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**RESEARCH IN THE REVISIONED PATH
TO AGRICULTURAL DEVELOPMENT**

BAR R&D Digest is the official quarterly publication of the Department of Agriculture-Bureau of Agricultural Research (DA-BAR). A staff bureau of DA, it was established to lead and coordinate the agriculture and fisheries research and development (R&D) in the country. Specifically, BAR is tasked to consolidate, strengthen, and develop the R&D system to improve its effectiveness and efficiency by ensuring customer satisfaction and continuous improvement through work excellence, teamwork and networking, accountability and innovation.

This publication contains articles on the latest technologies, research results, updates, and breakthroughs in agriculture and fisheries R&D based from the studies and researches conducted by the member-institutions of National Research & Development System for Agriculture and Fisheries (NaRDSAF).

BAR R&D Digest welcomes comments and suggestions from readers.

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by: **NICOMEDES P. ELEAZAR CESO IV**

R&D Notes

Research in the Revisioned Path to Agricultural Development

Having a progressive agriculture sector is one of the primary solutions to the country's food security and food sustainability concerns. Agricultural development can provide the much needed answers to the problems of rural economic stagnation, and unemployment, and help address the issue of mass migration from the countryside to the cities.

While it is true that food and poverty problems are concerns for all Filipinos, the government and its strong leadership is taking the initiative in searching for the proper solutions. Only the government can set the policies, strengthen the necessary institutions, and empower farmers and fishers for desired improvements in agriculture. It is the government's responsibility to see to it that these imperatives are well addressed.

With the installation of Secretary Emmanuel F. Piñol at the helm of the Department of Agriculture (DA), he carried with him the marching order of President Rodrigo R. Duterte to the agriculture portfolio, and that is **to provide available and affordable food for the Filipino people**. The call to produce food at an affordable cost is now the centerpiece of this administration.

The Bureau of Agricultural

Research (BAR), for its part, will make sure, as it has always done in the past, that farmers and fishers are empowered by research and development (R&D) - driven high-impact projects and technologies for specific markets, and by providing agri-entrepreneurs with quality agri-fishery product technologies, which are key elements in taking the path towards agricultural development. BAR, as the lead coordinating body for R&D of the DA, also aims to strengthen the organizations and networks of agri-fishery stakeholders that can provide the platforms for increased food production, profitable ventures, and business matching opportunities.

The urgency is to produce affordable food that is available at any given time. Admittedly, this is a huge task to handle but is doable. In the call for greater food production, prioritizing specific commodities within the sub-sectors of crops, livestock and poultry, and fisheries, will indeed contribute to the call for food production as it will make the response more rational and efficient.

Maximizing the production levels of the country's food staples, rice and corn; tapping champion crops such as banana, cacao, coffee, and rubber; and further



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WINDS OF CHANGE SET ON

On July 1, 2016, an important date at the Department of Agriculture (DA), incoming Secretary Emmanuel F. Piñol received the stewardship of the department from outgoing Secretary Proceso J. Alcala. Along with this transition, major changes were introduced in the department.

One fundamental change is a redirection of the Department's work. Even before he came to the DA, Secretary Piñol had already taken stock of the efforts being done for Philippine agriculture and saw that the bureaucracy needed to change its vision. This much was already indicated in the book that he co-authored earlier with then Davao City Mayor Rodrigo R. Duterte, "Feeding Millions," that tackled what they viewed to be the fundamental mission

of government in agriculture and which is "to make certain that food is both available and affordable".

Once settled in at the DA, Secretary Piñol asked its people on what should be the department's proper response to two basic questions - "What do Filipinos eat and where and how do we produce these commodities?" and "What do the local and foreign markets need which the Philippines could produce?"

It has become clear that, in terms of agricultural commodities, the DA needs to increase its focus on those for food to meet the Filipinos' nutritional requirement and on those that can provide farmers and fishers and others dependent on agriculture with the means and income for survival and prosperity. It is along this path that

BAR and agricultural R&D now find themselves traversing.

In the first major meeting that he conducted at the DA, Secretary Piñol identified a number of agricultural commodities as needing attention. On those "that Filipinos eat", these are: rice, corn, chicken, meat, milk and dairy products, fish and marine products, and fruits. On those that the local and foreign markets seek, these are: coconut, Cavendish and Lacatan bananas, pineapple, cacao, coffee, rubber, oil palm, abaca, shrimps, fish and marine products, seaweeds, organic rice, vegetables, pork, halal chicken, spices, essential oils, and tropical fruits.

We are going back to the basics. And as Secretary Piñol says it, this is to "Produce Food and Address Poverty". It looks



R AND BAR

by: VICTORIANO B. GUIAM

fortuitous that BAR's research plans and programs have sufficiently flexibility to adapt to whatever demand may be placed on agricultural R&D by the new vision in the department. Concerns identified with the commodities mentioned by the Secretary have been anticipated to various extents by previous planning exercises. At the least, a bit of tweaking could be in order for the research agenda and programs to remain in tune with the times.###

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looking at specific livestock and fisheries commodities like native swine and seaweeds, respectively, are featured in this chronicle of winnable commodities.

In this issue of the BAR Digest, it features the R&D programs and projects that focus on specific R&D interventions that can take our clientele towards the Secretary's vision for Philippine agriculture. Several of the crops mentioned here are already contributing significantly to the local and export markets.

The narratives on each of the commodities featured discuss their potentials at length. For instance, rice is given attention particularly on the upland traditional varieties known as heirloom rice. The characterization of existing heirloom varieties in selected provinces and the identification of opportunities for adding value and creating market linkages are shown here.

For corn, aside from being a food staple and a raw ingredient for livestock and poultry feeds, the story on its other uses took shape by researching on corn cobs as an alternative source of potassium. There are a number of corn-based R&D projects that are being coordinated for the identification of appropriate corn varieties in various areas, the application of corn as an organic fertilizer, and its integration to livestock and poultry needs.

For champion crops, such as banana, cacao, coffee, and rubber, BAR has collaborated with various project proponents from the DA-Regional Field Offices, state universities and colleges, and international institutions, among

others. These projects are funded and assisted in order to boost production and identify production bottlenecks as well as pinpoint other researchable areas that will complement R&D, production, and marketing.

On the banana industry, our article shares that this multi-billion peso agribusiness ranked second in terms of revenues from fresh Cavendish banana exports. It also shows that countries like Japan and China are the country's top export markets and that the banana producing and exporting companies employ close to 320,000 people.

The Philippines is one of the world's biggest producers of semi-processed seaweed product called Carrageenan. Seaweed farming has been generating livelihood for many coastal communities including a women-led fishing village cited in this issue. See how these women have created economic impact through producing and marketing seaweed-based products.

Featured also is BAR's pro-active campaign to promote and conserve the Philippine native swine. The bureau, in collaboration with various livestock agencies of the department, has ventured into R&D-related projects that will aid the characterization of native swine, among others.

Deciding on the path to take for a better Philippine agriculture and fisheries must be anchored on the identification and prioritization of key and basic food crops and it is clear that the new DA administration has this in mind. This and more are discussed in the succeeding pages. ###

For the small upland communities in Ifugao, heirloom rice is not only a staple passed down from their ancestors, it is a heavenly manifestation of the kindness of their gods.

Legend says of two brothers, Wigan and Kabigat, who were out hunting, ending up capturing game in the backyard of Liddum, the god of plenty. It was there that these two brothers and Liddum reached an agreement of an exchange. Liddum, who only knew how to eat food raw, offered these brothers the opportunity to bring home some of Kabunyan's aromatic large grain rice if the brothers would teach him how to cook with fire just as how Wigan and Kabigat prepared their caught pig to share with the god and his people. With Liddum's favor bestowed upon the brothers, Wigan and Kabigat went back to their village with the god-sent rice. With this gift came the Ifugaos' golden age in agriculture and with it, new rituals and cultural practices.

If we were to look into the nutritional value of heirloom rice varieties from the Cordillera and Cotabato regions, it is easy to understand why, to the indigenous people, these rice might as well be food for the gods. Not only are they aromatic and organically grown, but heirloom rice varieties are also full of antioxidants and exhibit lower calorie levels compared to commercial white and brown rice. Heirloom varieties are also good sources of fiber which helps sustain the feeling of a full stomach even after eating just one cup. Heirloom rice varieties can also serve as alternative sources of protein and iron which can be very helpful for people looking to start a vegetarian diet.

The past two government administrations have equally put out and sustained efforts as to how to further preserve preferred

heirloom varieties propagated in marginalized communities across the Cordilleras.

According to a study by the DA-Upland Rice Development Program back in 2011, data showed that almost 19,300 hectares of upland areas in Region 12 (Soccsksargen) were planted to local rice varieties while 6,700 ha were planted with the traditional crops at CAR. It was during the early 2000s that the International Rice Research Institute (IRRI) managed to develop holistic activities aimed at restoring and preserving traditional rice varieties in Region 12. It was also during this time that local farmers were trained to utilize new varieties which were climate-resilient. This was accomplished with the establishment of Community Seed Banks.

Today, as the Department of Agriculture (DA) explores the potential of heirloom rice in significantly increasing the country's Gross Domestic Product, it also aims to ensure that the economic benefits of such an increase would eventually reach the indigenous communities who have, since time immemorial, carried on the planting and harvesting of the special rice varieties.

There are serious threats to the sustainability of heirloom rice varieties. As yields of heirloom rice are low at the farmer's level of technology, farmers in the upland areas cannot even harvest sufficient rice to sustain the demand of their own households. Climate change, extreme weather disturbances and the lack of continuous water supply, as well as the use of seeds that are not climate-resilient contribute to the already low harvest performance. Aside from the rising threat of climate change, the socio-economic status of indigenous communities across Cordillera also presents limitations to a good harvest. There are none or very few certified seed growers

and the seed banks do not meet the right standards to ensure good yield.

Yet despite these limitations, it is without doubt that heirloom rice varieties, because of the plethora of health benefits that they offer, are globally marketable even with the expensive price tag. And so began the DA's collaborative efforts for restoring the former glory of heirloom rice varieties, back to a time when indigenous people didn't need to worry about climate change.

In February 2014, the Heirloom Rice Project was launched under a tri-partite partnership among the DA, the Philippine Rice Research Institute (PhilRice), and IRRI. "The project aims to empower indigenous communities in unfavorable rice-based ecosystems by enhancing the productivity of heirloom rice," said Dr. Casiana Vera Cruz of IRRI who is the project leader of the interagency Heirloom Rice Project. In doing this, the DA is also preserving the rich culture of the Cordilleras. Indigenous people will be equipped with the necessary tools to continue planting their rice varieties and pass on their farming practices along with the stories embedded in such practices to the next generation of rice farmers.

The Heirloom Rice Project has the following objectives:

(1) Characterization of existing heirloom or traditional varieties in selected provinces.

This involves the "collection, inventory, definition, maintenance and conservation of heirloom rice varieties for active use" with the help of the members of the community participating in imparting knowledge. By determining the genetic make-up of heirloom rice varieties, they are examined for resistance to plant diseases, and their tolerance to drought, submergence, or salinity. Using field plots, high quality seeds

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RENAISSANCE *of Philippine Heirloom Rice*

by: EPHRAIM JOHN J. GESTUPA



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are made readily available for the community.

(2) Enhancement of local capacity and enterprise-building in farming communities.

Through training programs such as Farmer Field Schools, members of the farming community, a majority of whom are women, are equipped with the necessary know-how to increase crop production and seed quality. Through these trainings, farmer associations will also be strengthened in their operations and activities.

(3) Identification of opportunities for adding value and creating market linkages for heirloom or traditional rice varieties.

The Heirloom Rice Project is also responsible for putting out finished value-added products for the local and international markets, trade fairs, culinary expos, and inter-agency trade events. The DA also utilizes market-focused collaboration among different stakeholders who produce and market value-added products. Using this framework, heirloom rice is introduced to the market and consumers as they are tied up to

major business brands, an example of which is the incorporation of heirloom rice in the in-flight menus for international flights of the country's flagship airline, PAL.

The Heirloom Rice Project has R&D outputs all throughout the value chain: From the assessment of the production sites to planting quality heirloom rice, to putting up community institutions that will sustain the knowledge imparted for the long term, to the development of products and the showcasing of such to the rest of the world.

In this project, the Bureau of Agricultural Research (BAR) serves as both the coordinating and fund facilitating agency. BAR facilitates the evaluation and review of progress made by the implementing bodies, namely the DA and IRRI, in partnership with the DA regional field offices of the Cordillera Region and Region 12. Funding is sourced out of the DA's Food Staples Sufficiency Program. ###

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Future looking brighter for Corn R&D

by: DIANA ROSE A. DE LEON

About 20 percent of the country's total population relies on white corn as its main staple food especially in parts of the Visayas and Mindanao regions. Yellow corn accounts for about 40 – 50 percent of the livestock and poultry mixed feeds produced locally. There are also other industrial and commercial products that need corn as raw material.

It is estimated that around 600,000 farm households are into corn farming as their primary livelihood. With the corn industry contributing about 5.67 percent of the 2015 gross value added (GVA) in agriculture, it is just fitting to say that, next to rice, corn is one of the most important commodities in the Philippines.

For 2017, the Department of Agriculture (DA), through the National Corn Program, has targeted to increase corn production and corn grain yield/hectare. Based on Philippine Statistics

Authority data for 2015, the country's white corn production stood at 2.13 million metric tons (MT) while yellow corn was at 5.38 million MT. The 2017 target is to increase white corn production to 2.790 million MT and yellow corn to 6.328 million MT. Furthermore, the program has targeted to increase white corn grain yield to 2.05 MT/ha up from 1.69 MT/ha in 2015, and yellow corn grain yield to 4.52 MT/ha from 4.15 MT/ha in 2015.

In order to realize the goals for corn, it is crucial that there be continuous pouring of investments on corn research and development (R&D) to ensure that the country will have the technologies essential for preventing shortages in corn supply for human consumption, feeds and industrial uses; increase the income of corn farmers; and contribute to resiliency to climate change.

The Bureau of Agricultural Research (BAR), as the DA's lead funding agency for agriculture R&D, is tasked to spearhead the continuous implementation of projects related to the establishment of corn germplasm collection and selection, and the conduct of researches for improving corn productivity and profitability. The following are the major initiatives and researches on corn supported by BAR:

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A. Site-Specific Nutrient Management (SSNM)

SSNM is a cost-effective farming strategy developed by the International Plant Nutrition Institute (IPNI) that deals with proper nutrient management needed by a plant (e.g., nitrogen, phosphorus, and potassium) taking into account various factors that include nutrient supply, crop variety/type, and climate/agro-ecological conditions, among others. The goal of SSNM is to prove that corn farming can be a profitable endeavor by increasing the yield without additional spending on inputs specifically on fertilizers.

Through funding support by BAR, the IPNI was able to test SSNM Maize in the country. It

was piloted by DA-Regional Field Offices (DA-RFOs) 2 and 10, and the University of the Philippines Los Baños (UPLB) in 2005. By 2008, a nationwide implementation of SSNM Maize had been conducted. Ten years since the project started, all 16 DA-RFOs were able to conduct SSNM corn trials for hybrid, open-pollinated and traditional varieties.

With the SSNM Maize proven as an effective strategy to increase corn yield and profit, technology dissemination and transfer to corn stakeholders followed thereafter. SSNM Fertilizer Quick Guides and SSNM Nutrient Expert (NE) for Hybrid Maize were produced through a collaboration of the DA's National Corn Program, IPNI, BAR, UPLB, and the DA-Bureau of Soils and Water Management.

The SSNM Fertilizer Quick Guide is a one-page summary of plant nutrition and crop management guidelines for larger areas. Quick guides are designed to provide farmers with location-specific guidelines based on the principles of SSNM which captures the most important factors that affect fertilization recommendations for a given region. SSNM-NE for Hybrid Maize, on the other hand, is a computer-based decision support tool that was developed to assist its users on quickly formulating fertilizer guidelines for yellow and white corn varieties. It is available for use in personal computers and mobile gadgets, and is compatible with Windows, Mac, and Android formats.

B. Corn Germplasm Utilization through Advanced Research and Development (CGUARD)

CGUARD is a program led by the DA National Corn Program, together with other corn stakeholders and agencies, including the Bureau of Plant Industry and BAR, to conserve the existing native and traditional corn varieties of the country, develop breeding materials using native germplasm, and determine the genes responsible for different

unique traits in native varieties.

There are 24 CGUARD projects being supported by BAR which are implemented by DA-RFOs, UPLB, and Bureau of Plant Industry. At the end of the program, it is expected that there will be established, well-documented and characterized corn germplasm collections in each region, developed and populated CGUARD database, and technically-equipped researchers who will continue practicing corn germplasm

conservation and utilization.

As of the latest tabulation, there were already 1,172 corn entries collected from 15 regions; 145 collections planted for regeneration/characterization, and 103 accessions characterized. The current CGUARD germplasm collection consists of 225 native populations from the Philippines, 16 of which have been found to be resistant and/or tolerant to biotic and abiotic stresses.

C. Community-based Participatory Action Research (CPAR) in Corn-based Areas

CPAR is one of the banner programs of BAR that is being implemented to boost the farming systems (FS) of a certain location by introducing or improving the agriculture technologies used. The program is anchored on the premise that agricultural production will be greatly improved with the appropriate technology interventions for a given locality. A number of CPAR projects have been

implemented in corn-based areas in the country (see Table 1).

Among the technology interventions introduced in corn-based areas are the use of appropriate corn varieties, application of organic fertilizers, integration of livestock and poultry (includes native swine and native chicken), the use of integrated nutrient management and integrated pest management, modification of cropping system, vegetable production, etc.



D. The Use of Corn Cobs as Alternative Source of Potassium

Corn cob is considered as a waste as it has no known use except as fuel in household domestic cooking. Though there are a few farmers who use corn cobs as fertilizer, there are no scientific studies that prove the effectiveness of corn cobs as an alternative source of potassium (K). This prompted Dr. Apolonio M. Ocampo of UPLB to do a research on the said subject.

Based on the results, using the corn cob rates of 5, 10, 15, and 20 tons cobs per hectare (ton cobs/ha), the grain yields from commercially K-fertilized plots and plots that use corn cobs have no significant difference. It is recommended by the study that the white open pollinated variety (OPV) be applied with 10 – 15 tons cobs/ha and 20 tons cobs/ha for the hybrid corn to get a grain yield comparable to those of commercially K-fertilized plots.



E. Development of Village-type Corn Mill

The Philippine Center for Postharvest Development and Mechanization (PhilMech) developed an improved village-type corn mill that has a degerming efficiency of 94.7 percent and product recovery of 64.7 percent. The improved corn mill can also efficiently segregate the corn grits #10, #12, #14, #16, #18 and the corn flour. It is a movable equipment that can be transported from one location to another, eliminating the hassle for the farmers of bringing their harvest to commercial corn millers.

Aside from abovementioned initiatives, there are other corn R&D projects being supported by BAR. There are numerous corn varietal improvement studies, yield trials, and performance evaluation being conducted nationwide. There are also researches on product enhancement for white corn and native varieties, initiatives to improve their nutritional content, research to increase consumers' consumption, and market studies. Pest and diseases of corn are also being studied, such as the leaf blight epidemic, and the development of a rapid detection method for aflatoxin in white corn.

As there is now greater emphasis on the country's goals of food self-sufficiency and agriculture profitability, the corn stakeholders are responding collectively to contribute towards their achievement. With continuous support from the government to help the corn industry players and address the gaps in the corn value chain, it is seen that the country will achieve 100 percent corn self-sufficiency in the foreseeable future. ###

Banana is one of the most widely consumed fruits in the world. It is believed that there are almost 1,000 varieties of bananas worldwide. Bananas are grown in Africa, Latin America, the Caribbean, and the Pacific.

Just like many tropical countries, the Philippines produces bananas as a staple food. Around 20 percent of all bananas that are produced are exported. Locally consumed bananas play a major role in terms of food security.

Most of the country's banana production is in Mindanao and the most commonly known is the Cavendish variety which is mostly exported. The country also produces many varieties of banana, such as *saba*, *lakatan*, and *latundan*. The major markets for fresh bananas are Japan and China.

In 2016, the country produced 2,215 thousand metric tons (MT) of bananas. The Davao Region remained the top producer of banana with 906 thousand MT for a share of 40.9 percent. This was followed by Northern

Mindanao with 18.3 percent and SOCCSKSARGEN (South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos) with 9.8 percent. The Cavendish variety accounted for 54.3 percent of the country's total banana production. Saba and lakatan varieties were next with 26.3 percent and 9.2 percent shares, respectively. (PSA, 2016)

Threats to the Industry

One serious threat to global banana production is the re-emergence of Fusarium Wilt after a long hiatus. The disease, also known as "Panama disease", is caused by the soil-borne fungi, *Fusarium oxysporum* f. sp. *cubense* (Foc). Fusarium Wilt, one of the most destructive of modern-day plant diseases, wiped out the Gros Michel-based banana industry in Central America and the Caribbean in the mid-twentieth century.

The effects of Foc Race 1 were addressed by a shift to resistant Cavendish cultivars. But unfortunately, a new strain

of Foc called Tropical race 4 (TR4) developed that overcame resistance to Foc in Cavendish clones. Even other banana cultivars which were not previously susceptible to races 1 and 2 became susceptible to TR4.

The devastating impact of Fusarium wilt on Cavendish plantations in Asia was first observed in Taiwan in the late 1960s, causing significant reduction in production and huge increases in production costs, rendering its exports much less competitive. In the Philippines, the disease was suspected to be present in the country since the 1970s, but TR4 was only confirmed in 2008. Its incidence in the surveyed farms increased from 700 cases in 2005 to 15,000 in 2007.

The occurrence of TR4 epidemics in Cavendish farms in the Philippines in 2008 has renewed serious concerns with regard to its destructive potential. It has since threatened the million-dollar banana export industry of the Philippines, putting the stability of

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Strengthening **RESEARCH** to improve the **BANANA INDUSTRY**

by PATRICK RAYMUND A. LESACA



the industry into question.

The TR4 outbreaks reported in Oman, Jordan, Pakistan (under evaluation), and Mozambique in 2013 has proven its threat as a trans-boundary disease of special importance to other major banana producing countries.

To date, although banana production remains highly profitable, several other issues still confront the industry. As with other crops, adverse climatic conditions increase the risks of damage and crop loss. Extreme climatic events can also increase the occurrence of banana pests and diseases like bunchy top, Fusarium, and Sigatoka.

Pests and diseases cause pre-harvest losses but are more damaging after harvest. Postharvest losses are generally high for this perishable product which lacks quality standards specially in the local market.

New Man at the Helm and Addressing the Foc Menace through R&D

With the installation of Secretary Emmanuel F. Piñol at the helm of the Department of Agriculture (DA) in July 2016, the DA chief echoed President Rodrigo R. Duterte's marching order to the department, **provide available and affordable food for the Filipino**

people. Since then, the Secretary calibrated his plans of actions and called for revisiting the DA's thrust on food production particularly on champion crops like banana.

Parallel to the DA's campaign relative to this cutting-edge approach, the agriculture portfolio is also aware of the clamor of big banana commercial growers in Southern Mindanao for the department to address the serious threats of banana pests and diseases to food security and the economy in general.

As cited in a published news article, Mr. Virgilio Gutierrez, focal person of the Department of Agriculture of Davao Region, said there are at least 700 farmers who have been affected by the Fusarium wilt disease. The DA has therefore earmarked a total of P102.2 million for 2015 and 2016 to stop the spread of Fusarium wilt. According to Gutierrez, Davao has put in place appropriate measures to help minimize the spread of the disease. "Through the Fusarium wilt management program, affected farmers are provided financial assistance by paying those who burned infected plants," he said.

Gutierrez said that banana farms which have five percent and above Fusarium wilt infection can do crop shifting as the DA can provide them with GCTCV 219, a

banana variety that is resistant to the killer disease. Apart from this, the DA is holding seminars for small growers to help them better understand the disease.

Research and Development Initiatives

The magnitude of the Foc problem is serious, but efforts to address it must be premised on a strong science-base driven by R&D initiatives.

The Bureau of Agricultural Research (BAR) is strong in interventions when it comes to addressing the effects of Fusarium Wilt and other crop problems. In order to establish the strength of a collective R&D community, BAR has partnered with experts from the DA-Biotechnology Program Office and the DA-High Value Commercial Crops and collaborated with institutions like the National Academy of Science and Technology (NAST), University of the Philippines Los Baños (UPLB)-National Institute of Molecular Biology and Biotechnology (BIOTECH), State Universities and Colleges (SUCs), and Bioversity International-Asia and the Pacific. This was done in order to map out preventive measures that can be undertaken to address pest and diseases related to banana production.





One such initiative is the project by the Bioversity International represented by Dr. Agustin B. Molina, Honorary Research Fellow of Bioversity International (for Bananas). In further collaboration with the Bureau of Plant Industry-Davao National Crop Research, Development and Production, Regional Field Office XI, UPLB-Institute of Plant Breeding, Lapanday Foods Corp, and the small banana growers in the Davao Region, BAR funded and assisted the project proposed by Bioversity International titled, “Mitigating Banana Fusarium Wilt Tropical Race 4 Through a Farmer-Participatory Approach of Developing Disease Management Strategies”. This has provided smallholder farmers an immediate solution to mitigate the epidemic of Foc TR4 in their farms with the introduction, through the

conduct of farmer-participatory selection, of the improved Giant Cavendish Tissue Culture Variant (GCTCV) 219 which promises better yield and agronomic traits, disease resistance, fruit quality and marketability.

Plantlets of GCTCV 219 were established by selected partner Cavendish banana grower-collaborators to undergo farmer participatory evaluation and selection of these improved genotypes specially on disease incidence, agronomic traits, yield, and fruit quality characteristics. They showed promising results as to resistance to TR4, with an average of only 1.04 percent Fusarium wilt incidence, and are comparable to the existing commercial Cavendish varieties in terms of fruit quality and acceptability. Although these varieties have longer maturity and

have smaller bunch size compared to existing commercial varieties, its high resistance to TR4 makes it a good alternative particularly for small banana growers who do not wish to abandon their farms already infested with TR4.

Aside from the project with Dr. Molina, BAR has also funded and supported other banana production and disease management studies being undertaken with UPLB and the University of Southern Mindanao (USM) as follows:

- Enhancing Capacities of Farmers, Extension Agents and Local Researchers Towards the Effective Management of Foc for Small-Scale Cavendish Banana Sector
- Molecular Based Detection and Analysis of Population Structure of *Mycosphaerella fijiensis*, the Casual Pathogen of Black Sigatoka


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Pushing the development of **Phl native animals** thru R&D

by: ANNE CAMILLE B. BRION



A group of native piglets and adult pigs are shown in a wooden enclosure. The piglets are in the foreground, some standing and some resting. The adult pigs are in the background, some standing and some resting. The enclosure is made of wooden logs and is filled with straw bedding. The background is a warm, orange-brown color.

In the Asian region, particularly in the rural areas, native animals are highly regarded in most agricultural production systems. Apart from being used during ritual ceremonies and providing additional income to small-scale growers and raisers, native animals also become a source of nutritious and palatable food. While unpredictable production performance including inferior size and slow growth rates as compared to commercial breeds have been characteristic of native animals for years, their ability to thrive even in adverse conditions with minimal production inputs have renewed interest in them and generated heightened importance especially in their economic value. The increasing local demand for quality and healthy food has also opened opportunities to develop, and more importantly, conserve, improve,

and commercialize our very own native species of pigs and chickens.

R&D collaboration for native pigs

For native animal productions systems to be sustainable and profitable over the long run, the availability and accessibility of genetic resources must first be ensured towards meeting, not only the needs of small-scale farmers, but the demands and preferences of consumers as well. Way before the institutionalization of the Philippine Native Animals Development (PNAD) Program in 2010, the Bureau of Agricultural Research (BAR) had already supported R&D initiatives on native animals that intend to boost the growth and conservation of native animals and explore their potentials as sources of income and profit. One of these was the project, “Conservation, Evaluation, and Commercialization of Philippine Native Pigs,” implemented by the National Swine and Poultry Research and Development Center (NSPRDC) of the Bureau of Animal Industry (BAI) and supported by BAR through its National Technology Commercialization Program. Under the project, production of native breeder pigs was carried out using 20 heads of breeder sows and two boars from NSPRDC’s stock farm in Tiaong, Quezon. Their offspring were later on distributed to farmer-cooperators in Quezon and Laguna to boost the needed stocks of native pigs for multiplication and livelihood opportunities.

Studies focusing on another equally-important component of native pig production were also carried out. These were undertaken in the effort to lessen the cost of feeds which take up a huge portion of the production cost. In a study led by the University of Rizal System under the project, “Developing the Potential of Native Pigs for Organic Meat Production,”

the economic potential of raising native pigs using locally-grown feedstuff was determined to lessen the estimated 70-80 percent of the total cost of production spent on feeds if pure commercial feeds are used. In the study, the feeding value of *Trichantera* as feed supplement for native pigs was tested and showed that the fodder plant can be fed up to 30 percent of the native pigs’ diets, whether as a replacement of commercial rations or as formulated diets, and can be maximized up to 45 percent in combination with high-energy feeds such as corn.

Meanwhile, the University of the Philippines Los Baños implemented “Native Swine for Lechon de Leche Production: Improving Feed Availability through Integration of Sakwa Forage in Coconut-based Production Systems.” The project promoted the utilization of *sakwa* or the mother corm of Gabing San Fernando as the main source of feed for ranging native pigs in Mulanay and San Narciso in the province of Quezon. By integrating the production of *sakwa* under coconuts and utilize them as feed for native pigs, nutrient availability was improved. As a result, average daily gain in weight of the native pigs was increased, thus allowing for a shorter growing period. In two years time, an increase of 50-100 percent in animal holdings and 50 percent increase in income among farmer cooperators were noted. Apart from being used as feed, *sakwa* has also become an additional source of income as it is now being sold at P120/sack.

Recognizing that native animal products are highly preferred and are bought at a premium price by consumers, BAR likewise gave funding support to efforts such as the “Improvement of Processing Technologies for

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Meat and Skins from Selected Strains of Native Pigs” undertaken by BAI’s Animal Products Development Center. Under the project, meat products from native pigs, specifically using the Black Tiaong strain, were developed such as lechon, dried tapa, smoked bacon, native sausage, and pork hotdog. Standardization of recipes based on the standardized formulation of BAI was made for the meat products to guarantee the consistency of quality and preservation of the native pig’s unique flavor and also to ensure the safety of the consumers. Apart from the developed meat products, the project also looked into the possibility of utilizing the native pig skin as a raw material for leather.

R&D collaboration for native chickens

Just like for the native pigs, BAR also supported initiatives that will intensify the production of native chickens in the country.

The need to conserve and preserve the unique identity of the four strains of native chickens



present in Luzon including the Banaba of Batangas, Bolinao of Pangasinan, Camarines of Bicol, and Paraoakan of Palawan paved the way for the implementation of the project, “Comparative Performance and Community-based Production of Native Chickens.” Through a community-based approach, the project aimed to develop progressive native chicken producers in Luzon. Part of the activities was the establishment of a baseline data to determine the production practices and production levels in the different regions that took part in the project. From this, alternative technology interventions on production and reproduction performance were developed and introduced to the farmer-cooperators. These farmer-cooperators were further taught about proper management practices, breeding techniques, and feed supplementation that can bring about improvement of their productivity and incomes. These technologies and interventions were enhanced and fine-tuned to improve production efficiency and sustainability.

BAR’s role in the development of native animals

The above-mentioned

are only some among the many projects supported by BAR involving native pigs and native chickens over the years. Cognizant of the health, social, and economic benefits of these native animals, BAR remains committed to ensuring that support will continue to be given for the development of the Philippine native animals.

Currently, BAR serves as a member of the Technical Working Group of the PNAD Program of the Department of Agriculture. Aside from attending meetings at the top to field levels, and participating



in seminars and workshops for native animal entrepreneurs and stakeholders, BAR is also supportive of PNAD-related undertakings such as PNAD-hosted summits, printing of publications on native animals, and other related endeavors that will further promote the conservation, improvement, and commercialization of the country's native species. ###

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Various reports from proponents submitted to BAR.



Strengthening research... from page 15

- of Banana (UPLB)
- Assessment of Genetic Identity and Integrity of Somaclonal Variants from Tissue Culture-Derived Bananas c.v. Lakatan (USM)
- Evaluation of Activation of Endogenous Banana Streak Virus Sequences in *Musa* Germplasm from Southeast Asia through PCR-based Techniques (UPLB)

The projects stated above have been financially assisted as early as 2014 and are nearing their completion date. These projects are categorized as applied biotech research whose coverage includes pest/disease management, biotechnological conversion and utilization of wastes/by products of several crop commodities, genetic improvement, and genetic diversity.

The bureau's current R&D intervention is the project, "Geographic distribution and genetic diversity assessment of Philippine isolates of *Fusarium oxysporum* f.sp *cubense* through molecular and VGC analysis and reaction of *Musa* hybrids to *Fusarium* wilt", which is being coordinated with UPLB. The project is focused on the assessment of distribution and race identification of *Foc* areas where the pathogen is present. The genetic diversity of the different *Foc* isolates will be determined using molecular markers. Race-specific primers that can be used by other researchers and regulatory officers will also be developed. The existing germplasm collection of *Musa* spp. will be evaluated for reaction to *Foc* race 1 and tropical race 4. As of August 2016, the project was able to collect *Foc* isolates in areas of Northern Luzon and Eastern Visayas specifically in the provinces of Quirino, Cagayan, Isabela, Iloilo and Leyte.

The banana industry will remain challenged by biotic and abiotic production constraints, including social and market issues. Research will be needed more than ever to address these issues for sustainability. With the challenges that the industry faces, science-based integrated production systems are crucial and a truly collective government-industry R&D effort is much needed. ###

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There is no “dark” moment for CACAO, only sweet bites of success

by: MA. ELOISA H. AQUINO

The love for sweets makes chocolates a worldwide craze. May it be as appetizer, dessert, an ingredient in cooking confectionary preparations, as part of designs for special occasions, or as gift presents, chocolate is always a hit. And to every chocolate there is cacao behind it. With the great demand for chocolate, cacao businesses are now earning good returns .

According to the World Cocoa Foundation, people around the world enjoy cacao products as chocolate in thousands of different forms, consuming more than 3 million tons of cocoa beans annually. Furthermore, it was reported that annual increase in

global demand for cocoa products has been consistent at three percent per year for the past hundred years. It is estimated that global cocoa demand will continue to increase at similar levels in the coming years with increasing populations. Asia is in the fortunate position to be the source of cacao products of the future.

ISU leads Region 2 in cacao technology development

“Cacao processing industries have been termed as sun-rise industries and efforts have been made in the last few years to give a big thrust to this sector. The local processing of cacao is recognized as having

an important role in improving farmers’ productivity, and providing better nutrition and improving cacao products’ availability for the domestic as well as the global markets,” Ms. Perlita P. Raymundo, project leader and director of the Cagayan Valley Cacao Development Center (CVCDC) of Isabela State University (ISU) in Echague, Isabela said. However, there is a need to promote technology on cacao processing in order to improve the livelihoods and prosperity of the small farmers in the region.

In the Philippines, particularly in Region 2 where cacao is suitable for growing, attention is now being paid to research activities in order to address the





problems and issues of local cacao production which include:

a) availability of healthy cacao seedlings, b) inadequate knowledge on best production and post production practices, c) processing and marketing aspects.

It is in this context that the ISU team packaged a project proposal titled, “R & D/E Project on Cacao Production, Processing and Utilization in Region 2”, which was eventually funded by the Bureau of Agricultural Research (BAR). It aimed to generate production and post production technologies appropriate for the region. Through this project, cacao production in Region 2 has really taken off as it successfully addressed the concerns of the cacao farmers.

The project conducted varietal trials on cacao using 10 varieties. However, only four (4) cacao varieties, BR 25, UF 18, PBC 123, UIT 1 were found to be adapted to the local agroclimatic conditions of Region 2. The four varieties performed well in the region in terms of number of pods per tree and this encouraged the project to propagate these varieties for distribution to farmers.

Intensive training activities/seminars were conducted on cacao production and the participants were enlightened on the scientific way of growing cacao, its benefits to health, and its contribution to

economic and social development.

As a result of the massive promotion of cacao production, the area planted to cacao and the number of cacao trees increased tremendously. Following the dissemination of cacao technologies by the project, the number of farmers and other stakeholders engaged in cacao production and processing in the region also multiplied.

New cacao products now made in Cagayan Valley

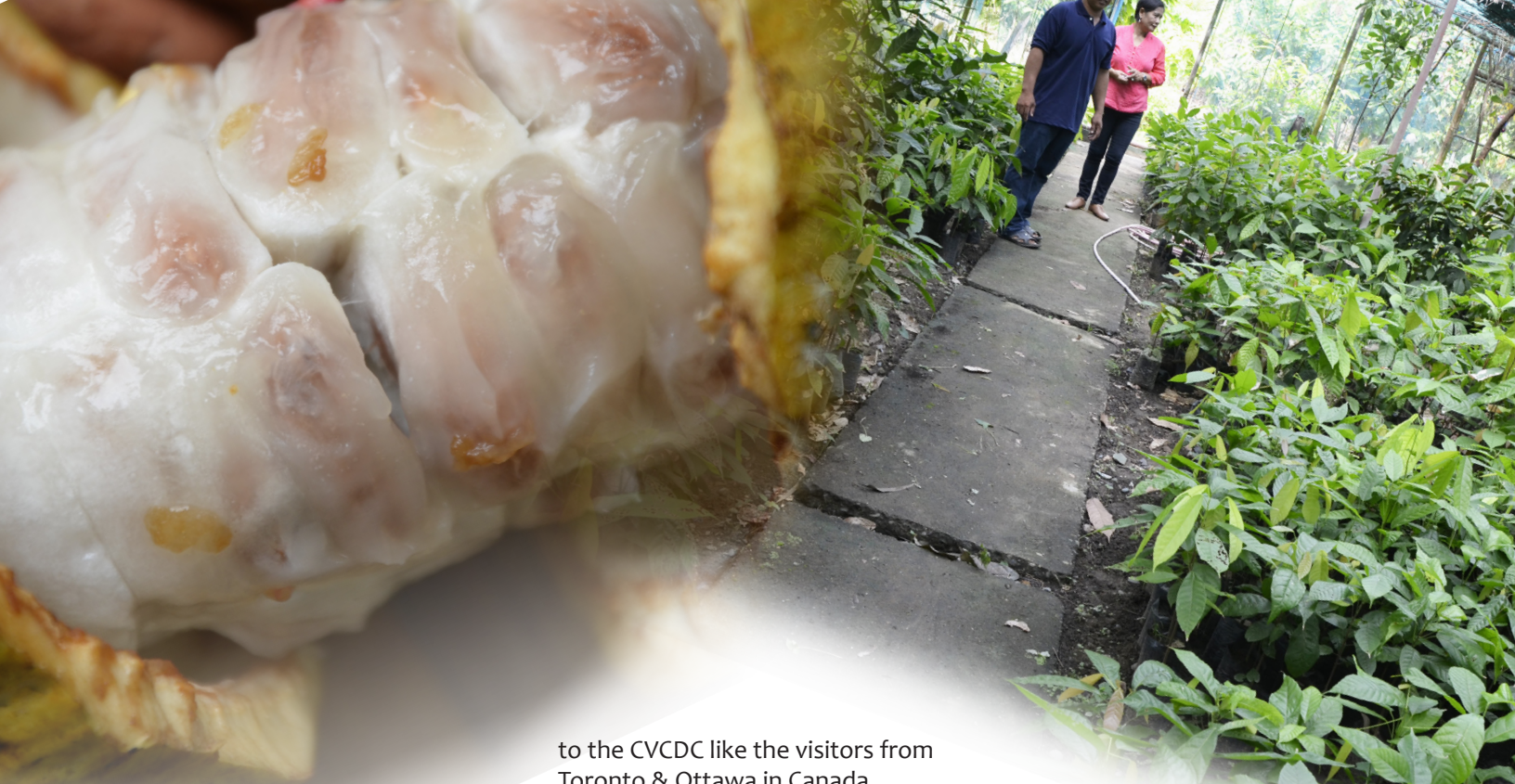
Dr. Raymundo shared that, previously, in the region, very few farmers were processing their cacao beans, and that is why tablea could only be found during trade fairs and sold in only two or three selected stores with very minimal supply. According to her, farmer-processors were experiencing inadequate knowledge on processing cacao beans, lack of or unavailability of good processing facilities, and inadequate supply of cacao beans.

To address the problems of the farmers and realizing that there will be a surplus of cacao

beans in the region once the massively-planted cacao start to bear pods, the ISU team submitted a new package proposal titled, “Promotion of Cacao Generated Technologies and Development of New Products for Improved Livelihood”. BAR provided funds from its National Technology Commercialization Program (NTCP) for the project. The project will develop technologies on processing cacao products that farmers and would-be entrepreneurs will find easy to adopt. The project will also conduct capacity building to increase awareness of the community regarding the benefits of value-adding of cacao products through processing and promotion of generated technologies.

“Through the practice of good cultural management, a tree could produce two (2) to three (3) kilos of fermented beans that can be sold at Php300 per kilo. Hence, a hectare with 600 cacao trees, intercropped with permanent or temporary shade

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trees, could potentially let a farmer earn an average gross income of Php360,000 a year (5 years onwards)", Dr. Raymundo said.

The research team is closely monitoring the cacao plantations of its beneficiaries situated in San Antonio, Sta. Maria, Isabela; Daligan, Jones, Isabela; Masaya Centro, San Agustin, Isabela; Anao, Cabagan, Isabela; and Panang, San Agustin, Isabela.

It conducted six (6) one-day seminars on cacao production and processing for various cooperatives and farmers' associations that include the Isabela Cacao Producers Cooperative in Mallig, Isabela; Calaocan Upland Farmers Association in Delfin Albano, Isabela; Kaddua ti Pinagrang-ay Credit Cooperative in Masaya Centro, San Agustin, Isabela; Barangay Matusalem in Roxas, Isabela; Kavitenon Kooperative in Magleticia, Echague, Isabela; and farmers in Barangay Magassi, Cabagan, Isabela. This service is on top of walk-in inquiries about cacao technology from individuals and entrepreneur groups coming

to the CVCDC like the visitors from Toronto & Ottawa in Canada, and from Germany who showed interest in the cacao business. Due to strong need, the project also conducted a six month "Season-Long Training of Trainers on Good Agricultural Practices (GAP) for Cacao Production and Processing with Food Safety and Quality Management".

One good outcome of the projects, particularly the NTCP-supported project, is the development of cacao product lines for local entrepreneurs. In addition to tabletop-processing of hot chocolate (*sikulati*) and the famous champorado, other products developed include tablea tops & kisses, 80% dark chocolate, yema-filled dark chocolate, polvoron de cacao, pastillas de cacao, tablea-mango tart, tablea-raisins tart, tablea-soybean chips, choco-nut crispy cookies, choco cream pie, and choco custard pie. Other by-products include decorative products made out of fossilized cacao leaves, cacao pods for organic fertilizer and cacao pods for livestock feed. The products were subjected to sensory evaluation by Agricultural Extension Workers (AEWs) trainees

and Farmer Field School (FFS) participants who attended the season-long training on cacao production and processing.

Dr. Raymundo shared that by April of next year, 150 kilos of cacao nibs will be delivered to a popular big food supplier in Metro Manila which sells the produce at Php300 per kilo. A Netherlands-based business man has an order of 500 kilos of nibs. Other potential investors who have become interested to collaborate with the CVCDC want to buy fermented nibs. In addition to this, the team will be exporting to Winnipeg, Manitoba, Canada 100 packs of tablea tops. "We are overwhelmed with the demand for our products. We are happy that products developed by ISU are now able to penetrate the international market. This would not have been possible without the support of BAR which has helped us all the way from our production research to the commercialization of our products. Credit is also due to CocoaPhil which has supported us in terms of marketing," she added.

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BAR brews fresh coffee technologies from the R&D pot

by: VICTORIANO B. GUIAM

The country's coffee production went on a downtrend that began in the late 1980s lasting until 2014. The collapse of the International Coffee Agreement in 1989 removed the quota system among coffee producing and consuming countries and this led to low price levels and forced reductions in coffee hectareage among the producing countries, the Philippines included. In the DA publication, *Coffee: A Commodity Digest*, many gaps and challenges, as well as opportunities, all along the coffee value chain were identified, starting from input suppliers, to growers/producers, postharvest processing, traders/marketers, roasters and secondary processors, retailers, all the way to the consumers and other end users.

The rise of Vietnam and Indonesia as more efficient producers and exporters of inexpensive coffee and the opening up of the Philippines to coffee imports at the beginning of this century also account for the decline of the local coffee-growing industry. Another reason has been the conversion of coffee farmlands to other non-farm uses such as housing and industrialization. Still other causes are climatic abnormalities, shifts to other crops and the continued use of poor agronomic practices by local coffee producers.

According to the Philippine Statistics Authority, the coffee area in the early 1990s was 145,000 ha. By 2014, it had gone down to 117,450 ha. In 2015, small increases showed that the industry was somehow reviving.

BAR has kept busy in developing R&D strategies to make the country's coffee industry competitive once again. In the Research & Development, and Extension Agenda and Programs (RDEAP) for the medium terms, 2011-2015 and 2016-2022, crafted by BAR with its partners in research and in industry, coffee is a priority crop for which proper research should be done. The RDEAP for 2016-2022 now looks at researchable areas, vis-à-vis, sustainable growth & development. It takes the cue from the DA-High Value Crops Development Program whose aims for the coffee industry are: increase productivity and production; improve the farmer's standard of living through diversified high value agriculture; increase rural employment; promote environment-friendly technologies; lessen coffee bean and coffee products importation; and improve incomes of farmers, processors and other stakeholders.

With the RDEAP tracking the supply chain, the researchable areas for coffee for the medium-term, identified as to "subsystem", are:

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| Subsystem | Problem | Researchable Area(s) |
|-------------------------------------|---|---|
| Input | Lack of quality planting materials | Multi-location trials of NSIC-recommended coffee varieties |
| Production | Low yield/productivity | Development of appropriate farming systems that look into: water & nutrient management; Integrated Pest Management (IPM); Good Agricultural Practices (GAP); Integrated Crop Management; and Cropping and farming systems (e.g., agroforestry, intercropping) |
| | | Development of appropriate & cost-effective and climate-resilient production technologies (e.g., Sloping Agriculture Land Technology, Climate-Smart Agriculture, Indigenous Knowledge, harvesting techniques) |
| | No specific Package of Technology (POT) for organic coffee production | Appropriate practices for organic coffee production |
| Post-harvest/processing | Poor quality beans | Drying and other post-harvest practices; Quality improvement of green coffee beans (GCB); Good manufacturing practices |
| Marketing | Low market acceptability | Competitive packaging & promotional strategies for coffee products |
| By-product utilization & waste mgt. | Limited/low utilization of by-products | Utilization of coffee pulp and other by-products |
| Others | Need for sustainability assessment | Carbon footprint, water footprint and energetics of pulp |
| | Lack of standards for specialty coffee | Establishment of quality standards & certification process for Civet coffee and organic coffee |
| | Food safety and quality | Identification of chemical & toxin contamination of coffee beans |

To date, BAR has given financial support to R&D initiatives being carried out by various R&D institutions. These are:

1. Technology Piloting and Commercialization of Microcontroller-Based Coffee Roasting Machine. 2011 (completed). Cavite State University (CvSU) National Coffee Research, Development & Extension Center (NCRDEC).

Technology promotion for roasting machine for commercial coffee processing to include fabrication, demonstration, pilot testing and field performance evaluation of the machine designed for small-scale businesses (5-10 kilos of roasted coffee in 20 minutes).

2. Production and Processing of Premium Quality Coffee Liqueur and Packaging Development for

the Niche High End Market. 2014 (on-going). DA-RFO4a - Quezon Agriculture Experiment Station.

Improvement of Barako Coffee Liqueur using the Batangas processing technique and further filtration to achieve clarity and smoothness comparable to premium brands to produce premium coffee liqueur for the high end niche market.

3. Utilization and Promotion of Developed Postharvest (PH) Technologies for Sustainable Community-Based Coffee Processing Enterprise. 2015 (on-going). Philippine Center for Postharvest Development & Mechanization (PhilMech).

Technology promotion of the PHilMech PH System for Coffee; establishment of effective technology and business management through farmer-



led community - based coffee processing enterprise.

4. Climate Change (CC) Adaptation and Mitigation Program for Coffee Growers in the Philippines. 2013 (on-going). CvSU.

Assessment of CC impact on coffee production in selected coffee-growing areas in the Philippines; generation of information on awareness, perception & adaptation practices on CC of coffee growers in selected coffee-growing areas; and promotion of CC adaptation & mitigation practices

5. Piloting Arabica Coffee Rooted Cuttings as Plant Materials in the Highlands. 2015 (on-going).

BPI - Baguio National Crop R&D Center.

Mass propagation of quality Arabica coffee rooted cuttings to increase the supply of planting materials; expansion of clonal gardens to serve as sources of plant materials and set-up demo farms in strategic locations to pilot the performance of rooted stem

cuttings in high, medium & low elevations

6. Characterization of Philippine Coffee Varieties. 2014 (on-going). CvSU.

Physical, mechanical, chemical, biological and other functional characterization of four Philippine coffee varieties; Development of integrated coffee information database.

7. Land Resources and Suitability Assessment of Strategic Production Areas for Cacao and Coffee. 2015 (on-going). Bureau of Soil and Water Management.

Identification and characterization of strategic areas for coffee

8. Effects of Pests, Diseases, Biocontrol and Weather on the Phytochemical Production of Coffee and Cacao in Mindanao. 2016 (on-going). University of Southern Mindanao.

Identification of emerging pests & diseases of coffee & cacao in Mindanao (symptoms

& signs, disease severities, population dynamics, and insect pest damage); development of biocontrol strategy; and conduct of phytochemical & proximate analysis of undamaged & damaged coffee & cacao beans as affected by pests & diseases.

BAR has also collaborated with other organizations in coffee-promoting endeavors. One is the R&D Forum on Coffee & Cacao conducted in 2012 with Options, Inc to encourage local investments in coffee and cacao to encourage import substitution. Another was the Mindoro Arabica Coffee for Agro-Forestry Enhancement Project: A PPP (Public-Private Partnership) in 2013 with the Provincial Government of Oriental Mindoro, Earth Rights Peoples Rights, Mac Nut Philippines, the National Commission on Indigenous Peoples, and Indigenous Peoples/ Upland Farmers Organizations to promote Arabica coffee plantation and enhance coffee production as an agribusiness enterprise in Mindoro where 120,000 Arabica coffee seedlings were planted

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in 60 ha of open/barren and coconut areas as the DA's contribution to the National Greening Program and to create livelihood opportunities for some 75 farmers.

With the hope bright for the return of coffee as a major economic crop, BAR and its research partners are doing their part in perking up the industry. "With renewed commitment and support from both the government and private sectors, it's not impossible to realize the dream of the Philippines becoming a major producer of coffee once again," said Dir. Eleazar in the 2012 Coffee Day Celebration in CvSU. ###

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There is no "dark"... from page 22

Interviews with farmer-beneficiaries



management graduate from a prestigious university in Manila, Krizelle Karen Lactao decided to return to her hometown to start a business at the young age of 28. Her family owns a 10-hectare rice farm area in Maliig, Isabela and, upon learning the potentials of cacao, she decided to close her previous business as she found a new love in farming. CocoaPhil introduced her to Dr. Raymundo. Now she serves as chairman of the Isabela Cacao Producers Cooperative. The 30 members have attended trainings on the technical and management aspects of production and Good Agricultural Practices (GAP) at ISU. The cooperative is now managing a nursery that presently houses 8,000 seedlings but which has a capacity of 20,000 seedlings.

Married to a seaman, Juliet Cayanga Guieb, graduate of BS Mass Communication, of Panang, San Agustin, Isabela has given thought of their retirement plan. When they heard about the cacao project at ISU, the couple visited the project and was amazed that cacao is also adapted in Isabela. Noting their interest in cacao production, the project gave them 500 seedlings to start with. They attended trainings/seminars conducted by the project and, with adequate technologies gained from the training, they ventured into cacao production. At present, they are now maintaining cacao planted in their 8.5 hectare farm. Juliet works in a credit cooperative where a number of its 490 members also saw the income potentials of cacao production and processing.



R&D cultivates opportunities to expand the Philippine rubber industry

by: DARYL LOU A. BATTAD

Rubber in the Philippines is regarded a high value crop due to the unrelenting high demand for it in the global economic arena. A resource with many practical uses, it's no wonder rubber is considered the most profitable agro-industrial crop in the world.

Given its strong commercial possibilities, many major rubber-producing countries have intensified their production of rubber to cope with the increasing market and user demand. Here in the Philippines, efforts have doubled in the recent years in the hopes of strengthening the country's hand in the global rubber industry.

Key rubber R&D players

Towards the goal of a vibrant rubber industry, the Department of Agriculture (DA) through its research arm, the Bureau of Agricultural Research (BAR), has been doing its share in the advancement of rubber through research and development (R&D). This has been evident in the various researches supported by the bureau with significant results which, by far, have made major impact for the rubber growers of the country.

Done through partnerships with different agencies, these efforts paved way for BAR to engage in collaborative work that have focused on clonal improvement, integrated pest and nutrient management, and tapping panel dryness management that are geared towards one goal: to enhance the production of natural rubber specifically in the Mindanao

region where it is mainly produced.

The University of Southern Mindanao (USM), the University of the Philippines – Los Baños (UPLB), and the Department of Agriculture – Regional Field Offices 4B and 11 have so far led pioneering R&D initiatives on rubber supported by BAR whose general objective is to contribute to increased rubber production, in terms of area and yield, and, consequently, to the economic growth and social development in the countryside.

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Harvesting success *from* seaweeds

by: MARA SHYN M. VALDEABELLA

With seaweeds' wide range of uses from food and fertilizer to cosmetic and pharmaceutical industries, seaweed farming has rapidly grown into an industry that offers sustainable income and employment to fishers. The Philippines, one of the world's biggest producers of the semi-processed seaweed product called Carageenan, cites seaweeds as its top aquaculture commodity, followed by milkfish and tilapia.

Seaweed farming has been generating livelihood for many coastal communities in the country since the 1970s. With seaweed farming not entirely limited to men, the industry has also opened livelihood opportunities for women, with some becoming economically active for only the first time.

Women Winning at Seaweeds

This has been the case for the members of the women's organizations tapped by the Bureau of Fisheries and Aquatic Resources (BFAR)-Region V in the implementation of the project, "Product Development/Improvement and Commercialization of Seaweeds in Bicol Region".

Funded by the Bureau of Agricultural Research (BAR) under the National Technology Commercialization Program (NTCP), the project tapped existing organizations such as the Tabaco Faith International Church (TFIC) Ladies Association, Tobacco, Albay and Rural Improvement Club of Layog, Barcelona, Sorsogon, Through the seminars and trainings that the team of BFAR V Research Manager Aida Andayog conducted, the members of these organizations were taught

how to formulate, produce, develop, package and market food products processed from seaweeds.

"We also conducted trainings and held seminars to educate farmers and the organizations' members on the principles of good manufacturing practices (GMP) and sanitation standard operating procedures (SSOP)," says Andayog. GMP and SSOP are prerequisites of the Hazard Analysis Critical Control Points Program (HACCP), an internationally recognized guarantee of the quality of food products.

Aside from these, Andayog takes pride in the tests that the group successfully conducted to really ensure the quality of their seaweed products. "Our products underwent sensory evaluation to assess the products' appearance, odor, flavor and textures, and, more importantly, their nutritional value through nutritional evaluation. We also conducted microbiological analysis of our products, such as seaweed juice, pickled seaweeds and nata de seaweeds, as well as nutritional analysis of various seaweed-finished food products," Andayog adds.

According to Nimfa B. Moreno, a seaweed processor and member of the TFIC Ladies Association, not only has the project provided the seaweed processors with additional knowledge on the processing of seaweed for food, thus increasing their income opportunities, but has also taught the people in the communities to use their time well by taking part in seaweed-related ventures. She says the biggest benefit of the project was that it made the people realize that they can help themselves through

entrepreneurship, and this helps make sure that the purpose of the project will continue even after the project is concluded.

Seaweed-based products expand into enterprises

Aside from the commercialization of seaweeds and processed seaweed products in Bicol, the project also aimed to establish village-level seaweed production and processing enterprises, providing greater chances for Bicolano fisherfolk and seaweed processors to engage in agribusiness. Thus, to further pursue this goal, the project, "Commercialization of Seaweed Products and Other Fishery Value-Added products in Bicol Region," was implemented by BFAR-Region V.

The demand for seaweed-based products can be easily met by the six Bicol provinces now actively engaged in seaweed farming: Albay, Camarines Sur, Camarines Norte, Sorsogon, Catanduanes, and Masbate, with Sorsogon being the top producer due to its vast coastal waters. To encourage even more fisherfolk and coastal communities to engage in seaweed farming and product development, various techno-demo and training activities were conducted by the projects.

The uniqueness, taste, and nutritional value of Bicol-made seaweed products, which Andayog noted as their competitive advantage, play a significant role in commercializing and marketing them. According to her, "Seaweeds are nutritious. They can help build and sustain the broad nutritional requirements and balance of vitamins, minerals and vital

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R&D cultivates...from page 27

Three prime examples of these rubber R&D efforts are described briefly.

Commercialization of rubber through nurseries, budwood gardens

Implemented by DA-RFO 4B through its research division, this project specifically aims: to develop and promote rubber towards commercialization in the provinces of Oriental and Occidental Mindoro; to produce and make available quality rubber budwood/budsticks and planting materials; and to develop information, education, and communication (IEC) materials in the effort to raise awareness on the potentials of rubber in the region.

With sites at the Agricultural Demonstration Center (ADC) in Barcenaga, Naujan, Oriental Mindoro, and at the Oriental Mindoro Agricultural Experiment Station (ORMAES) in Acate, Victoria, the project established rubber budwood gardens with 2 clones in 100 hills and 5 clones in 444 hills in ORMAES and ADC, respectively.

With the establishment of the rubber nurseries, DA-RFO 4B was able to bud a total of 14,000 seedlings in both sites. Side experiments were also carried out in ADC to determine the most suitable clones for the two Mindoro provinces. Further, clonal adaptability trials for five high-yielding clones of rubber were conducted in production areas in the municipalities of Victoria and Roxas in Oriental Mindoro.

Such accomplishments led to the availability of quality planting materials to interested clientele of rubber particularly potential growers in the region. For the smallhold farmers, this means that stable, sustainable, and profitable farming is within reach.

nutrients on which optimum health and vitality depend.”

In 2012, the TFIC Ladies group produced about two tons of pancit fortified with seaweeds which were marketed and sold in Manila and Cebu, even reaching as far as South Korea. Developed and packaged seaweed products were also displayed and marketed by the organization in various trade fairs and exhibits for product promotion and market-matching.

Seaweed pancit and nata de seaweed have both give the project beneficiaries return-on-investment (ROI) of 65 percent on the average, with annual net income hitting P93,600 and P15,360, respectively. Seaweed pickles yielded a net income of P34,512 with a 70 percent ROI.

Other food products

derived from seaweed also posted high ROIs: seaweed marmalade (89%), candied dried seaweed (86%), seaweed chips (79%), seaweed cracknels (67%), seaweed chocolate (85%), seaweed tart (71%), seaweed morcon (94%), seaweed longanisa (66%), fish lumpia with seaweeds (76%) and yema with seaweeds (55%).

Seaweed products continue to provide extra income, not only to the women of the TFIC, but also to other organizations that BFAR Region V has trained. And, as these and other products to be developed improve in taste and quality, it will not be long before these become national and international hits, and good sources of health and wellness, income, and pride for the Bicolanos. ###

Intercropping Para rubber (*Hevea brasiliensis*) with indigenous trees

The project team from the University of the Philippines – Los Baños (UPLB) College of Forestry and Natural Resources sees rubber as a potential base for crop diversification. Located in selected sites in Laguna, Quezon, and Batangas, which were classified as marginal lands, the project is an attempt towards rehabilitating marginal upland areas by establishing mixed plantations of rubber and indigenous tree species.

The project specifically targets interplanting good clones of rubber for quality latex production with indigenous non-traditional timber species that are fast-growing, easy to manage, marketable, but are not commonly propagated.

Utilizing promising clones of rubber such as RRIM 600, PB 311, PB 260, PB 330, and USM 1 along with indigenous plants, the plantation now promotes biodiversity which has been found to be effective in controlling pest and disease occurrences. Each crop combination has 15 rubber trees and 10 indigenous tree species considered as treatments that include batino, batikuling, malapapaya, and cacao.

Planting of agricultural crops were carried out with considerations of the agro-climatic conditions of the sites. These were planted in between rubber trees and fast-growing indigenous tree species. Papaya, *Gabing* San Fernando, string beans, pechay, banana cultivars (such as turdan, lagkitan, and saba), Heliconia flowers, bell pepper, sitao, *talong*, okra, and cassava were planted in project areas of the Agroforestry Learning Laboratory in Sitio Kapus, Brgy. San Rafael in Santo Tomas, Batangas; in the Boy Scout of the

Philippines reservation in Jamboree, Los Baños, Laguna; and in San Jose, Sta. Cruz in Laguna.

The project continues its advocacy of biodiversification through planting rubber trees as reforestation species to minimize the degradation of our forest lands, rejuvenate marginal and barren lands, and increase the participation of the community in rubber production while reducing their dependence on forest products.

Molecular Marker (SSR) protocol for Rubber

The project, "Development of Molecular Markers for Identification and Authentication of Rubber (*Hevea brasiliensis*) Clones", aims to develop procedures for reliable, rapid detection, and sorting of rubber planting materials, to establish molecular markers for identifying genotypes, and to package technologies that will be made available to rubber stakeholders.

Implemented and pioneered by the University of Southern Mindanao (USM) Agricultural Research Center, the clone selection project targets to have successful rubber plantations by identifying varieties as true-to-type before they are distributed to farmers for planting. Having the proven genuine varieties assures the growers that they have the full genetic potentials of the high-performing plants at their disposal.

To achieve this goal, 107 rubber clones were collected and characterized phenotypically. Such characterization defined the clones' morphological characteristics like leaf characters, stem and crown shape and intensity, branching habit, and trunk and bark characteristics. It also established genetic diversity, molecular groupings and SSR markings which are used in clone

authentication of existing rubber germplasm in the Philippines.

This study led the way in distinguishing the different clones of rubber which assists rubber breeders in the selection for desirable parents and the traits that can be improved and disseminated.

The results of this project demonstrated the relevance of using molecular techniques in evaluating and identifying rubber clones. Moreover, the primers tested can be useful tools for detecting variation even at the early stages of plant development which can be most advantageous for commercial purposes.

BAR and rubber R&D

Generally, the rubber program of the DA targets an increase in productivity by achieving cost efficiency through higher yield, the use of new technologies, and enhanced on-farm investments to expand rubber areas while value-adding quality rubber and rubber products. When achieved, this will surely result to increase in income and enterprise sustainability of the farmers, processors, and other stakeholders.

With significant growth in rubber production areas in the Philippines from 128,337 hectares in 2009 to 217,687 hectares in 2014, BAR is well aware of the already tremendous effort being made by both public and private sectors. However, the still growing demand for rubber in the world market calls for even more intense effort among the stakeholders to further pursue innovations in rubber productivity particularly through R&D. With this, BAR will continuously establish partnerships with public and private sector entities in the pursuit of a strengthened and competitive Philippine rubber industry. ###



Community-based Participatory Research or CPAR is one of the banner programs of the Bureau of Agricultural Research (BAR), which is a location-specific research cum extension initiative that deals with improved farming systems technologies. The number of farmers adopting the agricultural technologies introduced through CPAR is continuously growing. One of such farmer-adopter is Mr. Villafuerte Camat of Lamut, Ifugao. As CPAR introduced the organic integrated farming system, Mr. Camat is one who adopted the technologies. Now, he operates an organic integrated farm which produces rice, tilapia, swine, chicken, and vegetables. It also became a learning site for farmers accredited by the local government unit of Lamut and the Agricultural Training Institute. *(Photo by Ddeleon)*



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