

2019 PCAARRD ANNUAL REPORT

Addressing regional needs
through sustained
partnerships

DEPARTMENT OF SCIENCE AND TECHNOLOGY (DOST)
PHILIPPINE COUNCIL FOR AGRICULTURE, AQUATIC AND NATURAL
RESOURCES RESEARCH AND DEVELOPMENT (PCAARRD)

About DOST-PCAARRD

The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) is one of the sectoral councils under the Department of Science and Technology (DOST). It was formed through the consolidation of the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) and the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) on June 22, 2011 pursuant to Executive Order No. 366.

Originally established on November 10, 1972 as the Philippine Council for Agricultural Research (PCAR), it became the Philippine Council for Agriculture and Resources Research (PCARR) to include mines research in 1975. Affirming the role of S&T in development, PCARR changed its name to Philippine Council for Agriculture and Resources Research and Development (PCAARRD) in 1982. The Council was tasked to provide a unified and focused direction for the country's agricultural research. It then became an apex organization that supports and manages the national network of government

and higher education institutions involved in crops, livestock, forestry, fisheries, soil and water, mineral resources, and socio-economic research and development (R&D). In 1987, the Council was renamed the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development but retained the acronym PCARRD. On January 30 of the same year, the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) was created from the Fisheries Research Division of PCARRD with functions focused on aquatic and marine sectors.

With expanded coverage, functions, and responsibilities, the Council formulates policies, plans, and programs for science and technology-based R&D in the different sectors under its concern. It coordinates, evaluates, and monitors the national R&D efforts in the agriculture, aquatic, and natural resources (AANR) sector. It also allocates government and external funds for R&D and generates resources to support its program.

As the apex Council of the AANR sector, PCAARRD is engaged in active partnerships with international, regional,

and national organizations and funding institutions for joint R&D, human resource development and training, technical assistance, and exchange of scientists, information, and technologies. The Council is implementing its program primarily through its Research and Development and Extension Consortia, which are located all over the country. It also supports the National Agriculture, Aquatic, and Natural Resources Research and Development Network (NAARRDN) composed of national multi- and single-commodity and regional R&D centers, cooperating stations, and specialized agencies.

Being an ISO 9001:2015-certified agency for its quality management system, PCAARRD is committed to achieving a sustained dynamic leadership in science and technology (S&T) innovation in the AANR sector by providing a strategic leadership in promoting S&T as a platform for AANR products innovation and environment resiliency. Guided by its core values of relevance, excellence, and cooperation, PCAARRD will remain steadfast in catalyzing the Philippine AANR sector toward self-sufficiency and global competitiveness.

| | |
|-----------------|--|
| MAILING ADDRESS | PHILIPPINE COUNCIL FOR AGRICULTURE, AQUATIC AND NATURAL RESOURCES RESEARCH AND DEVELOPMENT Los Baños, Laguna, Philippines 4030 |
| TELEPHONE | Los Baños - (63) (49) 554-9670 |
| FAX | Los Baños - (63) (49) 536-0016; 7922 |
| TELEFAX | Manila - (63) (2) 837-1651 |
| E-MAIL | pcaarrd@pcaarrd.dost.gov.ph |
| WEBSITE | www.pcaarrd.dost.gov.ph |

2019 PCAARRD ANNUAL REPORT

Addressing regional needs
through sustained
partnerships

DEPARTMENT OF SCIENCE AND TECHNOLOGY (DOST)
PHILIPPINE COUNCIL FOR AGRICULTURE, AQUATIC AND NATURAL
RESOURCES RESEARCH AND DEVELOPMENT (PCAARRD)

Los Baños, Laguna
2020

Philippine copyright ©2020 by DOST-PCAARRD

All rights reserved

Citation:

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). 2019
PCAARRD Annual Report. Addressing regional needs through sustained partnerships. Los Baños, Laguna:
DOST-PCAARRD, 2020. 129p.

MESSAGE FROM THE SECRETARY



I commend the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) for its leadership and guidance in providing research-based solutions and innovations for the improvement of the agriculture, aquatic, and natural resources (AANR) sector. The DOST appreciates and recognizes PCAARRD's significant contributions in addressing the pressing problems in the AANR sector with the help of its partners in research and development (R&D).

Major accomplishments in 2019 have provided support to various industries such as the one for coconut, abaca, vegetables, livestock, furniture, and aquaculture, among some.

The Council's Industry Strategic S&T Programs (ISPs) have been a good guide. Crosscutting concerns were likewise addressed through the formulation and implementation of relevant policies.

All of these were achieved with the PCAARRD Quality Management System (QMS) in place. The Council has been consistently compliant to international standards as ISO 9001:2015.

Congratulations, DOST-PCAARRD!


HON. FORTUNATO T. DE LA PEÑA
Secretary
DOST

MESSAGE FROM THE UNDERSECRETARY FOR R&D




ROWENA CRISTINA L. GUEVARA, PhD
Undersecretary for Research
and Development
DOST

The year 2019 has recorded a volume of significant accomplishments in research and development in the country. The Department of Science and Technology (DOST)-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) has strong leadership in providing concrete directions, strategies, programs, and plans for the agriculture, aquatic, and natural resources (AANR), which has produced results that have high impact on the food value chain. Moreover, PCAARRD has maintained a harmonious relationship with all its partners locally and internationally, and has supported the DOST in establishing new and expanded linkages that have increased collaborative activities in research and development (R&D).

The Council's contributions to the achievement of DOST's priority areas under the Harmonized National R&D Agenda (HNRDA) can be measured by the large number of program and project proposals on various commodities, which were approved for funding through PCAARRD and/or the DOST Grants-in-Aid Program, which include but are not limited to abaca, coconut, fruits and vegetables, fisheries, and environmental concerns. Likewise, PCAARRD has efficiently managed its funds from all sources because of its strict compliance to relevant policies being implemented in the government through its ISO 9001:2015 certified quality management system processes.

During the year, PCAARRD assisted the DOST in developing the Department's Program Monitoring and Evaluation (M&E) Protocol that will standardize the mechanism in monitoring and evaluation of all programs and projects supported by the DOST, from the call for proposals to the evaluation of the impact of completed programs/projects.

The abovementioned undertakings are highlighted in this 2019 Annual Report publication of the Council.

Congratulations, DOST-PCAARRD!

PREFACE

I am pleased to present the 2019 Annual Report of DOST-PCAARRD, in which we would like to share with you stories of individuals, communities, and institutions that have been part of our achievements in the past year. This report provides an account of the Council's performance against its key priorities adhered to the directions of the HNRDA 2017–2022 and the DOST's Eleven-Point Agenda.

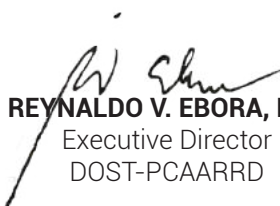
Within the pages of this report are the endeavors we have taken, from providing dynamic support to the ISPs to strengthening human resources, policy research, and technology transfer and commercialization. It features the significant outputs of our projects and programs particularly on agri-fishery, genomics/biotech for agri-aqua productivity, environment and natural resources management, biodiversity S&T initiatives, and support to policy initiatives, pointing the way forward to enhanced utilization, adoption, and commercialization of R&D outputs.

We at DOST-PCAARRD have been setting out clear targets to ensure that relevant R&D strategies are in place to create long-term value for all our stakeholders. We have continued to accelerate our pace of engagement with regional and national organizations and funding institutions to improve R&D efforts. We were able to ramp up our technology transfer and commercialization initiatives and bring S&T innovations at the doorstep of our farmers and fisherfolk through the consortia, known as PCAARRD in the Regions; the establishment of Niche Centers in the Regions for R&D (NICER); and various knowledge-sharing platforms such as Farms and Industry Encounters through the Science and Technology Agenda (FIESTA), social media engagements, and media conferences. As an ISO 9001:2015-certified agency, we aim to continuously improve our quality management system and deepen our positive impact on the communities that we serve.

Consequently, our determined efforts and that of our partners and key industry players are equally important in achieving these prime achievements. As our way to contribute to the development agenda of the administration, our goal is to remain a beacon of good governance and reliable source of productive and sustainable S&T directions across all the regions.

All these efforts are for our people and the nation.




REYNALDO V. EBORA, PhD
Executive Director
DOST-PCAARRD

CO NT EN TS

| | |
|---|-----|
| Message from the Secretary | iii |
| Message from the Undersecretary for R&D | iv |
| Preface | v |
| Executive Summary | 1 |
| DOST's Eleven-Point Agenda | 1 |
| AGENDA 1: Pursue R&D to Address Pressing National Problems | 6 |
| Multilocation trials of carrageenan PGP | 8 |
| Soybean R&D program | 9 |
| Biological control strategies against cacao pests and diseases | 10 |
| Native animal R&D program | 12 |
| R&D to propel production of halal-compliant goats | 14 |
| AGENDA 2: Conduct R&D to Enhance Productivity and Improve Management of Resources | 15 |
| Genomics for Improved Agri-Aqua Productivity | 15 |
| Improvement of coconut varieties through genomics-assisted molecular breeding | 15 |
| Breeding to enhance the competitiveness of Philippine carabao mango | 17 |
| Molecular markers for economically important traits of Philippine specialty coffee | 18 |
| DNA-based detection kit for <i>Trypanosoma evansi</i> | 19 |
| Selective breeding for improved growth and white spot syndrome virus resistance of Philippine <i>Penaeus vannamei</i> | 19 |
| Developing other potential uses of mussel | 20 |
| Agri-fishery Mechanization | 21 |
| Modified drip irrigation system | 21 |
| Semi-automated furnace type dryer | 22 |
| Dehydrator for herbal tea materials | 22 |
| 'Balut' vending machine | 23 |
| Environment and Natural Resources Management | 24 |
| Quality planting materials of indigenous tree species | 24 |
| Tissue culture technique for mass production of selected bamboo species | 24 |
| Increasing the supply of bamboo propagules and bamboo shoots | 24 |
| Assessment of rubber planted in non-traditional areas | 25 |
| Development of coral reef assessment tools | 26 |
| Biotoxin Adsorption Tracking Techniques (BATT) to detect HAB toxins | 27 |
| Biodiversity S&T initiatives | 28 |
| Natural fungicide from <i>Tasmannia piperita</i> (Hook.F.) Miers | 28 |

| | |
|--|----|
| Flora and fauna assessment in Cebu Island key biodiversity areas | 29 |
| Biodiversity in selected mountain ecosystems of Mindanao | 29 |
| Mollusks | 30 |
| Giant clams | 31 |
| Seaweed | 32 |
| Marine fishes | 32 |
| R&D to support policy-initiatives for a more conducive S&T policy environment | 33 |
| Policy studies | 33 |
| Internal control system (ICS) for safe cabbage and eggplant production | 33 |
| Changing patterns of farmers' social, demographic and economic conditions | 33 |
| Science-based policy for bamboo industry development | 33 |
| Tracing the value of soybean as food | 34 |
| Massive technology transfer for organic-based production technologies | 34 |
| Policy advocacy | 34 |
| Promoting PCAARRD's legislative agenda | 34 |
| Participation in the crafting of SAGIP-SAKA IRR | 35 |
| Review of EU policies on maximum residue limit | 35 |
| Other activities disseminating policy research results | 35 |
| AGENDA 3: Engage in R&D to Generate and Apply New Knowledge and Technologies Across Sectors | 36 |
| Non-invasive pregnancy diagnostic kit for goat | 36 |
| SMS-based goat traceability system | 36 |
| Nano-technologies for sustainable AANR | 37 |
| Nano (zeolite-silica) for wastewater treatment in tilapia culture | 37 |
| Colloidal gold non-particles for disease detection in tilapia | 37 |
| AGENDA 4: Strengthen and Utilize Regional R&D Capabilities | 38 |
| PCAARRD in the regions | 38 |
| Establishment of Niche Centers in the Regions for R&D (NICER) | 39 |
| AGENDA 5: Maximize utilization of R&D Results through technology transfer and commercialization | 44 |
| Technology transfer and commercialization | 44 |
| DOST-PCAARRD National Agri-Aqua Technology Business Incubation Program | 44 |
| Intellectual Property and Technology Business Management (IP-TBM) | 45 |
| DOST-PCAARRD Science for Convergence of Agriculture and Tourism | 46 |

| | |
|---|----|
| Technology Innovation for Commercialization (Technicom) Project | 47 |
| Science and Technology Community-based for Inclusive Development (STC4iD) Modality | 47 |
| Technology promotion | 48 |
| Farms and Industry Encounters through the Science and Technology Agenda (FIESTA) | 48 |
| Promoting R&D results through IEC materials, social media engagements, media conferences, etc. | 49 |
| Technology to People (T2P) and Technology Media Conference (TMC) | 49 |
| Institutional support for trade and exhibitions for PCAARRD programs | 50 |
| AGENDA 6: Develop Science, Technology, and Innovation (STI) Human Resources and Build a Strong STI Culture | 51 |
| Balik Scientist Program | 51 |
| Graduate Research and Education Assistance for Technology (GREAT) Program | 52 |
| Thesis/Dissertation Assistance Program | 53 |
| Publication Incentives Program | 53 |
| Non-degree training program | 53 |
| The Agribusiness Master Class: Gearing Towards the Value Chain Thinking | 53 |
| Enhancing capacity on R&D through mentoring | 54 |
| Seminar series on socio-economics researches | 54 |
| Support to DPGAA | 55 |
| PCAARRD S&T Awards Program | 55 |
| External awards received by PCAARRD directorate and staff | 59 |
| AGENDA 7: Upgrade STI Facilities and Capacities to Advance R&D Activities and Expand S&T Services | 61 |
| Facilities development for the NAARRDN | 61 |
| Socio-Economics Research and Data Analytics Center (SERDAC) | 62 |
| Socio-Economics Research and Data Analytics Laboratory (SERDAL) | 62 |
| AGENDA 9: Provide STI-based Solutions for Disaster Risks and Climate Change Adaptation and Mitigation | 63 |
| Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (SARAI) | 63 |
| SARAI-Enhanced Agricultural Monitoring System (SEAMS) | 63 |
| SARAI Smarter Pest Identification Technology (SPidTech) | 64 |
| AGENDA 10: Strengthen Industry-Academe-Government and International STI Collaboration | 67 |
| Support to the Los Baños Science Community | 67 |

| | |
|---|-----|
| Global Technology and Information Search (GTIS) | 69 |
| International S&T collaboration | 72 |
| New and strengthened partnerships including maintained and in the works | 78 |
| Partnership in the works | 87 |
| International visitors program | 90 |
| AGENDA 11: Enhance Effectiveness of STI Governance | 94 |
| Human resource management | 94 |
| PCAARRD personnel with completed graduate studies | 94 |
| PCAARRD service awardees and retirees | 94 |
| Trainings, seminars, and workshops participated in by the Secretariat | 96 |
| Financial resources management | 97 |
| Fund utilization | 97 |
| Resources generation | 97 |
| Continual improvement | 102 |
| Knowledge Management for AANR | 104 |
| Support to gender and development | 105 |
| Way Forward | 106 |
| List of Acronyms | 107 |
| List of Tables | |
| Table 1. 2019 PCAARRD S&T Awardees. | 52 |
| Table 2. GTIS Activities Conducted by PCAARRD Staff and NAARRDN Researchers/Scientists/Experts, 2019 | 69 |
| Table 3. International S&T-related activities participated by PCAARRD staff and NAARRDN researchers/ scientists/experts, 2019 | 73 |
| Table 4. Status of international S&T linkages, 2019 | 89 |
| Table 5. Estimated amount of resources generated from external sources, 2019 | 98 |
| Appendices | 116 |
| PCAARRD Governing Council, CY 2019 | 117 |
| PCAARRD Directors' Council, CY 2019 | 122 |
| RRDCC Chairpersons and Consortium Directors, CY 2019 | 125 |
| Production Team | 129 |
| The PCAARRD Logo | 131 |

EXECUTIVE SUMMARY

DOST's Eleven-Point Agenda

1. Pursue research and development (R&D) to address pressing national problems
2. Conduct R&D to enhance productivity and improve management of resources
3. Engage in R&D to generate and apply new knowledge and technologies across sectors
4. Strengthen and utilize regional R&D capabilities
5. Maximize utilization of R&D results through technology transfer and commercialization
6. Develop science, technology, and innovation (STI) human resources and build a strong STI culture
7. Upgrade STI facilities and capacities to advance R&D activities and expand S&T services
8. Expand STI assistance to communities and the production sector, particularly micro, small, and medium enterprises (MSMEs)
9. Provide STI-based solutions for disaster risks and climate change adaptation and mitigation
10. Strengthen industry-academe-government and international STI collaboration
11. Enhance effectiveness of STI governance

With an average accomplishment rate registered for the year at 120%, the Council has exceeded its targets across the Department of Budget and Management (DBM)-prescribed performance indicators under the Program Expenditure Classification (PREXC).

From the 48 priorities indicated in the Harmonized National Research and Development Agenda (HNRDA) for agriculture, aquatic, and natural resources (AANR) sector, 45 or 94% have been addressed by PCAARRD supported projects, based on proposals evaluated/funded and monitored during the year. It was successfully achieved by maintaining partnerships with

147 public and private, local and international organizations through continuous collaborative S&T/R&D activities.

A total of 488 projects were supported with PCAARRD-GIA funds, which exceeded the annual target of only 385 by 26%. The variance is due to receipt of quality proposals worth pursuing and those continuing projects, which were funded upon satisfying documentary requirements for financial assistance. In 2019, processing of fund release was dependent on the implementing agency's compliance with required documents, especially the Commission on Audit's (COA) rule

on 'no release to agencies with pending funds for liquidation.'

Hence, the reported 766 projects monitored included newly implemented, ongoing, extended, and completed projects as of year-end. Compared to the annual target of only 575, this registered an accomplishment rate of 135%. As expected, 90% of completed programs/projects in 2019 reported utilization of respective project outputs through presentation in local and national fora including trainings and exhibits, while some have intellectual properties filed through PCAARRD's technical assistance.

In support to the achievement of the Department of Science and Technology's (DOST) vision and delivery of its identified outcomes, the Council employed the different strategies identified by the Department known as the DOST's Eleven-Point Agenda. PCAARRD ensured that the strategies are feasible and applicable to all its Industry Strategic S&T Plans/Programs (ISPs) being implemented by its partners.

Agenda 1: Pursue R&D to Address Pressing National Problems.

On carrageenan Plant Growth Promoter (PGP), multilocation trials on mungbean and peanut in Regions 2, 3, 7, and 10 were completed. Using carrageenan PGP as foliar fertilizer and the farmer's usual practice showed an average increase of 88.7% and 69% in mungbean and peanut yield, respectively. The label expansion (LE) of carrageenan PGP for legumes (i.e., mungbean, peanut, and soybean) has been approved by Fertilizer and Pesticide Authority (FPA). Carrageenan PGP technology is ready for commercialization. On cacao, five biological-based strategies to control insect pests and diseases affecting pods and beans that consequently result in huge losses to farmers, were developed. Likewise, R&D on native animal improvement has increased the productivity and marketability of native breeds of ducks, chickens, and pigs. Technologies on the production of salted duck egg powder and salted eggs with longer shelf life (from 3 weeks to 3 months) were developed to widen the market of duck eggs. Trademark registration of salted egg, DOST-UP Duck, has been approved by the Intellectual Property Office of the Philippines (IPOPHL). Four genetic groups of Philippine native chickens—Darag, Zampen, Boholano, and Camarines were developed into breeding

true-to-type populations through breeding and selection R&D. Increased production performance and growth rate to the desired 1.2-kilogram (kg) slaughter weight is now achieved 2 weeks earlier. These inspire farmers to produce native chickens in commercial scale. The native pig R&D program has established breeding true-to-type populations that have uniform physical characteristics, improved production performance and product quality, and adaptability to local environment. The production of halal-compliant goats has successfully developed halal goat production protocols focused on transportation and marketing, slaughtering, chevon processing, and laboratory-based haram detection. These protocols have been used as bases for the development of the Philippine National Standard on Code of Halal Goat Production—a guide for goat raisers in producing authentic halal goat that are safe and fit for human consumption and compliant with the Shari'ah.

Agenda 2: Conduct R&D to Enhance Productivity and Improve Management of Resources.

Researches on genomics were supported to: a) improve coconut varieties for better use and application in agriculture, medicine, and chemical industries; b) enhance competitiveness of Philippine mango; c) develop molecular primers for NSIC-registered coffee varieties such as Arabica derivatives, Liberica, and Robusta. These will be beneficial in properly identifying the coffee seedlings or coffee plants with desirable characteristics prior to their distribution to coffee growers/farmers; d) treat protozoa-based disease of livestock through DNA-based detection kit, which provides preliminary diagnosis using simpler laboratory equipment (heat block

and centrifuge) that aids in giving conclusive results in addition to other methods of diagnosis; e) conduct selective breeding for growth and white spot syndrome virus (WSSV) resistance through selective breeding of shrimp—Philippine *Penaeus vannamei*; and f) develop green mussel for other potential food and non-food uses—as source of antioxidants, anti-inflammatory properties, and high value compounds like glycogen for biotechnology application and pharmacological uses.

On agri/fishery mechanization, the following were developed: a) modified drip irrigation system capable of increasing yields of bulb onions and garlic, uses water more efficiently, and is cheaper compared to commercially-available drip systems; b) semi-automated furnace-type dryer (FTD) for lumber, bamboo, and other raw materials of the forest-based industries, to prevent human errors such as improper or excessive fuel feeding and over spraying; c) herbal tea material dehydrator to raise the production capacity and product quality of tea materials in Region VI; and d) 'balut' vending machine to make balut accessible 24/7 in non-traditional markets and to facilitate distribution in areas that are not accessible to balut vendors such as airport terminals, hotel lobbies, malls, resorts, and other high-end tourist destinations.

On environment and natural resources management, the Council supported activities to: a) improve quality planting materials of indigenous tree species ('Makaasim' and 'Batikuling') for the wood-based industry through cloning as this can prevent the spread of diseases by producing disease-free and pest resistant clones; b) develop effective tissue culture protocols for sterilization, plantlet regeneration,

multiplication, and in vitro rooting using growth regulators, to increase production of selected bamboo species; c) increase supply of bamboo propagules and bamboo shoots through branch cutting and use of sprinkler, respectively; d) development of coral reef assessment tools particularly the Handbook of Protocols for the Conduct of Reef Assessment in the Philippines; e) assessment of rubber planted in non-traditional areas showed that it can be planted anywhere in the Philippines with its one-site species compatibility; and f) deployment of Biotoxin Adsorption Tracking Technique (BATT) units in harmful algal blooms (HAB)-affected areas of Puerto Princesa Bay and Cancabato Bay to record toxin levels with changing densities of toxic plankton species present and shellfish toxicities.

Biodiversity S&T initiatives include: a) field verification trials on the use of a natural fungicide from the leaves of *Tasmannia piperita* confirmed that it can suppress the disease severity caused by *Alternaria brassicae* and by *Phytophthora infestans* in lettuce and tomato, respectively; b) assessment of flora and fauna in selected key biodiversity areas (KBAs) in Cebu were conducted and were able to tag 2,000 tree species and recorded 19 bats; c) strategies on forest protection and biodiversity conservation were developed in selected mountain ecosystems in Mindanao; d) inventory of commercially-important mollusk species in coastal areas of Panay Island highlighted the high diversity of the mollusk fauna of Panay and the multi-gear character of their fisheries; e) restocked giant clams in selected areas showed evidence of adaptation to their local environments by a change in their

algal associates; f) discovery of new seaweed species (red algae), *Pterocladia maribagoensis* (Gelidiales, Rhodophyta) in the Philippines; and g) collection of more than 290 reef fish species from 52 families in Davao, Basilan, Sulu and Tawi-Tawi study sites for tissue processing.

To provide a more conducive S&T policy environment, the Council supported the conduct of the following: a) development and pilot-testing of an Internal Control System (ICS) for the conventional production of cabbage and eggplant, which proved high acceptability of vegetables produced for trade and passing the pesticide residue standards of the ASEAN and the EU; b) establishment of a comprehensive profile of farmers in the country to validate the phenomenon on aging population and the seeming disinterest of the youth in agriculture through a study of changing patterns of farmers' social, demographic, and economic conditions; c) development of a web-based inventory system and assessment of the policy environment of bamboo to address the information and policy constraints that discourage private investments in bamboo plantations; d) tracing the value of soybean as food; e) impact assessment of the PCAARRD-funded National Research and Development Program for Organic Vegetable results showed the program generated organic-based farm production technologies like varietal seeds, biofertilizers and biopesticides and was able to validate significant initial impacts; f) provision of inputs/comments/recommendations to 57 House bills, 7 Senate bills, 4 draft implementing rules and regulations (IRR), 3 House resolutions, 2 Senate resolutions,

2 draft Executive Orders (EO), 2 other draft bills and 25 other policy documents that directly or indirectly affect the AANR sector; and g) attendance to public hearings and meetings that tackled major policy issues affecting AANR sector.

Agenda 3: Engage in R&D to Generate and Apply New Knowledge and Techniques Across Sectors.

For goat, the Council supported the development of: a) a non-invasive pregnancy diagnostic kit to ensure that only dry does are subjected to estrus synchronization and artificial insemination (AI) and b) the SMS-based goat traceability system for transmission of data from goat farms to the central database unit in the Cagayan Valley Small Ruminants Research Center CVSRRC-Isabela State University (ISU). On nanotechnology for tilapia, a cost-effective nano (zeolite-silica) composite was developed using rice hull to improve the water quality and reduce heavy metal accumulation in tilapia culture system; and development of an immune assay for rapid detection of colloidal gold nanoparticles for disease detection in tilapia.

Agenda 4: Strengthen and Utilize Regional R&D Capabilities.

The Council continued to strengthen its partnership with 15 regional R&D consortia by providing funds, policies/guidelines, technical expertise, and capability building for R&D to be implemented nationwide to address various concerns of the AANR sector. Under the Science for Change Program, the Council established 12 Niche Centers in the Regions for R&D (NICER) on potato, freshwater fisheries, citrus, sweetpotato, tamarind, native pig, pili, mollusk, crustacean, sea cucumber, halal goat, and seaweeds.

Agenda 5: Maximize Utilization of R&D Results through Technology Transfer and Commercialization.

The DOST-PCAARRD National Agri-aqua Technology Business Incubation (ATBI) Program supported 16 ATBIs nationwide, produced 18 “graduate” incubatees, and 91 ongoing ones. The aggregate gross income of the incubatees’ enterprises is now at P11.1 million (M), and pave the way to the creation of 309 jobs. The Intellectual Property and Technology Business Management (IP-TBM) Program currently supports 26 SUCs and RDIs. A total of 121 technology transfer officers from these institutions successfully graduated/trained under the 12-module DOST-PCAARRD Intellectual Property Master Class and Technology Commercialization Mentorship Series. With the skills gained, the trainees were able to generate the following IP applications: 49 patents, 228 utility models, 28 industrial designs, 23 trademarks and 313 copyrights. Under the DOST-PCAARRD Science for the Convergence of Agriculture and Tourism (SciCAT), four farms were transformed into tourist spots to create and maximize opportunities, utilizing agri-aqua technologies to improve productivity. On the other hand, the S&T Community-based for Inclusive Development (STC4iD) modality benefited upland and lowland farmers and coastal community groups in conflict-vulnerable communities in Mindanao. They have started to earn 20% more than their average monthly income and provide more sustainable food security for their households. Technology promotion activities included: a) conduct of 10 Farms and Industry Encounters through the Science and Technology Agenda (FIESTA), which showcased single or multi-commodities, which enhance not only awareness and promotion, but the transfer of

commercial technologies beyond regional boundaries, creating collaboration and integration with the industry; b) production and dissemination of 26 new titles of IEC materials, disseminating 150,225 copies and serving 64,242 clients through exhibits, S&T weeks, and conferences; c) conduct of Technology to People (T2P) and Technology Media Conference (TMC); and d) use of promotional LED Boards situated at the PCAARRD gate and in DOST compound in Bicutan.

Agenda 6: Develop STI Human Resources and Build a Strong STI Culture.

The Council, supported human resources development programs, namely, the Balik Scientist Program with 58 beneficiaries, the Graduate Research and Education Assistantship for Technology (GREAT) Program with 43 scholars, thesis/dissertation assistance to 25 graduate students, publication incentives to 57 researchers/students who have published articles of PCAARRD-funded programs/projects in refereed journals and 34 non-degree training courses, which benefited 822 participants from 300 host institutions. The Sandwich Program was launched to provide financial assistance to graduate students enrolled in the fields related to AANR sector who needed to conduct their research in foreign universities and research institutions to avail themselves of the host institution’s facilities and research expertise. Also, it supported the conduct of the biennial convention of the DOST-PCAARRD Graduates Alumni Association, Inc. (DPGAA), which was highlighted by the oath taking of new batch of officers and paper/poster presentations by members of the association.

Through the PCAARRD S&T Awards Program, private individuals/

professional media practitioners were given the Ulat SIPAG Award in recognition of their efforts in promoting the Council’s programs/projects through print and broadcast. Some officials and staff were recipients of various awards outside PCAARRD.

Agenda 7: Upgrade STI Facilities and Capacities to Advance R&D Activities and Expand S&T Services.

Building capabilities of the PCAARRD network has always been among the Council’s priorities as it will support and ensure the successful implementation of its R&D programs/projects. Several facility development projects including laboratory upgrading were implemented to support R&D activities on metallomics and inorganic biochemistry, marine biodiversity, histopathology, and molecular R&D for tuna, bamboo production facility improvement, coconut phytohormones, sea cucumber research, aquaculture, goat embryo-transfer, plant pest and disease clinic, and agricultural machinery testing facility. In addition, the Socio-Economic Research and Data Analytics Centers (SERDAC) and Socio-Economics Research and Data Analytics Laboratory (SERDAL) were maintained and continuously enhanced to support the needs of researchers in accessing socio-economics data and information to facilitate their conduct of time-series studies.

Agenda 9: Provide STI-based Solutions for Disaster Risks and Climate Change Adaptation and Mitigation.

The PCAARRD-funded Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (SARAI) program has developed the tool called SARAI-Enhanced Agricultural Monitoring System (SEAMS) for monitoring and forecasting of:

a) crop growth and yield; b) pest and disease incidence; and c) flood and drought occurrence. SEAMS is also able to provide timely crop and weather advisories. The android application (app) SARAI Smarter Pest Identification Technology (SPidTech), is a tool developed for insect pests and diseases identification on rice, corn, coffee, cacao, banana, sugarcane, coconut, soybean, and tomato. The app helps extension workers and farmers to prepare better for coming pest and disease epidemics brought about by climate variability and extremes. Another is, Real-time Online Surveillance for Banana (ROSANNA), a near-real time decision support system for early detection and control of banana leaf spot (BLS) or Black Sigatoka and banana bunchy top virus (BBTV) diseases. It was later expanded to track and trace Fusarium Wilt and Moko diseases. ROSANNA provided the platform for farm surveyors, technicians, and managers. It is a combination of web and mobile apps.

Agenda 10: Strengthen Industry-Academe-Government and International STI Collaboration.

As Secretariat to the Los Baños Science Community through the Los Baños Science Community Foundation, Inc. (LBSCFI), PCAARRD continued to facilitate transfer and adoption of S&T research outputs and services generated by its member-agencies to target customers and users through provision of financial support and other logistics during the annual science festival SyenSaya. In addition, the Council facilitated the evaluation of R&D papers

submitted for the awards given by the Foundation during the year, namely, the Philippine Agriculture and Resources Research Foundation, Inc. (PARRFI) R&D Award and the Youth Science Award. Other activities to strengthen international partnership include: a) financial assistance to 4 researchers/scientists/experts (RSEs) and 6 ISP Managers in conducting Global Technology and Information Search (GTIS) benchmarking activities; b) sending 34 RSE participants and project managers to various activities sponsored by international partner organizations like Asian Productivity Organization (APO), Asia Pacific Association of Agricultural Research Institutions (APAARI), Food and Fertilizer Technology Center (FFTC), Australian Centre for International Agricultural Research (ACIAR), Taiwan Agriculture Research Institute (TARI), Rural Development Administration (RDA) among others; c) revived 1 international partnership, maintained 14, with 16 new partnerships on the works; and d) received 136 visitors from international organizations who were briefed on PCAARRD operations, programs, and projects in the AANR sector.

Agenda 11: Enhance Effectiveness of STI Governance.

In 2019, PCAARRD had 213 regular employees and 80 contractual staff; 37% of which are males and 63% are females. From the total number of regular employees, 6 have completed their graduate studies while 25 are ongoing, either through scholarships or self-financing. There were 16 personnel who have

retired and 23 were recognized with loyalty service awards. The Council managed a total of P1.203 billion (B) budget under the General Appropriations Act (GAA) for regular agency programs and additional releases from the Department of Budget and Management (DBM) for terminal leave benefits and authorized employer's share on retirement insurance with fund utilization rate of 91%. A total of P558.11 M were generated from external sources, i.e. local and international partnerships either in cash or kind. The Council has also maintained its ISO 9001:2015 Certification, which shows that it has demonstrated its ability to consistently provide products and services that meet customers' and regulatory requirements. On knowledge management, PCAARRD has developed relevant in-house information systems and the Knowledge Management for the AANR Sector (KM4AANR) Portal which integrates knowledge nodes from some of PCAARRD's information systems and the 14 consortia databases. The portals include Knowledge Sharing System, Technology Dashboard, FIESTA, Community, and eLibrary. PCAARRD has continuously supported Gender and Development (GAD) mainstreaming initiatives. Proof of this was the Council's corporate social responsibility (CSR) activity, which highlighted the significant contribution of PCAARRD in integrating GAD in R&D to improve livelihood of men and women in organic vegetable farming.

AGENDA 1: PURSUE R&D TO ADDRESS PRESSING NATIONAL PROBLEMS

Increased mungbean  and peanut  **yield**

Developed **5 Biological Control Strategies** Against Cacao Pests and Diseases 

Improved duck egg  **production**

 **Improved growth rate & egg production performance** of 4 genetic groups of native chickens

Established breeding **true-to-type populations of Philippine native pigs** that are uniform in physical characteristics with improved production performance and product quality 

Established **Farmer Livestock School on Halal Goat Enterprise Management** 

Integrated Crop Management for Tomato (ICM-Tomato)

The program titled *Development of Integrated Crop Management (ICM-Tomato) for Increasing the Productivity of Fresh and Processing Tomato*, is being implemented by the University of the Philippines Los Baños (UPLB) using adaptable and site-specific pest and nutrient management technologies. It has three component projects that focus on the development of disease management, insect pest and weed management and site-specific nutrient management technologies.

Disease surveys were conducted in processing and fresh tomato production areas in Ilocos Norte and Ilocos Sur. Field validations and efficacy testing of ICM technologies to control viral diseases, insect pest and weed management, and site-specific nutrient management

experiments were also conducted. ICM technologies tested include the use of carrageenan technology, healthy seedling technology and

modified biological control agents release strategy for the control of viral diseases specifically tomato leaf curl; modified release strategy,



Tomatoes harvested per treatment using Carrageenan Technology and Farmer's Practice.



Training modules on mass production of nucleopolyhedrosis virus (NPV), earwigs, and *Trichogramma* developed by the ICM-Tomato-Project 2 research team.



Ilocos Red tomato variety infected by leaf curl disease observed in Batac, Ilocos Norte experimental site.



PCAARRD ISP Manager for legumes, Rolando S. Corpuz, comparing peanut plants treated with carrageenan PGP with control plants during field monitoring and evaluation of project sites at Pampanga State Agricultural University (PSAU), Magalang, Pampanga.

and stale seedbed techniques for insect pest and weed management.

Based on the omission plot technique (OPT) conducted in Paoay, Ilocos Norte, and Sinait, Ilocos Sur, the research team was able to formulate and recommend site-specific nutrient management (SSNM) for processing type tomatoes. These are 110-26-125 kg/ha and 126-70-20 kg/ha in Sinait and Paoay, respectively. The recommended SSNM rates have the potential to generate an increase in income of around P31,000/ha/season in Sinait and around P51,000 in Paoay when compared with the National Food Corporation's (NFC) recommended rates.

Multilocation trials of carrageenan PGP

The multilocation trials of the carrageenan PGP on mungbean and peanut in Regions 2, 3, 7, and 10 were completed. Carrageenan PGP as foliar fertilizer applied at 4.8 liters (L) per ha at different growth stages in addition to the farmer's usual practice, resulted in an average increase of 88.7% in mungbean yield from 710 to 1,340 kg/ha.

On the other hand, about 69% increase in peanut yield (from 1,622 to 2,741 kg/ha) was observed. PGP promoted plant growth, seed germination, shoot elongation, root

growth, and flower production. It also suppressed heavy metals and attracted friendly insects and beneficial arthropods that minimized the population of insect pests on mungbean and peanut.

The label expansion (LE) of carrageenan PGP for legumes (i.e., mungbean, peanut, and soybean) has been approved by the Fertilizer and Pesticide Authority (FPA) in September 2019. The protocol on LE is similar for mungbean and soybean. A separate protocol for FPA registration was developed for peanut. With these, the technology can now be commercialized. The good news and the cumulative results of the study were presented



Harvesting of mungbean treated with carrageenan PGP at one of the project sites at the DA–Cagayan Valley Research Center (CVRC), Tuguegarao City, Cagayan.

to the farmers and extension workers, through the Department of Agriculture (DA) and local government units (LGUs) in Regions 2, 3, 7, and 10.

Soybean R&D Program

Through the leadership of the University of the Philippines Los Banos-Institute of Plant Breeding (UPLB-IPB), in collaboration with the DA-Regional Integrated Agricultural Research Centers (RIARCs) Regions 2, 10, 11, and 13, Surigao del Sur State University (SDSSU), and Davao Oriental State College of Science and Technology (DOSCST), the Council-supported program, "Improvement of Soybean (*Glycine max* (L.) Merr.) for Better Nutrition, Higher Income and Enhanced Soil Health," commenced implementation during the year. The program aimed to increase farm income by integrating soybean in different cropping systems and improve the supply of local soybeans from more efficient supply chains and more productive food-grade soybeans on-farm.

Initial results of on-farm trials on different cropping systems (soybean after rice and corn, and as intercrop to cassava) in Regions 2, 10, 11, and 13 showed that the World Vegetable Center accessions SP 963-9 and 'Manchuria,' performed best. Soybean accession, AGS 374 across

from Tiwala 8 x LXI8A (lipoxygenase null) ranked second in all farm trials.

In terms of insect pests and diseases, AGS 374 remained resistant to aphids and powdery mildew compared with SP series in on-farm trials. Initial findings further showed SP 963-5, SP 963-7, SP 963-1, SP 963-6, and SP 963-2 as the top five soybean varieties, all exhibiting good crop stand and high number of pods. Further research and evaluation of these varieties aim to determine the soybean lines with desired traits and suitable to different growing areas.

After two more years of project implementation, the program will also have developed populations of soybean with large seed, good processing quality, high yields, enhanced functional properties (isoflavones and lunasin), and good adaptation to different agro-ecological zones. Marker-assisted selection will also be done to test soybean's adaptability and functional properties.



Ms. Lorena V. Duna (left), Project Staff from DA-Regional Field Office (RFO) 10 and Mr. Elmer E. Enicola, Program Leader of the Soybean R&D Program, "IPB-UPLB," discussing their observations in one of the on-farm trials at DA-Northern Mindanao Agricultural Crops and Livestock Research Complex (NMACLRRC), Malaybalay, Bukidnon.



PCAARRD ISP Manager for legumes, Rolando S. Corpuz, assessing the soybean seeds produced at DA-NMACLRC, Malaybalay, Bukidnon.



Soybean-based food products such as tofu, soy chocolate bar, roasted soybeans, soy hotcake, black soytea, soymilk, and 'taho' and other products were served during the 7th Farmers' Field Day at DA-Del Monte Lowland Rainfed Research Station (DMLRRS), Talacogon, Agusan del Sur.

Biological control strategies against cacao pests and diseases

Through a research implemented by the De La Salle University (DLSU), UPLB, and DA-Philippine Center for Postharvest Development and Mechanization (DA-PhilMech), five biological-based strategies were developed to control the rapid spread of insect pests and diseases affecting quality of cacao pods and beans:

1. Sex pheromone trap for cacao pod borer (CPB) uses a sex pheromone, "alpha-pinene," extracted from a female CPB to lure and trap male CPBs present in the cacao plant.
2. Mass rearing system and field release of lynx spider (*Oxyopes javanus*), a major predator of CPB and cacao mirid bug (CMB). A rearing system and an artificial diet to grow lynx spiders before they are released on infested cacao plants were developed. Lynx spiders do not harm the cacao pods but feed on CPB and CMB, thus reducing pests in cacao farms.
3. Clay particle called "zeolite" as coating agent in cacao pods. Zeolite is found to have the best surface coating efficiency. It reduces feeding punctures due to CMB and prevent the oviposition of CPB.
4. Biological control of fungal diseases. A biological assay identified microbial epiphytes and endophytes that can control black pod rot (BPR) and vascular streak disease (VSD), common fungal diseases of cacao.
5. Nanobiosensor diagnostic kit for the detection of BPR and VSD was developed. It is a "matting" technique that uses magnetic nanoparticles to detect the presence of *Phytophthora palmivora*, a causal organism of BPR, and *Ceratobasidium theobromae*, a causal organism of VSD.



Lynx spider feeding on the cacao mirid bug, one of the major pests of cacao.



Dr. Divina Amalin, project leader from DLSU, discussing the biological control strategies that have been developed.



Dr. Alberto Barrion showing a cacao pod infested with CMB.



Newly developed IP-Itim (L) and IP-Kayumanggi (R).

Native Animal R&D Program

R&D on native animal improvement has increased the productivity and marketability of native breeds of ducks, chicken, and pigs.

ITIKPinas (IP). The duck R&D program has improved the egg production performance (weight and size) of IP. In 2017, the program developed 2 purelines—IP-Itim and IP-Khaki, and 1 commercial line, IP-Kayumanggi. These lines are capable of producing at least 260 eggs per duck per year with consistent product quality. Hatching eggs and day-old ducklings of IP are already available in five cooperating duck farms.

As of 2019, a total of 23,973 IP-Kayumanggi ducks and drakes have been distributed to 63 farmer-cooperators in seven regions. IP-hatching eggs and day-old ducklings are now available in five private commercial duck breeder farms in Regions 3, 4A, CARAGA, and in Zamboanga City. Technologies for the production of salted duck egg powder and salted eggs with longer shelf life (from 3 weeks to 3 months) were also developed to widen the market of

duck eggs. Moreover, prototype of a balut vending machine has been developed to facilitate balut distribution in areas that are not accessible to balut vendors (e.g., hotel lobbies and airport terminals).

In a related development, the trademark registration of salted egg, DOST-UP Duck, of the UPLB-Institute of Food Science and Technology (IFST) was registered and approved by IPOPHIL last December 2019. It features a duck

in a 'salakot' with a cracked shell on its lap, representing the Filipinos, who are usually depicted in 'barong tagalog' and 'salakot.' Since IP-Kayumanggi is a little darker than IP-Khaki, the duck in the logo has a darker shade of brown. Lastly, the cracked egg symbolizes the new opportunities offered by IP as compared with the native Philippine Mallard Duck. This trademark logo will be used in salted eggs produced from IP-Kayumanggi.



Trademark logo for salted IP duck egg.

On the other hand, the patent on the process of extending the shelf-life of salted eggs using cassava-potassium sorbate coating is for final review of the UPLB Technology Transfer and Business Development Office (TTBDO) prior to submission to IPOPHIL.

Native chicken. Four genetic groups of Philippine native chickens namely Darag, Zampen, Boholano, and Camarines were developed into breeding true-to-type populations through breeding and selection R&D. Egg production performance of these native chickens increased from 100 eggs/hen per year to 110 eggs/hen per year. Growth rate was also improved, thus the desired 1.2-kg slaughter weight is now achieved 2 weeks earlier (from 18 to 16 weeks old). The improved native chickens are uniform in physical characteristics, predictable in performance, and consistent in product quality. These traits inspire farmers to produce native chickens in commercial scale.

Native pigs. The native pig R&D program established breeding true-to-type populations of Philippine native pigs that are uniform in physical characteristics with improved production performance and product quality while maintaining their adaptability to local environment. To date, breeding true-to-type native pig populations of Markaduke (Marinduque), Q-Black (Quezon), Yookah (Kalinga), ISUbela (Isabela), Benguet (Benguet), and Sinirangan (Eastern Samar) have been developed. These breeds exhibit 90% uniformity in physical characteristics, increase in average litter size from 5 to 7, and increase in average daily gain by 20%.

Also, Markaduke and Q-Black sows now produce more than 10 piglets/litter. Native pigs R&D activities on

native pigs are now focused on the roll-out and commercialization of the six native pig genetic groups. Breeding techniques such as AI and use of genetic markers are being conducted to further improve the production performance and hasten the genetic improvement.

Lastly, a Philippine Native Pig Center will be established at the Marinduque State College (MSC) in Torrijos, Marinduque in 2020 for the continuous development, promotion, and utilization of native pigs in the country.



Darag native chickens, one of the genetic groups of Philippine native chickens, are found in Panay Island.



Philippine native pigs developed through organized breeding and selection with 90% uniformity in physical characteristics.

R&D to propel production of Halal-compliant goats

The potential of producing authentic halal goat is a niche that Region 12 capitalized on when it developed the halal goat production and assurance protocols in 2015. It encompasses protocols on halal goat production, transport and marketing, slaughtering, chevon processing, and laboratory-based haram detection. These protocols underscored the importance of identifying critical control points from production to post-production,

where haram contamination occurs, which when enhanced, could give Muslim raisers a better share in the trade of halal goats. These protocols have been used as foundation for the development of the Philippine National Standard (PNS) on Code of Halal Goat Production, which DA-Bureau of Agriculture and Fisheries Standards (BAFS) produced and released in collaboration with PCAARRD and Sultan Kudarat State University (SKSU) in June 2019. The Philippine National Standard (PNS) is a guide for goat raisers in

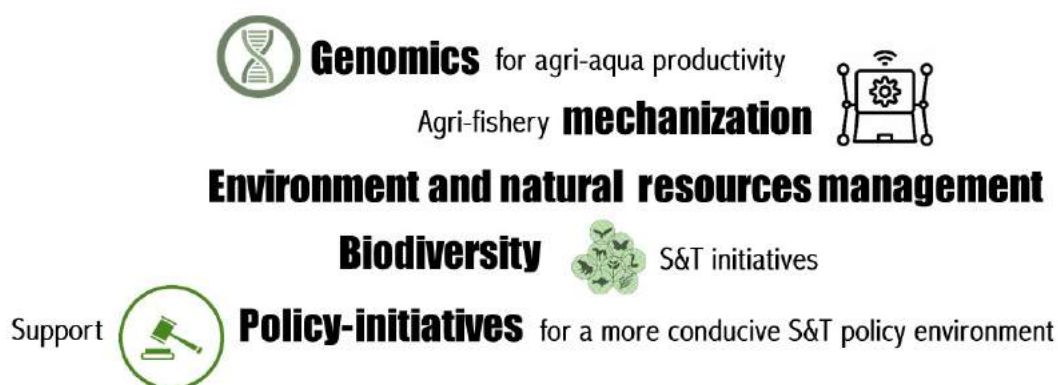
producing authentic halal goat that are not only safe and fit for human consumption but also compliant with the Shari'ah. To promote these protocols, a Farmer Livestock School on Halal Goat Enterprise Management (FLS-HGEM) was developed and piloted in 2018–2019 in five municipalities in Cotabato and Sarangani Province with 252 Muslim farmer-cooperators. Preliminary data showed that adoption of the production protocol translated to increased survivability and heavier kids.



FLS-HGEM
FARMER LIVESTOCK SCHOOL ON
HALAL GOAT ENTERPRISE MANAGEMENT

The official logo of the FLS-HGEM that will be fully rolled out starting 2020 in Mindanao.

AGENDA 2: CONDUCT R&D TO ENHANCE PRODUCTIVITY AND IMPROVE MANAGEMENT OF RESOURCES



Genomics for agri-aqua productivity

Improvement of coconut varieties through genomics-assisted molecular breeding

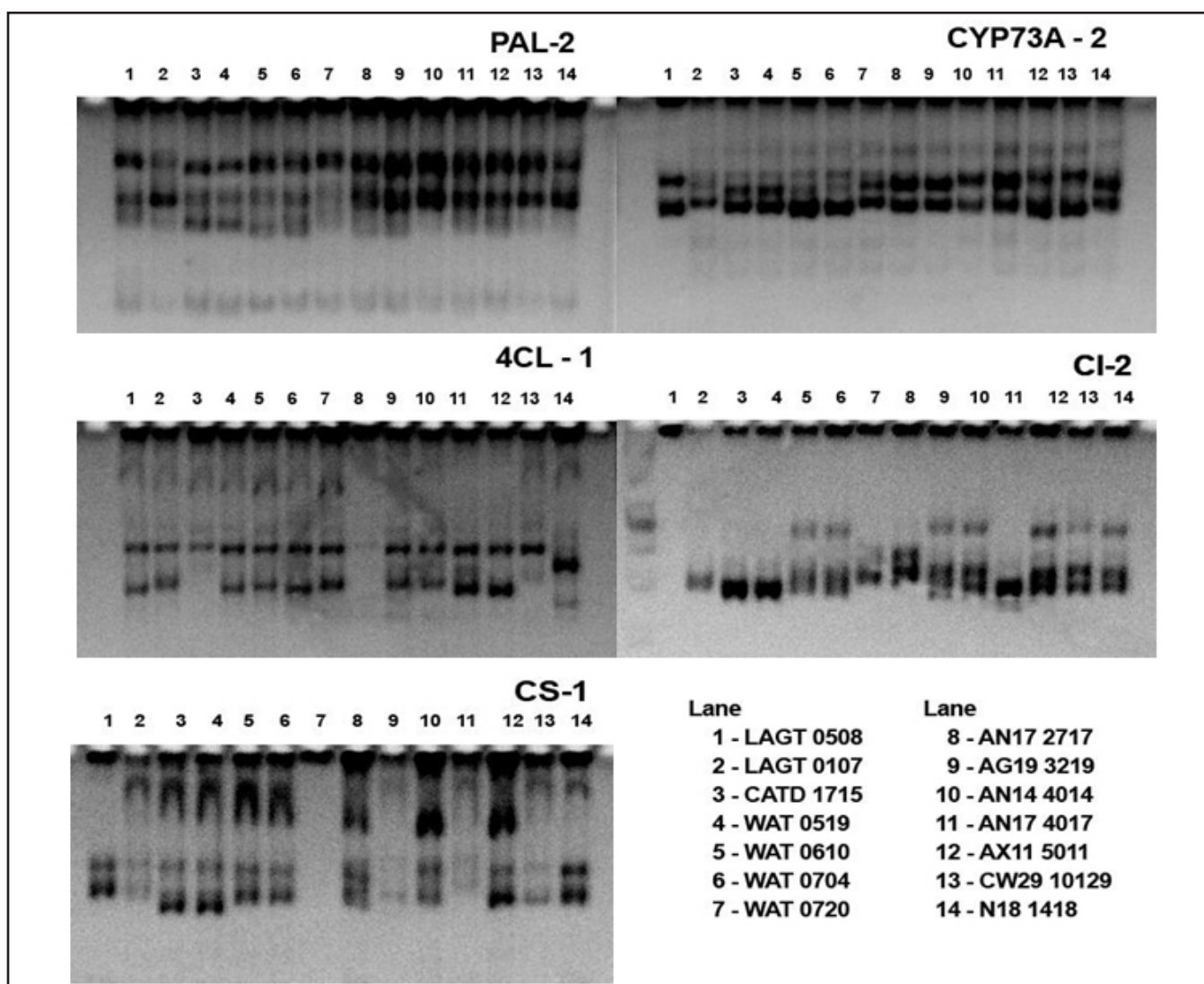
The GREAT Program's research thesis, "Detection and Mining of Molecular Markers for Naringenin Biosynthesis in Coconut (*Cocos nucifera* L.) Solid Endosperm" augmented the results of Coconut Genomics Project 7, "Quantitative Trait Locus (QTL) Mapping in Coconut for High Yield and Outstanding Quality of Copra Oil and Other Coconut Major By-

products." Genes associated with the biosynthesis of naringenin were identified and 10 gene-specific simple sequence repeat (SSR) markers were designed through assembly of the coconut endosperm transcriptome. All molecular markers, which showed amplification upon screening among the parental, synthetic, and mapping populations may prove to be useful for future breeding programs.

The said graduate research was able to report the first isolation of the phytochemical naringenin from coconut and its

structure was confirmed through liquid chromatography-mass spectrometry (LC-MS), and ¹H and ¹³C NMR. Earlier studies confirmed that naringenin has significant pharmacological benefits including antioxidant, anti-inflammatory, hepatoprotective, and antidiabetic properties among others (Den Hartogh et al., 2019).

This study reinforces the role of coconut as the "Tree of Life" and paves way for new research on the benefits from coconut and their further application in agriculture, medicine, and chemical industries.



The representative polymorphism electrophoretograms of the SSR primers PAL 2, CYP73A-2, 4CL-1, CI-2, CHS-1 among the parental coconut varieties (Lanes 1-7) and hybrids (Lanes 8-14).

Breeding to enhance the competitiveness of Philippine 'Carabao' mango

PCAARRD's mango breeding program aims to enhance the competitiveness of Philippine 'Carabao' mango through varietal improvement. One of its specific objectives is to identify molecular markers associated with red blush, thick peel, and resistance to fruit fly and anthracnose through genotyping by sequencing (GBS) technology. The recently completed

project, "Identification of Molecular Markers in 'Carabao' and Other Mango Varieties Associated with Red Blush, Thick Peel, and Resistance to Anthracnose and Fruit Fly," generated single nucleotide polymorphism markers for the target traits. These markers are useful for future initiatives on marker-assisted breeding.

Implemented by the UPLB-IPB, outstanding accomplishments in 2019 include identification of

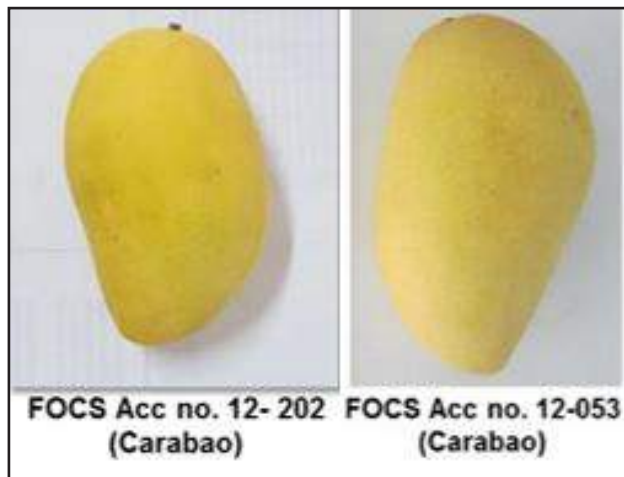
the NSIC-registered 'Carabao' mango variety 'GES 77' with consistent resistance to fruit fly. Other accessions with consistent resistance to the said insect pest—FOCS Acc. No. 12-209; FOCS Acc. No. 12-127; and FOCS Acc. No. 12-103 ('Farrales'). FOCS Acc. no. 12-202 and FOCS Acc. No. 12-053, showed consistent resistance to anthracnose. The program team facilitated the registration of 'Mangoming,' a large-size variety, for processing.



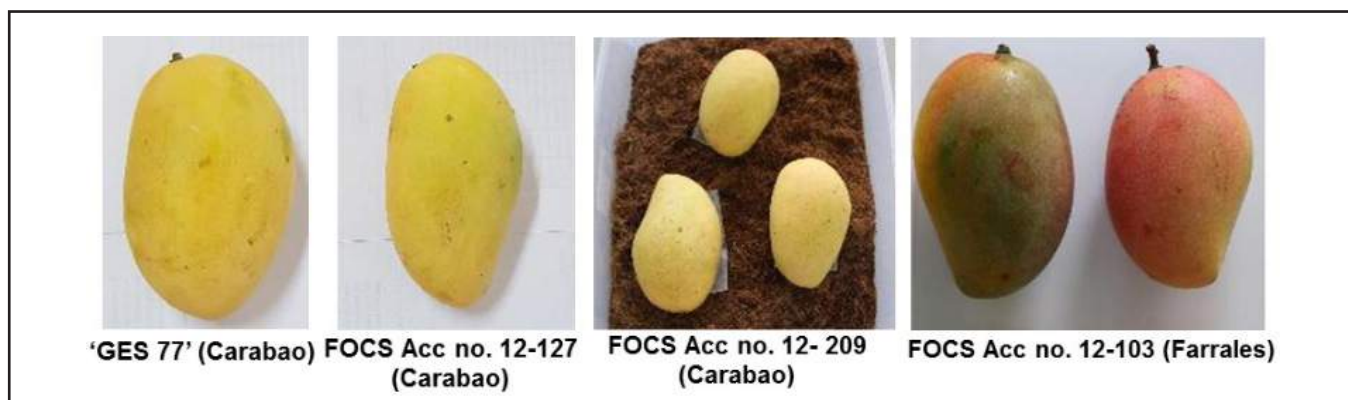
University Research Associate Mr. Niño P. Laurel shows Dr. Rita P. Laude of the technical review and evaluation panel the different anthracnose isolates stored at the Plant Pathology Laboratory, IPB-UPLB.



PCAARRD staff examines the fruit fly rearing cages at the Entomology Laboratory, IPB-UPLB.



Mango accessions resistant to anthracnose. Image credit: Institute of Plant Breeding, UPLB



Mango variety and accessions resistant to fruit fly. Image credit: Institute of Plant Breeding, UPLB.

Molecular markers for economically important traits of Philippine specialty coffee

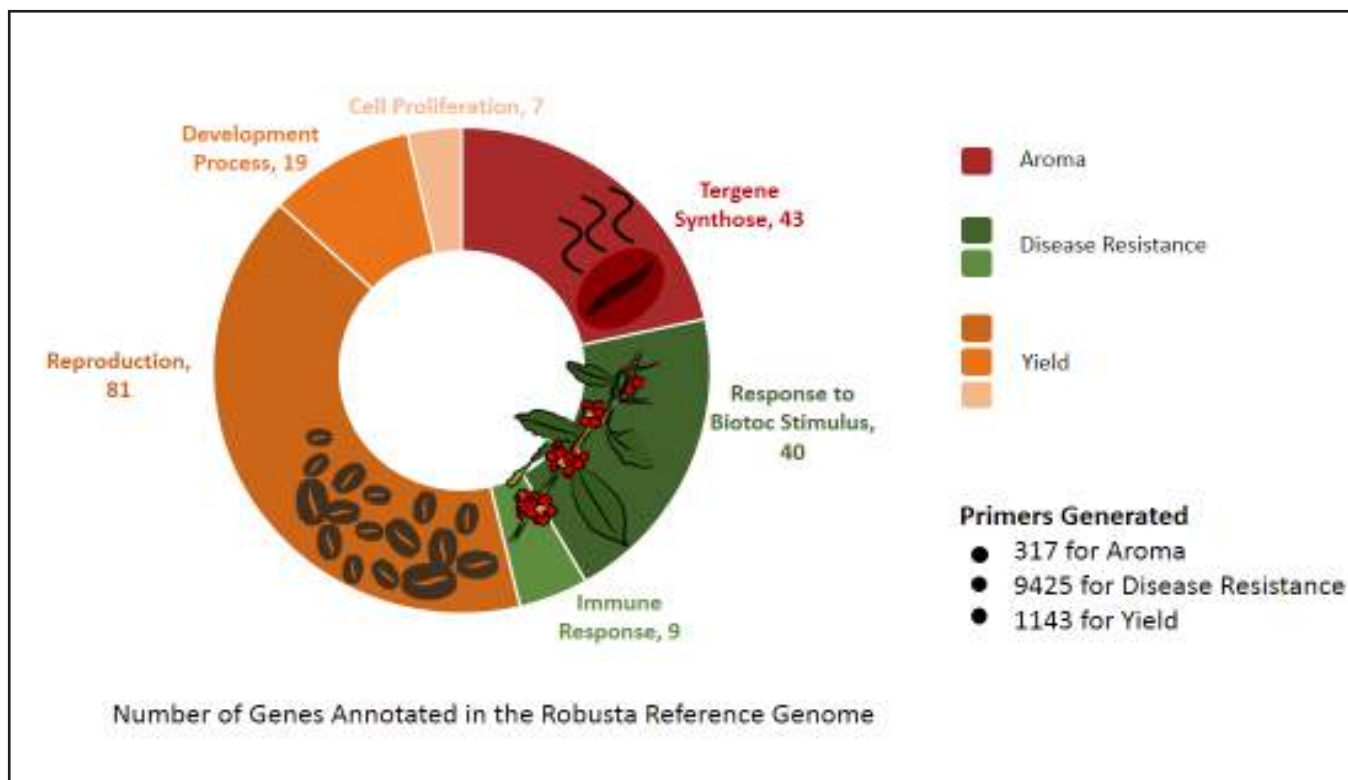
Molecular primers for National Seed Industry Council (NSIC)-registered Arabica derivatives, Liberica, and Robusta were synthesized for pest and disease resistance, yield, and aroma. Validation of these primers yielded 8 molecular markers for

insect pest and disease resistance, 15 for yield trait, and 27 for aroma trait.

The candidate markers were able to differentiate pest and disease resistance, yield, and aroma of NSIC-registered Philippine specialty coffee species and varieties and the reference species Robusta. The markers developed will be beneficial

in properly identifying the coffee seedlings or coffee plants with desirable characteristics prior to their distribution to coffee growers/farmers.

The markers are currently deposited in the Plant Genetics and Cyanobacterial Biotechnology Laboratory, Institute of Biology at the University of the Philippines Diliman (UPD).



Mining of genes from the bioinformatics analysis of the Robusta reference genome and number of primer pairs generated per trait of interest.

DNA-based detection kit for *Trypanosoma evansi*

Surra or trypanosomiasis is a disease caused by a protozoan parasite, *T. evansi*. It is a neglected disease in the Philippines, which affects many animals including livestock such as buffaloes, where disease prevalence is not determined. Infection can result in chronic loss of body condition, behavioral abnormalities, and death of animals. *T. evansi* also causes sleeping sickness in humans. Hence, an outbreak could significantly reduce farm incomes and pose a public health concern. There is a need to detect infection so that proper control strategies can be implemented.

The DNA-based test kit developed by Dr. Claro N. Mingala of the DA-Philippine Carabao Center (PCC) uses a solution with gold nanoparticles embedded with short nucleic acid chains that act as probes, which specifically bind to a target region of the *T. evansi* gene. A colored marker is attached to each probe. Once a target gene from the sample binds to a probe, the colored marker is detached producing the color change in the solution. Hence, a blood sample drawn from an animal infected with *T. evansi* will produce a positive result, signified by a change in color of the solution. The kit therefore shows visible response, i.e., distinct color changes, to both positive and negative results, thus eliminating use of highly technical equipment. Using polymerase chain reaction (PCR) is the gold standard of detection, but is expensive and tedious.

The kit provides preliminary diagnosis using simpler laboratory equipment (heat block and centrifuge) and aids in giving conclusive results in addition



Prototype *T. evansi* test kit containing the Gold Nanoparticle (GNP) Solution, Phosphate Buffer Solution (PBS), Thiolated Oligonucleotide targeting *T. evansi* gene (Probe), sodium chloride (salt), sodium dodecyl sulfate (SDS), positive control (PC), and negative control (NC).

to other methods of diagnosis. Improvements to the kit will make it available for use by local farmers and other non-technical people to help improve animal health management.

Selective breeding for improved growth and WSSV-resistance of Philippine *Penaeus vannamei*

To develop a fast growing and WSSV-resistant *P. vannamei*, researchers from the University of the Philippines Visayas (UPV) established a nucleus breeding population in the Philippines of two family founder lines of *P. vannamei* from the United States of America (USA) and one family from the farmed shrimp within the Philippines. Maturation diet was developed to induce the spawning of

non-ablated shrimp broodstock. F2 generation of selected lines of KONA or SIS *P. vannamei* were produced.

The cross between shrimp improvement system (SIS) and KONA lines (F2) exhibited gain in growth that is intermediary to the performance of the parents. The cross exhibited about 17–30% increase in growth performance as compared with the normal unselected population. Broodstock of local KONA with disease resistance are obtained and maintained. Four out of 30,000 broodstock and 50 out of 45,000 juveniles survived the WSSV infection in natural pond conditions and showed natural resistance against WSSV.



F2 broodstock produced.

Developing other potential uses of mussel

Mussel is mostly known as a food commodity because of its high protein content. However, it has other potential food and non-food uses.

Peptides and amino acids from mussel proteins possess

antioxidant, antihypertensive, and antimicrobial properties. Lipids from mussel have been also shown to possess anti-inflammatory properties. Mussel is also a potential source of high-value compounds like glycogen for biotechnology application.

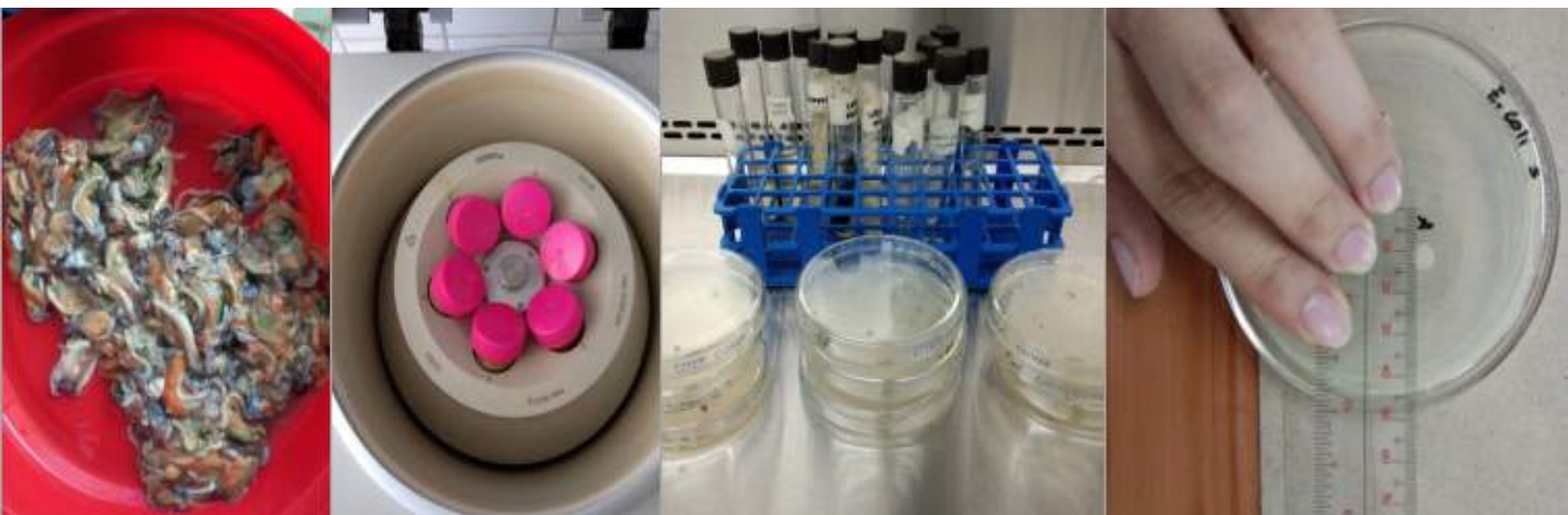
Under the Mussel Biotechnology Program, research was done to

characterize and isolate bioactive peptides and lipids from three mussel species studied. The goal is to obtain peptide isolates and lipid fractions that have high-value applications as food supplements, functional food ingredient, and other nutraceutical uses. The protocol for the extraction of bioactive protein, lipids, and glycogen from mussel has been optimized. The extracted peptides and lipids are currently being characterized, while shelf life studies of the peptide and lipid products are underway.

Research was also done to extract and utilize glycogen from mussels for other non-food applications and possible pharmacological uses. Biotechnology-grade and food-grade glycogen from three mussel species were purified and characterized. Extraction protocol that will yield the highest glycogen purity was optimized. The applications of extracted glycogen in molecular biology as ribonucleic acid (RNA) and DNA carrier and that of food grade glycogen as cosmetic component are currently being tested.



Optimizing the supercritical fluid lipid extraction protocol for Philippine green mussels.



Extraction and evaluation of the antibacterial and antifungal properties of *Perna viridis*.

Agri-Fishery Mechanization

Modified drip irrigation system

The modified drip irrigation system developed by the Central Luzon State University (CLSU) is capable of increasing yields of bulb onions and garlic, uses water more efficiently, and is cheaper compared with commercially available drip systems. The system features a CLSU-designed drip kit for 500-square meter (m^2) onion production, which uses appropriate sizes of materials and proper installation protocol.

In greenhouse and open field experiments, irrigating garlic and onion when soil moisture reaches 50% of the total available water, was the best irrigation scheme compared with farmers' practice and other irrigation treatments. In this scheme, which uses atmometers and soil moisture sensors, the modified drip irrigation field trials in Nueva Ecija and Ilocos Norte resulted in 23.04–32.22 tons (t)/ha onion yields and 5.0–6.33 t/ha garlic yields. These are more than 30% higher than the national average yields of

8.7 t/ha for onion and 3.52 t/ha for garlic.

Water productivity or crop yield per cubic meter (m^3) was higher in drip-irrigated onion under open field condition at 6.37–8.06 kg/m^3 than that of farmers' practice, which ranged from 0.97–1.17 kg/m^3 . Likewise,

drip-irrigated garlic under open field condition yielded more at 2.52–2.89 kg/m^3 than that of farmers' practice at 0.92–1.15 kg/m^3 .

The modified drip irrigation system is cheaper at P9,900 than the price of commercially available drip system, which ranges from P15,000 to P20,000.



Installation of drip irrigation systems in open field and in greenhouses. Image credit: CLSU.

Semi-automated furnace-type dryer

Using acquired knowledge and information on kiln drying design and efficiency in Malaysia's kiln drying technology, the DOST-Forest Products Research and Development Institute (FPRDI) developed the semi-automated furnace type dryer (FTD) for lumber, bamboo, and other raw materials of the forest-based industries. The switch from manual to semi-automatic operation of the FTD prevents human errors such as improper or excessive fuel feeding and over spraying. By optimizing the FTD design, essential factors such as heating system, humidification, air circulation, and kiln structure were improved.



Improved FTD developed by FPRDI.

Dehydrator for herbal tea materials

To raise the production capacity and improve product quality of tea materials in Region 6, a new dehydrator machine that efficiently dries herbal tea materials was developed by the Iloilo Science and Technology University (ISAT-U) in partnership with Ephrathah Farms, Inc., a producer of herbal tea in Badianan, Iloilo.

The machine can dry fresh leaves of guava, moringa, guyabano, and roselle flower petals using solar radiation to heat up the air, which flows inside the dehydrator. For optimum results, herbal tea materials should be dried at 45 degrees Celsius (°C) until the desired moisture content of 8% is obtained. At this moisture content, most of phenol content and high antioxidant activity of the tea materials are retained.

The drying process takes place when the heated air flows through the trays containing the leaves/samples. This drying process is



The dehydrator system consists of a solar heat catcher installed outdoor and a drying chamber fitted with 12 trays where the leaves are dried.

known as convective heat transfer. In case of insufficient solar radiation, the dehydrator will utilize a back-up electric heater.

Patent application for the machine has already been filed at IPOPHL (Registration No. 3-2018000623).

With the new dehydrator machine, Ephrathah Farms, Inc. can increase its tea production capacity from the usual 0.5 kg/day to 5 kg/day at a lower energy cost.



Holding the herbal tea products processed from the dehydrator machine are: (from right) ISAT-U President Raul F. Muyong; PCAARRD's Dr. Juanito T. Batalon, and Ephrathah Farm's general manager Engr. Ed Roderick V. Canuto. Image credit: ISAT-U.

Balut vending machine

A prototype of a 'balut' vending machine was developed by the University of Sto. Tomas (UST) in 2019 to make balut accessible to non-traditional markets and to facilitate balut distribution in areas that are not accessible to balut vendors. It will be useful in airport terminals, hotel lobbies, malls, resorts, and other high-end tourists' destinations. This machine is an innovation in balut marketing and distribution that will meet the requirements of the target consumers and the non-traditional balut retailers.



Prototype of balut vending machine intended for hotels and resorts.

Environment and natural resources management

Quality planting materials of indigenous tree species

'Makaasim' (*Syzygium nitidum* Benth) and 'Batikuling' (*Litsea leytenis* Merr.) are threatened indigenous tree species due to the demand for wood pallets, furnitures, and wood carving. To support the needs of the wood-based industry and the government's National Greening Program (NGP), the Southern Luzon State University (SLSU) endeavored to produce quality planting materials of these species through clonal propagation.

Cloning can prevent disease spread by producing disease-free and pest-resistant clones. SLSU's existing clonal nursery can produce any volume of cloned seedlings at any time of the year and meet the requirements of LGUs, nursery managers, and tree farmers.

Protocols for the vegetative propagation of Makaasim and Batikuling were also developed. R&D technologies and findings on production of quality planting materials: vegetative propagation using mist system and vegetative propagation using stem cuttings of batikuling in non-mist system were disseminated through trainings and IEC materials such as posters and brochures.

Tissue culture technique for mass production of selected bamboo species

The Visayas State University (VSU) developed effective tissue culture protocols for sterilization, plantlet regeneration, multiplication, and in vitro rooting using growth regulators for economically important bamboo species.



Experimental set-up in strip-split plot.



Shoot multiplication of the different bamboo varieties in cytokinin-supplemented MS medium.

Six bamboo species were established in the nursery from cuttings and seeds as source of planting material. These are *Dendrocalamus giganteus*, *Bambusa tulda*, *D. asper*, *D. membranaceus* var *Grandis*, *D. latiflorus* var *Machiku*, and *Guadua angustifolia* var *Oliver's*.

Commercial bleach solution and ethyl alcohol as sterilants were more effective compared with use of mercuric chloride in establishing clean cultures as they lessened browning and contamination of cultures. Nodal segments from field grown mother plant and seeds grown in vitro were the best sources

of explants for micropropagation of test bamboo species. The research team inoculated and established stock plants of the selected bamboo species.

Increasing the supply of bamboo propagules and bamboo shoots

The booming bamboo industry is due to high demand for bamboo-based products such as furniture, handicraft, and food from bamboo shoots. To support this, Pampanga State Agricultural University (PSAU) researchers conducted a study to increase the survival rate of bamboo propagules and enable year-round production of bamboo shoots.



Bamboo shoot (left) and stored bamboo shoots in cling wrap (right).

Results showed that branch cutting is better than culm cutting in propagating propagules. The recommended two-node branch cutting resulted in 64% survival rate in 'kawayan tinik,' 46% in 'bolo,' and 50% in giant bamboo.

Sprinkler irrigation was the best irrigation method during dry season, with increased shoot production from 6–7 to 10–12 shoots/clump per year in kawayan tinik. Wrapping the shoots with paper towel and cling wrap before refrigeration was the best storage practice. Best results were also achieved when the bamboo shoots were soaked in 10 gm NaCl.

Assessment of rubber planted in non-traditional areas

The study assessed the suitability of planting rubber in non-traditional areas (NTAs) or areas outside Mindanao where rubber is not commonly grown. The NTAs studied include 10 provinces, namely: Abra, Cagayan, Isabela, Nueva Vizcaya, Laguna, Quezon, Oriental Mindoro, Palawan, Southern Leyte, and Negros Oriental.

Primary data were collected through key informant interviews and focused group discussions with rubber farmers, farm owners, traders, and processors. Climatic data such as temperature, relative humidity, wind speed, and rainfall were accessed from DOST-Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Data on tracks of tropical cyclones entering the Philippine Area of Responsibility (PAR) were also obtained in order to determine the location of rubber plantations in the NTAs relative to the typhoon pathway. Field visits were done to validate all primary and secondary data that were collected/generated.

A total of 4,144.8 ha in NTAs is planted to rubber. This is about 2% of the total area planted in the country. The agro-climatic conditions in majority of these NTAs are comparable to those of traditional rubber areas. Considering these conditions, the map generated by the study suggests that the areas planted in the NTAs are suitable for planting rubber. Additionally, more than 478,000 ha was also found

potential or suitable for rubber expansion in the NTAs.

Commonly grown clones in the NTAs are RRIM 600, PB 260, PB 330, and USM 1. These clones exhibit good plant stand with comparable girth size ranging from 52 to 65 centimeters (cm) for mature trees (8–18 years) and 20–38 cm for immature trees (3–4 years). These clones produced the following rubber cuplumps: 2,875 kg/ha per year in Palawan; 2,130 kg/ha per year in Laguna; 2,050 kg/ha per year in Quezon; 2,200 kg/ha per year in Oriental Mindoro; and 2,845 kg/ha per year in Negros Oriental. Such yields are comparable to the yields in traditional areas.

Overall, rubber can be planted anywhere in the Philippines with its one site-species compatibility. Among the major conditions, planting of rubber should be confined in areas not directly within the typhoon pathways. Areas in the eastern seaboard of the country such as Bicol, Eastern Quezon, and Cagayan Valley are not recommended for rubber plantation development.



Engr. Roger Bagaforo demonstrating proper tapping techniques on a rubber tree



Dr. Wilfredo Y. Licuanan during his lecture on the first day of coral reef assessment training in March 2019 at DLSU-Shields Marine Station, Lian, Batangas.

Development of coral reef assessment tools

A Handbook of Protocols for the Conduct of Reef Assessment in the Philippines was developed to pave the way to a standardized coral reef assessment protocol for the country. The handbook allows non-scientists and other coral reef managers to be involved in the conceptualization, planning, and implementation of more detailed

reef assessment. It also facilitates the development of a nationwide reef monitoring system to allow for more updated information on the status of the reefs.

On the other hand, the first version of the remotely operated vehicle (ROV)-mounted camera rig was designed, fabricated, tested for balance, and dragged up to 70 meters (m) without seawater

leaking into its enclosures. Initial tests indicate that it can maneuver properly though further tests are needed to verify its performance at greater depths. Underwater image enhancement algorithms that can compensate for poor lighting conditions in mesophotic depths were also developed. Results indicate that color balance can be exploited to improve fish visibility under this condition.



Participants during their review on coral taxonomy using coral skeleton.



Lecture on site selection for reef assessment by Dr. Licuanan in Lian, Batangas.



Participants preparing the equipment for the land simulation of reef assessment.



Setting-up of cameras during the coral reef assessment.



Dr. Mari-Ann Acedera of the Marine Resources Research Division of PCAARRD, Dr. Wilfredo Licuanan, the facilitators, and participants on the last day of the training at DLSU-Shields Marine Station (SMS), Lian, Batangas.

Biotoxin Adsorption Tracking Techniques (BATT) to detect HAB toxins

Harmful algal blooms (HABs), which include toxic "red tides" and fish kills, cause serious socio economic repercussions and are concerns for food security, livelihood and health. The capacity to detect toxic blooms early is key in managing the risks from this phenomenon,

and the program Hazard Detection and Mitigation Tools for Algal Blooms in a Changing Environment, aims to establish the capacity of the Biotoxin Adsorption Tracking Technique (BATT) as an early-warning device without having to rely on variable shellfish supplies. In collaboration with the Palawan State University and the UP Visayas Tacloban campus, BATT units were deployed in the HAB-affected

areas of Puerto Princesa Bay and Cancabato Bay. Sampling of the BATT units is synchronous with physico-chemical, plankton and shellfish sampling on a weekly basis over several months; and will provide the first detailed comparison of toxic plankton dynamics together with comparisons of shellfish vs BATT toxicities. This will give a better handle on the capacity of BATT as an early-warning device.



Stations in Puerto Princesa Bay, Palawan.



Biodiversity S&T Initiatives

Natural fungicide from *Tasmannia piperita* (Hook.F.) Miers

In a previous study, researchers from the Central Mindanao University (CMU) discovered leaves of *T. piperita* as a source of a natural fungicide against leaf spot disease of lettuce caused by *Alternaria brassicae* and late blight disease of tomato caused by *Phytophthora infestans*, as tested in vivo (greenhouse and field conditions). A follow-up field verification was conducted to optimize conditions for the effective use of the fungicide.

Field verification trial confirmed that natural fungicide from *T. piperita* is able to suppress the disease severity of *A. brassicae* and *P. infestans* in lettuce and tomato, respectively. The rates of

disease suppression and effect on yield depend on the frequency of application and concentration of the fungicide.

The research team coordinated with the local community of Bukidnon and other provinces in Region 10 to promote the importance of



Tasmannia piperita plant found in Bukidnon. Image credit: CMU.

T. piperita. Upland farmers were encouraged to plant and propagate the plant as additional source of income for upland farmers once local producers start developing the organic pesticide.

Flora and fauna assessment in Cebu Island key biodiversity areas

The Cebu Technological University (CTU) surveyed the flora and fauna in selected key biodiversity areas (KBAs) of Cebu: Mt. Lantoy KBA, Nug-as Forest KBA, Mt. Lanaya KBA, and Mt. Kapayasan KBA. Flora and faunal diversity, habitat types, and composition of KBAs were studied in the identified study areas thru Permanent Biodiversity Monitoring System (PBMS). This project aims to develop a plant and animal database for proper management and to strengthen our conservation efforts for the natural biological resources found in Cebu.

The research team tagged over 2,000 tree species in the four identified KBAs. A critically endangered tree, *Diospyros longiciliata* Merr., locally known as 'itom-itom,' was found in Nug-as forest and Mt. Lantoy KBA. This indicates a possible new distribution record in Cebu as said tree species can only be found in Surigao and Dinagat Islands, based on previous information.

The team also recorded 19 species of bats, 10 of which are frugivores and 9 are insectivores. Four of these species were Philippine endemic. The Philippine tube-nosed fruit bat, *N. rabori*, feeding on shoots/leaves, petioles, and other non-conventional plant parts was also observed. This is an unusual behavior as this bat normally feeds on fruits.

Further, a total of 3,268 bird individuals, 63 bird species in 33 families were documented



Philippine tube-nosed fruit bat.



Northern temple pit viper.

in all four KBAs and a total of 683 individual specimens of land snails were collected.

Biodiversity in selected mountain ecosystems of Mindanao

Through the project, "Conservation and Sustainable Development of Biodiversity in Selected Mountain Ecosystems of Mindanao," CMU developed strategies on forest

protection and biodiversity conservation in the Mt. Apo, Mt. Hamiguitan, Mt. Pantaron, and Mt. Tago ranges.

Critically endangered plants endemic to the Philippines such as the *Paphiopedilum adductum* Asher and *Paphiopedilum ciliolare* (Rchb. f) Stein were found. At present, there are many new possible species awaiting to be described such

as the *Corybas* sp., *Diclochia* sp., and *Hypericum* sp. The profiles of the forest ecosystem are updated through forest condition assessments, forest resources inventory and mapping, and socio-cultural services assessment.

IEC materials such as flyers and scientific articles have been drafted for possible publication. Data gathered from this research can develop protocols for *in-situ* and *ex-situ* set-up and assist local stakeholders in germplasm conservation for the establishment of conservation and livelihood sites such as fernery, butterfly garden, commercial nursery for indigenous plants, and commercial community economic garden. Local ordinances and policy measures for the protection and conservation of biodiversity, ecotourism, and livelihood options can also be recommended.

Mollusks

A ranked inventory of commercially-important mollusk species in coastal areas of Panay Island was conducted by UPV. The inventory highlighted the high diversity of the mollusk fauna of Panay, and the multi-gear character of their fisheries.

Thirteen species of cephalopods—6 species of squid, 1 species of nautilus, 3 species of octopus, and 3 species of cuttlefish were identified in Panay Island. On the other hand, the populations of bivalves and squids were observed to be declining and/or identified as overexploited. These include the Angel Wings (*Pholas orientalis*), Asian Moon Scallop (*Amusium pleuronectes*), Hiant Venus [*Marcia* (*Katelysia*) *hiantina*], Swordtip Squid (*Uroteuthis* [*Photololigo*] *edulis*), and Indian squid (*Uroteuthis* [*Photololigo*] *duvaucelii*). This



***Paphiopedilum adductum* Asher, a critically endangered lady slipper orchid.**



Dissection of squid samples to extract gonads for dehydration and embedding.



Interview of the scallop and *Spondylus* divers and their wives in South Gigantes, Carles, Iloilo and fisher diver of Comb Pen.

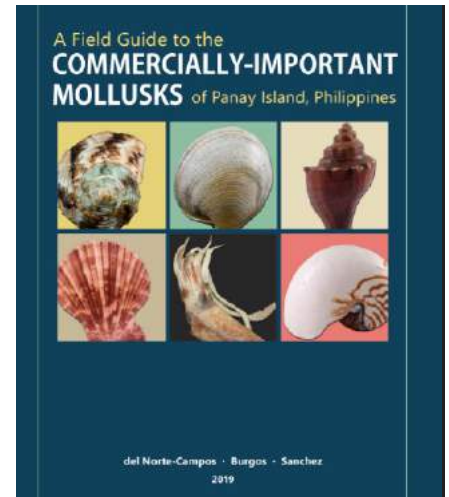
information will serve as important inputs for the management of the resources in the area such as in setting up a closed season policy.

A Field Guide to the Commercially Important Mollusks of Panay Island, Philippines is being prepared for publication. It aims to promote

awareness and understanding of the mollusk resources in Panay Island towards their proper and sustainable management. It will contain information about 123 mollusk species of Panay comprised of 57 gastropods, 54 bivalves, and 12 cephalopods.



Preparation of gonad slides for microscopic examination to identify the maturity stages of squids.



Cover page of the field guide to the commercially-important mollusks.

Giant clams

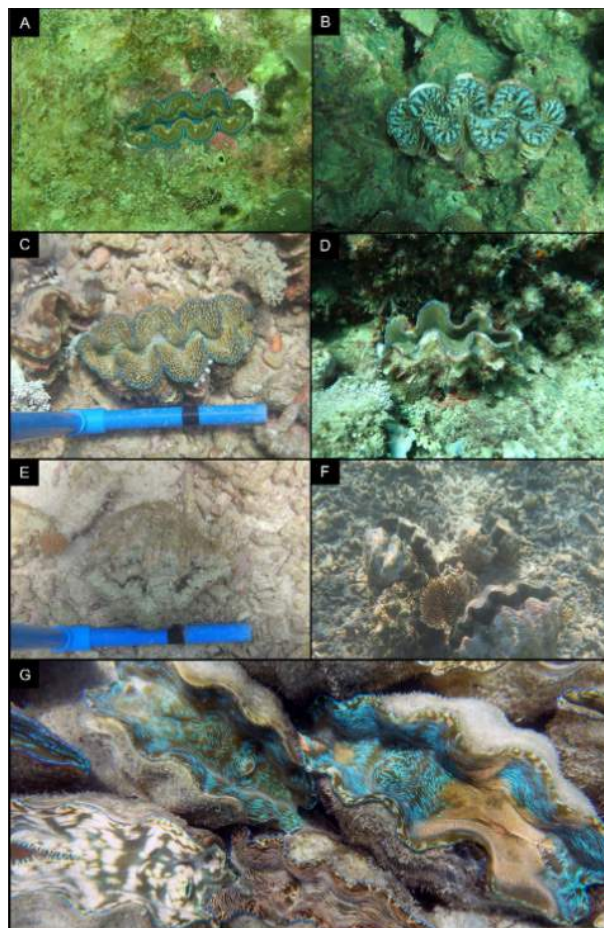
The giant clam program revisits the 12 giant clam study sites that were restocked in 1980s with the aim to assess the current giant clam diversity and abundance in the areas. It also aims to advance their culture and rearing protocols through modern molecular approaches.

Initial observations showed that a total of seven species of giant clams were evident in the sites, namely: *Tridacna crocea*, *T. maxima*, *T. noae*, *T. squamosa*, *T. derasa*, *Hippopus hippopus*, and *H. porcellanus*. Initial results also showed that well-protected areas, like Apo Reef in Mindoro and Calaguas in Camarines Norte, have higher giant clam diversity and abundance compared to other sites. Rare species like *T. gigas* and *T. derasa* were also observed in some areas. In Samal Island, Camiguin, Anda, and Hundred Islands National Park, the occurrence of giant clam recruits indicates success of restocking efforts.

The restocked giant clams show evidence of adaptation to their local environments by a change in their algal associates. An examination

of giant clam transcriptomes reveals genes that are critical for early development in culture. This is important in enhancing culture techniques to support local restocking and conservation efforts.

In light of the rampant poaching of giant clams, especially in shallow waters where they are more accessible to people, as well as bleaching in some sites due to climate change and global warming,



Giant clam species observed in different locations. *Tridacna crocea* (A), *T. maxima* (B), *T. noae* (C), *T. squamosa* (D), *Hippopus hippopus* (E), *H. porcellanus* (F) and *T. derasa* (G).



T. derasa, one of the rare species, is only known to be found in Apo Reef and Palawan.



Giant clam survey.



Public forum on giant clam.

the program engaged various stakeholders in disseminating information about giant clams and their threatened status to encourage peoples' participation in marine conservation.

Seaweed

The seaweed species (red algae), *Pterocladia maribagoensis* (Gelidiales, Rhodophyta), the first new species of *Pterocladia*, was discovered in the Philippines. This updated the world inventory of red algae to 19 species.



Pterocladia maribagoensis (Gelidiales, Rhodophyta).

Marine fishes

More than 290 reef fish species from 52 families were collected from Davao, Basilan, Sulu, and Tawi-Tawi study sites for tissue processing and will later be stored in the DNA barcode library of economically important fish species in Davao and Sulu Archipelago.



Some of the reef fishes collected and processed for tissue extraction.

R&D to Support Policy-Initiatives for a More Conducive S&T Policy Environment

Policy Studies

Internal control system (ICS) for safe cabbage and eggplant production

Occurrence of pesticide residues in vegetables is one food safety concern that people are wary of because of the preconceived notion that conventional agriculture is not as safe as organic agriculture. To address this concern, the Council supported the development and pilot-testing of an ICS for the conventional production of cabbage and eggplant.

By espousing judicious use of pesticides, the ICS developed for cabbage and eggplant guarantees safety of vegetables produced by conventional method. Vegetables produced were found acceptable for trade and passed the pesticide residue standards of the Association of South East Asian Nation (ASEAN) and the European Union (EU). The increased use of registered pesticides in cabbage and eggplant production among farmers who adopted the ICS provides evidence that conventional method can be safe and will not pose significant health risks.

Changing patterns of farmers' social, demographic, and economic conditions

In the Philippines, agriculture is facing an aging workforce and decreasing number of young people interested in farming, which negatively impact the sector. The increasing incidence of women working abroad is probably impacting the gender characteristics of the farming populace. Existing literature however, provides limited

understanding of the current social, economic, and demographic characteristics of Filipino farmers across various production systems. PCAARRD supported a study to establish a comprehensive profile of farmers in the country and to validate the phenomenon on aging population and the seeming disinterest of the youth in agriculture.

A nationwide survey was conducted in major producing areas of rice, selected plantation crops (such as coconut, mango, banana, and sugarcane); corn; vegetables (such as those used in 'pakbet' and chopsuey); trees and forestry species (such as gmelina, rubber, and bamboo); livestock and poultry (such as native pig, goat, cattle, chicken, and duck); and selected aquaculture and marine species. Empirical results validated the aging phenomenon among Filipino farmers.

The age of farmers ranged from 47 to 57 years old. This is older than the average age of 43 documented by Dr. Gelia Castillo in 1979. In terms of labor structure, while traditional crops, such as rice, plantation crops and smallhold trees are predominantly managed by males, females are equally (50%) contributing to the labor requirement of vegetable farming. The youths were generally disinterested to engage in agriculture because it involves hard labor, is perceived to be a low-profit endeavor, and an unstable source of income.

The study recommends for age of farmers be considered in developing technologies and for agriculture to be included in the basic education system such as the science, technology, engineering, and mathematics (STEAM) program of senior high school. STEAM can

be adopted to include agriculture in the curriculum (A stands for agriculture).

Science-based policy for bamboo industry development

PCAARRD's policy study aimed to address the information and policy constraints that discourage private investments in bamboo plantations.

A team of UPLB forestry researchers, led by Dr. Ramon A. Razal, developed a web-based inventory system and assessed the policy environment of bamboo, particularly the issuance of the Certificate of Verification (CoV) as a prerequisite in harvesting and transporting bamboo.

The bamboo community-based inventory system contains community maps that show physical availability of bamboo in key production areas. These maps were digitized to provide baseline information that enables communities and would-be entrepreneurs to appreciate bamboo resources and their potential for enterprise set-up. The final outputs were GIS-based distribution maps and a database for bamboo resources in key production areas. To implement the community-based bamboo inventory system, a policy must be formulated to institutionalize the system.

Unfavorable regulatory environment due to the CoV policy also hinders the growth and development of the bamboo industry. Based on a comparative analysis of the costs and benefits of retaining or eliminating the CoV, the project team crafted the Draft Department of Environment and Natural Resources (DENR) Administrative Order (AO), "Regulations Governing Bamboo Resources," which contains proposed policy option and other

rules and regulations on bamboo production, R&D, harvest, transport, and incentives.

With full support from the DENR, PCAARRD and the project team lobbied the draft DAO to the Forest Management Bureau (FMB). The bureau greatly supports the implementation of the draft DAO and recognizes the role of PCAARRD and the academe in creating an enabling policy environment for bamboo.

Tracing the value of soybean as food

Earlier studies showed that the country has no comparative advantage in producing soybean for feeds to support the livestock and poultry industry. A value chain study to assess the potential of soybean for food considering technical efficiency, competitiveness, profitability, and sustainability was conducted.

In general, the study showed the profitability of raw soybean and its products (e.g., taho, tofu, and soymilk) in selected production areas and major markets, respectively. Nevertheless, further study is recommended on the following:

- a) varietal improvement to enhance economically important traits such as milk recovery and physical appearance (size and color of hilum);
- b) development of seed system to ensure availability of planting materials;
- c) organization of farmers to improve access to support services (e.g., credit, equipment and infrastructure, technical trainings); and
- d) development of market linkages and quality standards for soybean products.

Results of the project served as input to the current soybean program of PCAARRD.

Massive technology transfer for organic-based production technologies

The impact assessment of the PCAARRD-funded National Research and Development Program for Organic Vegetable was completed. The said program aimed to increase organic vegetable production through the development of varieties suited under organic conditions and to improve soil nutrient management without the use of synthetic fertilizers and pesticides.

The study showed that the national program generated organic-based farm production technologies like varietal seeds, biofertilizers, and biopesticides. It was able to validate significant initial impacts although more widespread impacts will entail greater effort in transferring the technologies. These findings became the primary basis in developing an offshoot project to disseminate organic vegetable technologies to wider clientele.

Policy advocacy

PCAARRD continues to play a key role in enhancing the policy environment in AANR. In 2019, its policy analysis and advocacy initiatives, through its Policy Action Group (PAG), reviewed and provided inputs, comments, and recommendations to 57 house bills, 7 senate bills, 4 draft implementing rules and regulations (IRR), 3 house resolutions, 2 senate resolutions, 2 draft executive orders (EO), 2 other draft bills, and 25 other policy documents. Most of these legislative documents are crosscutting in nature (53%), while

others are related to fisheries (27%), forestry (10%), and crops (9%) sectors.

Among these documents are Sagip Saka Act and Philippine Innovation Act and their IRRs, Coconut Farmers and Industry Development Trust Fund Act, Philippine Genetic Resources Access and Benefit-Sharing (PGRABS) Act, Sugar Industry and Development Act, Procurement Act, Philippine Bamboo Industry Development Act, EU policies on Maximum Residue Levels (MRLs), and Socioeconomic Report (SER).

Promoting PCAARRD's legislative agenda

This year also marked the strengthening of PCAARRD's relationship with Congress. PCAARRD presented its menu of legislative agenda to the Secretariat of the Congressional Policy and Budget Research Department (CPBRD) in a briefing session at the House of Representatives, Quezon City. The briefing session was conducted to help the members of the Congress come up with legislative agenda that will be prioritized in the 18th Congress.

Top items in the agenda include financial management reform (FMR) for R&D operations, development and promotion of Smart Agriculture, and investigation in aid of legislation to examine the government programs designed to promote agricultural export products in the international market. Particularly for FMR, the CPBRD suggested to substantiate the issue using more empirical evidence. It then committed to spearhead the advocacy in Congress and help identify a policy champion among the legislators.

Participation in the crafting of SAGIP-SAKA IRR

PCAARRD had long been expressing its support to the Sagip Saka Act until it was finally signed into law in April 2019. Sagip Saka Act aims to strengthen the farmers and fisherfolk enterprise development program by establishing a comprehensive and holistic approach in the formulation, coordination and implementation of enterprise development initiatives. Another approach is by consolidating the roles of different government agencies involved in farmers and fisherfolk enterprise development and intensifying the building of entrepreneurship culture among farmers and fisherfolk.

In 2019, the Council joined in the crafting of its IRR. The Council recommended to make the IRR more leaning to entrepreneurship rather than simply providing technical support services to farmers and fisherfolk. In particular, it suggested that leadership skills development activities should be key for agricultural and fishery enterprises.

Review of EU policies on MRLs

The EU recently put forward amendment of its policies designed to lower the MRLs of pesticides and active substances in food and feed of plant and animal origin. This serves as a non-quantitative trade barrier, hence the need for a more informed assessment.

Through the assistance of the National Crop Protection Center

(NCPC) in UPLB, the Council crafted a policy stance that MRLs should be scientifically valid and must be aligned with the agreements set with the World Trade Organization (WTO). Also, options were recommended to prepare the country in complying with the new policies should these be fully implemented. These include revisiting the guidelines of good agricultural practices (GAP), reviewing the list of FPA-registered pesticides, and evaluating the practical use and efficacy of the active ingredient substitutes, which are not covered by new MRLs.

Other activities disseminating policy research results

Insights from policy researches were disseminated to different audience through various communication vehicles. In 2019, the Council published two policy briefs, "Development of a Framework for Harmonizing Biosafety Guidelines and Research Protocols on Biosafety in the ASEAN" and "Readiness of Commodity Stakeholders and Regulatory Agencies in Implementing the Food Safety Law."

The policy brief on biosafety focused on the three pillars in establishing a framework for harmonizing biosafety guidelines and research protocols. These were full characterization of the regulatory system, integrated perspective of the biosafety guidelines and GM introduction, and institutional capacity building. On the other hand, the policy brief on

food safety highlights the readiness of stakeholders in complying with food safety standards and policy recommendations for food safety regulatory agencies and LGUs.

PCAARRD also sponsored the 57th Philippine Economic Annual Meeting and Conference and 2019 Sustainable Agriculture Forum organized by The European Chamber of Commerce of the Philippines (ECCP), where the results of the project, Development of internal control system (ICS) for Conventional Production of Eggplant and Cabbage that Meet Food Safety Standards were shared to the participants coming from the government, private, and academe sectors.

The Council also participated in several public hearings and meetings that tackled major policy issues affecting AANR sector. These include meetings on the Philippine Development Plan (PDP) 2017–2022 Midterm Updating and drafting of Sagip Saka IRR; public hearing on Philippine Bamboo Industry Development Act; and Philippine Council for Agriculture and Fisheries (PCAF) Committee on International Trade (CIT) Quarterly Meeting, among others. The Council was also invited to different seminars to share its knowledge and experience in impact assessment to different government agencies. The seminar on impact assessment (IA) mostly focused on the motivation for doing impact assessment, framework, protocols, and cases, which the audience treat as a benchmark case for doing IA studies.

AGENDA 3: ENGAGE IN R&D TO GENERATE AND APPLY NEW KNOWLEDGE AND TECHNIQUES ACROSS SECTORS



Completed a **portable and non-invasive pregnancy detection kit** for goat using barium chloride

Developed **SMS-capable data transmission and traceability system for goat and goat products**; now operational in **Region 2**



Developed **cost-effective nano (zeolite-silica) composite** to improve the water quality and reduce heavy metal accumulation in **tilapia culture system**



Developed **colloidal gold nanoparticles for immune assay** for rapid detection of bacterial pathogens infecting tilapia



Non-invasive pregnancy diagnostic kit for goat

To enhance productivity and upgrade goats in the countryside, PCAARRD, in recent years, invested in the promotion of goat AI as alternative to natural breeding.

In 2019, a portable and non-invasive pregnancy detection kit for goat using barium chloride was completed by researchers from Isabela State University (ISU). This was done to ensure that only dry does are subjected to estrus synchronization and AI. This non-invasive pregnancy test has 92% specificity or ability to identify dry does and 96% sensitivity or precision in diagnosing true pregnancy. To use the kit, 2 milliliters (mL) urine is added to 2 mL BaCl₂. Precipitation indicates pregnancy, while clarity of mixture indicates otherwise. Accuracy based



Pregnancy detection kit containing a urine collecting bag and a tube holding the barium chloride (BaCl₂) solution.

on field test is 90% at 60 days post breeding. The kit and the protocol have been submitted for patent registration to IPOPHIL.

Short messaging system (SMS)-based goat traceability system

Capitalizing on the stability, access, and cost of the widely-used system,

an SMS-capable data transmission system from goat farms to the central database unit in CVSRRC-ISU was developed.

Initially, a computer program was developed and codes for different production parameters like birth, weaning, mature weights and activities related to breeding, health management, and husbandry practices were established. Movements of goats related to sale, transfer, and death were likewise coded for easy transmission of the information.

The SMS-capable data transmission and traceability system for goat and goat products is now operational in Region 2. At present, more than 200 smallhold raisers in Cagayan Valley have been assigned farm identification numbers and enrolled in the system. Data submission via SMS has started with each stock properly identified. With the developed system, traceability of stocks and products as well as analysis of the different parameters across the region became more efficient, thus evaluation of farm production performance is now more consistent.

Nanotechnology for sustainable AANR

Nano (zeolite-silica) composite for wastewater treatment in tilapia culture

A cost-effective nano (zeolite-silica) composite was developed to improve water quality and reduce heavy metal accumulation in tilapia culture system. One of the benefits of using this technology is reusing/recycling water, which reduces the pressure of too much underground water extraction. This technology uses rice hull, an agricultural waste

which is converted into a high-value product.

Colloidal gold nanoparticles for disease detection in tilapia

Colloidal gold nanoparticles for immunoassay was developed for rapid detection of bacterial

pathogens infecting tilapia. Protocols in the production of polyclonal antibodies of isolated pathogenic bacteria were optimized. The kit developed is easy to use and uses accurate testing methods that ensure farmers that early detection can prevent an outbreak of the disease.



(L-R) Centrifuged serum from rabbits and isolated unidentified bacteria from fish.
Image credit: Dr. Ravelina Velasco.

AGENDA 4: STRENGTHEN AND UTILIZE REGIONAL R&D CAPABILITIES



PCAARRD in the regions

In 2019, the partnership of PCAARRD and the Regional R&D Consortia continued to be strengthened in addressing regional development and concerns in the AANR sector. The 15 regional R&D consortia are composed of 195 R&D implementing SUCs/higher education institutions (HEIs), and research and development institutes (RDIs) and 107 non-R&D implementing agencies such as LGUs, other government organizations (GOs), and non-government organizations (NGOs). These agencies responded to the needs of stakeholders in the regions through the Council's banner programs on strategic R&D, R&D results utilization, capability building and governance, and policy analysis and advocacy.

To sustain and assist the Consortia operations and management, the

Council has provided P24.3 M for the year, which is 14% higher than the previous year. This enabled the Consortia to perform regional planning, coordination, monitoring and evaluation, and packaging, implementation, and financial liquidation of programs and projects. In 2019, PCAARRD approved 14 consortia-assisted R&D project proposals for implementation by consortium member-institutions (CMIs).

PCAARRD also supported the Consortia in the conduct of the Farms and Industry Encounters through the Science and Technology Agenda (FIESTA). FIESTA is the Council's main platform for technology promotion. In 2019, a total of P15.8 M was provided by the Council to 12 consortia that conducted 8 individual FIESTAs and 2 cluster FIESTAs featuring technologies on crops (coconut, sweetpotato, queen pineapple,

banana, mango, muscovado, coffee, oyster mushroom, biofertilizer, and biopesticide), livestock ('Darag' native chicken, Yookah native pig, and Halal goat) and marine/inland aquatic resources (sea cucumber and seaweed). The Council also provided P3 M to 12 consortia for their participation to DOST's Regional Science and Technology Week (RSTW), which featured more than 40 technologies developed by the CMIs.

To capacitate the consortia and CMIs, the Council provided to nine consortia supplementary funds amounting to P2.8 M for the conduct of 14 non-degree trainings. A total of 363 researchers were trained to enhance their skills and competencies on financial management, project impact evaluation, research design and proposal preparation, basic image processing and statistical methodologies in biological research

for natural resource planning and management, technology transfer and commercialization, selected quantitative methods for impact evaluation, and persuasive communication and presentation. PCAARRD, in coordination with the regional consortia also initiated the conduct of financial management seminars to 14 regions, which aimed to update the partners in the regions on the rules and regulations pertaining to fund release and liquidation of unexpended balances (UBs) of completed projects.

During the first quarter of 2019, the Council hosted the joint meeting of the Regional Research and Development Coordinating Committee (RRDCC) Chairpersons, Consortium Directors, and PCAARRD Directorate at the PCAARRD headquarters. During the meeting, PCAARRD committed to level up its support to the consortia's regional activities/operations. The consortia, in turn, committed to further improve their

performance in delivering their regional mandates.

Establishment of Niche Centers in the Regions for R&D (NICER)

The Niche Centers in the Regions for R&D (NICER) in AANR is a program under the DOST's Accelerated R&D Program for Capacity Building of

R&D Institutions and Industrial Competitiveness or the Science for Change (S4C) Program. It aims to provide institutional capacity building grants to HEIs involved in AANR R&D in the regions to improve their S&T infrastructure and enable them to undertake quality research in AANR that will promote regional development.

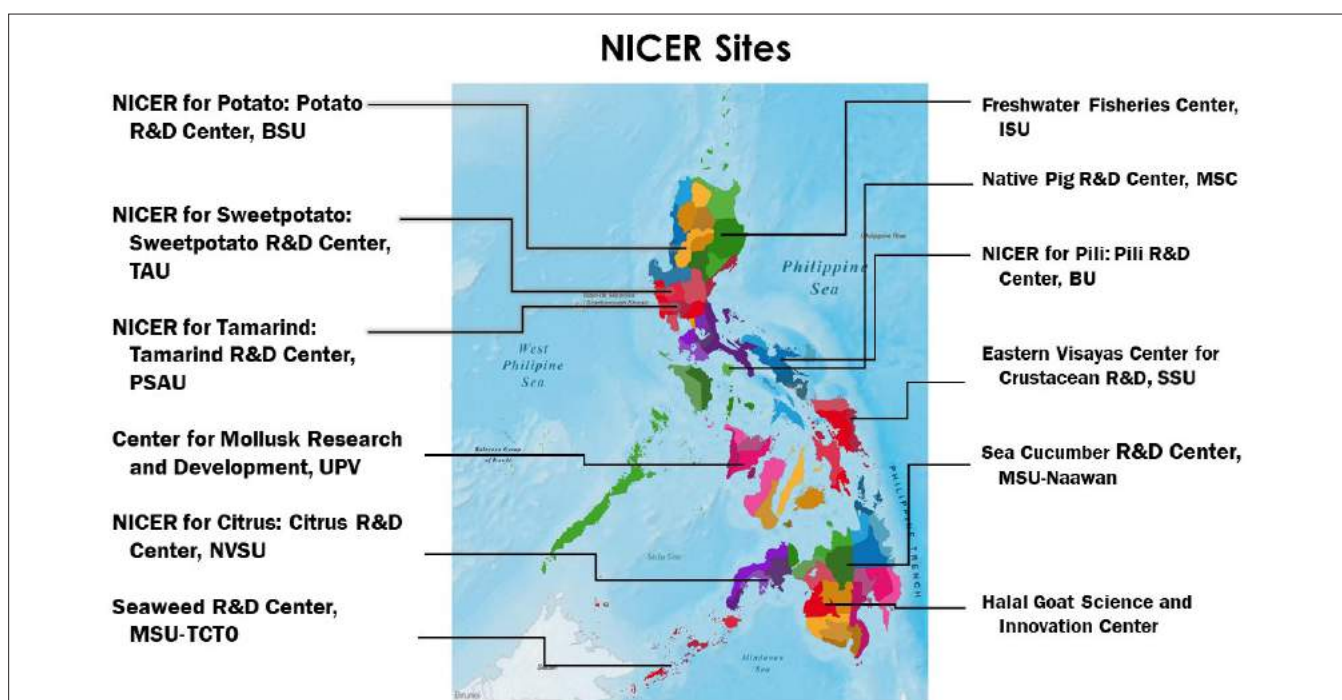


2019 Joint RRDCC Chairpersons, Consortium Directors, and PCAARRD Directorate's Meeting.

In 2019, PCAARRD supported the following Niche Centers:

| Region | NICER | HEI | R&D Focus |
|--------|-----------------------------|---|--|
| CAR | Potato R&D Center | Benguet State University (BSU) | <ul style="list-style-type: none"> • Integrated crop management • Enhancement of micropropagation system • Improvement of aeroponics and storage techniques |
| 2 | Freshwater Fisheries Center | ISU | <ul style="list-style-type: none"> • Development of artificial breeding and/or culture techniques for high-value species, lobed-river mullet or 'ludong' and freshwater eels |
| 2 | Citrus R&D Center | Nueva Vizcaya State University (NVSU) | <ul style="list-style-type: none"> • Quality planting materials (QPM) production • Database of citrus germplasm collection • Entomopathogenic biopesticide • Training of farmers on best cultural management practices |
| 3 | Sweetpotato R&D Center | Tarlac Agricultural University (TAC) | <ul style="list-style-type: none"> • Clean planting material production • Climate-smart crop management strategies |
| 3 | Tamarind R&D Center | Pampanga State Agricultural University (PSAU) | <ul style="list-style-type: none"> • Genomic characterization for improvement of sour and sweet tamarind • Development of S&T-based production management strategies • Value chain analysis and marketing |
| 4 | Native Pig R&D Center | Marinduque State College (MSC) | <ul style="list-style-type: none"> • Development, promotion, and utilization of native pigs • Upscaling of native pig production in Marinduque |

| Region | NICER | HEI | R&D Focus |
|--------|--|---|--|
| 5 | Pili R&D Center | Bicol University (BU) | <ul style="list-style-type: none"> • QPM production and distribution • Improvement of pest and disease protocol • Enhancement of pili nut postharvest processing equipment technologies • Development and maintenance of pili knowledge management system |
| 6 | Center for Mollusk Research and Development | UPV | <ul style="list-style-type: none"> • Assessment of the mollusk resources in Panay Island, Western Visayas for its sustainable management and utilization • Capacity building for mollusk research (facilities and human resource development) |
| 8 | Eastern Visayas Center for Crustacean Research and Development | Samar State University (SSU) | <ul style="list-style-type: none"> • Development/refinement of culture technology for blue swimming crabs, <i>Portunus pelagicus</i> • Stock enhancement of blue swimming crabs • Capacity building |
| 10 | Sea Cucumber Research and Development Center | Mindanao State University (MSU) -Naawan | <ul style="list-style-type: none"> • Refinement of culture production of sandfish, <i>Holothuria scabra</i> • Development of mariculture technology for <i>H. fuscogilva</i> • Management and stock enhancement of sea cucumber species in Mindanao • Capacity building of researchers and community partners • Assessment of the sea cucumber fisheries in Mindanao towards sustainable production and effective resource management • Assessment of the ecology, biology, and population genetic diversity and structure of <i>Holothuria fuscogilva</i> |
| 12 | Halal Goat Science and Innovation Center, SKSU | Sultan Kudarat State University (SKSU) | <ul style="list-style-type: none"> • Development of innovative halal-compliant food, feed, and health products • Roll out all previously developed technologies thru FLS-HGEM, eLearning, and SOA • Capacity development • AAA-class halal slaughtering and processing services |
| BARMM | Seaweed R&D Center | Mindanao State University (MSU)–Tawi-Tawi | <ul style="list-style-type: none"> • Optimization of the seaweed (<i>Kappaphycus</i> and <i>Eucheuma</i>) value chain • Creation and promotion of a commercially sustainable cultivated seaweed industry |





The freshwater fisheries center in Isabela State University.



Workshops, meetings, and trainings on the use of the state-of-the-art equipment of the Center for Mollusk Research and Development attended by UPV personnel with partner institutions.



Site visit of DOST Undersecretary for R&D Rowena Cristina L. Guevara at the NICER on Mollusk.



Activities conducted by EVCCRD such as (a) forum for fisherfolk, (b) morphometric and reproductive assessment of blue swimming crab (BSC), (c) identification of mature BSC, and (d) measurement of BSC fecundity.



(a) Dried sea cucumbers, (b) Fresh *Holothuria fuscogilva*, and (c) Fresh *H. scabra*

AGENDA 5: MAXIMIZE UTILIZATION OF R&D RESULTS THROUGH TECHNOLOGY TRANSFER AND COMMERCIALIZATION



Technology transfer and commercialization

PCAARRD maintained its momentum in technology transfer and commercialization activities. Buoyed by its performance in 2018, it continued to identify more technologies that are ready for transfer or with potential commercial interest or values. New programs and initiatives were also introduced.

DOST-PCAARRD National Agri-Aqua Technology Business Incubation (ATBI) Program

The DOST-PCAARRD ATBI program aims to effectively support the use and commercialization of mature technologies in the AANR sector by establishing and developing viable agribusinesses through technology incubation. The program supports 16 ATBIs nationwide in

selected SUCs and research and development institutes (RDIs). The ATBIs have produced 18 “graduate” incubatees and are now supporting a total of 91 incubatees. The

aggregate gross income of the incubatees’ enterprises is now at P11.1M. Moreover, these paved the way to the creation of 309 jobs.



DOST Undersecretary for R&D Dr. Rowena Cristina L. Guevara, CLSU President Tereso A. Abella, and CLSU Vice President for Business Affairs, Dr. Ernesto A. Martin with incubatees at the PCAARRD-supported CLSU Agriculture and Food Technology Business Incubator (CLSU-AFTBI).

The ATBI Program held the 1st National Conference on Agri-Aqua Technology Business Incubation in August in Baguio City. The event convened more than 200 project leaders and staff of the PCAARRD-supported technology business incubators (TBIs) and their incubatees, partners from the academe, local government units (LGUs), and private sector, as well as representatives from the neighboring ASEAN countries.

Dr. Choncharoen Sawangrat of the Chiang Mai University, Thailand and Ms. Hasimah Hafiz Ahmad of the Malaysian Agricultural Research and Development Institute (MARDI) also shared their best practices in running a TBI for AANR-based startups.

Intellectual Property and Technology Business Management (IP-TBM) Program

IP-TBMs are technology transfer offices that are envisioned to mirror the initiatives of the DOST-PCAARRD Innovation and Technology Center (DPITC). The DPITC is a one-stop hub for technology owners and generators, investors, end-users, and other stakeholders within the AANR innovation system. Currently, the IP-TBM program supports 26 SUCs and RDIs.

A total of 121 technology transfer officers from these SUCs and RDIs were successfully graduated/trained under the 12-module DOST-PCAARRD Intellectual Property Master Class and Technology Commercialization Mentorship Series (IPMCTCMS). With the skills gained, the trainees were able to generate IP applications such as 49 patents, 228 utility models, 28 industrial designs, 23 trademarks, and 313 copyrights.

The 2nd Technology Pitch Day, which was the culmination of the 2019 IPMCTCMS, featured 34 agri-aqua technologies pitched. The event was attended by about 100 SUCs/RDIs officials, technology generators, technology transfer officers, and potential collaborators and partners from the industry.

The IP-TBM program also conducted IP audits and institutional

IP Policy (IPP) and Technology Transfer Protocol (TTP) reviews. Ten out of 26 revised IPP and TTP were already approved by the respective Board of Regents (BOR). The agencies have also forged 21 memoranda of understanding (MOUs) with industry partners that match their technologies or services.



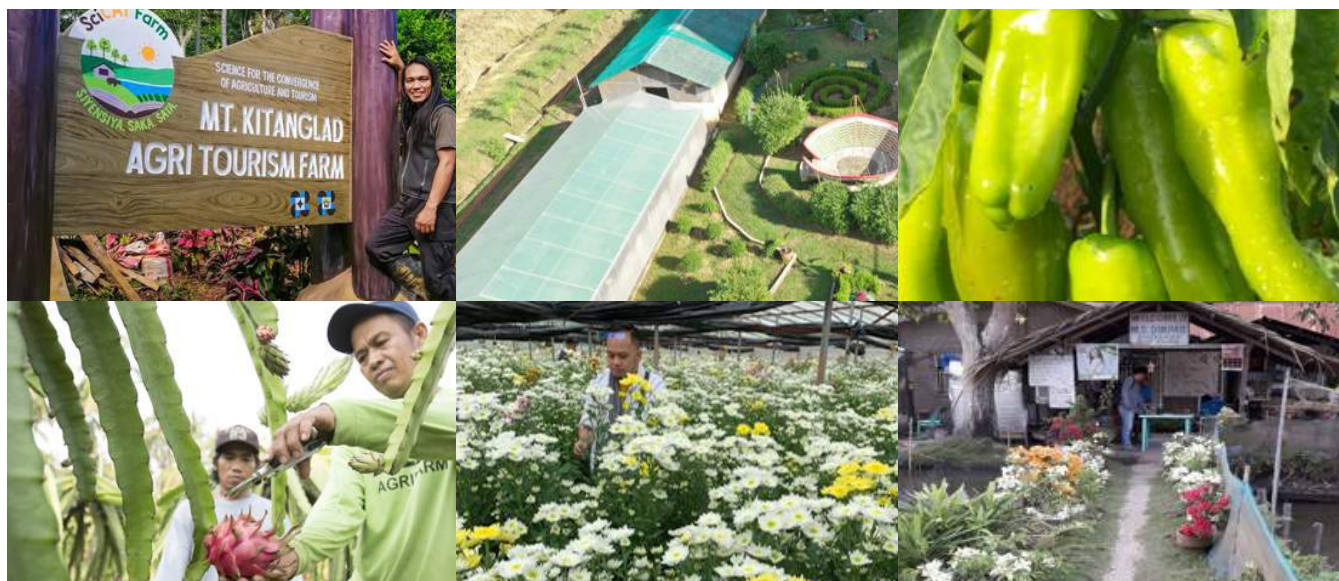
The first National Conference on ATBI attended and participated by heads, representatives, and incubatees from different SUCs around the Philippines.

DOST-PCAARRD Science for the Convergence of Agriculture and Tourism (SciCAT)

The DOST-PCAARRD SciCAT program aims to transform identified Magsasaka Syentista (MS) and institutional farms into tourist spots to create and maximize opportunities by utilizing agri-aqua technologies to improve productivity. In 2019, seven farms were transformed into SciCAT in collaboration with

respective implementing agencies and cooperating farm tourism sites: DOST X and Mt. Kitanglad Agri-Tourism Farm; University of Southeastern Philippines (USEP) and Dimpas Greentigrated Farm; Cavite State University (CvSU) and Silan AgriFarm, and the Bureau of Plant Industry-Los Baños National Crop Research and Development and Production Services Center (BPI-LBNCRDPSC) with Seeds and Seedlings Plaza, which is also

operated by BPI. Ten packages of technologies (POTs) are being implemented in the sites, including papaya processing technology, sweet bell pepper, chemical-free cabbage, grafting technology, black pepper seedling production (columnar method), Darag native chicken, System of Rice Intensification (SRI), Itik Pinas, inland aquaculture, and goat production technologies.



Various farm tourism sites established under the SciCAT program showcase and promote the package of technologies funded and assisted by PCAARRD.



Site visits, launching, and unveiling ceremony of the SciCAT sites.

Technology Innovation for Commercialization (TECHNICOM) Program

A program funded by DOST-Technology Application and Promotion Institute (TAPI) and monitored by PCAARRD, TECHNICOM aims to fast track the transfer, utilization, and commercialization of R&D outputs in identified priority areas by providing support to pre-commercialization activities.

Seven TECHNICOM projects, in collaboration with CLSU, DOST-FPRDI, Technological Institute of the Philippines (TIP), and Saint Louis University-Baguio (SLU) were monitored by PCAARRD. These are cacao sheller, potato digger, wine barrel, cacao pod maturity, carrot seeder, automated hydroponics system, and carrot washer. The Design Center of the Philippines is finalizing the aesthetic designs of these machines. Field testing

is being done in partnership with farmer collaborators.

The cacao by-products project, a collaboration with the DA-PhilMech, was also monitored by PCAARRD. The project has produced a total of five cacao by-products including wine, vinegar, health drinks, briquettes, and jam, the first three of which are now registered utility models. The project has also partnered with Cocoa Foundation of the Philippines, Inc. (CocoaPhil), KVT Farm, Rosit Cacao Farm, Albay Pili and Cacao Industry Association (APCIA), and Mayon Farmers Association (MFA).

S&T Community-based for Inclusive Development (STC4iD)

Under the STC4iD modality, the program, Enhancing Livelihood Opportunities in Conflict-vulnerable Areas in Mindanao through the Livelihood Improvement through

Facilitated Extension (LIFE) Model, was on its second year of implementation by UP Mindanao. It aimed to establish more sustainable and resilient community-based livelihoods by scaling up the LIFE Model in various conflict-vulnerable communities in Mindanao. The program benefited select upland farmers group in Surallah, South Cotabato; lowland farmers' group in Datu Abdullah Sangki (DAS), Maguindanao; and coastal community farmers group in Ipil, Zamboanga Sibugay. Apart from additional knowledge and skills in farming, the farmer-beneficiaries gained better access to services and programs of government agencies. They had started to earn 20% more than their average monthly income and provided more sustainable food security for their households.

A new program under the STC4iD also commenced during the year with UPLB as the lead agency. Its primary goal is to use different extension modalities to establish sustainable livelihoods towards inclusive development of selected geographically, economically and/or socially disadvantaged (GESDA) communities and social groups in the AANR sector, focusing on some of the poorest of the poor provinces of the country.

The program has six project components being implemented with six partner institutions/associations and GESDA communities: a) Kiharong Women's Association in Bukidnon with CMU; b) Salangsang Vegetable Farmers' Association in Lebak, Sultan Kudarat with SKSU; c) Sulu Farmers' for IDPs Organization (SFIDPO) in Jolo, Sulu with MSU-Sulu; d) Bitaud Small Coconut Farmers' Association in Larena, Siquijor with SSC; and e) Biga Innovation Group for Advancement and Inclusiveness Association (BIGANI) in Magallanes, Sorsogon with SSU.



TECHNICOM Programs aim to provide funds to fast track the transfer and commercialization of R&D results in identified priority areas by providing support to pre-commercialization activities.

Technology Promotion

FIESTA

In 2019, PCAARRD's trademark registered technology promotion platform, the Farms and Industry Encounters through the Science and Technology Agenda (FIESTA), evolved to become a technology transfer modality. In addition, the traditionally region-focused event showcasing single or multi-commodities, has taken the form of a cluster event, where various regional consortia, performing R&D on a common commodity of importance to the collaborating regions, jointly host the FIESTA.

This new approach in the conduct of the FIESTA creates an enhanced platform, not just for awareness and promotion, but on the transfer of commerciable technologies beyond regional boundaries, thus creating collaboration and integration with the industry. Awareness and promotion have been clear in the holding of past commodity FIESTAs, but the cluster approach places more emphasis on the commercialization pathway of technology transfer.

This enables the conduct of the FIESTAs truly achieve its original aim of creating opportunities for farmers and micro-entrepreneurs to learn from interacting with big industry, other stakeholders, and technology generators, as well as getting feedback from a wider set of consumers and users.

For this year, PCAARRD conducted 10 FIESTAs, composed of 7 regional and 3 cluster FIESTAs. These include:

- a) Bicol Agri FIESTA by the Bicol Consortium for Agriculture, Aquatic and Natural Resources Research and Development (BCAARRD) focusing on

- coconut, sweetpotato, and Queen pineapple;
- b. 'Uong Balat' FIESTA by the Ilocos Agriculture, Aquatic and Natural Resources Research and Development Consortium (ILAARRDEC) focusing on mushroom and sea cucumber;
- c. AbaMaDaMu FIESTA by the Western Visayas Agriculture Aquatic and Resources Research and Development Consortium (WESVAARRDEC) focusing on abaca, mango, Darag native chicken, and muscovado sugar;
- d. Goat FIESTA by the Central Luzon Agriculture, Aquatic and Resources Research and Development Consortium (CLAARRDEC);
- e. Seaweed FIESTA by the Central Visayas Agriculture, Aquatic and Natural Resources Research and Development Consortium (CVAARRDEC);
- f. Yookah Native Pig and Coffee FIESTA by the Cordillera Consortium for Agriculture Aquatic and Resources Research and Development (CorCAARRD);
- g. Coffee FIESTA by the Southern Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium (SMAARRDEC);
- h. Sweetpotato Cluster FIESTA jointly hosted by the Visayas Consortium for Agriculture, Aquatic and Resources Program (ViCARP), CLAARRDEC, and BCAARRD;

- i. Halal Goat Cluster FIESTA by the Cotabato Agriculture, Aquatic and Natural Resources Research and Development Consortium (CAARRDEC), SMAARRDEC, Cagayan Valley Agriculture, Aquatic, and Natural Resources Research and Development Consortium (CVAARRD), CLAARRDEC, and ILAARRDEC; and
- j. Biofertilizer and Biopesticide FIESTA jointly conducted by the Northern Mindanao Consortium on Agriculture, Aquatic and Natural Resources Research and Development (NOMCAARRD), Caraga Consortium for Agriculture, Aquatic and Natural Resources Research and Development (CCAARRD), ILAARRDEC, SMAARRDEC, and CVAARRDEC.

Through the years, the FIESTA has borne much fruits in support of the Council's R&D Results Utilization (RDRU) banner program. It has provided an avenue for learning new technologies by about 4,500 farmers and has inspired thousands of students on the value of agri-aqua research and development activities. More than these gains, the FIESTAs supported have inspired farmers and fisherfolk to elevate their economic livelihood from farm keepers to producers of products and services, thereby promoting entrepreneurial activities for the local micro, small, and medium enterprises (MSMEs).



Most notable of all its outputs, FIESTA has paved the way to the commercialization pathway of technology transfer. For Halal goat, two investors had signed the term sheets, which means that they had signified intentions to license two technologies, particularly the SemEx and the halal goat processing technologies.

Promoting R&D results through IEC, and social media engagements

The Council produced 26 new titles of IEC materials, disseminated 150,225 copies, and served 64,242 clients. These IEC materials were disseminated through the regular mailing list and during DOST and PCAARRD events and activities including the FIESTAs, National Science and Technology Week (NSTW), RSTW, other exhibitions, and conferences.

PCAARRD also produced 234 press releases sent to the media. The total media value garnered for the year was P16,181,734.27 or the total cost if PCAARRD were to pay for advertisement in print media outlets.

The coverage from top print and online media outlets were from Philippine Daily Inquirer, Philippine Star, Manila Bulletin, BusinessWorld, BusinessMirror, Manila Standard Today, Manila Times, Daily Tribune, and SunStar. Meanwhile, the coverage from magazines include those in MARID AgriBusiness Digest, Philippine Panorama, and Agriculture Magazine.

Media coverage in local newspapers with online counterparts were from Baguio Midland Courier, Herald Express, Mindanao Daily News, Palawan News, Marinduque News, Cebu Daily News, SunStar Pampanga, SunStar Davao, Bohol Chronicle, Palawan Daily News, Panay News, and Edge Davao.

PCAARRD is also featured in online news sites such as Daily Guardian, Diaryong Tagalog, Dispatch Today, SDN: Scitech and Digital News, Diaryo Pilipinas, Philippine Information Agency, PTVNews online, The Philippine Business and News, Freeman online, HortiDaily, and Tuklasin Natin.

The Council was also featured in local Laguna newspapers including Midday Monitor News, People's Monitor, Midway Star, Ang Dyaryo Natin, Laguna Courier, Free Times, Free Time Journal, Laguna Scope News, and Makabuluhang Balita Publication.

Broadcast coverage include those from DZMM Teleradyo, GMA News TV, Radyo Agila DZEC 1062, Radyo Pilipinas, DWSS 1494 kHz, and ONE Mindanao.

In terms of social media, the Facebook page of DOST-PCAARRD has an average of 118,453 total reach or the number of times people viewed the Council's posts. A total of 7,945 likes were garnered organically from January to December 2019. Organic likes pertain to likes obtained without using paid Facebook ads. PCAARRD developed an average of two posts per day, accounting for more than 700 created posts throughout the year, composed of

laid out image, press releases, trivia, media coverage, and photos of the Council's activities, among others.

Technology to People (T2P) and Technology Media Conference (TMC)

Technology to People (T2P) is one of the promotional activities of DOST-PCAARRD to disseminate information about its technologies through its media partners. In 2019, the Council organized two national T2Ps in February and December and regional T2Ps/media conferences during FIESTAs.

On February 27, DOST-PCAARRD held the "Promoting the R&D gains of 2018," which focused on the important technologies developed in the past year. These technologies include the microalgae paste for aquaculture; quality planting material (QPM) production system for citrus in Nueva Vizcaya; production of tissue culture-derived planting materials of selected Queen Pineapple via somatic embryogenesis and; drying system for seaweeds and mechanization of the seaweed production system.

The other T2P was held on December 19, which focused on the announcement of the Ulat Strategic Industry [S&T] Program for Agri-Aqua Growth (SIPAG) Awards 2020.



Technology Media Conference (TMC) is another promotional platform initiated by the DOST-Office of the Undersecretary for R&D. The TMC was designed to serve as a venue for the latest technology programs and projects of the DOST's Councils and RDIs be introduced to the general public through the press through a focused, visual, and popular presentation with no less than the Secretary as the spokesperson. A mini-exhibit may also be staged featuring actual products, prototypes, and additional information regarding the program/project/technology in focus.

In 2019, DOST-PCAARRD was involved in two TMCs: one on June 4, which focused on Marine Biodiversity and another on September 5, which focused on the Global Innovation Index. The June 4 TMC was held at the Philippine International Convention Center (PICC), Pasay City. DOST-PCAARRD handled the content of the press conference and media invitation. Meanwhile, DOST-PCAARRD served as a participant during the September 5 TMC held at the Crowne Plaza Hotel, Manila. DOST Secretary Fortunato T. de la Peña served as the main speaker during both TMCs.

Apart from the traditional medium of information dissemination strategy

of the council, PCAARRD has levelled-up its game in promoting S&T innovations through the Promotional LED Boards situated at the PCAARRD gate and in DOST compound in Bicutan. This initiative was done through the DOST Technology Application and Promotion Institute (TAPI) project, "Enhancing the Promotion of AANR Technologies Through Complementary Platforms." The project aims to promote various PCAARRD technologies through different communication media with the LED boards as the digital media catering to the informational needs of its constituent community. Also included in the TAPI project is a display showroom, known as TAPI Display and Exhibit Center (TAPI DEC), wherein PCAARRD technologies are promoted, along with those of other DOST agencies. It also serves as a replicate of PCAARRD's existing exhibit and bazaar display facilities located at its headquarters in Los Baños, Laguna.

Institutional support for trade and exhibitions of PCAARRD technologies programs

The Council actively participated in various national and regional exhibitions and fairs. It took a major role in the conceptualization and design of the Biodiversity Cluster, featuring 40 AANR technologies

during the NSTW held at the World Trade Center (WTC) in Pasay City in July. The Biodiversity Cluster attracted and welcomed 5,340 guests, including students, teachers, researchers, and private individuals during the week-long event.

In the regions, PCAARRD participated in 15 RSTW celebrations. Seventeen technologies were featured, the most requested/most popular of which were native chicken production technology, carrageenan PGP, ItikPINAS, rubber root trainer, indigenous vegetables, biofertilizers, native pig breeds, and production technologies.

PCAARRD also promoted its technologies in other events, such as SyenSaya: the Los Banos Science Festival 2019 in UPLB, Laguna in August; Davao Agri-Trade Expo 2019 at the SMX Lanang, Davao City in September; the Agrilink, Aqualink, Foodlink 2019 at the World Trade Center, Pasay City in October; and the 6th Laguna Organic Agriculture and 3rd Agrifishery Congress in Sta. Cruz, Laguna also in October.

The Council also exhibited its technologies, as requested at the Kerusso Christian Academy S&T Fair in Dasmarinas, Cavite, and Niño Jesus Science-oriented Montessori Science and Math Fair in San Pablo City in February, and the College of Forestry and Natural Resources (CFNR) Anniversary Celebration in UPLB last April.

Other activities participated in include NSTW Aquatic Forum on Eel Fishery, Seminar-Workshop on Use of Crabfrier, Regional Congress on Root and Tuber Crops for Food Security and Climate Change Resilience in Asia, and Forum on Promises and Challenges of Gene Editing.




AGENDA 6: DEVELOP STI HUMAN RESOURCES AND BUILD A STRONG STI CULTURE

Supported **43 GREAT scholars**  **16 Balik Scientists** 

 **57 Publications Incentive Awardees,**
25 Thesis/Dissertation Assistance Scholars,
2 Sandwich Scholars, 

34 Non-degree Training Courses attended by **822 trainees**
 from **300 institutions**
 Conducted **Training on R&D Management** and
Seminar Series on Socio-economic Researches

 **22 papers, 10 posters presented, 175 scholars** attended the
 DPGAA Biennial Convention

Awarded **5**  **recipients**

In 2019, PCAARRD generated P42.2 M from DOST to support two programs on human resources development—the Balik Scientist and Graduate Research and Education Assistantship Program for Technology (GREAT) Programs. PCAARRD likewise provided P35.8 M for the continuation of its capacity building activities and programs—the GREAT Program, thesis/dissertation assistance, publication incentives, and non-degree training programs, to improve its reach and ensure continued relevance in the sector. The Council also launched its Sandwich Program, to provide financial assistance to graduate students from PCAARRD-accredited universities enrolled in AANR fields. These are the students who need to conduct their researches in foreign universities and research institutions to avail themselves of the host institution's facilities and research expertise.

Balik Scientist Program

With the enactment of RA 11035 or the Balik Scientist Act in 2018, the Balik Scientist Program was institutionalized as a DOST-directed program. This led to the increasing number of target Balik Scientists per year and greater involvement of host institutions. For 2019, the number of Balik Scientists engaged in the AANR sector increased to 16 (12 short-term and 4 long-term) from 11 in 2018. Two new institutions—the Ilocos Sur Polytechnic State College (ISPSC) and FPA also engaged the expertise of Balik Scientists.

Fields of specialization of 2019 Balik Scientists are ocean acidification, marine biogeochemistry, agricultural waste management and policy, agricultural engineering, precision agriculture, soil science, climate change and remote sensing, pesticide regulation/investigation

and environmental monitoring, integrated pest management, molecular biology and genetic research, hydroponics systems, GIS, plant genomics, plant genetics, seaweed biodiversity, metallomics, fish nutrition and physiology, and marine oceanography. The Balik Scientists engaged were from USA, South Korea, Australia, Singapore, Oman, Japan, and Taiwan.

With the help of the Balik Scientists, implementation of new projects has been realized. The following were the off-shoots of Balik Scientists engagements:

- a) Establishment of the Metallomics and Inorganic Biogeochemistry Facility for Research and Development at University of the Philippines-Marine Science Institute (UP-MSI) in Diliman. This facility will be the first of its kind in the country. The project is led by Dr. Irene B. Rodriguez, long



Balik Scientists, together with Sec. Fortunato de la Peña, during the 5th Annual Balik Scientist Program Convention held at PICC, Manila.

term Balik Scientist hosted by UP-MSI. The said facility will be primarily used by the projects on Macronutrient, Carbon Cycling, and Aerosol Deposition: Impacts on Phytoplankton Community Structure and Toxin Production of Harmful Algal Blooms (Trace-HABs) and Trace Metals and Nutrients from Aerosol Deposition: Impacts on Community Structure of Harmful Algal Blooms (MEDIATE-HABS).

- b) Suitability Assessment for Agriculture and Aquaculture of the Floodplains of the Taft River Basin Impacted by Post Operations of Bagacay Mines. This project has been realized through the assistance of Dr. Venecio U. Ultra, short-term Balik Scientist hosted by Northwest Samar State University (NwSSU). Last year was the first for NwSSU to host a Balik Scientist. The assistance of Dr. Ultra paved the way for the university to be an active member of ViCARP in R&D initiatives.

- c) NICER Program for Sweetpotato. The program, which was approved this year was made possible through the mentorship of Dr. Narceo B. Bajet, Balik Scientist hosted by the Tarlac Agricultural University (TAU) in 2017.

PCAARRD spearheaded the conduct of the 5th Annual BSP Convention in November at the Philippine International Convention Center, Pasay City. This was attended by more than 300 participants—DOST officials and staff, officials from the SUCs, government agencies and private firms, Balik Scientists, faculty researchers and their personnel, and other stakeholders. Themed Balik Scientists: Innovators for Sustainable Development, the convention aimed to create opportunities to build stronger scientific community in the Philippines through technical presentations and panel discussions. It also provided an avenue in increasing awareness on how Balik Scientists have been

contributing to address national concerns and the outcomes of their engagement to Filipinos and the economy. Balik Scientists presented their research works in the AANR; health sciences; and industry, energy, and emerging technology. DOST Secretary Fortunato T. de La Peña recognized the 58 Balik Scientists and 41 Host Institutions who engaged in the program from 2018 to 2019.

GREAT Program

From CY 2017 to CY 2019, 54 grantees (40 masteral studies and 14 doctorate) have been awarded with GREAT Scholarship. For CY 2019, PCAARRD managed 33 scholars with 20 masterals and 13 doctorates, 10 of whom also graduated during the year. The fields of specialization for the Master's Degree were: agriculture (25), aquatic (7), and natural resources (6) and for Doctor of Philosophy (PhD): agriculture sector (7), aquatic (4), and natural resources (2).



GREAT Program Scholars ready to take the next steps with Dr. Reynaldo V. Eborá and Dr. Fezail Luz C. Decena, Director of Institution Development Division (IDD).

Thesis/Dissertation Assistance Program

Under this program, PCAARRD provides financial support for graduate students' thesis/dissertation expense of up to P100,000 for PhD and P50,000 for MS for research within the PCAARRD priority areas. A total of 25 graduate students—9 PhDs, 15 MS, and 1 Master of Arts (MA) availed themselves of this program. Majority (92%) of the grantees for the year are from UPLB, while the VSU and UPV—Miagao Campus had one grantee each. Fields of specialization are on agricultural engineering, agricultural chemistry, plant breeding, botany, genetics, plant pathology, molecular biology and biotechnology, animal science, forestry, environmental science, sociology, and ocean sciences.

Publication Incentives Program (PIP)

PCAARRD's PIP has been gaining popularity in 2019. Partnering the program with a training course on the PCAARRD-sponsored Technical Writing for Publication in a Refereed Journal for researchers and scholars in the NAARRDN, the

Council has been encouraging and motivating NAARRDN researchers, authors, PCAARRD staff, and scholars to publish their research results in reputable local refereed and/or international journals.

Publications in refereed journals entitle the author to a grant, the amount of which depends on the impact factor of the journal where the article was published. This is PCAARRD's way of promoting scientific productivity in the AANR sector to encourage the generation of new ideas leading to more innovative researches, advancement of science, and generation of technology.

The number of grantees (in terms of number of articles published) more than doubled in 2019 from 24 (CY 2018) to 57. Total grants for publication incentives increased from P1.4 M in 2018 to P3.7 M in 2019.

Non-degree Training Programs

A total of 34 non-degree training courses were conducted benefiting 822 participants from around 300 host institutions. Majority of the training courses offered were

crosscutting in nature (65%), while technical courses offered were in the fields of agriculture (15%), aquatic (15%), and natural resources (5%).

PCAARRD strives to offer new technical training courses every year. These are results of R&D projects funded by PCAARRD. In 2019, the six new technical training courses offered were: rubber production and latex harvesting; native duck egg production; native pig production; aquatic animal nutrition; mussel depuration; and patent prosecution. New general/crosscutting training courses were also offered to enhance the competencies of researchers, extension workers, and partners from the NAARRDN. For this year, four new general courses were offered: FIESTA clustering; presentation of R&D results; value chain; and management of extension projects.

PCAARRD also explored modalities for co-funding of non-degree training courses. The Council partnered with the Australian Center for International Agricultural Research (ACIAR) in the conduct of the Master Class training course on Value Chain Analysis: Training on Agribusiness Management, Value Chain Analysis and Leadership, which benefited ISP managers of PCAARRD and researchers from the NAARRDN.

The agribusiness master class: Gearing towards value chain thinking

Experiences in other countries show that agriculture development can be accelerated through the value chain approach. ACIAR has embarked on a program to capacitate the key players in agricultural development through their Agribusiness Master Class (AMC) Program. Found



management. The skills needed in R&D management are acquired and learned during the course of performing their functions, usually through learning by doing. Although there are procedures, guidelines, and manuals in place, the context and nuances may vary. Hence, an initiative to tap the expertise of PCAARRD staff-retirees was necessary and relevant. The experiences, knowledge, and management skills of former PCAARRD staff are rich source of information that can be explored to enhance the capabilities of ISP managers, technical staff, and new project leaders. In 2019, the trainings on R&D management have been completed.

successful in Vietnam and Lao PDR, PCAARRD collaborated with ACIAR to conduct the same capacitation in the Philippines.

The AMC Philippines is a four-series training program for PCAARRD's ISP Managers, NAARRDN researchers, and private sector representatives. The first two series had been completed in 2019, the participants of which were expected to be involved in a value chain

development program for selected vegetables. The program will be pursued through the collaboration of PCAARRD and ACIAR.

Enhancing capacity on R&D management through mentoring

Currently, PCAARRD has no established training and mentoring system to cater to technical, administrative, and financial capability requirement in R&D

Seminar-series on socioeconomic researches

Cognizant that outputs of socioeconomics research (mostly information) will have no use unless disseminated to relevant stakeholders, PCAARRD annually conducts the Seminar Series on Socioeconomics Researches. In 2019, the Seminar Series featured the results of the two important



studies, The Role of Cooperatives in Technology Adoption for Improved Production and Market Efficiency in Dairy Buffalo and Coffee and Creating an Enabling Environment for a Vibrant Philippine Bamboo Industry: Addressing Policy Constraints and Information Needs.

The seminar series was attended by more than 300 participants from the academe; government agencies such as National Economic and Development Authority (NEDA), DOST, DA, DENR, Department

of Trade and Industry (DTI), and Department of Agrarian Reform (DAR), among others; LGUs; NAARRDN; and the private sector.

Support to DPGAA

The DOST-PCAARRD Graduate Alumni Association, Inc. (DPGAA) is a professional organization composed of DOST-PCAARRD graduate scholars. To support the association, the Institution Development Division (IDD) of PCAARRD acts as its Secretariat.

Several PCAARRD Directors also serve as members of its Board of Directors. The association holds a biennial convention aimed at bringing scholars together to share the results of their research, development, and extension activities/initiatives. It also serves as a venue for linking and forging partnerships and collaboration.

The Association held its 2019 DPGAA Biennial Convention last October at CLSU. About 175 scholars and members of the organizing committee attended the convention. Six plenary papers focusing on the theme, "Innovative AANR Solutions Amidst Fourth Industrial Revolution," were presented by local and international speakers. Twenty-two papers, categorized into basic and applied sciences, were presented during the concurrent session, while 10 posters were presented under the AANR.

PCAARRD S&T Awards Program

PCAARRD confers its S&T Awards in recognition of the outstanding contribution of individuals and institutions in the advancement



Induction of newly-elected board of directors of the DPGAA.



New members of the DPGAA in 2019.

of S&T in the AANR sectors. For the year, PCAARRD conferred the Pantas Award (biennial), Tanglaw Award (biennial), Dr. Elvira O. Tan Award (annual), Best R&D Papers Award (annual), and Ulat SIPAG Award (annual). Winners each received a cash prize and a plaque/trophy.

For its third year, the 'Ulat' SIPAG Awards for print and broadcast recognized the efforts of private professional media practitioners

(PPMP) in popularizing S&T in relation to PCAARRD's priority concerns, primarily on its ISPs.

Mr. Julio P. Yap, Jr. of Manila Bulletin's Agriculture Magazine took first place of the Ulat SIPAG Award print category. This is his second year of winning the top award for the said category.

The second place was awarded to Mr. Cecilio T. Gunio of the Manila Standard, while the third place was

awarded to the late Mr. Anselmo S. Roque of Punto! Central Luzon. Mr. Roque's wife, Mrs. Corazon C. Roque, received the plaque and the check on behalf of her late husband.

The three awardees were recognized for their outstanding contribution through their published articles on the different commodities under PCAARRD's ISPs.

For broadcast category, Dr. Custer C. Deocarlis of DZEC 1062 kHz Radyo Agila was awarded first place. He was represented by Mr. Dexter Q. Mahilum, assistant producer of Radyo Agila's radio program, Pinoy Scientist.

The second place was awarded to Ms. Annabelle D. Surara of DZEC 1062 kHz Radyo Agila. Ms. Surara hosts the program, "Eat Konnect Na."

All five awardees displayed their commitment to the cause of responsible journalism for the interest of the country's farmers and fisherfolk. Their articles and radio programs have greatly benefited in improving a great number of lives in the AANR sector.

The awards were given during the S&T Awards and Recognition in commemoration of PCAARRD's 8th Anniversary held at the Philippine International Convention Center (PICC), Pasay City in June.

Ulat SIPAG Awards started in 2017 and is held annually to boost the Council's branding initiative, which currently focuses on promoting SIPAG. 'Ulat' is a Filipino term, which means "to announce or make public."

Table 1. 2019 PCAARRD S&T Awardees.

| S&T Award Category | Recipient | Authors/Agency |
|--|--|---|
| Pantas Award Outstanding Research Administrator | Dr. Carlito P. Laurean | Benguet State University |
| Tanglaw Award Outstanding Research Institution | Visayas State University | |
| Dr. Elvira O. Tan Awards | | |
| Outstanding Published Paper in Agriculture | Mass Rearing and Dispersal of Biological Control Agents (BCAs) as Interventions in Coconut Scale Insect (CSI) Calamity Areas in Basilan, Philippines | Rosemarie dR. Josue/Mindanao State University-Maguindanao |
| Outstanding Published Paper in Aquatic Science | Immunization Regimen in Asian Sea Bass (<i>Lates calcarifer</i>) Broodfish: A Practical Strategy to Control Vertical Transmission of Nervous Necrosis Virus During Seed Production | Rolando V. Pakingking, Jr., Evelyn Grace de Jesus-Ayson, Ofelia Reyes, and Norwell Brian Bautista/Southeast Asian Fisheries Development Center |
| Outstanding Published Paper in Natural Resources and Environment | Estimation and Mapping of Above-ground Biomass of Mangrove Forests and Their Replacement Land Uses in the Philippines Using Sentinel Imagery | Jose Alan A. Castillo, Armando A. Apan, Tek N. Maraseni, and Severino G. Salmo III/Ecosystems Research and Development Bureau, Department of Environment and Natural Resources |
| Best R&D Paper Award Research Category | | |
| First Place | Enhancing Milk Production of Dairy Goats through <i>Indigofera zollingeriana</i> Supplementation | Edgar A. Orden, Neal A. Del Rosario, Rhanny L. Gonzales, Loretta C. Romero, and Jovani S. Galamgam/Central Luzon State University |
| Second Place | Spore Bank Establishment, Propagation and Conservation of Selected Economically Important Ferns | Victor B. Amoroso, Fulgent P. Coritico, Chris Rey M. Lituañas, and Aurfeli D. Nietes/Central Mindanao University |
| Third Place | Innovation of Root Trainer Technique and Precision Grafting Technology for Rapid Propagation of Quality Planting Materials of Rubber | Erlinda A. Vasquez, Lucia M. Borines, Algerico M. Mariscal, Andrea B. Inocencio, Danilo T. Dannug, Resa M. Dacera, Lady Fatima G. Palermo, and Ricardo A. Maranguit/Visayas State University |
| Best R&D Paper Award Development Category | | |
| First Place | 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, Justina Sacro, Joi Labii, and Eliemar Ragadi/Department of Agriculture-Regional Field Office 1 |
| Second Place | Technology Demonstration and Promotion of Mechanized Rice Farming in the Lowland Irrigated Rice Areas in Region 2 | Generoso M. Oli, Eva J. Ventura-Eslava, Eddie T. Rodriguez, Quirino L. Asuncion, Fidel R. Cabantac, Arlyn J. Beltran, Zarina Pini, Lloyd C. Cantor, Elme J. Malamnao, and Ferdinand R. Serquina/Department of Agriculture-Regional Field Office 2 |
| Third Place | Enhancing Mungbean Production in Bicol Region | Luz R. Marcelino, Henrilyn R. Yamson, Danilo Bordon, Nellie Passion, and Edgar R. Madrid/Department of Agriculture-Regional Field Office 5 |

Table 1. (continued)

| S&T Award Category | Recipient | Authors/Agency |
|--|-----------------------|---|
| Ulat SIPAG Award Broadcast Category | | |
| First Place | Custer C. Deocaris | Pinoy Scientist, Radyo Agila DZEC 1062 kHz |
| Second Place | Annabelle D. Surara | Eat Konnect Na, Radyo Agila DZEC 1062 kHz |
| Ulat SIPAG Award Print Category | | |
| First Place | Julio P. Yap, Jr. | Agriculture Magazine and Panay News |
| Second Place | Cecilio T. Gunio, Jr. | Manila Standard |
| Third Place | Anselmo S. Roque | Manila Standard |





PCAARRD Executive Director Reynaldo Ebor and DOST Secretary Fortunato de la Peña with Ulat SIPAG Award print category winner Julio Yap, Jr.



PCAARRD Executive Director Reynaldo Ebor and DOST Secretary Fortunato de la Peña with Ulat SIPAG Award broadcast category winner Custer Deocar.

External awards received by PCAARRD and selected personnel

The following officials and staff are recipients of various awards outside of PCAARRD in 2019:



Dr. Reynaldo V. Ebor was likewise conferred with CESO Rank III by the Career Executive Service Board (CESB).



Dr. Edwin C. Villar was conferred with CESO Rank IV by the Career Executive Service Board (CESB). Likewise, he received the Most Outstanding Award for Administration given by the DPGAA.



Engr. Bryan Joseph C. Nobleza was a recipient of the 2019 College of Engineering and Agro-Industrial Technology (CEAT) Distinguished Young Alumni Award given by UPLB.



Ms. Rubiriza DC. Resuello was awarded as an Outstanding Academic Achiever by UPLB-College of Public Affairs.






Dr. Melvin B. Carlos received the Outstanding Alumnus Award from UPLB-College of Economics and Management (UPLB-CEM).



DOST-PCAARRD was recognized as Program to Institutionalize Meritocracy and Excellence in Human Resource Management (PRIME-HRM) agency by the Civil Service Commission (CSC).

AGENDA 7: UPGRADE STI FACILITIES AND CAPACITIES TO ADVANCE R&D ACTIVITIES AND EXPAND S&T SERVICES

Supported **9 major**  **facilities development projects** for the NAARRDN
Established **SERDAC** in Luzon, Visayas, and Mindanao; developed modules and conducted **16**  **trainings** from at least **60 NAARRDN member-agencies** and **14 local and regional government offices**
Developed **11 SERDAL training modules**  and conducted trainings for **294 participants**

Facilities development for the NAARRDN

The implementation of R&D projects by various PCAARRD regional partners requires upgrading and/or improvement of the partner's facilities to enable them to deliver the desired outputs and continuously conduct R&D. The following are among the major projects supported by the Council in 2019:

- Metallomics and inorganic biochemistry facility establishment in UP-MSI;
- Marine Biodiversity, Hispatology and Molecular R&D laboratory improvement (tuna) in MSU-Gensan;
- Bamboo production facility improvement and IP-TBM facility upgrading at PSAU;
- Coconut phytohormones R&D facility upgrading of UPLB-College of Engineering and Agro-industrial Technology (CEAT);
- Development of a sea cucumber research facility for the UPD-Institute of Chemistry;
- Upgrading of the Aquaculture Research Station of Laguna

State Polytechnic University (LSPU);

- Goat embryo-transfer laboratory upgrading for ISU;
- Establishment of a plant pest and disease clinic surveillance

and research center in CLSU, Central Luzon; and

- Agricultural machinery testing facility in support to UPLB-Agricultural Machinery Testing and Evaluation Center (AMTEC)



PSAU Bamboo Research Facility.



PSAU Plant Disease and Biocontrol Laboratory.



PSU Hatchery Facility for Mangrove Crab.



ISU Native Pig R&D Facility.



UPV Research Facilities Laboratories.

Socioeconomics Research and Data Analytics Centers (SERDAC)

A major challenge in socio-economics research is the absence of a common facility for researchers to access state-of-the-art software programs and journals. In addition, there is no facility to serve as repository of socioeconomic data and information, which makes the conduct of time-series studies enormously difficult.

PCAARRD addressed these challenges by establishing SERDAC in Luzon, Visayas, and Mindanao. CLSU, VSU, and USEP spearheaded the program with the goal of enhancing the country's capacity in socio-economic research.

Since its establishment, the Centers have developed modules and conducted 16 trainings with over a thousand participants from at least 60 member-agencies of the NAARRDN and 14 local and regional government offices. On top of all these, SERDACs were able to provide technical assistance to researchers from other fields on methodological design, data processing, and analysis for research projects and other papers that need socio-economic analyses.

Socioeconomics Research and Data Analytics Laboratory (SERDAL)

The laboratory was established to support the formation of SERDACs in each major island

group in the country. Located at the UPLB-College of Economics and Management (CEM), SERDAL reinforces research capability on socio-economic and R&D research by developing capacity building programs and providing access to research facilities with computers and licensed software programs.

SERDAL provides central capacity development direction and planning for SERDACs, a platform for data and research papers from the regions, and open data catalogue for use in other research. Currently, SERDAL has 11 training modules and has conducted several trainings with 294 participants. SERDAL also conducted hands-on trainings and workshops, as well as data analytics on rice, corn, bamboo, seaweed, garlic, swine, and milkfish.

AGENDA 9: PROVIDE STI-BASED SOLUTIONS FOR DISASTER RISKS AND CLIMATE CHANGE ADAPTATION AND MITIGATION



Smarter Approaches to Reinvalidate Agriculture as an Industry in the Philippines (SARAI)

SARAI-Enhanced Agricultural Monitoring System (SEAMS)

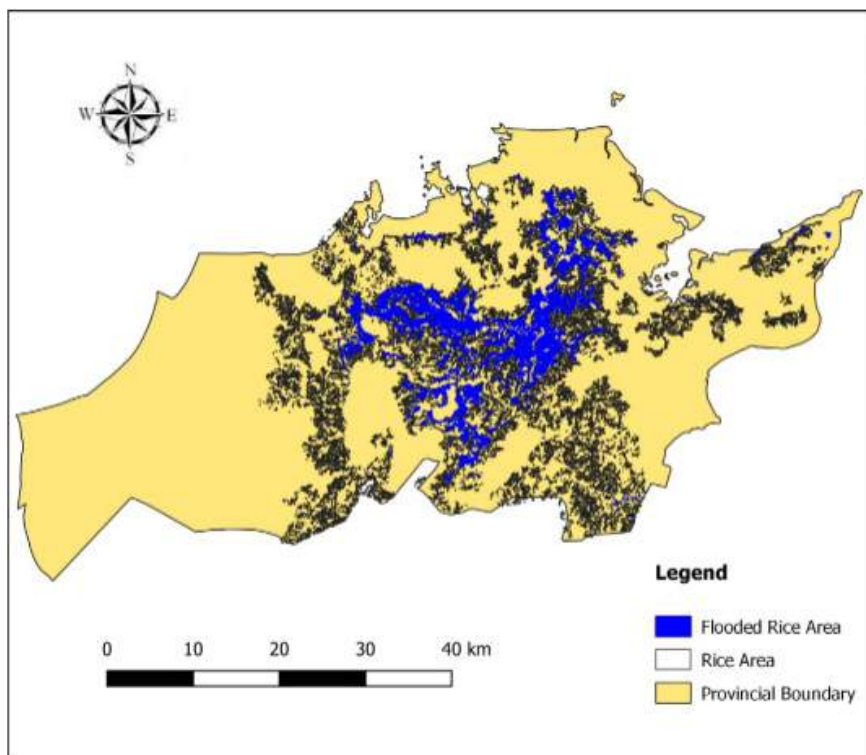
The UPLB-led and PCAARRD-funded SARAI program is a response to the pressing challenges brought about by climate change in the agriculture sector. SEAMS is one of the tools developed by SARAI. It is an inexpensive satellite remote sensing-based agricultural monitoring and disaster risk reduction and management (DRRM) system. Built on a platform of free and open source GIS and

remote sensing (RS), it is capable of performing spatio-temporal analyses on high resolution and near real time RS data. Thus, it is able to perform relevant and site-specific monitoring and forecasting of crop growth and yield; pest and disease incidence; and flood and drought occurrence; and is able to provide timely crop and weather advisories.

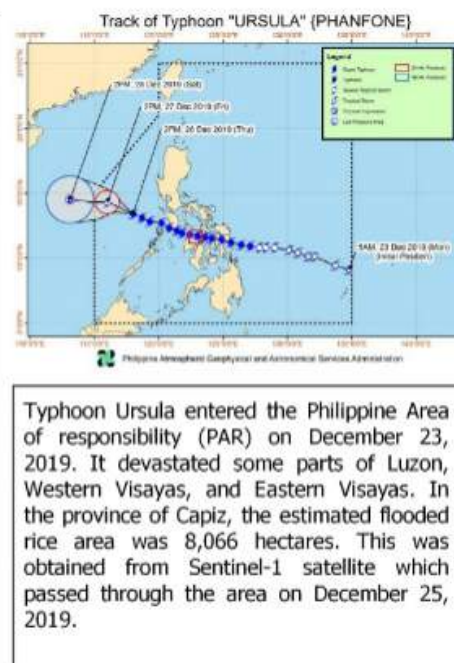
The capability of SEAMS to process the all-weather, day or night data from Synthetic Aperture Radar (SAR) satellites enables the system to immediately and more accurately monitor and assess damages of large-scale flooding within

1–5 days. Rainfall intensity data, which is not normally available in the Philippines, especially in agricultural areas, can also be obtained to enable a more accurate assessment of flooding.

SEAMS has been used in flood monitoring and damage assessment. It was used to evaluate flooding due to Typhoon Ursula in Capiz in December. The report was submitted by the UPLB team to Field Programs Operational Planning Division (FPOPD) of the DA. The data can be used to determine the percentage of standing crop recoverable and corresponding hectareage.



SEAMS showing the flooded rice area in Capiz due to typhoon Ursula.



SARAI Smarter Pest Identification Technology (SPidTech)

Another tool developed by SARAI, SPidTech is an android application for insect pests and diseases identification on focus crops—rice, corn, coffee, cacao, banana, sugarcane, coconut, soybean, and tomato. The application helps extension workers and farmers to prepare better for coming crop pest epidemics brought about by climate variability and extremes.

SPidTech has three main components:

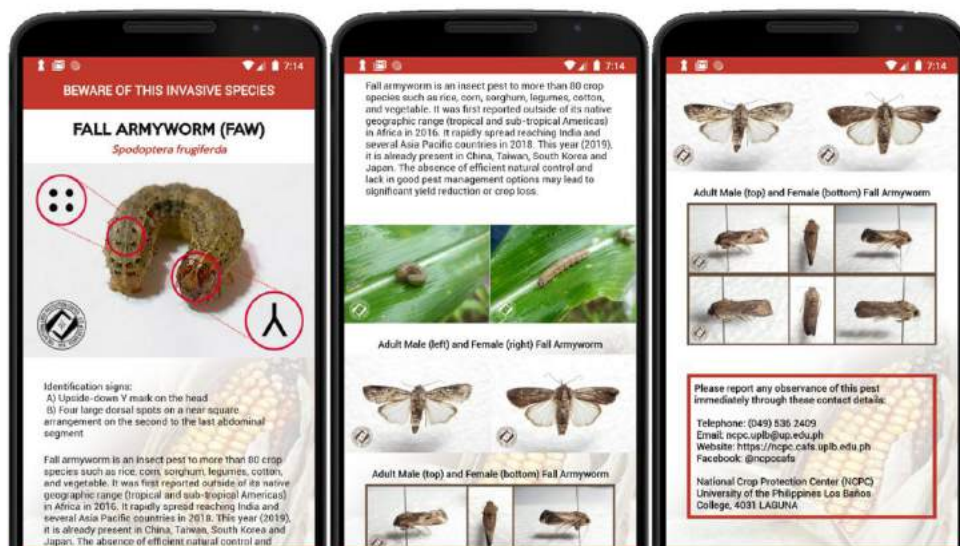
- Insect Pest and Disease Identification**, powered by machine learning technology, helps users to digitally identify insect pests and diseases through the use of mobile

cameras. This feature can now be used to identify pests of rice, corn, coffee, and cacao.

- Insect Pest and Disease Library** is a virtual encyclopedia of major pests as well as beneficial insects of the nine focus crops. The library contains information lifted from various sources and from consultations with experts from the National Crop Protection Center (NCPC) of UPLB, such as identification signs, recommended control methods, life cycle, and other pertinent details about a specific insect pest or disease. As of now, the library contains data on insect pests of rice, corn, coffee, cacao, and banana and diseases of rice, corn, coffee, and cacao.

- Insect Pest and Disease Remote Monitoring** application fetches data from every user interacting with it. In every identification instance, the application logs data such as image, identification results, data stamp, and GPS location. These data can be mapped and accessed in SARAI Knowledge Portal (www.sarai.ph) for active remote monitoring of insect pests and diseases.

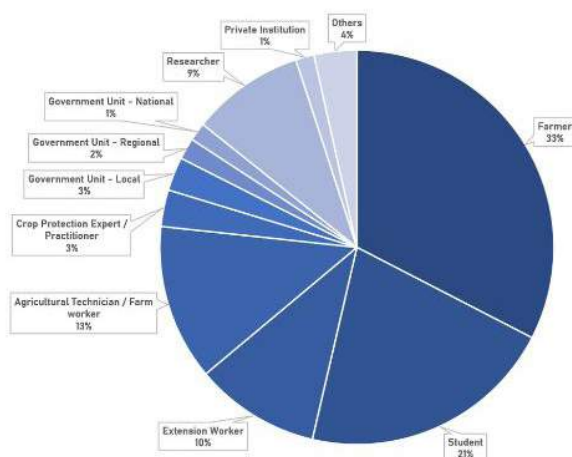
SPidTech was first released on Google Playstore for public download and testing in March 2019. Its registration feature was rolled out to live version in August 2019. As of December 2019, a total of 1,082 unique devices have installed the application while 399 users have registered.



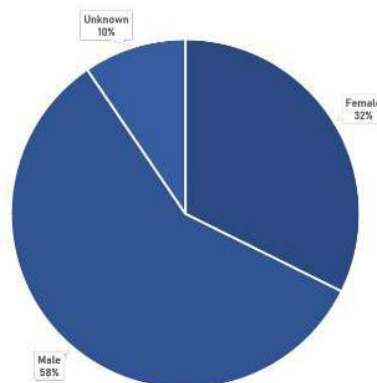
SpidTech advisory page.



399 registered users from August to December 2019



Social Classification Distribution of SPIDTECH Users



Sex Distribution of SPIDTECH Users

Provincial Origin of Registered Users

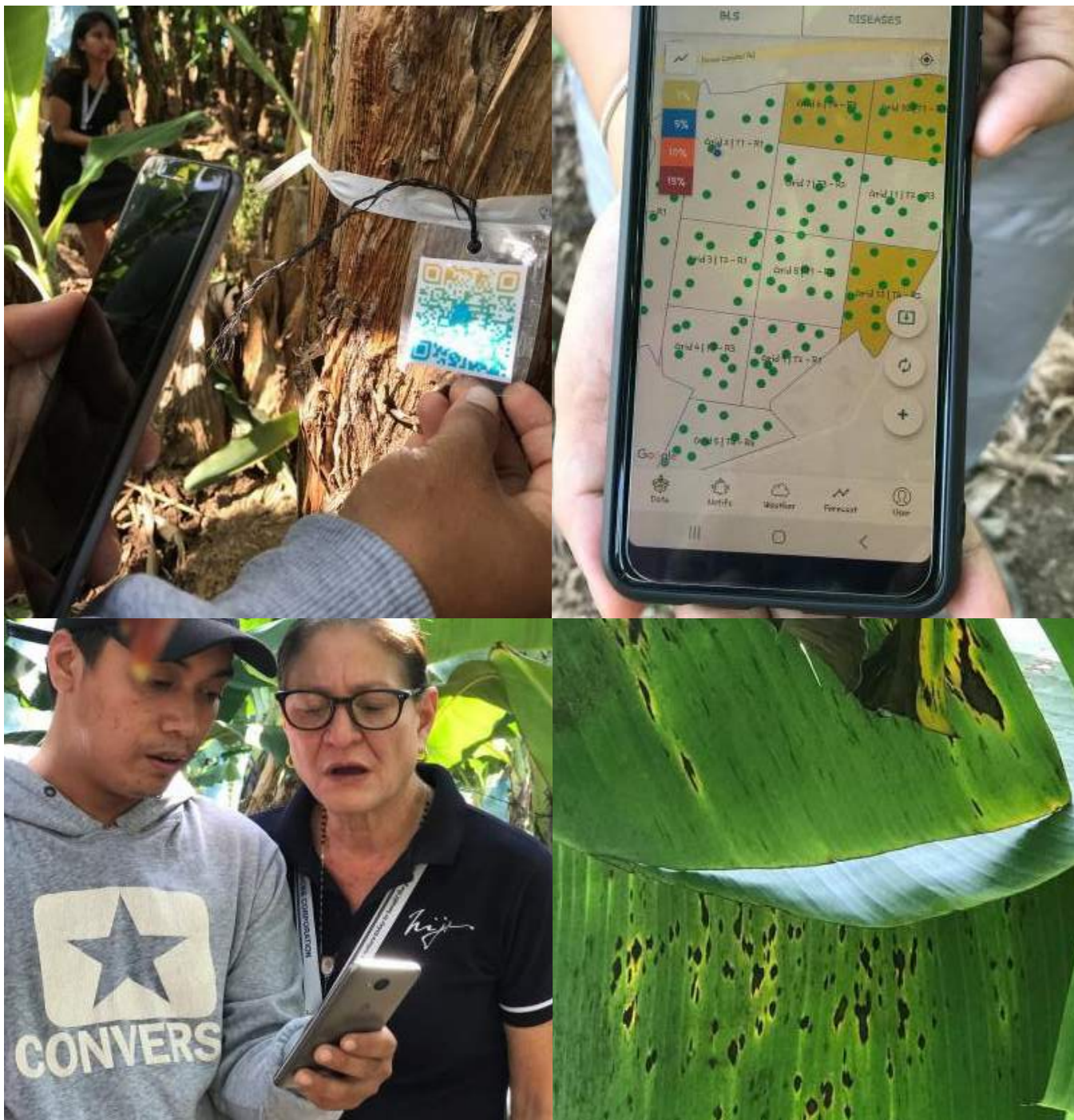
| | | | | |
|------------------|-------------------|--------------------|--------------------|-------------------|
| Abra | Cagayan | Isabela | Negros Occidental | Sorsogon |
| Agusan del Norte | Camarines Sur | Kalinga | Negros Oriental | South Cotabato |
| Agusan del Sur | Cavite | La Union | Nueva Ecija | Southern Leyte |
| Albay | Cebu | Laguna | Occidental Mindoro | Sultan Kudarat |
| Antique | Compostela Valley | Leyte | Oriental Mindoro | Surigao del Norte |
| Apayao | Cotabato (North) | Marinduque | Palawan | Tarlac |
| Aurora | Davao Del Norte | Masbate | Pampanga | Zambales |
| Batangas | Davao Del Sur | Misamis Occidental | Pangasinan | Zamboanga del Sur |
| Benguet | Ifugao | Misamis Oriental | Quirino | |
| Bohol | Ilocos Sur | Mountain Province | Rizal | |
| Bukidnon | Iloilo | NCR | Romblon | |
| Bulacan | | | Samar | |

Banana disease surveillance system

The Real-time Online Surveillance for Banana (ROSANNA) was developed by UseP in collaboration with HIJO Resources Corporation (HRC) in a 340-ha banana plantation

in Davao del Norte. ROSANNA is a near-real time decision support system designed for early detection and control of banana leaf spot (BLS) or Black Sigatoka and BBTV diseases. It was later expanded to track and trace Fusarium wilt and Moko diseases.

ROSANNA provided the platform for farm surveyors, technicians, and managers. It is a combination of web and mobile applications. The systems' content can be managed via web application, which is accessible to supervisors and managers of HRC.



Using ROSANNA.

AGENDA 10: STRENGTHEN INDUSTRY-ACADEME-GOVERNMENT AND INTERNATIONAL STI COLLABORATION

Supported **GTIS benchmarking** activities of **10 RSEs/PCAARRD ISP Managers** 
 Sent **35 RSEs/PCAARRD officials**  **and staff**
 to participate in activities sponsored by international partners
 Organized and supported  **local and international activities**
 Revived **1 international partnership,**  **maintained 14,**
 with **6 new partnerships** in the works
 Received **136 visitors**  **from international organizations**

Support to the Los Baños Science Community

The Los Baños Science Community through the Los Baños Science Community Foundation, Inc. (LBSCFI), a non-stock, non-profit organization composed of 23 member-agencies from within the Los Baños Community continued to get administrative and financial support from PCAARRD. As a member of the foundation, PCAARRD continuously supports its programs and activities through its various sectoral committees—education, environment, livelihood, information, tourism, membership, and ways and means. LBSCFI

continues to facilitate transfer and adoption of S&T research outputs and services generated by its member-agencies to clients and users through various projects.

PCAARRD plays a significant role in the activities of LBSCFI, serving as Secretariat of the Foundation. It continues to provide financial support to the annual SyenSaya: The Los Baños Science Festival, the local activity in celebration of the NSTW. SyenSaya showcases the Wonderama S&T exhibits and features a techno-forum where issues affecting the local community are addressed through S&T interventions.

In addition, PCAARRD facilitates the evaluation of R&D papers submitted for the different awards being conferred by the foundation. For 2019, the awards given were the Philippine Agriculture and Resources Research Foundation, Inc. (PARRFI) R&D Award and the Youth Science Award.

PCAARRD leads the LBSCFI Information Committee, which coordinated the Medical and Dental Mission, in cooperation with the Makiling Medical Society, at the Los Baños Bureau of Jail Management and Penology benefiting persons deprived of liberty (PDLs). The mission was held in March.



Activities of the LBSCFI.

Global Technology and Information Search (GTIS)

PCAARRD supports and encourages innovations from scientists and researchers of the NAARRDN. Among the activities being conducted/supported by PCAARRD are the GTIS missions, which provide opportunities for the PCAARRD ISP managers/staff and NAARRDN researchers/scientists/experts to be exposed

on the S&T breakthroughs of other countries as well as learn their best practices and successful strategies in implementing scientific and technological developments in the AANR sector.

Table 2 enumerates the PCAARRD-supported GTIS/benchmarking activities of 4 researchers/scientists/experts from the NAARRDN and 6 PCAARRD ISP managers/officials/staff.

As a follow-through of their GTIS activities, the researchers are developing R&D projects on how the technologies/best practices can be applied under Philippine conditions, while some are improving the implementation of their projects based on their learnings from the GTIS. Partnerships with the agencies visited are also being negotiated by PCAARRD for co-implementation of projects/activities.

Table 2. GTIS activities conducted by PCAARRD officials/staff and NAARRDN researchers/scientists/experts, 2019.

| Area | Name of Participant/Agency | Date/Venue |
|---|--|---|
| Advanced prawn breeding | Dr. Arturo O. Lluisma UP-MSI | March 18–24 James Cook University, Australia |
| | Dr. Adelaida T. Calpe Inland Aquatic Resources Research Division (IARRD), PCAARRD | |
| Mussel biotechnology | Dr. Sharon N. Nuñal UPV | March 25–29 Chinese Taipei: National Taiwan Ocean University; National Sun Yat-sen University; Academia Sinica |
| | Ms. Kristine Joy L. Tandang IARRD, PCAARRD | |
| S&T administration for improved resource management and utilization | Dr. Melvin B. Carlos OED-ARMSS, PCAARRD | June 24–28 Asian Institute of Technology (AIT); Thailand Institute of Scientific and Technological Research (TISTR); Thailand Research Fund (TRF); Kasetsart University (KU), Thailand |
| | Dr. Procy B. Sobreviñas OED-RD, PCAARRD | |
| Technology transfer and commercialization initiatives and technology business incubation program | Dr. Pablo J. Rafael CLSU | December 9–13 MARDI, Malaysia |
| | Ms. Abigail F. Gueco TTPD, PCAARRD | |
| Mangrove reserves and wetlands | Dr. Engelbert R. Lalican TTPD, PCAARRD | December 18–20 National Parks Board, Sungei Buloh Wetland Reserve, Singapore |



Dr. Arturo Lluisma of UP MSI and Dr. Adelaida Calpe of PCAARRD-IARRD during their GTIS mission on advanced prawn breeding in Australia.



Dr. Sharon Nuñal of UPV (4th from the right) and Ms. Kristine Joy Tandang of PCAARRD-IARRD (3rd from the right) during their GTIS mission on mussel biotechnology in Chinese Taipei. Image credit: UPV.



Left photo: Dr. Pablo Rafael of CLSU (3rd from left) and Ms. Abigail Gueco of PCAARRD-TTPD (5th from left) during their GTIS mission on technology transfer and commercialization initiatives and technology business incubation program in Malaysia.



GTIS mission on mussel biotechnology in Chinese Taipei. Image credit: UPV.



Dr. Melvin B. Carlos (3rd from the left) and Dr. Procy B. Sobreviñas (4th from the left) of PCAARRD during their GTIS mission on S&T administration for improved resource management and utilization. Image credit: AIT School of Environment, Resources and Development.



Dr. Engelbert R. Lalican of PCAARRD-TTPD with Ms. Florence Sim of National Parks Board (NParks)-Sungei Buloh Wetland Reserve (SBWR) during his site visit as part of his GTIS mission on mangrove reserves and wetland in Singapore.

International S&T Collaboration

With the commitment to increase the competence and competitiveness of its regional research arms, the NAARRDN and the regional consortia, PCAARRD has continued to tap opportunities and provide support to its researchers, scientists, and experts, either financial support for or through recommendations and nominations of their participation to international trainings, study missions, seminars, conferences,

symposia, workshops, and expert consultations. Participation in these international activities have opened doors to enhance linkages, networking, and collaborative activities with international organizations, including possible resource generation that would augment support to S&T and R&D programs, projects, and activities for the AANR sector.

In 2019, the Council sent 35 scientists/researchers/experts

from the secretariat, NAARRDN, and regional consortia to participate in activities sponsored by its international partners such as the Asia-Pacific Association of Agricultural Research Institutions (APAARI), Asian Productivity Organization (APO), Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC), and ASEAN, among others. The specific activities participated by PCAARRD experts and researchers are shown in Table 3.

Table 3. International S&T-related activities participated by PCAARRD officials/staff and NAARRDN researchers/scientists/experts, 2019.

| Partner Agency | Name of Participant/Agency Affiliation | Title of Activity | Date of Activity/Venue |
|----------------|--|--|---|
| ACIAR | Ms. Princess Alma B. Ani and Ms. Mia Barbara D. Aranas PCAARRD-SERD | 3 rd Project Workshop on the Development of Mixed Method Approaches to Impact Assessment of Philippine Research Projects; Benchmarking and Networking with IA practitioners from CSIRO; discussion on theory of change formulation and establishment of impact pathways | June 23–30 Brisbane, Australia |
| APAARI | Dr. Rachel June R. Gotanco UP-MSI | Regional Workshop on Underutilized Fish and Marine Genetic Resources and their Amelioration | July 10–12 Colombo, Sri Lanka |
| | Dr. Lerma S.J. Maldia UPLB-College of Forestry and Natural Resources (CFNR) | International Training Course on <i>In-Vitro</i> and Cryopreservation Approaches for Conservation of Plant Genetic Resources | November 5–19 New Delhi, India |
| | Dr. Maria Genaleen Q. Diaz UPLB-Institute of Biological Sciences | International Hands-on Training on Genome Editing Technologies | October 14–25 Hyderabad, India |
| | Ms. Dianne Rose P. Cabello PCAARRD-TTPD | Workshop on Innovations in Agribusiness for Young Entrepreneurs | July 1–5 Chinese Taipei |
| | Ms. Maria Adelia C. Belen PCAARRD-Crops Research Division | 4 th Master Class in Agricultural Research Leadership and Management | November 3–8 Penang, Malaysia |
| APO | Prof. Rowena A. Dorado UPLB-CEM | Multicountry Observational Study Mission on Sustainable Food Value Chains | April 22–26 Tokyo, Japan |
| | Engr. Efren L. Linan Capiz State University (CapSU)-Department of Agricultural Engineering | Workshop on Innovations in Agribusiness for Young Entrepreneurs | July 1–5 Chinese Taipei |
| | Dr. Jonar I. Yago NVSU | 4 th International Conference on Biofertilizers and Biopesticides: Integrated Pest Management | August 20–23 Pintung, Chinese Taipei |
| | Dr. Cecirly G. Puig USEP | | |
| | Dr. Renerio S. Mucas ISAT-U | Workshop on Agricultural Transformation | September 30–October 4 Bali, Indonesia |
| | Engr. Rodrigo C. Muñoz, Jr. Bataan Peninsula State University (BPSU) | Workshop on Smart Farming Models | November 4–8 Bangkok, Thailand |
| | Dr. Juanito T. Batalon PCAARRD OED-RD | | |
| | Engr. Vicente G. Ballaran, Jr. UPLB-CEAT | Workshop on the Formulation and Study of Spatial Development, Climate Change, and the Environment for Agricultural Transformation | November 18–22 Manila |

Table 3. (continued)

| Partner Agency | Name of Participant/Agency Affiliation | Title of Activity | Date of Activity/Venue |
|--|---|---|---|
| ASEAN | Dr. Reynaldo V. Ebor PCAARRD-OED | ASEAN Project Development Workshop at the ASEAN Next 2019: Science, Technology, and Innovation (STI) Leading towards Community Happiness | March 19–20 Bangkok, Thailand |
| | Ms. Virna G. Salac PCAARRD-TTPD | ASEAN-India Workshop on Intellectual Property Rights and Technology Transfer | April 1–5 New Delhi, India |
| | Dr. Rex B. Demafelis UPLB | Initiative Meeting on ASEAN Network of Excellence Centre of Biomass Conversion Technology (ANEC) | May 28–31 Nakhon Ratchasima, Thailand |
| | Engr. Reynaldo L. Esguerra DOST-Industrial Technology Development Institute (ITDI) | Russia-ASEAN Member States Joint Workshop: Study and Development of Recommendation on Industrial Wastewater Treatment Technologies for Industrial Enterprises | May 13–16 Ho Chi Minh, Vietnam |
| | Dr. Mylene G. Cayetano UPD | | |
| BAPNET | Dr. Reynaldo V. Ebor PCAARRD-OED | BAPNET Steering Committee Meeting | May 7–9 Guangdong, China |
| FFTC | Dr. Eufrocino C. Marfori UPLB-National Institute of Molecular Biology and Biotechnology (BIOTECH) | Enhancing Capacity in Production and Application of Biopesticides and Biofertilizers for Soil-borne Disease Control and Organic Farming | May 6–10 Hanoi, Vietnam |
| | Dr. Fe B. Perlas Central Bicol State University of Agriculture (CBSUA) | International Seminar on Smart Agriculture for Environmentally and Consumer-friendly Food Production | May 27–31 Pintung, Chinese Taipei |
| | Dr. Jasper G. Tallada Philippine Rice Research Institute (PhilRice) | Workshop on ICTs for Precision Agriculture | August 26–30 Selangor, Malaysia |
| | Dr. Juan M. Pulhin UPLB-CFNR | International Symposium on Implementing the Sayotama Initiative for the Benefit of Biodiversity and Human Well-being | September 16–20 Chinese Taipei |
| | Dr. Ronaldo T. Alberto CLSU | International Symposium on Developing Innovation Strategies in the Era of Data-driven Agriculture | October 29–30 Jeonju, South Korea |
| | Dr. Nelio C. Altoveros UPLB | | |
| | Ms. Eileen M. Redera PCAARRD-MRRD | International Training on Ecosystem Approach to Fisheries Management | October 1–3, 2019 Iloilo City, Philippines |
| International Lake Environment Committee (ILEC), Japan | Engr. Eduardo V. Manalili PCAARRD-IARRD | International Workshop and Use of Multilingual Knowledgebase/Knowledge Mining System (LAKES) | February 27–March 1 Shiga, Japan |
| Indian Technical and Economic Cooperation | Ms. Mia Barbara D. Aranas PCAARRD-SERD | Training on Science and Technology and Innovation Policy | November 26– December 4 India |
| Japan International Cooperation Agency | Mr. Christian L. Abeleda PCAARRD-SERD | JICA's Knowledge Co-creation Program | January 8–24 Japan |
| TECO | Dr. Lilian G. Bondoc PCAARRD-PCMD | 2019 Taiwan Institute of Diplomacy and International Affairs Summer Program | May 19–25 Chinese Taipei |

Table 3. (continued)

| Partner Agency | Name of Participant/Agency Affiliation | Title of Activity | Date of Activity/Venue |
|--------------------------------|--|--|------------------------------------|
| | Dr. Reynaldo V. Ebor PCAARRD-OED | MECO TECO Pre-Joint Science and Technology Commission (JSTC) Meeting | September 17 Chinese Taipei |
| | Dr. Lilian G. Bondoc PCAARRD-PCMD | | |
| UKRI | Dr. Lilian G. Bondoc PCAARRD-PCMD | Newton Fund UK-China-Philippines-Thailand Research-Vietnam Sustainable Rice Research Initiative Workshop | January 16–18 Bangkok, Thailand |
| UNESCO and Government of Japan | Dr. Mari-Ann M. Acedera PCAARRD-MRRD | Regional Planning Workshop for the North Pacific and Western Pacific Marginal Seas | July 31–August 2 Tokyo, Japan |



Participants of the FFTC Workshop on ICTs for Precision Agriculture held on August 26–30, 2019 in MARDI, Malaysia with Dr. Jasper G. Tallada as the Philippine participant. Image credit: PhilRice.



Participants of the APAARI International Training Course on *In-Vitro* and Cryopreservation Approaches for Conservation of Plant Genetic Resources held on November 5–19, 2019 in New Delhi, India with Dr. Lerma SJ. Maldia as the Philippine participant. Image credit: UPLB-CFNR.



Participants of the FFTC International Workshop on Enhancing Capacity in Production and Application of Biopesticides and Biofertilizers for Soil-borne Disease Control and Organic Farming held on May 6–10, 2019 in Hanoi, Vietnam with Dr. Eufrocino C. Marfori as the Philippine participant. Image credit: UPLB-BIOTECH.



Dr. Juan M. Pulhin presenting his country report during the FFTC International Symposium on Implementing Satoyama Initiative for the Benefit of Biodiversity and Human Well-being held on September 16–20, 2019 in Chinese Taipei. Image credit: UPLB-CFNR.



Participants of the Training on Science and Technology and Innovation Policy held on November 26–December 4, 2019 in India with Ms. Mia Aranas as Philippine participant.



Dr. Renerio S. Mucas presented a country report in the APO Workshop on Agricultural Transformation held on September 30–October 4, 2019 in Bali, Indonesia. Image credit: ISAT-U.



ASEAN-India Workshop on Intellectual Property Rights and Technology Transfer held on April 1–5, 2019 under the ASEAN-India Innovation Programme (AIIP) for ASEAN Member States with Ms. Virna Salac as Philippine participant under the financial aegis of the Department of Science and Technology (DST) India.

New and Strengthened Partnerships

PCAARRD's international partnerships and collaborations continue to flourish. Over the years, PCAARRD, in cooperation with various international agencies, has coordinated, implemented, and participated in a number of successful and notable programs/projects and activities that have been providing better solutions to the various pressing problems in the AANR sector.

ACIAR

With more than 36 years of productive partnership, PCAARRD and ACIAR conducted the 1st PCAARRD-ACIAR Partnership Health Check in October at the Council's Headquarters. The Health Check is an integral part of the ACIAR-PCAARRD Partnering Arrangement signed in December 2018. Progress of the partnership was reviewed vis-a-vis its objectives and success indicators. The agreed respective roles of each agency were also reviewed and new areas for collaboration were explored.

Dr. Eborá and Dr. Peter Horne, General Manager for Country Programs of ACIAR, led the discussion.

The status of the nine cooperative projects were discussed, while initial comments were provided by both sides on the possible new projects. The implementation guidelines and financial arrangements for the PCAARRD-ACIAR Scholarship Program was also discussed in detail. The first batch of scholars is envisioned to be sent to Australia by June 2020.



Participants of the 1st PCAARRD-ACIAR Partnership Health Check.



Representatives from ACIAR. From left to right: Ms. Mara Faylon, Ms. Jing Grey, Ms. Mai Alagcan, and Dr. Peter Horne.

Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC)

FFTC Director Dr. Kuo-Ching Lin visited PCAARRD in April to discuss other possible areas and modes of collaboration to pursue under the partnership and to discuss the progress/updates of preparations for the PCAARRD-FFTC Training Workshop on Ecosystem Approach to Fisheries Management held on September 30–October 4 in Iloilo City.

The said training workshop, co-organized with UPV, convened academicians, researchers, scientists, and fisheries managers from Germany, Taiwan, Cambodia, Thailand, and the Philippines. The activity aims to exchange basic knowledge on the ecosystem approach to fisheries management process and how this can assist in the decision-making for responsible and sustainable fisheries in their respective countries. It focused on the development of professional planning, analytical, and interpersonal skills needed for

better structured and more informed decision-making.

In terms of capacity building, FFTC sponsored the participation of six NAARRDN researchers/scientists in various FFTC-organized activities on biopesticides and fertilizers, smart agriculture, information and communications technology (ICT), data-driven agriculture, and biodiversity held in Vietnam, Chinese Taipei, South Korea, and Malaysia. All travel and participation costs were shouldered by FFTC.



Participants in the Training Workshop on Ecosystem Approach to Fisheries Management held on September 30–October 4, 2019 in Iloilo City.

International Potato Center (CIP)

As part of the 2014–2019 Work Plan of Cooperation, PCAARRD and CIP co-organized the Regional Congress on Root and Tuber Crops for Food Security and Climate Change Resilience in Asia held in October in Quezon City. The Congress served as a venue to discuss and promote cross learning of advanced root and tuber crop technologies, policy measures, and realistic approaches

for exploiting opportunities and challenges amidst climate change.

There were over 100 participants from 11 countries composed of representatives from government agencies, research institutions, academe, farmer's cooperatives, private sector, and media. The Congress consisted of four parts: 1) plenary sessions on breeding, agronomy, pest management, and contribution of roots and tubers to

the resilience of agri-food systems; 2) Knowledge Learning Fair (KLF) showcasing innovations in seed systems, postharvest practices, and product development from selected organizations; 3) roundtable discussion; and 4) field visits in Pampanga showcasing successful experiences on cultivation, processing, and contractual arrangements for sweetpotato and cassava.



Participants of the Regional Congress on Root and Tuber Crops for Food Security and Climate Change Resilience in Asia held on October 17–18, 2019 in Quezon City.

Rural Development Administration (RDA)

Two PCAARRD staff members and one instructor/knowledge management coordinator from the NAARRDN were dispatched to RDA from January 16 to December 23, 2019 under the Applied Communication Experts (ACEs) Program of the 2019 PCAARRD-RDA Work Plan of Cooperation. Each of the three ACEs assisted in process documentation and

publication of RDA for at most four months.

To enhance and further strengthen the PCAARRD-RDA partnership, Dr. Eborá and Dr. Kwon Taek-ryoun, Director of International Technology Cooperation Center (ITCC), RDA discussed, through a teleconference in October, other possible areas and modes of cooperation to be implemented under the work plans and how to improve the ACE Program. Smart farming/agriculture

was among the identified areas of cooperation.

Moreover, RDA, through the Philippines-RDA Alumni Association (PhilKoRAA), provided funds for two PhilKoRAA Board of Directors, namely, Dr. Edwin C. Villar, President and PCAARRD Deputy Executive Director, and Dr. Mildred Padilla, Vice President and Professor at UPLB, to participate in the 2019 KoRAA High-Level Workshop held in July in Sri Lanka.



Ms. Maria Adrielle S. Estigoy, PCAARRD-RDA ACE from CLSU, with Dr. Lee Ji-weon, RDA Director General of Technology Cooperation Bureau (TCB). Image credit: CLSU.



Ms. Maria Adrielle S. Estigoy, PCAARRD-RDA ACE from CLSU, with Dr. Kwon Taek-ryoun, Director of the RDA International Technology Cooperation Center (ITCC). Image credit: CLSU.



Engr. Romeo Santiago of PCAARRD receiving his Certificate of Completion as PCAARRD-RDA ACE.



Ms. April Rose I. Mulimbayan of PCAARRD receiving her Certificate of Completion as PCAARRD-RDA ACE from Dr. Lee Ji-weon, RDA Director General of TCB.

Taipei Economic and Cultural Office (TECO)

Chinese Taipei's Ministry of Science and Technology hosted the 7th MECO-TECO Pre-Joint Science and Technology Commission (JSTC) Meeting in September. The meeting was attended by a delegation from DOST, which included Dr. Eborá and Dr. Lilian G. Bondoc, Director of the

PCAARRD-Policy Coordination and Monitoring Division.

Dr. Eborá reported the status of five ongoing PCAARRD-monitored R&D projects, three of which are under the MECO-TECO Joint Research Project (JRP) on *Tridacna* sp. using NGS technology, genetic diversity of selected marine fishes, and QTL on carabao mango using and genome-

wide association study (GWAS), and two are under the MECO-TECO Health, Agriculture, and Training (HAT) initiative on citrus rind borer (CRB) and on organic production of broccoli and strawberry. Three new PCAARRD projects were officially endorsed for implementation in 2019. These are on macroalgae-fermented chicken feed additive, HABS, and tomato and pepper.



Participants of the 7th Manila Economic and Cultural Office (MECO)-Taipei Economic and Cultural Office (TECO) Pre-Joint Science and Technology Commission (JSTC) Meeting held on September 17, 2019 in Chinese Taipei. Image credit: DOST-ITCU.

Taiwan Agricultural Research Institute (TARI)

As a side event of the MECO-TECO Pre-JSTC meeting, the DOST delegation visited TARI in

September and met with TARI officials. It was agreed that the PCAARRD-TARI MOU, which expired in 2017, will be renewed for another 3 years through a Letter of Intent (LOI). The PCAARRD-

TARI partnership is subsumed under the MECO-TECO Agreement on Scientific and Technological Cooperation signed on March 13, 1997.



Visit to Taiwan Agricultural Research Institute on September 18, 2019. Image credit: DOST-ITCU.



TARI officials together with DOST officials discussed the renewal of PCAARRD-TARI partnership.

Malaysian Agricultural Research and Development Institute (MARDI)

MARDI delegation, led by its Director General, YBhg. Datuk Dr. Mohamad Roff bin Mohd Noor visited PCAARRD in June to sign the PCAARRD-MARDI MOU and revive the partnership since the signing of two earlier agreements in July 1975 and in November 1994. Modes of cooperation under the revived memorandum of understanding (MOU) include joint planning and implementation

of collaborative R&D projects; exchange of scientists, experts, and researchers; conduct of joint trainings, conferences, symposia, and workshops; participation in scientific seminars, workshops, conferences, symposia, and other related meetings; exchange of scientific/technical publications; and encouraging collaboration among other relevant scientific institutions and organizations from the Philippines and Malaysia through PCAARRD and MARDI.

The first work plan of cooperation will focus on development of aquafeeds, technologies for value addition of corn and coconut products and process, livestock breeding, and technology transfer and commercialization. MARDI is a statutory body under the Malaysian Ministry of Agriculture and Agro-based Industry conducting research in agriculture, food, and agro-based industries.



YBhg. Datuk Dr. Mohamad Roff bin Mohd Noor, MARDI Director General and Dr. Reynaldo V. Eborá, PCAARRD Executive Director during the MOU Signing Ceremony.



MARDI delegation with Dr. Reynaldo V. Eborá with some PCAARRD officials and staff.

Asia-Pacific Association of Agricultural Research Institutions (APAARI)

PCAARRD sent three researchers from the NAARRDN and two technical staff/ISP managers to participate in various APAARI-sponsored and -organized activities on agribusiness for young entrepreneurs, underutilized fish and marine genetic resources, genome editing, agricultural leadership, and on *in-vitro* and cryopreservation approaches held in Chinese Taipei, Sri Lanka, India, and Malaysia. The cost of their international travel and participation in said activities were all shouldered by APAARI.

Moreover, two PCAARRD articles, "FertiGroe® to improve cacao's nutrient uptake and yield" and "Nueva Vizcaya State University (NVSU) establishes production system for citrus quality planting materials," were published in the semi-annual APAARI Newsletter.

Association of Southeast Asian Nations (ASEAN)

Dr. Eborá attended the ASEAN Project Development Workshop held in March in Bangkok, Thailand and the 51st Meeting of the ASEAN Committee on Science, Technology and Innovation (COSTI) Sub-Committee on Biotechnology (SCB) held in October in Singapore. As the Philippine SCB Focal Point, he reported updates on two projects supported by the ASEAN Science, Technology and Innovation Fund (ASTIF) on: 1) Capacity building and knowledge sharing on mushroom production, biofertilizer, and composting technologies in different farming systems in the Philippines, Vietnam, and Thailand and pioneering the establishment of a linked ASEAN macrofungi germplasm collection and 2) Health Information Infrastructure,



Ms. Maria Adelia C. Belen (leftmost on first row) participated in the APAARI- and Crawford Fund-sponsored 4th Master Class in Agricultural Research Leadership and Management held in Penang, Malaysia last November 3–8, 2019.



Participants in the ASEAN Project Development Workshop held on March 19–20, 2019 in Bangkok, Thailand. Image credit: ASEAN.



ASEAN COSTI Workshop activities on March 20, 2019. Image credit: DOST-PCHRD.

Governance, and Incipient Technologies in the ASEAN region (HIIGIT ASEAN). The results of the PCAARRD-commissioned project, "Harmonizing biosafety guidelines

and research protocols on biosafety in the ASEAN region" were also presented during the ASEAN COSTI SCB meeting.



Delegates attending the 51st Meeting ASEAN COSTI Sub-Committee on Biotechnology (SCB-51) held on October 7–8, 2019 in Singapore. Image credit: DOST-PCHRD.



Dr. Edna Anit of PCAARRD-CRD represented the Philippines in the 23rd CORRA Annual Meeting held on October 14–15, 2019 at the ISARC in Varanasi, India. Image credit: IRRI-CORRA.

Moreover, four researchers/scientists/research managers from the NAARRDN, PCAARRD, and ITDI participated in various ASEAN international workshops/meetings on biomass conversion, industrial wastewater treatment, and IPR and technology transfer in Thailand, Vietnam, and India.

Council for Partnerships on Rice Research in Asia (CORRA)

Dr. Edna A. Anit, Director of the Crops Research Division, represented PCAARRD in the 23rd CORRA Annual Meeting held in October at the IRRI South Asia Regional Centre (ISARC) in Varanasi, India. The said meeting brought together the senior officials and representatives of national agricultural research and extension systems (NARES) of major rice-producing and consuming countries to assess, discuss, and agree on collaborative actions and initiatives



Participants in the e-ASIA JRP 8 Annual Board Meeting held on September 5–6, 2019 in Bangkok, Thailand. Image credit: e-ASIA Secretariat.

regarding principal issues and challenges facing the Asian and global rice industry.

e-ASIA

As a member of the Science Advisory Council, Dr. Ebor, participated in the e-ASIA JRP

8th Annual Board Meeting held in September in Bangkok, Thailand. During the meeting, the Board approved the project, "Assessment on genetic diversity and reproductive biology of Carangid fishes for sustainable use and conservation," submitted by UPD. PCAARRD will monitor said project.

Partnerships in the works

Two Chinese delegations from the Jiangxi Provincial S&T Department (JSTD) and Jiangxi Academy of Forestry (JAF) visited PCAARRD on November 4 and 12, 2019, respectively.

Together with the PCAARRD Directors' Council led by Dr. Ebor, they discussed the details of cooperative activities to be pursued under the memorandum of agreement (MOA) on the Establishment of the Philippines-

China Joint Program on Bamboo Research between PCAARRD and JAF and the MOA on the Establishment of the Philippines-China Joint Program on Rice Technology between PCAARRD and Jiangxi Academy of Agricultural Sciences (JxAAS), which are currently being negotiated.

For the collaboration on rice technology, both PhilRice and CLSU will be working with JxAAS on the project on green high-benefit rice-fishery farming systems models. For bamboo, PCAARRD

and JAF agreed to collaborate on research on advanced processing of bamboo resources and technology promotion; demonstration and showcasing of new technologies and products; and academic exchange, technical training and capacity-building services. The Joint Bamboo Laboratory will be housed at the DOST-FPRDI. The two MOAs are targeted to be signed in the first quarter of 2020.

PCAARRD, through Ms. Adelina Santos-Borja of the Laguna Lake Development Authority (LLDA)



JSTD delegation and PCAARRD Directors' Council (DC) members/representatives during the briefing and meeting on November 4, 2019 at the OED Boardroom of PCAARRD.



JAF delegation and PCAARRD DC members/representatives during the briefing and meeting on November 12, 2019 at the OED Boardroom of PCAARRD [1st photo from L-R: Assoc. Prof. Wang Haixia, Deputy Director of the Bamboo Research Institute; Dr. Wang Yu, Director of the Forest Products Industry Institute; and Dr. Yu Dongbo, President of JAF.

and Chair of the International Lake Environment Committee's (ILEC) Scientific Committee, is negotiating for PCAARRD's membership to the Southeast Asian Limnological Network (SEALNet) knowledge base/database system based on LAKES platform. Ms. Borja will officially communicate with ILEC Chairman, Dr. Masahisa Nakamura, to recommend PCAARRD's

membership to ILEC based in Lake Biwa, Shiga, Japan.

Beyond the acronym, PCAARRD is also an organization embodying Partnerships and Collaboration for Agriculture, Aquatic and Natural Resources Research and Development. International partnership is truly an effective avenue for PCAARRD and the Philippines, as a whole, to improve

the capacities of Filipino scientists to level up and be abreast with current global trends and advancements especially in AANR research. Through this, options can be better explored and new strategies can be developed to help Filipino farmers and fisherfolk. Table 4 shows the nature and status of PCAARRD's different international S&T linkages.

Table 4. Status of international S&T linkages, 2019.

| Name of Organization/ Partner | Nature of Scientific Linkage | Status of Collaboration |
|--|--|---------------------------------|
| Bilateral | | |
| ACIAR | <ul style="list-style-type: none"> • Joint R&D • Capacity building • Strengthening the policy system and monitoring and evaluation (M&E) of projects and programs under the cooperation | Maintained |
| Through the UK-DOST Newton Agham Programme | <ul style="list-style-type: none"> • Capacity building | Maintained through DOST |
| <ul style="list-style-type: none"> • Royal Academy of Engineering (RAEng) • British Council • United Kingdom Research and Innovation (UKRI) | | |
| JAF | <ul style="list-style-type: none"> • Research on advanced processing of bamboo resources and technology promotion • Demonstration and showcase of new technologies and products • Academic exchange, technical training, and capacity building services. | MOA being negotiated |
| Japan Society for the Promotion of Science (JSPS) | <ul style="list-style-type: none"> • Joint R&D • Capacity building | Maintained through DOST |
| JxAAS | <ul style="list-style-type: none"> • Adaptation trial and demonstration of green high-benefit and rice-fishery symbiotic farming models • Demonstration and showcase of new technologies, products, models, and intelligent agriculture related to rice-fish farming • Exchange visits of scientists/ researchers | MOA being negotiated |
| FFTC | <ul style="list-style-type: none"> • PCAARRD Executive Director serves as Member of the Technical Advisory Committee • Capacity building • Joint organization of international workshops/trainings/ seminars/conferences | Maintained |
| International Center for Tropical Agriculture (CIAT) | <ul style="list-style-type: none"> • Joint R&D • Capacity building • Access to experimental fields and facilities • Grant of fellowship to scientists and researchers • Convening of and participation in trainings/scientific seminars/ workshops/conferences/symposia • Exchange of scientific materials and information | Maintained |
| CIP | <ul style="list-style-type: none"> • Joint R&D • Capacity building • Conduct of joint conferences and workshops | Maintained |
| MARDI | <ul style="list-style-type: none"> • Joint R&D on the development of aquafeeds • Technologies for value addition of corn products and process • Technologies for value addition of coconut products and process • Livestock breeding • Technology transfer and commercialization | MOU revived |
| RDA | <ul style="list-style-type: none"> • Applied Communication Experts Program • Capacity building | Maintained |
| TARI | <ul style="list-style-type: none"> • Joint R&D • Capacity building | Renewal of MOU being negotiated |

Table 4. (Continued)

| Name of Organization/ Partner | Nature of Scientific Linkage | Status of Collaboration |
|--|---|---|
| Michigan State University (MSU) | <ul style="list-style-type: none"> • Exchange of materials in research and education, publications, and academic information • Exchange of faculty, researchers, and scholars • Joint research and meetings for education and research • Technical assistance | MOU being negotiated |
| AIT | <ul style="list-style-type: none"> • Joint R&D • Exchange of IEC materials, scientific/technical publications and other academic information • Capacity building • Conduct of joint trainings/conferences/symposia/workshops • Participation in scientific seminars/workshops/conferences/symposia | MOU being negotiated |
| Multilateral | | |
| APAARI | <ul style="list-style-type: none"> • PCAARRD as Philippine representative • Capacity building | Maintained |
| APO | <ul style="list-style-type: none"> • Capacity building | Maintained through the Development Academy of the Philippines (DAP) |
| ASEAN | <ul style="list-style-type: none"> • PCAARRD Executive Director serves as the Philippine focal point for the Sub-Committee on Biotechnology (SCB) under the ASEAN Committee on Science, Technology and Innovation (COSTI) • Capacity building | Maintained through DOST |
| Asia-Pacific Economic Cooperation - Policy Partnership for Science, Technology and Innovation (APEC-PPSTI) | <ul style="list-style-type: none"> • Capacity building | Maintained through DOST |
| CORRA | <ul style="list-style-type: none"> • PCAARRD as Philippine representative | Maintained |
| e-ASIA | <ul style="list-style-type: none"> • PCAARRD Executive Director serves as Member of the Science Advisory Council • Joint R&D | Maintained through DOST |
| TECO | <ul style="list-style-type: none"> • Joint research projects | Maintained through DOST |
| ILEC | <ul style="list-style-type: none"> • Membership to ILEC • Southeast Asian Limnological Network (SEALNet) knowledgebase/database system based on LAKES platform | Being negotiated |

International Visitors Program

PCAARRD is becoming more popular in the international S&T/agriculture community. For 2019, PCAARRD received a total of 136 researchers, scientists, and extension workers from international organizations/agencies who visited for activities/meetings

related to ongoing projects (ACIAR, CSIRO, University of Sunshine Coast (USC), Australian National University (ANU), FFTC, and APAARI); signing of new agreements (MARDI); negotiation of new partnerships (JSTD and JAF); and to know more about PCAARRD and its programs/projects activities (Prasad Seeds,

Inc., the Bangladesh Agricultural Council, International Coconut Community [ICC], and Korean delegates). Among the visitors were foreign diplomats—H.E. Steven J. Robinson, Australian Ambassador to the Philippines; and H.E. Tessie Eria Lambourne, Ambassador of the Republic of Kiribati.



Visit to PCAARRD of H.E. Steven J. Robinson, Australian Ambassador to the Philippines, on February 28, 2019.



Visit to PCAARRD of Dr. Kuo-Ching Lin, FFTC Director, on April 23, 2019.



Visit to PCAARRD of delegation from Prasad Seeds Pvt. Ltd. on April 5, 2019.



Visit to PCAARRD of the delegation from Bangladesh on April 25, 2019.



Visit to PCAARRD of the delegation from Korea on March 28, 2019.



Visit to PCAARRD of the delegation from the International Coconut Community (ICC) on August 29, 2019.

AGENDA 11: ENHANCE EFFECTIVENESS OF STI GOVERNANCE

Managed **213 competent regular employees** with 
21 PhD and 53 MS degrees; recognized **23 service awardees** and **16 retirees**
 Utilized  **Php962 M**, with 91% for National AANR Sector R&D Program and 9% for GAS;
 generated **Php558.1 M** from external sources
 Maintained **ISO 9001:2015 QMS Certification** 
 Enhanced  **7 Information Systems**
 Mainstreamed  KM4AANR through **KSS, Technology Dashboard, Online FIESTA**
 Provided publication and information service to **1237 online users** 
 Conducted CSR activity participated by  **100 farmer-beneficiaries**
 including children of PCAARRD GAD project

Human Resource Management

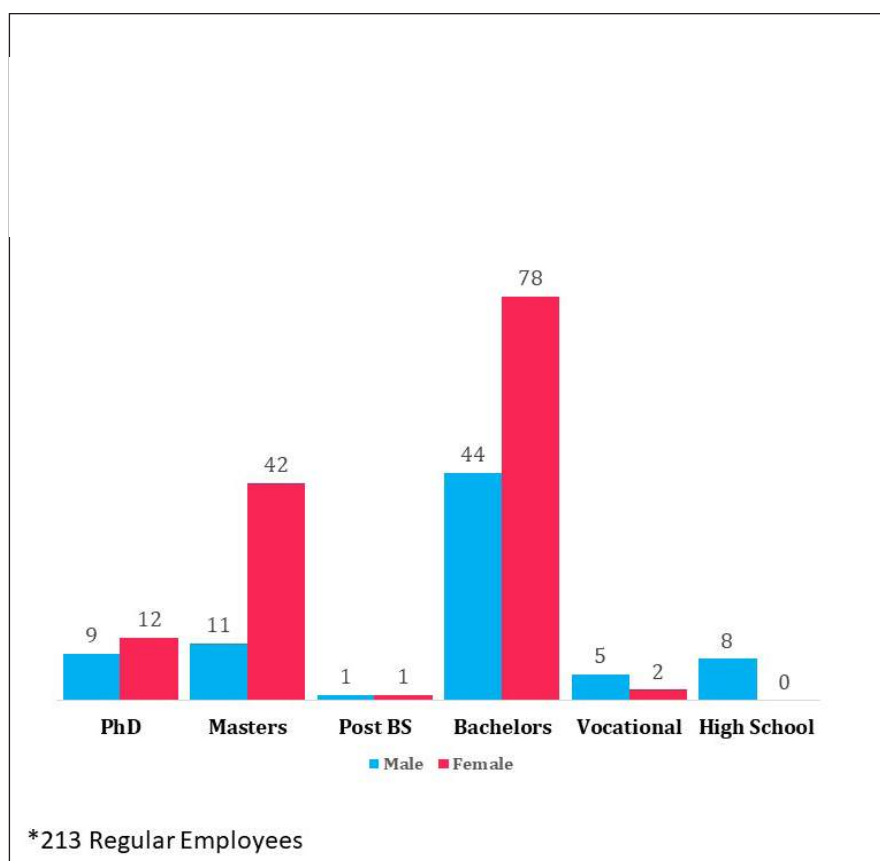
At present, PCAARRD is composed of 213 regular and 80 contractual staff with 110 males and 183 females. Among the total staff complement, 21 are PhDs and 53 are Master's Degree holders in various fields related to AANR.

Personnel with completed graduate studies

For Academic Year 2018–2019, six staff members have completed their graduate studies (3 PhD, 3 MS) while 25 (14 PhD, 11 MS) staff members are still continuing their studies.

PCAARRD service awardees and retirees

A total of 23 service awardees were recognized during the Council's 2019 Recognition Ceremony. There were also 16 optional and mandatory retirees.



Educational profile of PCAARRD regular employees (213).



From upper left: Dalisay Cabral (PhD in Forestry), Ronilo de Castro (PhD in Animal Science), Cynthia Almazan (PhD in Environmental Science). Lower left: Aleta Belissa Correa (MA in Sociology), Bryan Joseph Nobleza (MS in Energy Engineering), and Georgia Lawas (MM in People Management).



From left 1st row: Crystal Awardees (15 years)—Lilibeth Furoc, Jose Raymond Manalo, Adelina Jimenez, Maria Adela Belen; 2nd row: Silver Awardees (25 years)—Lilian Bondoc, Joel Eneristo Joven, Anna Cristina Samonte, Neil Bernardo, Rodelo Dimasapit; 3rd row: Pearl Awardees (30 years)—Ben Lajara, Cesar Katimbang, Ferdinand Fernando, Ma. Adela Corpuz, Marcelino Siladan, Edgardo Tagulabong; 4th row: Jade Awardees (35 years)—Demetrio Cinco, Ricaredo Manzanilla, Ricardo Mulimbayan, Maria Ester Catalina Lajara, Corazon Salud, Nida Mangalindan, Ana Regulacion; 5th row: Ruby Awardee (40 years)—Magdalena Ramos.



This year's retirees. From left 1st row: Evangeline Enriquez, Nelia Laroza, Emma Jabon, Benjamin Tamis, Flordeliza Gutierrez; 2nd row from left – Norida Samson, Leslie Brown, Dalisay Fernandez, Edwin Villar, Anacoreta Bobongo, Ricardo Argana; 3rd row from left – Belinda Gumanan, Armando Ocampo, Dulce Amor Salcedo, Edgardo Tagulabong, and Angelito Carpio.

Trainings, seminars, and workshops participated by the Secretariat

PCAARRD ensures that staff competence is enhanced through participation in various trainings, seminars and workshops. The following shows the different trainings, seminars, and workshops (both local and international) participated in by the Secretariat:

International:

- 5th Flora Filipina International Expo
- International Conference on Sustainability (ICS 2019)
- ASEAN Project Development Workshop at the ASEAN Next 2019: Science, Technology, and Innovation (STI) Leading towards Community Happiness
- Measurement Research Impact Beyond Publications and Citations
- 12th Intergovernmental Sessions of the IOC Sub-Commission for the Western Pacific
- 12th Asian Fisheries and Aquaculture Forum
- 2nd High Level Regional Meeting of the IMO/Norad Project on Marine Environment Protection of the South East Asian Seas (MEPSEAS)
- e-ASIA 8th Annual Board Meeting
- Training on Agribusiness Management, Value Chain Analysis and Leadership
- 15th Protocol for the PH-China Joint Commission Meeting on S&T
- International Training on Ecosystem Approach to Fisheries Management
- ASEAN Committee on Science, Technology and Innovation (COSTI SCB-77)
- 23rd Annual CORRA Meeting
- 12th Philippine Network of Educators of Environment (PNEE) International Conference and Scientific Meeting
- 6th Asia Packaging Network International Packaging Symposium
- 4th International Safe Transit Association: Asia Pacific Division (ISTA-APD) International

Symposium on Distribution Packaging

- AEA 33rd Annual Conference with the Theme "Paths to the Future of Evaluation"
- International Conference on Public Sector Productivity
- EAST Asia Summit Workshop on Maritime Cooperation: Sustainable and Responsible Fisheries Management
- Agribusiness Master Class Training Series I

Local:

- 18th National Mango Festival
- 1st National Forum on Technology Assessment and Intellectual Protection in Agriculture, Aquatic and Natural Resources
- Patent Landscape Forum
- Science and Policy and Information Forum 2019: The Philippine Blue Economy (Part II)
- Workshop for the Project re: Strengthening the Marine Protected Areas to Conserve Marine Key-Biodiversity Areas in the Philippines—SMARTSeas PH
- CBRACK Reef Assessment Training and Closing of CBTRACT Training
- NRCP's Annual Scientific Conference and 86th General Membership Assembly
- Data Privacy Act Awareness Seminar
- Training on Coral Reef Assessment and Coral Taxonomy
- 4th National R&D Conference
- 2019 Technology Transfer Day
- PRMRR Focus Group Discussion
- R&D and ME Monitoring Conference
- 2nd Palawan Seaweed Industry Summit as Resource Person
- 1st Fisheries Research and Development Summit (Resource Speaker)
- Technology Media Conference
- Quick Response Team Basic Training
- PCAARRD Procurement and Inventory Monitoring System V. 6 Orientation
- Networking Workshop "Hinun-anon para sa Pagpa-umwad it Baybayon ag Kaeawuran sa Islang Panay- Building sustainable coasts in Panay Island through research convergence of NGAs, LGUs, HEIs/ SUCs and Industry" (Resource Speaker)
- 3rd Marine Environment Protection Committee (MEPC) Group Meeting
- PhilCecNet's 14th Knowledge Exchange Conference in Palawan (PCAARRD as Chair)
- 51st Anniversary & Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. (PMCP)
- 15th National Symposium in Marine Science (PAMS 15)
- Regional Seminar-Workshop in Multidisciplinary Research: The Role of Research in Nation Building (MMA as Resource Person)
- 31st CLSU In-House Review of Completed and On-going R&D Projects
- Policy Workshop on Philippine Ocean Governance
- 25th Federation of Crop Science Societies of the Philippines (FCSSP)/1st Federation of Plant Science Associations of the Philippines (FPSAP)
- Asosasyon ng mga Propesiyonal sa Pangisdaan sa Pilipinas, Inc. (APPP) Annual Seminar
- Industry Forum on Developing the Native Animal Industry Through S&T Innovations
- 27th National Fruit Symposium
- Blue Carbon Strategy Workshop
- National Marine Summit
- National Consultation Workshop on Biosecurity and Aquatic Animal Health in Aquaculture in the Philippines
- PRMRR Strategic Communication Plan Workshop
- Year End Project Review and Planning Workshop of the Inter-Agency TWG on the Containment of Knifefish in Laguna de Bay
- 12th National Shrimp Congress
- 5th Balik Scientist Program (BSP) Convention
- 15th National Biotechnology Week: S&T Agri-Aqua Forum on Biotech Applications for Food Safety
- 1st National Coconut Research, Development and Extension Summit

Financial resources management

Fund utilization

PCAARRD managed a total of P1.203 B in 2019 that includes P1.190 B under the General Appropriations Act (GAA) for regular agency programs/projects/activities and additional releases from DBM of P13.538 M for terminal leave benefits and authorized employer's share on retirement insurance.

The current year appropriations were duly obligated to programmed projects and activities and reached fund utilization rate of 80%. A total of P873.491 M or 91% of the funds supported the AANR sector R&D Program, which contributed to the attainment of the organizational outcome of increased benefits to Filipinos from science know-how and tools for agricultural productivity in the AANR sector.

PCAARRD released funds totaling P685.794 M to various implementing agencies nationwide

to support priority R&D projects. Financial monitoring and evaluation activities as well as Financial Management Seminars were vigorously conducted with the implementing agencies for the immediate liquidation of these funds. The remaining unused appropriations were forwarded as continuing appropriations, which is valid for obligation until December 31, 2020 pursuant to Republic Act No. 11464.

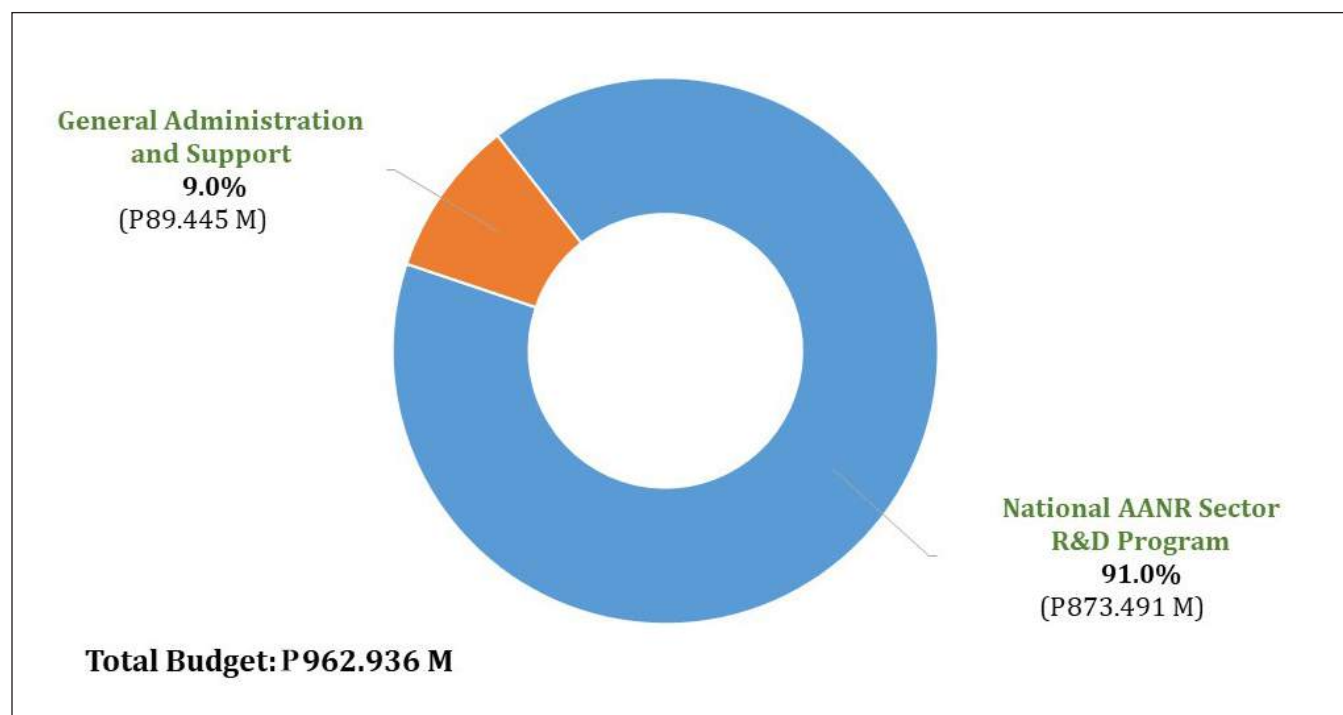
PCAARRD utilized P920.863 M cash allocation during the year covering the payment of current and prior years' obligations. The total disbursements covered 81% of current year's obligations. The cash allocation was carefully managed to ensure that all priority expenditures were settled.

In addition to the annual appropriations, PCAARRD managed a total of P42.400 M funds held in trust received from local sources to support and monitor projects and activities. This amount consists

of P2.494 M remaining balance from 2018 and P39.906 M which was actually generated in 2019. Of this amount, P25.965 M or 61% were utilized during the year, with P17.842 M or 69% spent for Human Resource Development programs and activities. The unexpended portion of the fund will be used to sustain ongoing projects and activities in 2020.

Resources generation

For 2019, PCAARRD generated about P558.11 M from external sources. The said amount includes cash counterparts from local implementing and cooperating agencies (public and private) and from international partners for various projects on R&D, RDRU, and capacity building. In-kind resources amounting to P5.2 million were generated from the participation of PCAARRD staff and NAARRDN researchers/scientists/experts in international conferences/seminars/workshops/fora sponsored by international partners.



Fund utilization, FY 2019.

Generated **P558.1 M** from **external sources**



P552.74 M in Cash



P5.36 M in Kind



P503.03 M Local

P55.08 M International

Resources generated, FY 2019.

Table 5. Estimated amount of resources generated from external sources, 2019.

| Source of Fund | Amount of Resources Generated (P) | |
|---|-----------------------------------|---------|
| | Cash | In Kind |
| Local | | |
| R&D | | |
| BPSU | 107,880.00 | - |
| BSU | 460,000.00 | - |
| Bicol University (BU) | 529,429.50 | - |
| Bohol Island State University (BISU) | 2,259,000.00 | - |
| Cagayan State University (CSU) | 251,000.00 | - |
| CvSU | 217,345.00 | - |
| Cebu Technological University (CTU) | 1,236,000.00 | - |
| CLSU | 1,516,031.67 | - |
| Cob-Vantress Phils | 1,022,000.00 | - |
| Davao Oriental State College of Science and Technology (DOSCT) | 1,669,000.00 | - |
| DLSU | 1,654,667.00 | - |
| DA-Agricultural Training Institute (ATI) Regional Offices | 810,000.00 | - |
| DA Regional Offices | 20,553,544.00 | - |
| DA-Philippine Carabao Center (PCC) | 1,988,224.00 | - |
| Department of Environment and Natural Resources -Ecosystems Research and Development Bureau (DENR-ERDB) | 235,400.00 | - |
| DOST | 139,367,296.03 | - |
| DOST-FPRDI | 536,358.00 | - |
| DOST-Philippine Nuclear Research Institute (PNRI) | 3,427,570.00 | - |

Table 5. (Continued)

| Source of Fund | Amount of Resources Generated (P) | |
|--|-----------------------------------|---------|
| | Cash | In Kind |
| DOST-Region 4A | 500,000.00 | - |
| DOST- Philippine Science High School (PSHS)- E. Visayas | 161,000.00 | - |
| Don Mariano Marcos Memorial State University (DMMMSU) | 705,125.67 | - |
| EDCOR Dev't. Coop | 1,000,000.00 | - |
| Father Saturnino Urios University (FSUU) | 837,582.99 | - |
| Franklin Baker | 400,000.00 | - |
| HIJO Resources Corp | 1,842,600.00 | - |
| Ifugao State University (IFSU) | 75,000.00 | - |
| ISU | 2,652,677.60 | - |
| LSPU | 944,698.87 | - |
| LGU-Bacoar | 550,000.00 | - |
| LGU-Cauayan City | 60,000.00 | - |
| LGU-Echague | 2,400,000.00 | - |
| MSU | 854,173.10 | - |
| Mountain Province State Polytechnic College (MPSPC) | 75,000.00 | - |
| PSAU | 73,500.00 | - |
| Pascual Pharma Corp | 807,812.00 | - |
| Samar State University (SSU) | 556,000.00 | - |
| Santeh | 390,000.00 | - |
| Southern Luzon State University (SLSU) | 183,225.60 | - |
| University of Santo Tomas (UST) | 224,101.53 | - |
| USEP | 1,556,187.20 | - |
| UPLB | 18,176,433.23 | - |
| UP Marine Science Institute (UP-MSI) | 7,472,671.00 | - |
| UP Mindanao | 350,000.00 | - |
| UPV | 8,832,141.19 | - |
| Sub-total (R&D) | 229,520,675.18 | - |
| RDRU | | |
| Abra State Institute of Science and Technology (ASIST) | 1,263,750.00 | - |
| Apayao State College (ASC) | 1,310,000.00 | - |
| BISU | 2,629,985.00 | - |
| BSU | 6,820,807.17 | - |
| BSU/CorCAARRD | 218,000.00 | - |
| Capiz State University (CapSU) | 6,559,615.00 | - |
| CLSU | 83,333.33 | - |
| CLSU/CLAARRDEC | 270,000.00 | - |
| Central Mindanao University (CMU) | 1,783,524.17 | - |
| CMU NOMCAARRD | 150,000.00 | - |

Table 5. (Continued)

| Source of Fund | Amount of Resources Generated (P) | |
|---|-----------------------------------|----------|
| | Cash | In Kind |
| DA-BPI - Los Baños National Crop Research, Development and Production Support Center (LBNCRDPS) | 871,827.20 | - |
| DA-PCC | 989,000.00 | - |
| DENR-ERDB | 312,648.40 | - |
| DMMMSU | 2,050,000.00 | - |
| DOST-FPRDI | 1,018,203.00 | - |
| DOST Regional Offices | 1,535,000.00 | - |
| IFSU | 930,562.75 | - |
| ISU | 7,297,000.00 | - |
| ISU/CVAARRD | 110,000.00 | - |
| Kalinga State University (KSU) | 652,500.00 | - |
| LSPU | 1,733,600.00 | - |
| Mariano Marcos State University (MMSU) | 218,956.00 | - |
| MMSU/ILAARRDEC | 60,000.00 | - |
| Mountain Province State Polytechnic College (MPSPC) | 632,250.00 | - |
| MSU | 1,646,208.67 | - |
| NVSU | 713,805.60 | - |
| PSAU | 520,000.00 | - |
| Siquijor State College (SSC) | 40,000.00 | - |
| Sorsogon State University | 54,000.00 | - |
| SSU | 500,000.00 | - |
| SKSU | 604,500.00 | - |
| University of Northern Philippines (UNP) | 283,333.33 | - |
| UP Diliman | 1,274,496.60 | - |
| UPLB | 1,852,517.78 | - |
| UP Mindanao | 1,425,170.40 | - |
| USEP | 850,000.00 | - |
| USEP/SMAARRDEC | 60,000.00 | - |
| USM | 1,507,871.00 | - |
| USM/CAARRDEC | 60,000.00 | - |
| VSU | 28,000,000.00 | - |
| Western Mindanao State University (WMSU) | 1,350,740.00 | - |
| Western Philippines University (WPU) | 1,382,992.00 | - |
| Sub-total (RDRU) | 81,626,197.40 | - |
| Capacity Building | | |
| BSU | 689,800.00 | - |
| CAARRDEC | 96,560.00 | - |
| Caraga State University (CarSU) | 4,924,296.00 | - |
| CorCAARRD | 187,700.00 | - |
| CTU | 80,000.00 | - |

Table 5. (Continued)

| Source of Fund | Amount of Resources Generated (P) | |
|--|-----------------------------------|---------------------|
| | Cash | In Kind |
| CVAARRD | 352,208.00 | - |
| CVAARRDEC | 634,076.00 | - |
| DOST | 171,049,692.91 | - |
| DOST-Science and Education Institute (SEI) | 27,600.00 | - |
| ISU | 486,330.00 | - |
| MAARRDEC | 104,350.00 | - |
| MSU-Naawan | 9,781,400.00 | - |
| NOMCAARRD | 185,720.00 | - |
| SSU | 1,763,918.00 | - |
| UP Visayas | 1,005,600.00 | - |
| ViCARP | 111,740.00 | - |
| WESVAARRDEC | 238,000.00 | - |
| Sub-total (Capacity Building) | 191,880,390.91 | - |
| TOTAL FOR LOCAL | 503,027,263.49 | |
| International | | |
| R&D | | |
| ACIAR | 36,540,878.60 | - |
| International Atomic Energy Agency (IAEA) | 1,550,000.00 | - |
| Japan Society for the Promotion of Science (JSPS) | 2,500,000.00 | - |
| National Chung-Hsing University (NCHU) | 4,890,000.00 | - |
| National Sun Yat-sen University | 1,217,200.00 | - |
| Sub-total | 46,698,078.66 | - |
| Capacity Building | | |
| APAARI | - | 603,198.40 |
| APO | - | 548,622.14 |
| ASEAN | - | 300,178.28 |
| Commonwealth Scientific Industrial Research Organisation (CSIRO) | - | 3,417,850.00 |
| FFTC | 1,172,205.55 | 316,017.40 |
| Indian Institute of Science | - | 120,000.00 |
| Intergovernmental Oceanographic Commission (IOC), Japan | - | 20,406.00 |
| Japan International Cooperation Agency (JICA) | - | 23,698.42 |
| Konrad ADENAUER STIFTUNG | - | 12,000.00 |
| RDA, Korea | 1,846,586.25 | - |
| Sub-total | 3,018,791.80 | 5,361,970.64 |
| TOTAL FOR INTERNATIONAL | 49,716,870.46 | 5,361,970.64 |
| GRAND TOTAL | 552,744,133.95 | 5,361,970.64 |

Continual Improvement

Demonstrating its ability to consistently provide products and services that meet customer and regulatory requirements, PCAARRD maintained its International Standard Organization (ISO) 9001:2015 Quality Management System (QMS) certification upon passing the first surveillance audit on August 5, 2019.

The Council's initiatives for continual improvement resulted in the following accomplishments:

- Revised 9 QMS processes, 20 risk management plans, and 20 QMS forms.
- Strengthened the monitoring process by including the following in the agenda for Management Review:
 - Customer satisfaction Feedback for PCAARRD services;
 - Technical evaluator's assessment;
 - Evaluation of external service providers; and
- Conducted the following in-house activities to capacitate PCAARRD staff in implementing the QMS:
 - Seminar-Workshop on the Assessment of PCAARRD QMS Risk Management Plan (RMP) in March;
 - ISO 9001:2015 QMS Awareness Seminar in March;
 - ISO 9001:2015 Training on Control of Documented Information in April; and
 - Training on Advanced Internal Quality Auditing (IQA) and Report Writing in May.

The IQA Team Leader also attended the Introduction to Risk Management and its Audit

Perspective in September organized by DOST Central Office.

Earlier this year, PCAARRD received an Emerald Award from the

SOCOTEC Certification International (formerly AJA Registrars), in recognition of the Council's loyalty and long-term partnership with the company.



PCAARRD Top Management during the Surveillance Audit closing meeting.



The Documented Information Control Officers (DICOs) during the ISO 9001:2015 Training on Documented Information held in DAP Tagaytay on April 25–26, 2019.



The QMSP owners and lead representatives during the Seminar-Workshop on Assessment of PCAARRD QMS's Risk Management Plan held on March 20, 2019 at PCAARRD-DPITC.



Participants of the Awareness Seminar on 9001:2015 Standards held on March 20, 2019 at the DPITC, with Mr. Leandro G. Bautista of Synergy at Work Learning and Development Corporation as Resource Person.



Emerald Award received from the SOCOTEC Certification International. Photo credit: SOCOTEC certification International.

Knowledge Management for the AANR

Development of in-house information systems

PCAARRD constantly provides innovative information and communications technology (ICT) solutions to automate workflows in the secretariat and to facilitate information exchange with its partners, clients, and beneficiaries. Simultaneous with software development, PCAARRD continues to manage and upgrade its information technology (IT) infrastructure.

The enhanced version of the Online Submission and Evaluation of Proposals (OSEP) will enable PCAARRD to comply with DOST's directive on automating R&D project management and centralizing submissions of all proposals funded by DOST agencies in one online platform. OSEP increases the efficiency of proposal approvals and reduces the associated costs and time by eliminating the lags caused by the repetitive encoding of proposal information, consolidation, and evaluation. The system also provides notifications on the status of proposals. This enhancement is also in compliance to RA 11032

otherwise known as the Ease of Doing Business Act.

The revitalized version of the Human Resource Information System (HRIS) was developed to support the council's human resource development program and the processes involved in coordinating with PCAARRD's partners in the regions. The HRIS contains a comprehensive databank of researchers, scientists, and S&T workers in the NAARRDN.

PCAARRD also enhanced the following systems:

1. Palihan, an R&D monitoring system which provides inputs to the DOST Project Management System (DPMIS);

2. PCAARRD Procurement and Inventory Monitoring Information System ver.5.7;
3. Strategic Performance Management Information System (SPMIS);
4. Document Tracking System (DocTracks); and
5. Vehicle Management Information System (VMIS).

Mainstreaming Knowledge Management for the AANR Sector (KM4AANR)

The KM4AANR Portal integrates distributed knowledge nodes from some of PCAARRD's information systems and the 14 consortia databases. The portal offers the following knowledge resources:



KM4AANR Knowledge Sharing System (KSS)

KSS is a real-time search and analytics engine that allows a user to search all the connected knowledge nodes and information systems in one command.

Technology Dashboard

The technology dashboard features a data visualization and summary information of all AANR technologies supported by PCAARRD. It is managed and administered by TTPD.

FIESTA

This is an online version of the past and present FIESTA and events conducted by PCAARRD and the consortia. While this is managed by the Applied Communications Division (ACD), the KM Cluster Coordinators from the regional consortia can upload content on upcoming FIESTAs.

Community

The community is a dynamic online fora of different AANR commodities and topics of interest. Each group is handled by a forum moderator and can be participated in by the general public. This module enhances the capture of tacit knowledge of forum participants, through the sharing of practical experience and advise.

The KM4AANR portal is part of the program Mainstreaming Knowledge Management for the AANR Sector (KM4AANR) with the following projects: 1) Strengthening the Consortia Knowledge Network of PCAARRD; 2) Enhancing the

KM4AANR System by the UPLB-Institute of Computer Science (ICS); and 3) Establishing DOST-PCAARRD Knowledge Networks of eLibraries by the DOST-Science Technology Information Institute (STII).

Knowledge assets of 26 industry strategic programs have been audited in PCAARRD. Initial audits have also been conducted for CLAARRDEC, STAARRDEC, BCAARRD, WESVAARRDEC, CAARRDEC, ViCARP, WESMAARRDEC, NOMCAARRD, and CCAARRD. A total of 91 consortia member-institutions (CMIs) were capacitated on knowledge mapping and audit. The rest of the consortia will go through the same process by 2020.

PCAARRD's eLibrary

The PCAARRD eLibrary was established through a project that started in 2017 with STII, Developing the DOST-PCAARRD Innovation and Technology Center eLibrary (DPITC eLibrary). The eLibrary uses a customized Science Library Information Management System (SLIMS) that enables PCAARRD to build its own database and organize its eLibrary resources for easy dissemination, sharing, exchange, preservation, access, and retrieval. Converting the traditional library into an information technology center/digital library facilitates resource sharing, networking, and exchange of resources leading to faster access and retrieval of S&T knowledge and information.

This year, this initiative began its second phase, aiming to create a knowledge network of eLibraries

with its PCAARRD-in-the-regions system.

PCAARRD has also levelled up on its presence online. Through this engagement, it has provided publication and information services to 1,237 online users. This coming year, the Council aims to further enhance its engagement with its stakeholders through the launching of the DOST-PCAARRD eLibrary, where interested individuals and groups can freely download digital copies of publications.

Support to Gender and Development (GAD)

PCAARRD has continuously supported gender and development mainstreaming initiatives through the packaging of R&D projects that integrated GAD as a key component. The Council has also supported the Philippine Commission on Women mandatory activities that highlights the importance of integrating GAD in all S&T activities.

The corporate social responsibility (CSR) activity of PCAARRD also recognized the significant contribution of the Council in integrating GAD in improving livelihood of men and women in organic vegetable farming. The CSR activity was participated in by 100 farmer-beneficiaries, including their children, of the PCAARRD-funded project Gender-responsive organic vegetable production livelihood enterprise for low-income communities of Los Baños, Laguna. The farmer-leader, Ms. Anabelle delos Reyes, encouraged the youth to be engaged in agriculture and value land as important resource.

Way Forward

Remaining relevant in the AANR sector is a big challenge to the Council. Through the years, reported accomplishments of the Council proved that its contributions gained the respect and trust of its partners for the longest time. In this light, PCAARRD will continue to find science-based solutions to the various problems besetting the country's AANR sector by consciously employing the following strategies in the coming years:

- Conduct dialogues with stakeholders in the sector

to identify problem areas and target outputs so that appropriate solutions can be determined and agreed upon;

- Closely coordinate with researchers/proponents and partner agencies to satisfy the requirements of programs and projects supported;
- Prioritize programs and projects according to the needs of the sector matched with the availability of all resources such as time, people, and money;
- Continue to implement flagship programs that have proven

beneficial to its stakeholders to create multiplier effects;

- Improve networking and linking mechanisms with potential partners to capacitate PCAARRD officials and staff and increase resources generated;
- Continuously improve internal systems and processes to facilitate program/project implementation and efficient use of resources; and
- Strictly comply to regulatory and statutory requirements of the administration.



LIST OF ACRONYMS

| | |
|-------------------|--|
| AANR | Agriculture, aquatic, and natural resources |
| ABTV | Abaca bunchy top virus |
| ACD | Applied Communication Division |
| ACE | Applied Communication Experts (program) |
| ACIAR | Australian Centre for International Agricultural Research |
| AI | Artificial insemination |
| AMC | Agribusiness Master Class |
| ANU | Australian National University |
| AO | Administrative order |
| APAARI | Asia-Pacific Association of Agricultural Research Institutions |
| APCIA | Albay Pili and Cacao Association |
| APEC-PPSTI | Asia-Pacific Economic Cooperation - Policy Partnership for Science, Technology and Innovation |
| APO | Asian Productivity Organization |
| APPP | Asosasyon ng mga Propesyonal sa Pangisdaan sa Pilipinas, Inc. |
| ASC | Apayao State College |
| ASEAN | Association of South East Asian Nation |
| ASEAN-COSTI-SCB | ASEAN Committee on Science, Technology and Innovation Sub-Committee on Biotechnology |
| ASIST | Abra State Institute of Science and Technology |
| ASTIF | ASEAN Science, Technology and Innovation Fund |
| ATBI | Agri-Aqua Technology Business Incubation |
| B | Billion |
| BaCl ² | Barium chloride |
| BAFS | Bureau of Agriculture and Fisheries Standards |
| BATT | Biotoxin Adsorption Tracking Technique |
| BBTV | Banana bunchy top virus |
| BCAARRD | Bicol Consortia for Agriculture, Aquatic, and Natural Resources Research and Development |
| BCAs | biological control agents |
| BIOTECH | National Institute of Molecular Biology and Biotechnology |
| BISU | Bohol Island State University |
| BLS | Banana leaf spot |
| BSC | blue swimming crab |
| BSP | Balik Scientist Program |
| BOR | Board of Regents |
| BPI-LBNCRDPSC | Bureau of Plant Industry-Los Baños National Crop Research, Development and Production Support Center |

| | |
|-----------|--|
| BPR | Black pod rot |
| BPSU | Bataan Peninsula State University |
| BU | Bicol University |
| C | Celsius |
| CAARRDEC | Cotabato Agriculture, Aquatic and Natural Resources Research and Development Consortium |
| CapSU | Capiz State University |
| CarSU | Caraga State University |
| CCAARRD | Caraga Consortium for Agriculture, Aquatic and Natural Resources Research and Development |
| CESB | Career Executive Service Board |
| CESO | Career Executive Service Officer |
| CIP | International Potato Center |
| CIT | Committee on International Trade |
| CLAARRDEC | Central Luzon Agriculture, Aquatic Resources Research and Development Consortium |
| CLSU | Central Luzon State University |
| CMB | Cacao mirid bug |
| CMI | Consortia member-institutions |
| CMU | Central Mindanao University |
| COA | Commission on Audit |
| CorCAARRD | Cordillera Consortium for Agriculture, Aquatic and Resources Research and Development |
| CORRA | Council for Partnerships on Rice Research in Asia |
| COSTI | Committee on Science, Technology and Innovation |
| CoV | Certificate of verification |
| CPB | Cacao pod borer |
| CPBRD | Congressional Policy and Budget Research Department |
| CRB | Citrus rind borer |
| CSC | Civil Service Commission |
| CSIRO | Commonwealth Scientific Industrial Research Organization |
| CSR | Corporate social responsibility |
| CSU | Cagayan State University |
| CTU | Cebu Technological University |
| CVAARRD | Cagayan Valley Agriculture, Aquatic and Natural Resources Research and Development Consortium |
| CVAARRDEC | Central Visayas Agriculture, Aquatic and Natural Resources Research and Development Consortium |
| CVSRRRC | Cagayan Valley Small Ruminants Research Center |
| CvSU | Cavite State University |
| DA | Department of Agriculture |
| DA-ATI | DA-Agricultural Training Institute |
| DA-BAFS | DA-Bureau of Agriculture and Fisheries Standards |

| | |
|-------------|---|
| DA-CVRC | DA-Cagayan Valley Research Center |
| DA-FPOPD | DA-Field Programs Operational Planning Division |
| DA-NMACLRC | DA-Northern Mindanao Agricultural Crops and Livestock Research Complex |
| DA-PCC | DA-Philippine Carabao Center |
| DA-PhilMech | DA-Philippine Center for Postharvest Development and Mechanization |
| DA-RIARC | DA-Regional Integrated Agricultural Research Centers |
| DAR | Department of Agrarian Reform |
| DAS | Datu Abdullah Sangki |
| DBM | Department of Budget and Management |
| DC | Directors' Council |
| DENR | Department of Environment and Natural Resources |
| DENR-ERDB | DENR-Ecosystems Research and Development Bureau |
| DENR-FMB | DENR-Forest Management Bureau |
| DLSU | De La Salle University |
| DMMMSU | Don Mariano Marcos Memorial State University |
| DNA | Deoxyribonucleic acid |
| DocTracks | Document Tracking System |
| DOSCST | Davao Oriental State College of Science and Technology |
| DOST | Department of Science and Technology |
| DOST-FPRDI | DOST-Forest Products Research and Development Institute |
| DOST-PAGASA | DOST-Philippine Atmospheric, Geophysical and Astronomical Services Administration |
| DOST-PNRI | DOST-Philippine Nuclear Research Institute |
| DOST-PSHS | DOST-Philippine Science High School |
| DOST-SEI | DOST-Science and Education Institute |
| DOST-STII | DOST-Science and Technology Information Institute |
| DOST-TAPI | DOST-Technology Application and Promotion Institute |
| DPGAA | DOST-PCAARRD Graduate Alumni Association, Inc. |
| DPITC | DOST-PCAARRD Innovation and Technology Center |
| DPMIS | DOST Project Management Information System |
| DRRM | Disaster Risk Reduction and Management |
| DTI | Department of Trade and Industry |
| ECCP | European Chamber of Commerce of the Philippines |
| EO | Executive orders |
| EU | European Union |
| FFTC | Food and Fertilizer Technology Center for the Asian and Pacific Region |
| FIESTA | Farms and Industry Encounters through the Science and Technology Agenda |
| FLS-HGEM | Farmer Livestock School on Halal Goat Enterprise Management |
| FMR | Financial management reform |
| FPA | Fertilizer and Pesticide Authority |
| FSUU | Father Saturnino Urios University |
| FTD | Furnace type dryer |

| | |
|-----------|---|
| GAA | General Appropriations Act |
| GAD | Gender and development |
| GAP | Good agricultural practices |
| GBS | Genotype by sequencing |
| GESDA | Geographically, Economically and/or Socially Disadvantaged |
| GIA | Grants-in-Aid |
| GIS | Geographic information system |
| GOs | Government organizations |
| GPS | Global positioning system |
| GREAT | Graduate Research and Education Assistantship for Technology |
| GTIS | Global Technology and Information Search |
| GWAS | Genome-wide association study |
| ha | Hectares |
| HAB | Harmful algal blooms |
| HAT | Health, agriculture, and training |
| HEI | Higher education institution |
| HNRDA | Harmonized National R&D Agenda |
| HIIGIT | Health Information Infrastructure, Governance, and Incipient Technologies |
| HRC | HIJO Resources Corporation |
| HRIS | Human Resource Information System |
| IAEA | International Atomic Energy Agency |
| IARRD | Inland Aquatic Resources Research Division |
| ICC | International Coconut Community |
| ICS | Internal control system |
| ICT | Information and communications technology |
| IDPs | Internally displaced persons |
| IEC | Information, education, and communication |
| IFST | Institute of Food Science and Technology |
| IFSU | Ifugao State University |
| ILAARRDEC | Ilocos Agriculture, Aquatic and Natural Resources Research and Development Consortium |
| ILEC | International Lake Environment Committee |
| IOC | Intergovernmental Oceanographic Commission |
| IP | ItikPINAS |
| IPOPIL | Intellectual Property Office of the Philippines |
| IPP | Intellectual Property Policy |
| IP-TBM | Intellectual Property and Technology Business Management |
| IQA | Internal Quality Auditing |
| IRR | Implementing rules and regulations |
| ISARC | IRRI South Asia Regional Centre |
| ISAT-U | Iloilo Science and Technology University |
| ISO | International Standard Organization |

| | |
|-----------|---|
| ISPs | Industry Strategic S&T Programs |
| ISPSC | Ilocos Sur Polytechnic State College |
| ISTA-APD | International Safe Transit Association: Asia Pacific Division |
| ISU | Isabela State University |
| ITCC | International Technology Cooperation Center |
| ITDI | Industrial Technology Development Institute |
| JAF | Jiangxi Academy of Forestry |
| JICA | Japan International Cooperation Agency |
| JRP | Joint Research Project |
| JSPS | Japan Society for the Promotion of Science |
| JSTC | Joint Science and Technology Commission |
| JSTD | Jiangxi Provincial S&T Department |
| JXAAS | Jiangxi Academy of Agricultural Sciences |
| KBA | Key Biodiversity Areas |
| kg | Kilogram |
| kgf/gm | kilogram force per gram |
| KLF | Knowledge Learning Fair |
| KM4AANR | Knowledge Management for the AANR Sector |
| KSS | Knowledge sharing system |
| LBSCFI | Los Baños Science Community Foundation, Inc. |
| LC-MS | Liquid chromatography-mass spectrometry |
| LE | Label expansion |
| LGUs | Local government units |
| LIFE | Livelihood Improvement through Facilitated Extension Model |
| LLDA | Laguna Lake Development Authority |
| LOI | Letter of Intent |
| LSPU | Laguna State Polytechnic University |
| M | Million |
| MA | Master of Arts |
| M&E | Monitoring and evaluation |
| MARDI | Malaysian Agricultural Research and Development Institute |
| MECO-TECO | Manila Economic and Cultural Office-Taipei Economic and Cultural Office |
| MEPSEAS | Marine Environment Protection of the South East Asian Seas |
| MFA | Mayon Farmers Association |
| MMSU | Mariano Marcos State University |
| MOA | Memorandum of agreement |
| MOUs | Memorandum of understanding |
| MPSPC | Mountain Province State Polytechnic College |
| MRLs | Maximum residue levels |
| MRRD | Marine Resources Research Division |
| MS | Master of Science |
| MSC | Marinduque State College |

| | |
|-----------|---|
| MSMEs | Micro, small, and medium enterprises |
| MSU | Mindanao State University |
| NARES | National Agricultural Research and Extension Systems |
| NAARRDN | National Agriculture, Aquatic and Natural Resources Research and Development Network |
| NCHU | National Chung-Hsing University |
| NEDA | National Economic and Development Authority |
| NGP | National Greening Program |
| NICER | Niche Centers in the Regions for R&D |
| NOMCAARRD | Northern Mindanao Consortium on Agriculture, Aquatic and Natural Resources Research and Development |
| NSIC | National Seed Industry Council |
| NSTW | National Science and Technology Week |
| NTAs | Non-traditional areas |
| NVSU | Nueva Vizcaya State University |
| NwSSU | Northwest Samar State University |
| OED | Office of the Executive Director |
| OED-ARMSS | OED-Administration, Resource Management and Support Services |
| OED-RD | OED-Research and Development |
| OSEP | Online Submission and Evaluation of Proposals |
| PAG | Policy Action Group |
| PAR | Philippine Area of Responsibility |
| PARRFI | Philippine Agriculture and Resources Research Foundation, Inc. |
| PBMS | Permanent Biodiversity Monitoring System |
| PCAF-CIT | Philippine Council for Agriculture and Fisheries-Committee on International Trade |
| PCAARRD | Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development |
| PCARRD | Philippine Council for Agriculture, Forestry and Natural Resources Research and Development |
| PCAMRD | Philippine Council for Aquatic and Marine Research and Development |
| PCAR | Philippine Council for Agricultural Research |
| PCARR | Philippine Council for Agriculture and Resources Research |
| PCARRD | Philippine Council for Agriculture and Resources Research and Development |
| PCR | Polymerase chain reaction |
| PCMD | Policy Coordination and Monitoring Division |
| PDP | Philippine Development Plan |
| PGP | Plant growth promoter |
| PGRABS | Philippine Genetic Resources Access and Benefit-Sharing |
| PhD | Doctor of Philosophy |
| PhilKoRAA | Philippines-Korea RDA Alumni Association |
| PhilRice | Philippine Rice Research Institute |
| PICC | Philippine International Convention Center |

| | |
|-----------|---|
| PIP | Publication incentive program |
| PNEE | Philippine Network of Educators of Environment |
| PNS | Philippine National Standard |
| POTs | Packages of technologies |
| PPMP | private professional media practitioners |
| PREXC | Program Expenditure Classification |
| PRIME-HRM | Program to Institutionalize Meritocracy and Excellence in Human Resource Management |
| PSAU | Pampanga State Agricultural University |
| PSU | Palawan State University |
| QMS | Quality Management System |
| QPM | quality planting material |
| QTL | Quantitative trait locus |
| RA | Republic Act |
| R&D | Research and development |
| RDA | Rural Development Administration |
| RDA-TCB | RDA-Technology Cooperation Bureau |
| RDIs | Research and Development Institutes |
| RDRU | Research and Development Results Utilization |
| RFO | Regional field office |
| RMP | Risk Management Plan |
| RNA | Ribonucleic acid |
| ROSANNA | Real-time Online Surveillance for Banana |
| ROV | Remotely operated vehicle |
| RRDCC | Regional Research and Development Coordinating Committee |
| RS | Remote sensing |
| S4C | Science for Change |
| SAFE | S&T Action Frontline for Emergencies and Hazards |
| SAR | Synthetic aperture radar |
| SARAI | Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines |
| SciCAT | Science for the Convergence of Agriculture and Tourism |
| SDSSU | Surigao Del Sur State University |
| SEALNet | Southeast Asian Limnological Network |
| SEAMS | SARAI-Enhanced Agricultural Monitoring System |
| SER | Socioeconomic Report |
| SERD | Socio-Economics Research Division |
| SERDAC | Socio-Economics Research and Data Analytics Centers |
| SERDAL | Socio-Economics Research and Data Analytics Laboratory |
| SIPAG | Strategic Industry (S&T) Program for Agri-Aqua Growth |
| SKSU | Sultan Kudarat State University |
| SLSU | Southern Luzon State University |

| | |
|------------|--|
| SMAARRDEC | Southern Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium |
| SMS | Short message service |
| SPidTech | SARAI Smarter Pest Identification Technology |
| SPMIS | Strategic Performance Management Information System |
| SRI | System of Rice Intensification |
| SSC | Sorsogon State College |
| SSC | Siquijor State College |
| SSR | Simple sequence repeat |
| SSU | Samar State University |
| S&T | Science and technology |
| STC4iD | S&T Community-based for Inclusive Development |
| STEAM | Science, Technology, Engineering, Agriculture, and Mathematics |
| STEM | Science, Technology, Engineering, and Mathematics |
| STI | Science, Technology, and Innovation |
| SUCs | State universities and colleges |
| T2P | Technology to People |
| TARI | Taiwan Agricultural Research Institute |
| TAU | Tarlac Agricultural University |
| TBIs | Technology Business Incubators |
| TECHNICOM | Technology Innovation for Commercialization |
| TMC | Technology media conference |
| TTP | Technology transfer protocol |
| TTPD | Technology Transfer and Promotion Division |
| UBs | Unexpended balances |
| UKRI | United Kingdom Research and Innovation |
| UNP | University of Northern Philippines |
| UPD | University of the Philippines Diliman |
| UPLB | University of the Philippines Los Baños |
| UPLB-AMTEC | UPLB-Agricultural Machinery Testing and Evaluation Center |
| UPLB-CEAT | UPLB-College of Engineering and Agro Industrial Technology |
| UPLB-CFNR | UPLB-College of Forestry and Natural Resources |
| UPLB-ICS | UPLB-Institute of Computer Science |
| UPLB-IFST | UPLB-Institute of Food Science and Technology |
| UPLB-IPB | UPLB-Institute of Plant Breeding |
| UPLB-NCPC | UPLB-National Crop Protection Center |
| UPLB-TTBDO | UPLB-Technology Transfer and Business Development Office |
| UP-MSI | UP Marine Science Institute |
| UPV | University of the Philippines Visayas |
| USA | United States of America |
| USC | University of Sunshine Coast |
| USEP | University of Southeastern Philippines |

| | |
|-------------|--|
| UST | University of Sto. Tomas |
| ViCARP | Visayas Consortium for Agriculture, Aquatic and Resources Program |
| VMIS | Vehicle Management Information System |
| VSD | Vascular streak disease |
| VSU | Visayas State University |
| WESVAARRDEC | Western Visayas Agriculture, Aquatic and Resources Research and Development Consortium |
| WMSU | Western Mindanao State University |
| WPU | Western Philippines University |
| WSSV | White spot syndrome virus |
| WTO | World Trade Organization |

AP PE ND IC ES

GOVERNING COUNCIL, CY 2019



Secretary Fortunato T. de la Peña (Chair)

Department of Science and Technology
Bicutan, Taguig



Dr. Rowena Cristina L. Guevara (Alternate)

Undersecretary for Research and Development
Department of Science and Technology
Bicutan, Taguig



Hon. Emmanuel F. Piñol (Vice-Chair)

Secretary
Department of Agriculture
Elliptical Road, Diliman, Quezon City
(until June 2019)



Dr. Siegfredo R. Serrano (Alternate)

Undersecretary
Department of Agriculture
Elliptical Road, Diliman, Quezon City



Dr. William D. Dar (Vice-Chair)
Secretary
Department of Agriculture
Elliptical Road, Diliman, Quezon City



Usec. Rodolfo V. Vicerra (Alternate)
Undersecretary
Department of Agriculture
Elliptical Road, Diliman, Quezon City



Hon. Roy A. Cimatu (Co-Vice-Chair)
Secretary
Department of Environment and Natural Resources
Quezon City



Dr. Sofio B. Quintana (Alternate)
Director
Ecosystems Research and Development Bureau-Department
of Environment and Natural Resources
Los Baños, Laguna



Hon. Ramon M. Lopez (Member)
Secretary
Department of Trade and Industry
Makati City



Dir. Nestor P. Arcansalin (Alternate)
Department of Trade and Industry-Industry Studies
Department
Makati City



Dr. Reynaldo V. Ebor (Secretary)
Executive Director
Philippine Council for Agriculture, Aquatic and Natural
Resources Research and Development-
Department of Science and Technology
Los Baños, Laguna



Dr. Fernando C. Sanchez, Jr. (Member-Academe)
Chancellor
University of the Philippines Los Baños
College, Laguna



Dr. Ricardo P. Babaran (Member-Academe)

Chancellor
University of the Philippines Visayas
Miag-ao, Iloilo



Mr. Jose P. Leviste, Jr. (Member-Private Sector)

Chairman
Oceanagold (Phils.), Inc.
Legaspi Village, Makati City



Mr. Roberto V. Azores (Member-Private Sector)

Legaspi Village, Makati City



Mr. Phillip L. Ong (Member-Private Sector)

President
Santeh Feeds Corporation
Quezon City



Engr. Augusto C. Natividad (Member-Private Sector)

Senior Vice President
Frabelle Fishing Corporation
Navotas



Mr. Arsenio Go Barcelona (Member-Private Sector)

President
Harbest Agribusiness Corporation
Pasig City

PCAARRD DIRECTORS' COUNCIL, CY 2019



Dr. Reynaldo V. Ebor
Office of the Executive Director (OED)



Dr. Melvin B. Carlos
OED-Administration, Resource Management and Support Services (ARMSS)



Dr. Edwin C. Villar (Retired, November 1)
OED-Research and Development (RD)



Dr. Juanito T. Batalon
Office-In-Charge
OED-RD
(November to December)



Ms. Marita A. Carlos
Applied Communication
Division (ACD)



Mr. Demetrio M. Cinco
Finance and Administrative Division (FAD)



Ms. Adoracion B. Armada
OIC
Agricultural Resources Management
Research Division (ARMRD)
(November to December)



Dr. Juanito T. Batalon
ARMRD



Dr. Edna A. Anit
Crops Research Division (CRD)



Engr. Eduardo V. Manalili
OIC
Inland Aquatic Resources Research
Division (IARRD)



Dr. Leila C. America
Forestry and Environment Research
Division (FERD)



Dr. Fezoil Luz C. Decena
OIC
Institution Development Division (IDD)



Dr. Synan S. Baguio
OIC
Livestock Research Division (LRD)



Dr. Lilian G. Bondoc
Policy Coordination
and Monitoring Division (PCMD)



Dr. Mari-Ann M. Acedera
Marine Resources Research Division (MRRD)



Dr. Ernesto O. Brown
Socio-Economics Research Division (SERD)



Dr. Richard E. Amansec
Management Information
Systems Division (MISD)





Mr. Noel A. Catibog
OIC
Technology Transfer
and Promotion Division (TTPD)
(January to August; December 2019)



Mr. Jose Tomas M. Cabagay
OIC
TTPD
(September to December 2019)

RRDCC CHAIRPERSONS AND CONSORTIUM DIRECTORS, CY 2019

| Region/Consortium Base Agency | RRDCC Chairpersons | Consortium Directors |
|--|--|--|
| <p>Region I – ILAARRDEC Ilocos Agriculture, Aquatic and Resources Research and Development Consortium</p> <p>Mariano Marcos State University (MMSU)</p> |  <p>Dr. Shirley C. Agrupis President, MMSU</p> |  <p>Dr. Epifania O. Agustin VP for Research, Extension, and Business, MMSU</p> |
| <p>Region II – CVAARRD Cagayan Valley Agriculture, Aquatic and Resources Research and Development</p> <p>Isabela State University (ISU)</p> |  <p>Dr. Ricmar P. Aquino President, ISU</p> |  <p>Dr. Miladis M. Afidchao Professor V, ISU</p>  <p>Dr. William C. Medrano VP for Research, Development, Extension and Training, ISU January 1 – September 30</p> |
| <p>Region III – CLAARRDEC Central Luzon Agriculture, Aquatic and Resources Research and Development Consortium</p> <p>Central Luzon State University (CLSU)</p> |  <p>Dr. Honorio M. Soriano, Jr. President, Pampanga State Agricultural University (PSAU)</p> |  <p>Dr. Fe L. Porciuncula VP for Research, Development, Extension and Training (RET), CLSU</p> |
| <p>Region IV-A – STAARRDEC Southern Tagalog Agriculture, Aquatic and Resources Research, Development and Extension Consortium</p> <p>Cavite State University (CvSU)</p> |  <p>Dr. Hernando D. Robles President, CvSU July 26–December 31</p> |  <p>Dr. Marilyn M. Escobar Dean, CvSU</p> |

Region IV-A – **STAARRDEC**
Southern Tagalog Agriculture,
Aquatic and Resources Research,
Development and Extension
Consortium

Cavite State University (CvSU)



Dr. Milo O. Placino
President, Southern Luzon State
University (SLSU)
January 1–July 25



Dr. Edna DA. Vida
Professor, CvSU
January 1–January 31

Region IV-B – **MAARRDEC**
MIMAROPA Agriculture, Aquatic and
Natural Resources Research and
Development Consortium

Mindoro State College of Agriculture
and Technology (MinSCAT)



Dr. Levy B. Arago, Jr.
President
MinSCAT



Dr. Maria Concepcion L. Mores
Vice President for Research,
Development and Extension, MinSCAT

Region V – **BCAARRD**
Bicol Consortium for Agriculture,
Aquatic and Natural Resources
Research and Development

TechnoCom Center, Bicol
University-College of Agriculture
and Forestry (BUCAF)



Dr. Arnulfo M. Mascariñas
President, Bicol University



Dr. Marissa N. Estrella
Professor, BUCAF



Dir. Tomas B. Briñas
Regional Director, DOST-Region V
January 1–March 7

Region VI – **WESVAARRDEC**
Western Visayas Agriculture,
Aquatic and Resources Research
and Development Consortium

West Visayas State University
(WVSU)



Dr. Raul F. Muyong
President, Iloilo Science and Technology
University (ISAT-U)



Dr. Pastor Jones T. Denusta
Consortium Director and Associate
Professor, VSU



Dr. Ma. Lulu L. Loyola
OIC-Consortium Director and Vice
President for Research, Extension &
Training, WVSU

Region VII – **CVAARRDEC**
Central Visayas Agriculture, Aquatic
and Natural Resources Research
and Development Consortium

Bohol Island State University (BISU)



Dr. Regucivilla A. Pobar
President, BISU
(effective June 2018)



Dr. Zina D. Sayson
Vice President for Research
Development and Extension, BISU



Dr. Tomas D. Reyes, Jr.
Associate Professor V, BISU
January 1–31

Region VIII – **VICAARP**
Visayas Consortium for Agriculture,
Aquatic and Resources Program

Visayas State University (VSU)



Dr. Edgardo E. Tulin
President, VSU



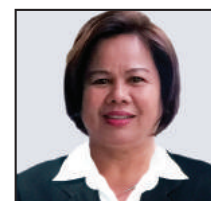
Dr. Othello B. Capuno
VP for Research, Development,
Extension and Training, VSU

Region IX – **WESMAARRDEC**
Western Mindanao Agriculture,
Aquatic and Natural Resources
Research and Development
Consortium

Western Mindanao State University
(WMSU)



Dr. Milabel E. Ho
President, WMSU



Dr. Teresita A. Narvaez
Vice President for Resource Generation
and Professor, WMSU

Region X – **NOMCAARRD**
(Northern Mindanao Consortium
for Agriculture, Aquatic and
Natural Resources Research and
Development)

Central Mindanao University (CMU)



Dr. Jesus Antonio G. Derije
President, CMU
(effective January 1, 2019)



Dr. Agnes S. Riñon
Associate Professor III, CMU
(March 15, 2019–January 12, 2020)



Dr. Maria Estela B. Detalla
Professor, CMU
January 1–March 14

Region XI – **SMAARRDEC**
Southern Mindanao Agriculture,
Aquatic and Natural Resources
Research and Development
Consortium

University of Southeastern
Philippines (USEP)



Dr. Anthony C. Sales
Regional Director (DOST-Region XI), USEP



Dr. Danilo B. Pacoy
VP for RDE, USEP

Region XII – **CAARRDEC**
(Cotabato Agriculture, Aquatic
and Resources Research and
Development Consortium)

University of Southern Mindanao
(USM)



Dr. Rolando F. Hechanova
President, Sultan Kudarat State University
(March 1–December 31)



Dr. Elizabeth C. Molina
Professor VI, USM
(July 1–December 31)



Dr. Francisco Gil N. Garcia
President, USM
(January 1–February 28)



Prof. Efren E. Magulama
Faculty Researcher, USM
(January 1–June 30)

Region XIII – **CCAARRD**
(Caraga Agriculture, Aquatic and
Natural Resources Research and
Development)

Caraga State University (CarSU)



Dr. Anthony M. Penaso
President, CarSU



Dr. Raquel M. Balanay
OIC, Office of the Vice President
for Research and Extension, CarSU

CAR – **CorCAARRD**
(Cordillera Consortium for
Agriculture, Aquatic
and Resources Research and
Development)

Batangas State University (BSU)



Dr. Feliciano G. Calora, Jr.
President, BSU



Dr. Ruth S. Batani
Vice President (VP) for R&D, BSU
(November 1–December 31)



Dr. Carlito P. Laurean
VP for R&D, BSU
(January 1–October 31)

PRODUCTION TEAM

The Office of the Executive Director, the Policy Coordination and Monitoring Division, and the Applied Communication Division packaged this PCAARRD 2019 Annual Report for publication.

| | |
|-----------------------|---|
| Writers/Contributors: | Mari-Ann M. Acedera, Ma. Cecilia S. Alaban, Victor P. Alcantara, Dannah Lee C. Alcomendras, Cynthia V. Almazan, Anna Marie P. Alo, Richard E. Amansec, Leila C. America, Princess Alma B. Ani, Mia Barbara D. Aranas, Ann Kristine C. Aranguren, Eirene Grace Z. Arcayos, Rose Anne M. Aya, Azel Glory C. Banganan, Faustina C. Baradas, Alexander Paul Z. Batalon, Sharon P. Batoon, Ma. Theresa T. Bautista, Mark Christopher L. Bautista, Kristine Joy A. Buenaobra, Cherry B. Bundalian, Dalisay E. Cabral, Alexandra Z. Cabrera, Diana Rose P. Cabello, Adelaida T. Calpe, Michelle Caparas, Monica B. Castillo, Aleli A. Collado, Ma. Adela C. Corpuz, Rolando S. Corpuz†, Marites R. Dayo, Fezoil Luz C. Decena, Ronilo O. de Castro, Mervin John C. de Roma, Michelle A. De Vera, Ofelia Domingo, Cyrill S. Estimado, Lilibeth O. Furoc, Shirley T. Gahon, Kariza M. Geminiano, Abigail F. Gueco, Alissa Carol M. Ibarra, Wilfredo C. Ibarra, Joel Eneristo A. Joven, Maria Ester Catalina V. Lajara, Audrey O. Lapitan, Lucy A. Lastimosa, Wilmar Lastimosa, Georgia M. Lawas, Rundolfo P. Llamas, El Vic R. Madrigal, Eduardo V. Manalili, Jaynee Lyn A. Manicad, Ricaredo V. Manzanilla, Susan S. Molina, Gretchen O. Nas, Ramon A. Oliveros, Mary Ranzelle A. Pasang, Rowena A. Parducho, John Christopher M. Polinar, Christine Anne A. Predo, Jennifer C. Puntanar, Eileen M. Redera, Preciosa C. Samonte, Christine D. Santiago, Musaenda Savarias, Marcelino U. Siladan, Yolanda M. Tanyag, Annette M. Tobias, Nimfa K. Torreta, Jaypee G. Trinidad, Shirley T. Ubal, Renelle C. Yebron |
| Editor: | Katrina Marie V. Mananghaya |
| Technical Editor: | Procy B. Sobreviñas |
| Editorial Assistant: | Rowena A. Parducho |
| Cover Design | Katrina Marie V. Mananghaya |
| Design and Layout: | Marie Joy L. Zuraek |
| Photos: | PCAARRD ISP Managers, PCAARRD Archive |
| Advisers: | Dr. Reynaldo V. Eborá, Dr. Melvin B. Carlos, Dr. Juanito T. Batalon, Dir. Marita A. Carlos, and Dr. Lilian G. Bondoc |

The PCAARRD Logo



The basic figure in PCAARRD's logo is from its mother agency, the Department of Science and Technology, which consists of four circles joined together side by side to form a square. The circles symbolize unit particles, the building blocks of nature, which are the subject and substance of science and technology. The circle design indicates movement signifying progress through Science and Technology (S&T).

The figure in the center square represents PCAARRD and is composed of a human figure carrying an oversized head gear or 'salakot.' The human figure with extended arms represents the research and development (R&D) community fused into a world-class research enterprise working towards enhancing productivity, innovative capacity, and global competitiveness in the agriculture, aquatic, and natural resources (AANR) sector.

The salakot, a traditional Filipino wide-brimmed hat depicts the Council's commitment to protect and improve the lives and well-being of the common farmers and fisherfolk by enabling the National Agriculture, Aquatic and Resources Research and Development System (NAARRDS) to respond to the challenges and impact of a constantly changing environment.

The brims in the salakot symbolize the joint efforts and collaborative S&T interventions for the AANR sectors. The upper green brim depicts the agriculture and natural resources sectors while the lower blue brim represents the aquatic and marine resources sectors, which all require sustainable use and management.



ISO 9001:2015