMAROPA)	2007 Gawad Saka Outstanding Scientist	Her research on mango pulp weevil problem was pivotal in saving Palawan's imperilled mango industry.
Dr. Carlos S. Dela Cruz	Chief of Regulatory Division and Organic Agriculture Focal Person of DA-RFO 8 (Eastern Visayas)	2011 Gawad Saka Outstanding Scientist	He has led various researches to save the Region 8's jackfruit industry.
Dr. Mudjekeewis D. Santos	OIC of the Marine Fisheries Research Division of the NFRDI, BFAR	2012 Gawad Saka Outstanding Scientist	He remains to this day as the country's leading marine scientist.
Dr. Cayetano C. Pomares	Vice President for Research and Extension, USM	2013 Gawad Saka Outstanding Scientist	He is a man on mission to develop the country's small ruminants industry starting from the countryside.
Dr. Jonar I. Yago	Researcher and Professor at the NVSU	2014 Gawad Saka Outstanding Scientist	He took the cudgels to rehabilitate the citrus industry of the Ilocos.

BAR-funded study wins during 55th PSAS Convention

The scientific paper titled, "Volatile Fatty Acids and Total Sugars in the Rumen Fluid of Dairy Cows Fed Water Hyacinth [*Eichhornia crassipes* (Mart.) Solms] and Banana (*Musa sp.*) Pseudostem won the Best Paper Award under the Anatomy, Physiology and Biochemistry Category during the 55th Philippine Society of Animal Science (PSAS) Scientific Seminar and Annual Convention held on 17-18 October 2018 at the Grand Menseng Hotel, Davao City.

The paper, presented by Caren R. Tumambing of the University of the Philippines Los Baños (UPLB), is a component study of a project, "Feeding Value of Banana Stalk and Water Lily in Dairy Cattle" which is funded by the Bureau of Agricultural Research (BAR). The project, led by Dr. Amado A. Angeles of UPLB, aims to assess and evaluate the potential of banana stalk and water lily as feed ingredients in dairy cattle.

Two other papers under the BAR-supported project were presented during the convention, including the results of *in situ* nutrient degradability trials, and the effect of feeding water hyacinth on the growth performance of dairy bull calves.

The projects presented are BAR's response to the directive of Department of Agriculture Secretary Emmanuel F. Piñol to conduct researches on the utilization of banana stalk and water lily as source of feeds and fiber. BAR has also supported related projects including the University of Southern Mindanao (USM) and Pampanga State Agricultural University (PSAU) research on goats, the Philippine Carabao Center (PCC) on buffalo, and the Philippine Fiber Industry Development Authority (PhilFIDA) on banana and water lily utilization as source of fiber.

AFACI recognizes Philippines' ATIN Principal Investigator

Julia Lapitan, head of the Applied Communication Division (ACD) of the Bureau of Agricultural Research (BAR), was announced as the "2018 Most Outstanding Principal Investigator (PI)" of the Agricultural Technology Information Network in Asia (ATIN) project in the Philippines.

This was the second time that Lapitan was hailed of such prestigious award outscoring other 13 AFACI member-countries. She was also named by the AFACI Secretariat as the "Most Outstanding ATIN PI" in 2017 awarded in an official ceremony held in Bangkok, Thailand.

AFACI, established in 2009 in South Korea, is a multilateral initiative aimed to promote sustainable agricultural growth and contribute in the economic development of the Asian region through technological cooperation and networking in food and agriculture sector. Its Secretariat is based at the International Technology Cooperation Center, Rural Development Administration in Jeonju, South Korea.

ANNEX


JIMBO

Directory of BAR Key Officials

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Acronyms Used

ABR	Applied Biotech Research
ACD	Applied Communication Division
AFACI	Asian Food and Agriculture Cooperation Initiative
AMIA	Adaptation and Mitigation Initiative in Agriculture
ASEAN-CRN	Association of Southeast Asian Nations-Climate Resilient Network
ASU	Aklan State University
ATI	Agricultural Training Institute
ATIN	Agricultural Technology Information Network in Asia
AWD	Alternate Wetting and Drying
BAFS	Bureau of Agricultural and Fisheries Standards
BAI	Bureau of Animal Industry
BBSRC	Biological Sciences Research Council
BFAR	Bureau of Fisheries and Aquatic Resources
BPI	Bureau of Plant Industry
BPI-LBNCRDPSC	Bureau of Plant Industry-Los Baños National Crop Research, Development and Production Support Center
BPO	Biotechnology Program Office
BSU	Benguet State University
BSUP	Biotech Scholarship Undergraduate Program
BSWM	Bureau of Soils and Water Management
BU	Bicol University
CABI	Centre for Agriculture and Bioscience International
CARES	Cavite Agricultural Research and Extension Station
CARIAC	Caraga Integrated Agricultural Research Center
CBSUA	Central Bicol State University of Agriculture
CTU	Cebu Technological University
CVSU	Cavite State University
CC	Climate Change
CCAFS	Climate Change, Agriculture and Food Security
CELPA	Center for Environmental Law and Policy Advocacy, Inc.
CGIAR	Consultative Group on International Agricultural Research
CHED	Commission on Higher Education
CLIARC	Central Luzon Integrated Agricultural Research Center
CLSU	Central Luzon State University
CPAR	Community-based Participatory Action Research
CPU	Central Philippine University
CSC	Civil Service Commission
CVRC	Cagayan Valley Research Center
DA	Department of Agriculture
DaCARS	Davao Commercial Agriculture Research Station
DBM	Department of Budget and Management
DLSAU	De La Salle Araneta University
DMMMSU	Don Mariano Marcos Memorial State University
DOST	Department of Science and Technology
DTRI	Dairy Training and Research Institute
ESU	Eastern Samar State University
FAO	Food and Agriculture Organization
FPA	Fertilizer and Pesticide Authority
FREEDOM	Foundation for Rural Enterprise and Ecology Development of Mindanao

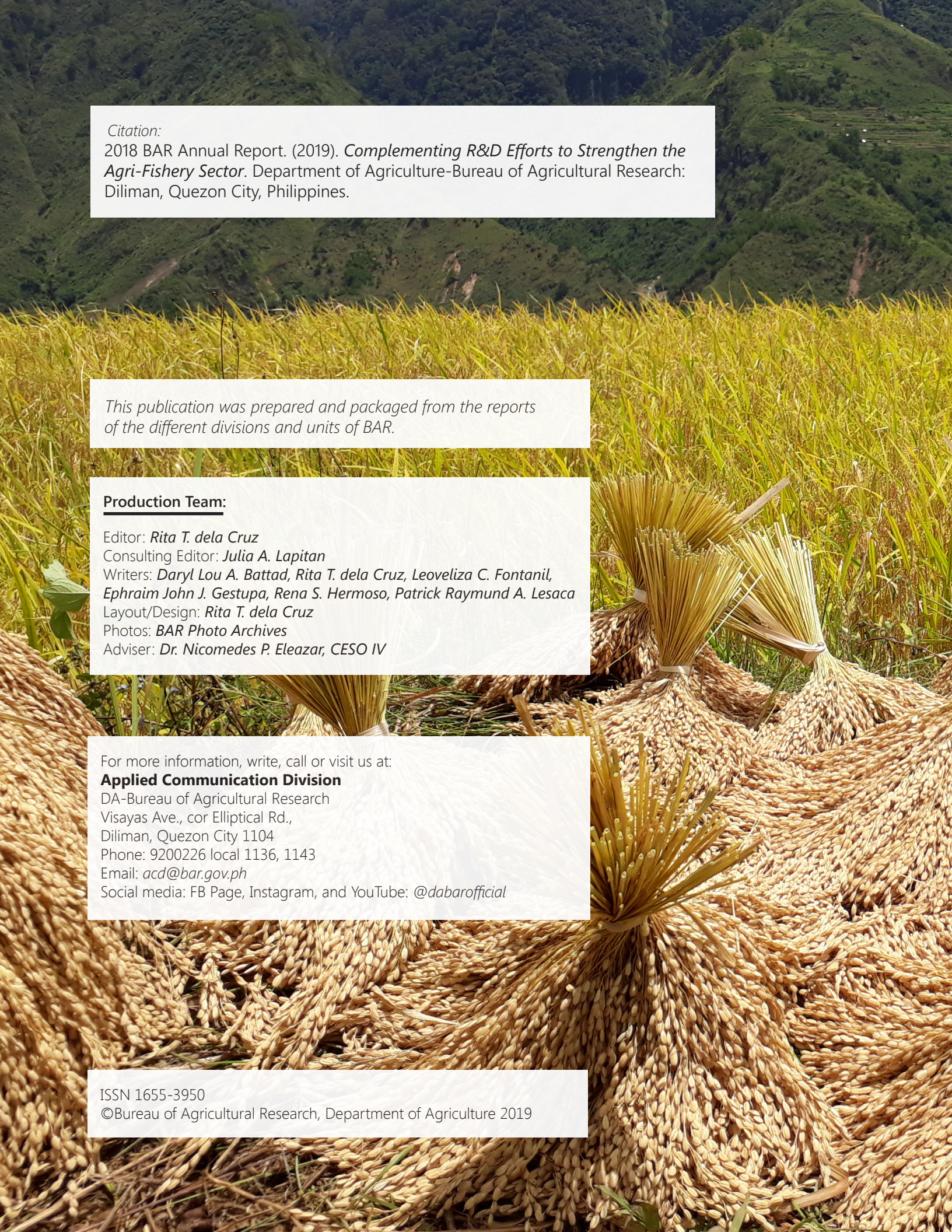
Acronyms Used

GAA	General Appropriations Act
GAP	Good Agricultural Practices
GEF	Global Environment Facility
GIS	Geographic Information System
HRDP	Human Resource Development Program
HVCDP	High Value Crops Development Program
ICE	Institutional Capacity Enhancement
ICTS	Information and Communications Technology Service
IDD	Institutional Development Division
IDG	Institutional Development Grant
IEC	Information, Education and Communication
IKM	Information and Knowledge Management
ILIARC	Ilocos Integrated Agricultural Research Center
INM	Integrated Nutrient Management
IPB	Institute of Plant Breeding
IPM	Integrated Pest Management
IPOPhil	Intellectual Property Office of the Philippines
IPRMS	Intellectual Property Rights Management Section
IRRI	International Rice Research Institute
ISAAA-SEA	International Service for the Acquisition of Agri-biotech Applications Southeast Asia Center
ISU	Isabela State University
IT	Information Technology
LGU	Local Government Unit
LPMPC	Labo Progressive Multipurpose Cooperative
MMSU	Mariano Marcos State University
MSC	Marinduque State College
MSU	Mindanao State University
MRL	Maximum Residue Levels
MSU	Mindanao State University
NaRDSAF	National Research and Development System for Agriculture and Fisheries
NCCAG	National Color-Coded Agricultural Guide
NFRDI	National Fisheries Research and Development Institute
NGO	Non-Government Organization
NOAB	National Organic Agriculture Board
NOAC	National Organic Agriculture Congress
NOMIARC	Northern Mindanao Integrated Agricultural Research Center
NMACLRC	Northern Mindanao Agricultural Crops and Livestock Research Complex
NSAP	National Stock Assessment Program
NTF	Agriculture and Fisheries Technology Forum and Product Exhibition
NVSU	Nueva Vizcaya State University
OA	Organic Agriculture
OPA	Office of the Provincial Agriculturist
OPV	open pollinated variety
PAO	Provincial Agriculture Office
PCA	Philippine Coconut Authority
PCA-ZRC	Philippine Coconut Authority-Zamboanga Research Center
PCC	Philippine Carabao Center

Acronyms Used

PCC-NHQGP	Philippine Carabao Center-National Headquarters and Gene Pool
PhilFIDA	Philippine Fiber Development Authority
PhilGEPS	Philippine Government Electronic Procurement System
PhilMech	Philippine Center for Postharvest Development and Mechanization
PhilRice	Philippine Rice Research Institute
PhilRootcrops	Philippine Root Crops Research and Training Center
PHTRC	Postharvest Horticulture Training and Research Center
PNAD	Philippine Native Animal Development
PNRI	Philippine Nuclear Research Institute
PRDP	Philippine Rural Development Plan
RDE	Research and Development and Extension
RDEAP	Research and Development and Extension Agenda Programs
RSP	Red Spanish Pineapple
PCA	Philippine Coconut Authority
PCA-ZRC	Philippine Coconut Authority - Zamboanga Research Center
PCIP	Provincial Commodity Investment Plan
PRA	Participatory Rural Appraisal
PSAU	Pampanga State Agricultural University
PRMSU	President Ramon Magsaysay State University
QARES	Quezon Agricultural Research and Experiment Station
RCM	Rice Crop Manager
RFO	Regional Field Office
RIC	Rural Improvement Club
RO	Regional Office
SAAD	Special Area for Agricultural Development
SCoPSA	Sustainable Corn Production in Sloping Areas
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SLSU-JGE	Southern Luzon State University-Judge Guillermo Eleazar
SPG	Scientific Publication Grant
SUC	State Universities and Colleges
SWCCO	Systems Wide Climate Change Office
TAU	Tarlac Agricultural University
TCD	Technology Commercialization Division
TCoW	Technology Commercialization on Wheels
TWG	Technical Working Group
UPLB	University of the Philippines Los Baños
UPLB FI	University of the Philippines Los Baños Foundation, Incorporated
UP-MSI	University of the Philippines-Marine Science Institute
UP-NSRI	University of the Philippines-Natural Science Research Institute
UPPAF	University of the Philippines Public Administration and Extension Services Foundation
USAID	United States Agency for International Development
USM	University of Southern Mindanao
VSU	Visayas State University
ViFARD	ViSCA Foundation for Agricultural and Rural Development, Inc.
ZAMPIARC	Zamboanga Peninsula Integrated Agricultural Research Center

PHOTO: Apple Llarena



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