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Implementing R&D Programs that Matter

R&D NOTES



Implementing R&D Programs that Matter

by DR. NICOMEDES P. ELEAZAR, *CESO IV*

The agriculture and fisheries sector plays an important role in the economic progress of every nation. For the Philippines, it is the lifeblood of its people particularly those in the rural areas wherein majority depends on the sector for food and livelihood.

The Department of Agriculture, as the government's lead agency responsible for promoting agricultural and fisheries development, provides the policy framework, investment, and support services to ensure that it is competitive and it contributes to the overall economic growth of the country. In short, it must ensure first and foremost that there is sufficient and affordable food for its people. "Rice and fish for all," as Agriculture Secretary Proceso Alcala would simply put it. Since rice and fish make up the basic diet of most Filipinos, it must be the agriculture's key mission result area of the Department.

To realize this, DA must provide the policy, the investment, and the support service thereby

implementing national programs that will answer specific needs of the sector. One important support service is through Research and Development (R&D). To make the agriculture and fisheries sector productive and competitive, it must craft R&D agenda and strategies needed in the implementation of programs that promote productivity enhancement, develop environment-friendly and efficient technologies throughout the value chain of food production.

The Bureau of Agricultural Research (BAR), as DA's lead arm for R&D, is taking all this into account. The bureau has realigned its RDE plans and programs to harmonize with DA's programs. This fourth quarter issue of the BAR R&D Digest follows that track as it discusses some of the DA-driven programs that BAR is currently undertaking. All the programs discussed in this issue are focused on the R&D component only to provide the stakeholders a better grasp on the various initiatives of the bureau.

In implementing its programs, BAR always takes into account the five thrusts of R&D to

ensure that the initiatives its taking is always in synergy with that of the Department. Among its R&D thrusts include: 1) food security, 2) increased productivity and profitability, 3) poverty eradication and people empowerment, 4) sustainable agricultural development, and 5) global competitiveness.

All the 11 BAR R&D Programs discussed in this issue are synergistic to the R&D Thrusts. These are: Organic Agriculture, Climate Change, Biotechnology, Indigenous Plants for Health and Wellness, Adlai, Rubber, Biofuels, Rainfed Agriculture, Apiculture/ Beekeeping, Soybean, and Breadfruit.

These R&D programs, although led by BAR, are multi-sectoral efforts of various R&D partners both international and local. They serve not only as responses to the various challenges of the agriculture and fisheries sector, but more importantly, they serve as testimonies that government programs works in the hope of improving the lives of farmers and fishers in the country. ###



R&D: Providing the Cutt

by VICTORIANO B. GUIAM

In the vision of the Philippine Development Plan (PDP) for 2011-2016, productivity enhancements are seen as making agriculture and fishery products more competitive and contributing to the growth of the other economic sectors. Increasing productivity and incomes of agriculture and fishery-based households and enterprises is a major strategy of the PDP towards modernizing the sector and attaining the goal of improved food security. Increasing this particular sector can lead to the improvement of the quality of lives of Filipinos and capital accumulation for investments.

Among the measures that need to be undertaken to implement the PDP strategy is the strengthening of Research, Development and Extension (RDE) through: 1) formulating a reliable and responsive National RDE agenda; 2) increasing of investments in integrated RDE programs that promote productivity enhancement, develop environment-friendly and efficient technologies throughout the value chain, in partnership with higher education institutions, LGUs, private and business sector; and 3) encouraging the participation of farmers, fisherfolk

and their organizations in research and promotion activities.

A major concern that cannot be ignored by the agricultural sector at the risk of losing its gains is its vulnerability to climate change. The impact of severe weather and the periodic occurrence of climate variability and its extreme conditions since the 1980s are partly to blame for erratic growth in national agricultural gross value-added (GVA). This is complicated by uncontrolled environmental degradation and loss of agricultural biodiversity. Therefore, an additional strategy under the PDP is on increasing the agriculture sector's resilience to risks that may be brought about by climate change and extreme weather events.

BAR has realigned its RDE plans and programs to follow the lead of the Department of Agriculture (DA) in responding to current challenges and emerging issues in agriculture. Guidance is now clearer with the promulgation of Secretary Proceso J. Alcala's DA Agrikulturang Pinoy (or Agri-Pinoy) Framework, the foundation on which the DA's programs and initiatives are to be built upon and implemented.

Concomitant to following the DA's lead, BAR has been entrusted as the national focal agency of various RDE programs of DA with an initial seven programs, namely: Organic Agriculture, Climate Change, Biotechnology, Indigenous Plants for Health and Wellness, Adlai, Rubber, and Biofuels; and, later, four more programs: Rainfed Agriculture, Apiculture/Beekeeping, Soybean, and Breadfruit/Rimas, for a total of 11 RDE-supported DA programs.

A key feature is that RDE activities are being focused, not only on program objectives and the efficient use of RDE resources, but also on tangible, long-term results and impact. The linking of RDE outputs to value-chain systems is also a major consideration. Thus, BAR's efforts are running in parallel with the thrusts and programs of the DA.

The RDE programs that BAR has developed in support of the DA's efforts are:

Organic Agriculture. Venturing into organic agriculture encourages the use of safer and more sustainable ways of producing food. Tasked to lead the Research, Development and Extension component of the National Organic Agriculture Program (NOAP), BAR is responsible for coordination among key



ting Edge of DA's Programs

government agencies and private institutions to consolidate activities towards the implementation of unified and integrated RDE plans and programs on organic agriculture.

Climate Change. As events unfold, climate change is proving to be a challenge for the agriculture and fisheries sector. BAR's Climate Change RDE Program is focused on short- and long-term adaptation and mitigation strategies in addressing the most pressing issues related to climate change.

Biotechnology. With its potential to address current limitations in food production, biotechnology is perceived as providing novel solutions for addressing food security issues and reducing poverty. It provides farmers other options towards increasing production and improving productivity. In support to the Agriculture and Fisheries Biotech R&D program, BAR, through the DA-Biotechnology Program Implementation Unit, has facilitated the funding of R&D projects under applied biotechnology research, regulatory research, capacity building, program administration and IEC/ policy advocacy being implemented

by different R&D institutions.

Indigenous Plants. The need to explore the untapped potentials of the country's indigenous plants was the reason for launching the Indigenous Plants for Health and Wellness Program. Through the program, it is hoped that indigenous plants in the Philippines can be utilized, promoted and developed as food and/or sources of materials for the nutraceutical, pharmaceutical and cosmeceutical industries.

Adlai. The promising potentials of adlai as a complementary crop to rice and corn paved the way for its inclusion among the priority commodities under the DA's High Value Crop Development Program (DA-HVCDP). With the creation of the Adlai R&D Program, various initiatives have been undertaken that push for the development, promotion, and utilization of adlai as a crop that will complement major staples such as rice and corn.

Rubber. Because of the potential and importance of rubber to the economy which provides livelihood to about 38,000 families and the fact that we will be increasingly dependent on outside sources if nothing is

done, the DA set into motion a plan that promises to pole vault the country's rubber industry to a more favorable position. BAR has been supporting and organizing different rubber-related RDE endeavors in the country as the lead agency in the Research, Development and Extension component of the said program.

Biofuels. Utilizing biofuels is a way to reduce the country's dependence on imported fuels while considering the health of the people and the environment. As a proactive member agency of DA's National Biofuel Feedstock Program, BAR has supported projects that will enable the development of viable and quality feedstock through research and development.

Rainfed Agriculture. Rainfed agriculture is an agricultural production system that relies on rain water for farming activities. Seeing its potential for increasing productivity sustainably, the Philippine Rainfed Agriculture Research, Development and Extension Program (PhiRARDEP) was created. The program is being developed by BAR in close technical



Strengthening Food Production with Organic Agriculture

by PATRICK RAYMUND A. LESACA

In 2010, the Bureau of Agricultural Research (BAR) made a major shift in its program thrusts when Proceso J. Alcala was named Secretary of the Department of Agriculture (DA). Secretary Alcala had brought with him his personal advocacy and reinforced his belief on the importance of organic farming in the country being the principal author of Republic Act (RA) 10068 also known as the Organic Agriculture (OA) Act of 2010. As the law provides for the development and promotion of OA in the Philippines, it thus became one of the major programs of BAR.

Republic Act (RA) 10068 provided the legal mandate for BAR to take on the specific research and development (R&D) initiatives of the Organic Agriculture program of DA. BAR takes the lead in coordinating with the Departments of Agriculture, Agrarian Reform, Science and

Technology, Education, and Interior and Local Government, including strategic agricultural-based state universities colleges (SUCs) and private organizations to develop, enhance, and support and consolidate activities related to OA technologies and the formulate and implement a unified and integrated organic agriculture research agenda from the national to the field level.

BAR was further tasked to lead and coordinate the OA research, development, and extension (RDE) plans and programs and to organize the OA-RDE Network which is composed of research and educational institutions, local government units (LGUs), non-governmental agencies, and recognized associations of interest such as organic fertilizer manufacturers and distributors, agricultural engineers, agriculturists, soil technologists, and farmers.

BAR and Organic Agriculture

Prior to the implementation of the act, BAR had already conducted consultation workshops and roundtable discussions among OA proponents and stakeholders in addressing the gaps, advantages and benefits of OA to the farming sector. As a result, the “Gap Analysis on R&D of Organic Agriculture: Focus on Organic Fertilizer” was launched in July 2009.

In 2010, the bureau submitted to DA the “Organic Agriculture Research and Development Program” whose primary objective is to coordinate and support the endeavors of concerned stakeholders in conducting R&D projects in the country in support to RA 10068 and to review and validate the list of available technologies, tools and practices in organic agriculture.

With the implementation of the Act, the bureau intensified its coordination function among various agencies of the government (including



DA), SUCs, private organizations (PO) and various research institutions through the conduct of workshops, consultations, national assessments and reviews.

During roundtable discussions, several BAR-funded OA projects were evaluated and went through series of deliberations with the purpose of establishing the advantages of OA farming. These projects, on a per category basis (crops, livestock and poultry, fisheries), were peer-reviewed by a pool of experts and subjected for modifications. The output of the activity formed part of the updated OA RDE Agenda and Program.

OA Impact Projects

Forty-seven organic agriculture projects were funded as of October 2013, of which 40 are already completed and terminated. From the 40, 7 are implemented by Regional Integrated Agricultural Research Centers, 30 by SUCs, 3 by private sector, 6 by DA-Bureau of Plant Industry, and 1 by Cotton Development Authority.

The status of on-going OA R&D projects served as baseline in assessing the current implementation of the OA R&D agenda towards a more focused direction in the attainment of the National Organic Agriculture

Program's (NOAP) vision of OA contributing to overall agricultural growth and development of the country in terms of sustainable management of natural resources, climate change adaptation and mitigation, competitiveness and food security.

A project, "Bio-Enterprise Development in Organic Agriculture Sector through Public-Private Partnership: Action Research, Policy Analysis and Advocacy, and Entrepreneurship Training Program," was developed by Dr. Flordeliza A. Lantican and Dr. Isabelita M. Pabuayon is one of the BAR-funded projects and is to be implemented in three phases. Dr. Lantican and Dr. Pabuayon articulated the role of public and private partnership in implementing agricultural and rural development projects/programs which is critical for the sustainability. One modality pointed out was the collaboration among academic institutions like University of the Philippines Los Baños (UPLB) and farmer's groups and people's organizations, including cooperatives in enterprise development. Bio-enterprise development, through the production of organic fertilizer and other farm inputs as well as products like organic rice and vegetables, provides a key entry point to jumpstart the implementation of the OA Act.

To substantiate the merits of the project, the proponents conducted benchmarking and value chain analysis for organic rice, vegetables (ampalaya, eggplant, tomato, lettuce, and pole sitao), organic fertilizers and pesticides. They also identified the best production and post harvest practices/ technologies, processing, and marketing schemes. They were also able to identify, analyze and suggest policy reforms to address issues and requirements relating to certification, labeling, product standards, and trade of organic products. Furthermore, the proponents identified existing business development services (BDS) relating to technologies, financing, input sources, and potential markets that could be tapped by farmer cooperatives for selected members and for the conduct of training on cooperative management

among the farmer cooperatives.

To be successful, a bio-enterprise requires efficient systems in the input procurement, production, transport, processing, storage, packaging, and distribution to ensure minimum cost and provide the right quality and quantity of products demanded by the market. Expected benefits are improved farm productivity, better quality and marketability of farmers' produce, favorable prices for producers, affordable prices to consumers, and adequate supply of raw materials and inputs for commercial business operations.

The study was piloted in Region 3 (Zambales, Tarlac, Nueva Ecija, Bulacan, Pampanga, and Bataan); in Region 4a (Cavite, Laguna, Batangas, Quezon, and Rizal); and in Region 4b (Oriental Mindoro, and Marinduque). These regions were selected due to their significant production of rice and vegetables; access to organic agriculture technology by farmers (Central Luzon State University, UPLB and other institutions); and proximity to urban markets (Metro Manila, Calabarzon and suburban areas).

Based on the progress and findings, the project leaders recommended that there should be an aggressive information awareness campaign and capacity-building for farmers and other stakeholders; redesign of training programs to include entrepreneurship, marketing and business planning; assessment of OA facilities and equipment provided through grants and donations; sustained support for strengthening cooperatives and farmers' associations; and continued conduct of hands-on training on production and post-production practices for farmers and other farm workers, among others.

The Phase I of the bio-enterprise project and its impact to the OA community was made possible through the funding support of BAR. It was implemented in December 2012 by the College of Economics and Management, UPLB in collaboration with UPLB Foundation Inc. ###

Weatherproofing Agriculture with Climate Change R&D

by PATRICK RAYMUND A. LESACA

The year 2009 will be remembered as a time when we harvested the winds as large swathes of the country were devastated by several powerful typhoons. Amid the gathering storms, the government crafted outlines as response to these abrupt changes in weather in the form of the Climate Change (CC) Act of 2009 (RA 9729). In heeding the call of this law to formulate the strategy and the programs of action on climate change, the Department of Agriculture (DA) crafted its own CC advocacies and programs in the pursuit of a climate change-safe yet productive agricultural environment. Its bureaus and agencies followed suit with their own CC agendas premised on their respective thrusts and given mandates.

BAR's Climate Change Program

Already mindful of what could place Philippine agriculture in peril, the Bureau of Agricultural Research (BAR), in October 2009, took initial steps and convened experts for a series of roundtable discussions and consultations on how BAR and the national agriculture and fisheries research and development (R&D) system could contribute to the adaptation and mitigation strategies of the government. As a result, the Research, Development and Extension Agenda (RDE) for Climate Change Program was drafted. The Program was launched in the later part of 2010 as one of the major programs of BAR.

The Program covers specific action plans or components designed to give full attention to the realization of short-term adaptation strategies;

long-term adaptation strategies; other adaptation strategies which are to be taken from the DA CC Program; and mitigation strategies. These components, which are confined within the precepts of R&D, address the ill effects of the changing weather phenomenon and shall serve as the blueprint for the effective implementation of climate change-related endeavors.

The bureau's contribution and accomplishments can be categorized as support to the R&D efforts of the government and other stakeholders like state universities and colleges (SUCs), scientific and research communities, international institutions as well as private sector-led organizations. Since the inclusion and implementation of this major program, BAR has funded 22 climate change-related projects (11 short-term adaptation, 4 long-term adaptation, 6 short-term and long-term adaptations, and 1 mitigation).

Projects are classified as "short-term adaptation" strategy when significant outputs are generated in a span of one to three years, whereas projects needing more than three years to produce significant results are classified as "long-term adaptation". One specific project with both short-term and long-term adaptation strategies, which is focused on the management of small-scale fisheries for sustainable resources and the assessment of risk and vulnerabilities of selected areas and the respective adaptation strategies of exposed communities, is the WorldFish project with BAR.

BAR and The WorldFish

Collaboration with international institutions is one of BAR's organizational strategies in the development and delivery of R&D interventions and is particularly true in undertaking fishery projects. The partnership with the WorldFish Center has led to the successful completion of a BAR-funded and supported project titled, "Economic Analysis of Climate Change Adaptation Strategies in Selected Coastal Areas in the Philippines."

Dr. Maripaz L. Perez, WorldFish Center Regional director for Asia and country manager in the Philippines, is also the main proponent of the project. Other collaborating agencies include: Bureau of Fisheries Aquatic Resources (BFAR) II, VIII, and X; Cagayan State University (CSU); Department of Science and Technology (DOST) II, VIII, and X; Mindanao State University-Iligan Institute of Technology (MSU-IIT); and Visayas State University (VSU).

The project generally aimed to study and assist selected coastal communities to gain better understanding of the risks associated with climate change and assess adaptation strategies and policy options to address these risks more efficiently. The specific objectives of the project are to: 1) validate and assess climate change impacts on selected coastal areas in the Philippines; 2) measure the economic costs and benefits due to specific effects of climate change in selected coastal areas in the three regions; 3) assess adaptation strategies to climate change in the selected coastal areas; 4) recommend viable adaptation options; and 5) explore and identify emerging issues in the assessment of vulnerability and



economic analysis of adaptation based on the results of the regional case studies.

The project was implemented from March 2012 to February 2013 and covered three coastal areas in the Philippines namely: Babuyan Channel in Region II, Sogod Bay in Region VIII, and Macajalar and Iligan Bay in Region X.

The proponents, based on their completed report, articulated that coastal communities are among the most vulnerable sectors to CC. For one, these communities are among the poorest of the poor thus their condition constrains them to fully insure themselves against climate-induced hazards. Coastal areas have long felt the impacts of over-fishing and needless destruction of coastal ecosystems. However, the advent of climate-induced hazards has added a new dimension to these existing problems. At the local government level, for example, current state of funds, expertise, and technical capability are already limited. This restricts the LGUs' ability to identify and prioritize effective adaptation strategies to climate change and implement public and planned adaptation measures that could otherwise protect and improve the resiliency of these coastal communities.

The methodologies applied presented rapid and systematic ways of gathering and analyzing information

relevant for local level CC planning.

According to the proponents, the project is a combination of participatory, community-based rapid assessment of hazard and vulnerability backed up by more technical and rigorous empirical economic analysis. The methodologies also further allowed an insightful analysis of vulnerabilities and hazards that these coastal communities face.

With BAR's support, the information generated by the project, in the context of R&D adaptation and mitigation measures, led to the understanding that the threat of climate change is inevitable and therefore must be confronted and that measures be backed up with solid scientific findings, such as the WorldFish project which obtained relevant and specific information on the impacts of the phenomenon. The adaptation strategies identified and the estimates on the difference in CC impact with and without adaptation were also the direct benefits of the undertaking to planners and policymakers.

The data and figures gathered during project implementation can be used to support the study sites in understanding the risks posed by CC. This information would aid decisionmakers, at both the local and national levels, to integrate

robust adaptation strategies into their development plans and budgets in a context of high uncertainty, competing needs and limited financial resources.

With the foregoing, BAR believes that this particular climate change-related project with WorldFish indicates the need for immediate response to the threat of climate change as determined by the project, not only by the government but by everybody in the clamor for food security and self-sufficiency.

The WorldFish Center, formerly known as the International Center for Living Aquatic Resources Management (ICLARM), was established in 1977. Since then, the Center has been working closely with a number of national research institutions and regional international organizations based in the country to resolve critical technical and socio-economic constraints in order to increase fish production, improve resource management and equitable distribution of benefits, and protect the environment. ###

References

1. Republic Act (RA) 9729 or the Climate Change Act of 2009
2. WorldFish Center. WorldFish Project on the Economic Analysis of Climate Change Adaptation Strategies in Selected Coastal Areas in the Philippines, Terminal Report, p20



Beekeeping in the Philippines is a viable enterprise. It is an emerging industry that is seen to have the ability to address food security and provide income-generating opportunities to Filipinos. As one of the priority commodities under the DA's High Value Commercial Development Program (HVCDP), beekeeping R&D interventions are being continuously introduced to contribute to the development of this thriving industry.

Despite the potentials of beekeeping, it could hardly take-off because growing bee species (pollinators) requires high inputs. Farmers can hardly afford the necessary supplies and equipment. Also, the use of the imported bee species, *Apis mellifera*, in commercial beekeeping, is not sustainable since we have to

import the queens from abroad due to the narrow gene pool of this species in Asia.

But given an appropriate strategy and sustainable interventions, beekeeping can be a profitable endeavor. "Currently, we are importing around 300 metric tons of honey yearly but our production is only about 100 metric tons. So we can clearly see the discrepancy. We are therefore obligated to increase production to meet the needs and demands," explained Dr. Cleofas R. Cervancia, president of Apimondia Regional Commission in Asia. Apimondia is the International Federation of Beekeepers' Associations and other organizations that are working on apiculture.

The Bee Roadmap

The Bureau of Agricultural Research (BAR) and HVCDP led the

conduct of two workshops for the crafting of the "Philippine Apiculture Status and Research and Development, and Extension (RD&E) Agenda 2012-2016". The bee roadmap aims to strengthen and further promote beekeeping in the Philippines. It was participated in by concerned government agencies, research institutions, academe, non-government organizations, beekeepers, and other key players in the industry. The roadmap was developed in conjunction with the bee roadmap of the National Apiculture Research, Training and Development Institute (NARTDI) and was presented during the 2011 Beekeepers Network of the Philippines Foundation Inc. (BEENET) Conference and Technofora in Tagaytay City.

The Bee Roadmap follows a private sector-led and market-oriented

Keeping it Sweet:

Sustaining BEEKEEPING with R&D

by RITA T. DELA CRUZ

approach and is to be implemented and monitored by the private sector in partnership with the government led by the Department of Agriculture (DA). It envisions a profitable national bee industry that supports agriculture, forestry and biodiversity conservation and one that is capable of supplying quality bees and bee products to local and foreign markets. “The priority areas identified in the roadmap are in line with our economic and political agenda. Beekeeping is also hoped to enhance agricultural productivity through effective pollination of crop plants,” said BAR Director Nicomedes P. Eleazar.

By 2016, the industry targets a continuous supply of quality queen bees and bee stocks, increased production of quality bees and bee products, implementation of quarantine protocol for imported queen bees and bee products, and the provision of channels for financing the industry and research needs, among others.

“The Bee Roadmap shall be implemented and monitored by the private sector, in partnership with the DA, which shall closely take note of changes in the industry,” said Dr. Cervancia.

Capacitating Beekeepers

The University of the Philippines Los Baños (UPLB) Bee Program, being the lead state university

that is involved in the development of beekeeping in the Philippines, along with NARTDI, which is based at the Don Mariano Marcos Memorial State University (DMMMSU), is regularly conducting a week-long intensive course on beekeeping. The training course aims to improve bee culture practices and address issues of existing beekeepers, and encourage more participants in beekeeping.

Integrated into the course are theoretical and hands-on training aimed at further developing the participants’ capacity to produce quality bee products and at imparting practices that ensure sustainable bee colonies.

Topics include in-depth discussion of the basics of apiculture: bee species, definition of the products and jargon, materials for beekeeping, as well as the dos and don’ts in bee production. The course activities are facilitated by lecturers and experts on beekeeping.

The training is aimed towards capacitating farmers on breeding, bee management, as well as product development. Apart from this, the project aims to establish techno-demo apiaries to showcase good practices that will enable beekeepers to maximize their profit.

Projects sites in Quezon (Nakar and Narciso), Albay (Sorsogon



and Albay), and Laguna (Los Baños and Calamba) served as learning grounds for existing and would-be beekeepers. Participants were also taught how to get the most out of bee by-products particularly beeswax, propolis, and pollen.

BAR continues to support research and development (R&D) initiatives directed at increasing profits of our farmers. Research institutions and academics with the capacity and knowledge to improve the farming practices are supported by institutions and agencies like BAR to translate plans aimed at attaining food security and sustainable living into reality.

Beekeeping R&D Projects

Since 2010, BAR, in collaboration with HVCDP, has been supporting R&D projects on beekeeping. To date, there are nine ongoing projects being implemented.

A recently approved project is “Promotion of Beekeeping and Bee Product and By-Product Development” implemented by the Pampanga Agricultural College (PAC). It aims to upscale the PAC’s apiary for training, research and extension

purposes, conduct relevant research on beekeeping, and extend beekeeping technologies to farmers through trainings. The project is targeting farmers and entrepreneurs residing in the vicinity of Mt. Arayat as beneficiaries.

Promoting the Local Bees

One of the R&D initiatives on beekeeping is the promotion of stingless bees. Although the interest in beekeeping is high and the enterprise is profitable, “the cost of re-stocking bees and equipment has proven to be prohibitive,” said Dr. Cervancia.

To address this, strategies and research and development activities have been developed through the project, “Commercialization of Beekeeping Technologies: Product Processing and Bee Production in Select Communities in Luzon”. The project is being implemented by the Bee Program of UPLB with funding support from BAR and HVCDP.

The project is promoting the use of local bee species: *Apis cerana* (locally called laywan), *Apis dorsata* (giant bees or pukyutan), and more importantly, *Trigona spp.* (stingless bee or lukot). Promoting these local bee species is more sustainable and

the farmers can easily adopt the technologies.

“That is why this is also the right time that we conserve our local species. We can get a lot of products from them, like honey, which has a very high demand, and others including pollen and propolis,” explained Dr. Cervancia.

Through the project, UPLB developed a package of technologies (PoTs) to strengthen the beekeepers’ capacity in managing these native bees.

Among the native bee species that the project is promoting are the stingless bees, (*Trigona spp*) locally known as lukot or lukutan. Dr. Cervancia considers its development as a milestone and refers to this local species as the “Bee of the Future”.

“Stingless are the bees of the future because growing them is sustainable. They are abundant in the wild and there are many viable products that we can produce out of them. For one, the honey from the stingless bees is quite expensive. We also have pollen and, most importantly, propolis,” she expounded.

Reports show that among the native species that the project is





pursuing, the stingless bees produce the highest propolis. “Propolis has high clinical value and among the bee products, this is the only one with high anti-fungal and anti bacterial properties. Propolis is used in medicine. In Korea and Japan there is what we call apitherapy wherein they extract flavonoids and phenolics from the propolis and use this to treat cancer patients,” Dr. Cervancia said. Although the study according to her is still in progress and more studies are needed, the potential of propolis as a component in medicine is bright.

“Here in the Philippines, propolis is used as a component for soaps and shampoo. It is also used in toothpaste. So, in almost every high end product being sold in the market, almost all of them have propolis as a component,” she added.

On top of these profitable products from the stingless bees, they

are also the number one pollinators of mango trees. “That is also why we developed this technology which is now being commercialized as it was proven that it could increase the yield of mango by 80 percent,” Dr. Cervancia revealed. Aside from mango trees, the *Trigona spp* is also a good pollinator of pili, rambutan, and lansones. Given this promising result, the group of Dr. Cervancia is looking into the potential of stingless bees as pollinators of other

high value crops.

One important component of the project is the establishment of techno-demo farms/apiaries. “We are training trainers who can also reach out to other sectors of the community. It’s kind of a showcase. If people can see that the farm is earning, they will believe and they will be encouraged. To me, this is more effective than training,” Dr. Cervancia concluded. ###

“One of the R&D initiatives on beekeeping is the promotion of stingless bees.”



BREADFRUIT

R&D's Response to Food Security

by RITA T. DELA CRUZ

Breadfruit is a carbohydrate- and energy-rich crop with low levels of protein and fat, and a moderate glycemic index. The Breadfruit Institute of the National Tropical Botanical Garden (NTBG), which is based in United States, cited breadfruit as also a good source of dietary fiber, potassium, calcium, and magnesium with small amounts of thiamin, riboflavin, niacin and iron.

This is the reason why breadfruit is being pushed and endorsed by the Department of Agriculture (DA) as a potential alternative food staple to rice. This initiative is in sync with the DA's Food Self-Sufficiency Program which aims to provide options for Filipino consumers on what to serve on their table other than rice.

Getting to Know Breadfruit

According to Dr. Roberto Coronel of the University of the Philippines Los Baños, in his book "Important and Underutilized Edible Fruits of the Philippines", in places where it abounds, immature breadfruit is often cooked as a vegetable while the mature fruit is boiled and eaten like bread, with sugar and grated coconut. Those who have tasted cooked breadfruit will say that it is starchy and tastes like a cross between potato and bread.

Breadfruit (*Artocarpus altilis*) is just one of the 300 important species of edible fruits in the Philippines that are important but, unfortunately, are underutilized. These potential fruit crops need to be properly introduced to the public.

Breadfruit is native to New Guinea and was introduced in the Philippines during prehistoric times. It is often mistaken for breadnut (*Artocarpus camansi*) which is a close relative of the breadfruit.

Tapping R&D to Explore the Potentials of Breadfruit

To look further into the potentials of breadfruit, the Bureau of Agricultural Research (BAR) was tasked to study the crop through research and development (R&D). Held at BAR in 2011, a consultation workshop was conducted for the crafting of the Breadfruit Development Program/Roadmap. Outputs of the activity include benchmark database setting, R&D interventions identification, and action plans that

would promote awareness and utilization of the crop.

The crafting of the roadmap resulted in the conduct of studies that would further explore the potentials of the commodity and be the basis for its promotion.

“BAR, as the focal agency to lead the Breadfruit R&D Program, is looking into the potentials of this underutilized crop. Through this program, we are exploring other applications because researches show that it can have multiple uses. This is in line with the effort of the government to address national food and nutritional security,” BAR Director Nicomedes P. Eleazar points out.

The program was launched in 2011 under the auspices of Agriculture Secretary Proceso J. Alcala. From then on, BAR, together with the DA’s High Value Crops Development Program (HVCDP), has conducted activities to support the program identified under the Roadmap for Breadfruit.

The Roadmap that was crafted in support to the implementation of the program has an allotted budget of P36 M which shall be sourced from BAR and HVCDP. The components of the roadmap include: 1) identification of planting materials in 16 regions for sustainable production; 2) enhancing farmers’ capability to propagate breadfruit; 3) development of postharvest technologies; and 4) establishment of 37 nurseries in the regions.

R&D Projects on Breadfruit

In support to this program, BAR and the HVCDP have provided funding support to five R&D projects on breadfruit.

Of the five projects, three are on-going. These are: 1) “Determination of the Incidence of Field and Postharvest Pests and Diseases of Breadfruit and Documentation of its Crop Production and Management Practices Adopted by Farmers” implemented by the University of Southern Mindanao (USM); 2) “Breadfruit Biodiversity Research, Conservation, Propagation and Utilization in the Bicol Region” implemented by the Bicol Integrated Agricultural Research Center, DA-RFU V; and 3) “Survey, Characterization, Evaluation

and Maintenance of Breadfruit from Nursery to Bearing Stage in Region XI” by the Southern Mindanao Integrated Agricultural Research Center, DA-RFU XI.

Of these projects, BIARC’s project on breadfruit ice cream is the one gaining a great deal of attention from the public. Breadfruit ice cream was one of the featured products at the BIARC booth during the 8th National Agriculture & Fisheries Technology Forum and Product Exhibition held in August 2013 at SM Megamall.

“We thought at once that breadfruit is a good flavor for ice cream because of its fine texture. It has good consistency with milk. Physically, it looks nice with its pure white flesh just like that of guayabano,” explained Luz R. Marcelino, manager of BIARC and project leader.

The breadfruit ice cream that BIARC developed comes in three variants: breadfruit with sweet potato, breadfruit with cheese and chocolate, and breadfruit with langka. In all variants, breadfruit makes the major flavor of the ice cream, taking up 80 percent of the mixture.

Although visitors who tasted the ice cream already expressed their delight and enthusiasm for the product, food technology experts from BIARC are further refining the taste and texture of the product for improved palatability. “We are still trying to improve the coagulation (curdling or thickness) of the ice cream and perhaps enhance the formulation by reducing the sweetness,” Marcelino said.

Currently, the group of Marcelino is developing another variant of spicy ice cream - breadfruit with

siling labuyo - a unique blend for a dessert that is expressly designed for the Bicolano taste bud like the famous Bicol express (*sinilihan*).

According to Marcelino, the breadfruit ice cream has its greatest potential in Masbate. When asked why Masbate, Marcelino explained that it is an area in the Bicol Region that has a hotter climate and hence a demand for cold products making the province the ideal market. Also, Masbate has a thriving livestock industry, and products from milk are popular, thus breadfruit ice cream will easily find a niche.

Production-wise, Masbate is an excellent launching area for a breadfruit ice cream industry because it has its own regional carabao breeding center which can develop local dairy carabaos that are needed by an ice cream-making industry.

As for its future plans, Marcelino said that BIARC will link with cooperatives or the business sector to market the ice cream products that they have developed. Currently, they are looking into a partnership with a potential enterprise, the La Huerta Farm, a culinary-oriented business engaged in herbs and spices concoction.

Aside from the three on-going breadfruit projects, another two were recently approved. These are: 1) “Establishment of Rapid Propagation Techniques for Seedless Breadfruit in Marinduque” implemented by the Marinduque State College; and 2) “Identification, Rehabilitation, Development and Establishment of Breadfruit Nursery in Zamboanga Peninsula” by the Zamboanga Peninsula Integrated Agricultural Research Center, DA-RFU IX. ###

“ Breadfruit is just one of the 300 important species of edible fruits in the Philippines that are important but, unfortunately, are underutilized.”

Adlai R&D

Complementing Efforts to Attain Food Staples Sufficiency

by ANNE CAMILLE B. BRION

Coming from the same family to which wheat, rice, and corn also belong, adlai is one of the crops that have been extensively promoted by the Department of Agriculture (DA) in line with its goal of attaining sufficiency in food staples in the country. Due to the crop's potentials that can complement long-established major staples such as rice and corn, the Adlai Research and Development (R&D) Program was initiated with the title, "Development and Promotion of Adlai (*Coix lacryma-jobi* L.) as an Alternative Staple Food for Rice." The Program pushes for the development, utilization, and promotion of adlai as an alternative crop to our food staples, and as an additional source of income and livelihood in non-traditional corn and rice areas. Coordinated by the Bureau of Agricultural Research (BAR), adlai promotion, through the conduct of adaptability yield trials, has brought about the development of site-specific recommendations for different areas in the country.

Status of Adlai R&D Program

In February of this year, BAR organized and facilitated the conduct of a review and planning workshop to assess the accomplishments of the projects being implemented under the program. After the trials conducted for both dry and wet seasons, it was found that adlai adapts well in some regions of the country, particularly in high elevation areas such as the hillsides of Nueva Vizcaya and Zamboanga del Sur, and in some parts of Regions 2, 4A, 5, 9, and

10. It has also been found out that adlai is accepted as an alternative staple food by Indigenous Peoples (IPs) such as the Subanen tribe in Zamboanga del Sur, and in farming communities where rice and white corn remain scarce, or are not traditionally produced.

Through the program, DA research stations have put in creative efforts for the development of various products using adlai, most of which follow the recipes for rice-based *kakanin*. Now, it is already being promoted as food, feed, and drink. The latest of these is adlai breakfast cereal which was developed by the Northern Mindanao Integrated Agricultural Research Center (NOMIARC) in Region 10. This product was hailed as among the "Best New Products" during the 9th National Agriculture and Fisheries Technology Forum and Product Exhibition held in August 2013 wherein champion products from different regions of the country were showcased.

Consumption of adlai can provide the body with the daily requirement for essential nutrients. This prompted the DA-STIARC, in cooperation with the National Food Research Institute of the Department of Science and Technology (NFRI-DOST), to conduct the nutritional analysis for polished adlai. The results show that 100 grams of adlai grits contain 2 mg of sodium, 0.4 mg of iron, 5 mg of calcium, 84 mg of potassium, and 0.4 mg of zinc. Analysis for adlai bran is also

being considered to further explore its potential as tea and as food/feed supplements.

As the market development of adlai is now also being focused on, Region 9 and BAR, with the assistance of Ms. Digna Narvacan of DA-STIARC, will facilitate the linking of the adlai producers to big potential markets such as Yazaki Torres. As such, the National Food Authority (NFA) and the Philippine Center for Postharvest Development and Mechanization (PhilMech) will be tapped for the development of quality standards for adlai grits.

As of August 2013, around 11,690 kilograms of adlai seeds were produced through different partner research stations and institutions in the country from about 185 hectares of land. Approximately 5.7 tons of the adlai seeds were distributed to farmers and other interested stakeholders. By December, a harvest of an additional 202.5 kg of seeds was projected with around 93 percent of the volume of the produce (189 kg) coming from Region 9. To date, BAR is spearheading the registration of adlai varieties with the National Seed Industry Council (NSIC) in close coordination with the Bureau of Plant Industry (BPI).





Zamboanga del Sur: A Thriving Place for Adlai

The most successful project sites in the country are in Zamboanga del Sur in Region 9. With the vast expansion of adlai in its underutilized production areas, the region is undoubtedly one of the most productive implementers and adopters of the Adlai R&D Program.

Different trainings and promotional activities initiated by the Betinan Research Outreach Station (BROS) of DA-RFU 9 have spurred the interest of many farmers in planting the crop. For instance, in the town of Molave, a 1.5-hectare farm was planted with adlai. Each hill produces about 8-12 tillers that reaches almost 3 meters high. Another 1.5-hectare farm in the town of San Miguel where coconut used to be the only commodity grown is now also being intercropped with adlai. Meanwhile, a

3-hectare farm in the town of Josefina was initially dedicated to the planting of industrial and hardwood trees. But after attending a consultation meeting with experts from the BROS and the Municipal Agriculturist Office, the farmer decided to adopt and plant adlai together with coconut and rubber.

As of now, there are already 547 farmers in 11 municipalities who have successfully grown adlai in their farms. This translates to about 104 hectares of land where majority of the farmers are using the Kinampay variety. Proven effective in an intercropping system, adlai has become a common intercrop to major industrial crops and staples such as coconut, rubber, cassava, banana, gabi, and sweet potato grown through organic agriculture. The average yield for an organic adlai production system ranges from 1.5-3 tons/hectare/cropping.

Postharvest concerns especially during the milling of adlai seeds were closely considered in the assessment of gains and losses for the said commodity. An existing corn mill being used in the town of Molave in Zamboanga del Sur has been documented to have a 50-60 percent milling recovery. Aside from high milling recovery percentage, the milling machine can also separate and sort the different sized particles of the milled grains. An existing organization in the area called MANAGLAHI (Magsasaka Nagkakaisa Laban sa Kahirapan) currently manages the operation of the machine. To date, there are two on-going projects on the fabrication and development of adlai milling machines under the initiatives of PhilMech and the Cagayan Valley Integrated Agricultural Research Center (CVIARC).

As adlai keeps on feeding families and providing income to farmers, the research community should not stop in pursuing R&D efforts that will further improve and promote the crop. Ways on how we can sustainably nurture its potentials should be prioritized as we continuously search for more benefits that this useful crop can give to us. ###

Commercial Bioethanol Production A Milestone for Biofuel R&D

by MA. ELOISA H. AQUINO



In response to the enactment of RA 9367, otherwise known as the Biofuels Act of 2006, which aims to reduce dependence on imported fuels with due regard to the protection of public health, the environment and natural resources, the Department of Agriculture (DA) crafted the DA Biofuel Feedstock Program.

The Bureau of Agricultural Research (BAR), as one of the member agencies of the Program, is in charge of developing viable and quality biofuel feedstock through research and development. The program covers strategies for ensuring sufficiency of feedstock supply for both biodiesel and bioethanol production. BAR coordinates and channels efforts of key players and stakeholders under unified biofuels R&D plans, programs, and activities.

BAR has continuously supported R&D activities which include identifying new feedstock, developing high-yielding varieties, and developing new processing technologies in cooperation with public and private research agencies, and international research institutes. It has also provided support for improving biofuel production management systems and the processing of raw materials. Feedstock identified for bioethanol include sugarcane, sweet sorghum, ligno-cellulosic materials, macro algae and cassava, while feedstock identified for biodiesel include coconut, micro algae and oil palm. At present, sugarcane is the main feedstock used for the production of bioethanol, while coconut is for biodiesel production in the Philippines. The Bureau is promoting sweet sorghum as a bioethanol feedstock complementary to sugarcane.

Sweet sorghum was introduced to the Philippines in 2006 through the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) under partnerships with local institutions particularly BAR. Through a series of projects that included adaptability trials, plantation and validation trials, production of quality sweet sorghum syrup, business

summits and a plantation showcase, and production of anhydrous ethanol from sweet sorghum funded mainly by BAR, the feasibility of producing bioethanol from sweet sorghum in the country was realized.

Through collaborative efforts, biofuels R&D is now reaping success. The first anhydrous bioethanol from sweet sorghum was produced in the Philippines, specifically, in Negros Occidental in May 2012.

These activities were implemented by the University of the Philippines Los Baños Foundation, Incorporated (UPLBFI) with financial support from BAR to showcase sweet sorghum's potential as bioethanol feedstock, that is complementary to sugarcane, and to mainstream its commercialization.

The agreement among UPLBFI, Organic Products in the Island of Negros-Multipurpose Cooperative (OPTION MPC), and San Carlos Bioenergy Inc. (SCBI) was part of the BAR-UPLB collaboration which aims to showcase the technical and economic viability, and to establish the commercial-scale logistical requirement of fuel grade bioethanol production from sweet sorghum.

Production and Collaboration

Sweet sorghum commercial production was conducted in Sagay City, Negros Occidental using sweet sorghum pureline, SPV422. This was evaluated in two cropping seasons in 30-hectare land area for seed crop and 2-hectare for ratoon cropping.

“Through the support of Governor Joseph Marañon and Mayor Rafael Leo Cueva, the local government of Sagay City facilitated the availability of the 30 hectares land which were used for commercial plantation of sweet sorghum of which 22 hectares came from the City of Sagay and 8 hectares from the private sector,” said Prof. Rex Demafelis, UPLB Alternative Energy Research, Development and Extension convenor and UPLB Energy Systems Committee chair.

A sugarcane-producing

region, Negros Occidental was slow to open its doors to commercial scale production of sweet sorghum and the attempt to introduce and further commercialize sweet sorghum production was not an easy task. However, with sheer determination, Prof. Demafelis and his team patiently endured a year before the first fuel production. “But because of the studies previously done and funded by BAR, we did not have to start from scratch. Then, we tapped various private companies to help in this endeavor,” he shared.

The team tapped the facilities of Organic Products in the Island of Negros-Multipurpose Cooperative (OPTION-MPC) of Sagay City and San Carlos Bioenergy Incorporated (SCBI) of San Carlos City where sweet sorghum syrup and fuel grade bioethanol were produced respectively.

“From a 24-hectare land allotted for seed production of sweet sorghum, there were 44 metric tons grain yield, 479.190 metric tons stalk yield, and 62 tons syrup yield which produced 15,000 liters of ethanol. This made the Philippines the first country in Southeast Asia to produce ethanol from sweet sorghum on a commercial scale,” Prof. Demafelis proudly reported.

The project implemented a parallel-system with sugarcane harvesting practices in order to easily introduce and, hence, facilitate easier adoption of sweet sorghum by the farmers. Convinced with the promising future of sweet sorghum, private farm land owners of sugarcane areas soon tried planting sweet sorghum. “The whole production cycle can generate additional employment and income opportunities for the people of Sagay,” Prof. Demafelis said.

Other than the beneficial uses of sweet sorghum, the locals were encouraged to plant the said crop since it requires less input (fertilizer, irrigation, etc.). Furthermore, sweet sorghum

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Expanding Capacities of Marginal Areas with Rainfed Agriculture

by DIANA ROSE A. DE LEON

In a country wherein agriculture is the bread and butter for economic growth, water is a crucial and essential resource particularly in the food production chain. Its absence or presence determines the success and/or failure of crop production. This is why significant efforts have been undertaken to exhaustively expand the scope of irrigated agricultural lands. However, despite the efforts, only 19 percent of arable agricultural land is irrigated with the rest depending on direct rainfall to water the lands.

In the absence of irrigation, the cultivation of crops that relies on using green water (that comes from precipitation and is stored in the soil) is called rainfed agriculture. In fact, 80 percent of the world's agricultural lands fall under rainfed agriculture and accounts for 60-70 percent of world food production.

With the pressing issue on poverty further aggravated by population explosion, food insecurity is imminently escalating the hunger incidence. This is why the call to invest more on improving

rainfed agriculture is becoming more urgent. There are studies asserting the potentials and possibilities of rainfed agriculture in answering the need to meet rising global food demand in the coming years and thus can be harnessed and this will help greatly in alleviating poverty.

Rainfed Agriculture in the Philippines

The country more or less has 13 million hectares of agricultural area devoted to crops of which only 1.626 million hectares are irrigated. A big chunk of the agricultural lands (estimated to cover 75 percent of the cultivated land) is into rainfed agriculture. With this scenario, it is high time for the government to pour in investments to support the practice of rainfed agriculture in the country.

The attempt to bring to the fore rainfed agriculture in the country gained headway when the India-based organization, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), began to

extend their expertise to the country and collaborated with the Department of Agriculture (DA) through the Bureau of Agricultural Research (BAR). Being the lead global agricultural research organization focusing on semi-arid/dryland/rainfed research, ICRISAT has been successful on improving the agricultural productivity in these areas and on stimulating change for the betterment of the lives of millions. This is what ICRISAT and BAR hope to accomplish with the collaboration.

The partnership aims to intensify research, development and extension (RDE) being done to address the current needs of rainfed agriculture in the country and shape it to the extent wherein it can be a large contributor to the growth of the agriculture sector, vis-à-vis, be one of the driving forces of the economic growth of the country. ICRISAT shared their knowledge and expertise through the extension of appropriate technologies and innovations on production of legumes which include sorghum, chickpea, pigeonpea, and groundnut.

From the efforts of the concerned

stakeholders and advocates of rainfed agriculture, one significant leap taken on the matter was the filing of House Bill 76752 in the 15th Congress that calls for the establishment of the Philippine Rainfed Agriculture Research and Development Institute (PhilRAI), formerly proposed as the Philippine Dryland Research Institute (PhilDRI). Once the bill is passed as a new law, PhilRAI will be in the forefront to encourage investments and move forward the cause of rainfed agriculture in the country.

PhiRARDEP

Way back in 2004, BAR and ICRISAT started their collaboration through a Memorandum of Agreement (MoA) signifying the interest of both parties to diversify legume production in the Philippines through utilizing the legume technologies developed by ICRISAT.

The agreement materialized in 2009 through a project titled, "Field testing of ICRISAT legume varieties and technologies in selected regions in the Philippines." The project is now on its third phase, wherein the legumes that performed well during the first and second phase are being subjected to on-station and on-farm seed production, and also the expansion of the project to other regions.

The partnership of these two organizations was further strengthened with the launching of the Philippine Rainfed Agriculture Research, Development, and Extension Program (PhiRARDEP) in 2011 with funding support from DA-High Value Crops Development Program (HVCDP). The program aims to "develop, coordinate, monitor and evaluate the implementation of a vigorous agriculture RDE program to enhance food, nutrition and energy security, improve livelihoods, and empower communities in the country's rainfed areas."

From the various consultations done with the stakeholders, including the DA's national and regional bureaus and agencies, state universities and colleges (SUCs), and non-government organizations (NGOs), a unified RDE action agenda for rainfed agriculture which will be used as a basis in prioritizing and funding specific projects was formulated. This action

agenda of PhiRARDEP focuses into four major areas which are: 1) rainfed farming systems innovation; 2) participatory watershed management; 3) strategic social science and policy research, and; 4) capacity building, communication and social mobilization.

To date, BAR has funded 16 on-going rainfed-related projects, of which four projects are newly-approved.

The Yamang Lupa Program

Encompassing the four components under the PhiRARDEP, the Yamang Lupa Program was launched in October 2013. The program is patterned after the ICRISAT's Bhoochetana mission program (meaning revival of the soil) implemented in Karnataka State, India. Due to massive success and recognitions received by the Bhoochetana program, which was able to increase crop productivity by 30 percent and help 2.2 million smallhold farmers in Karnataka, the program was brought to Philippine soil by the ICRISAT and, hopefully, it will garner the same success like in India.

Basically, the Bhoochetana program is working towards improving dryland agriculture through the use of scientific technologies while promoting the sustainable use of natural resources. The same principles, processes, approaches, and strategies that were successfully used in the original Bhoochetana program will be employed under the Yamang Lupa Program. Assessment of soil health status; preparation of GIS-based soil fertility status for developing specific nutrient management recommendations; development of best-bet soil, water, nutrient, pest and crop management; improvement of seed delivery systems; and capacitation of the stakeholders to realign their set knowledge and skills to the requirements of rainfed agriculture are the expected main outputs of the program.

In this program, the Bureau of Soils and Water Management (BSWM) serves as the lead implementing agency with ICRISAT providing the technical assistance, BAR as the coordinating agency and HVCDP providing the funding. Other collaborating agencies

are the Bureau of Plant Industry (BPI) and the Agricultural Training Institute (ATI), together with selected DA-Regional Field Units and state universities and colleges (SUCs). For the initial conduct of program activities, three pilot sites were identified representing Luzon, Visayas, and Mindanao. These are Region IV-A (CALABARZON), Region VIII (Eastern Visayas), and Region IX (Zamboanga Peninsula).

Future Endeavors

Millions of Filipinos depend on rainfed agriculture to sustain their living and yet, only in the recent years has this sector been given due attention and inclusion in the development agenda of the country. What have further aggravated the situation are the impending challenges being brought upon the country by the threat of climate change. Longer dry spells and droughts, and more intense typhoons and flooding, can be experienced by the country. This is why there is no other way but to strengthen the capacities of Filipinos to withstand its impacts and repercussions, and that adaptive measures be in place in critical areas such as the rainfed areas.

From the activities being pursued by BAR, together with the partner institutions under its rainfed program, this once neglected part of the agriculture sector is progressively coming into light and, in the future, be a significant contributor to the attainment of the development goals of the country.

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The rubber tree is one of the most important crops in the world. It is the source of one very useful material that goes into making the products that we use every day. We take full advantage of rubber in the clothes we wear, the tools and supplies we use in our homes, offices and hospitals, and perhaps the most popular use of rubber that we encounter everyday - tires. The wide range of rubber products and the demand for it puts rubber into the limelight as the most profitable agro-industrial crop, making it globally competitive.

For Philippine rubber to be at par in the global arena, its rubber industry is being strengthened through research and development (R&D). The government is continuously tying up with different sectors and partners to explore the expansion of the country's rubber industry. With more than 160,000 hectares of land already being utilized for raw rubber production in the country, it will not be a surprise if in the future, especially with the further expansion of its rubber hectareage, the Philippines becomes one of the world's top rubber exporters.

Rubber R&D Comes of Age

With the Department of Agriculture (DA) as the key player in enhancing the rubber industry of the country, it has been advocating quality standards and good practices for an inclusive and globally competitive rubber industry, and creating the policy conditions that will make possible holistic and sustainable benefits to all stakeholders. In contributing towards this end, R&D is being intensified. The government, together with various stakeholders, has embarked on the conduct of intensified rubber research and development as one of the strategies in the advocacy of promoting, expanding, and strengthening of the rubber industry in the Philippines. Furthermore, the DA aims on developing rubber R&D with an export orientation. This can be done through: 1) strengthening R&D efforts which include benchmarking on industry good practices and product development through market-based research; 2) improving the quality of rubber products; and 3) developing and sustaining export markets across the world.

Rubber R&D Initiatives

In support to the DA's initiatives on rubber R&D programs, the Bureau of Agricultural Research (BAR) has been among the stewards in the promotion and development of rubber through R&D.

PHILIPPINE RUBBER

Intensified through R&D

by DARYL LOU A. BATTAD

Research serves as an important tool in the development of commodities starting from production, technology development down to commercialization and rubber is no exception. It also forms much of the basis of policy formulation.

BAR was able to identify researchable areas such as Integrated Pest Management (IPM), Integrated Nutrient Management (INM), clonal improvement, tapping panel dryness management, and upgrading of management practices. The bureau has been supporting projects of rubber which ensure quality production and empower the smallhold farmers, and which are aligned with the DA's priorities on rubber.

Rubber production and production areas in the Philippines have continuously been increasing over the last 10 years. The bureau's efforts, in partnership with other agencies, have significantly contributed to the revitalization of the rubber industry.

To date, there are 13 on-going projects on rubber funded by BAR under its Community-based Participatory Action Research (CPAR) program, National Technology Commercialization Program (NTCP), and other basic and applied researches. It now also includes a focus on rubber's potential role for climate change mitigation.

One of the successful projects of the bureau is the "Development of Molecular Markers for Identification and Authentication of Rubber (*Hevea brasiliensis*) Clones" implemented by the University of Southern Mindanao Agricultural Research Center. The project developed procedures for reliable rapid detection and sorting of rubber planting materials; established molecular markers for identifying genotypes; and packaged technologies that were made available to rubber stakeholders.

Project leader, Dr. Emma K. Sales believes that clone selection should be given utmost importance in order to have a successful rubber plantation. Varieties or clones should be properly identified as true-to-type before they are made available to farmers for planting. Any simple mistake in the variety or clone to be planted can seriously jeopardize the economic profitability of the plantation.

With such commendable results, the project has resulted to a milestone for the Philippine rubber industry. The outcome of this study is a pioneering work, not only in the country but in the Southeast Asian region as well, on the authentication and identification of rubber clones. As a result, a handbook titled, "Hevealogue: A Catalogue of Hevea Germplasm in the Philippines" was published by USM researchers with funding support from BAR through its Scientific Publication Grant (SPG) to help stakeholders on the production of rubber in the country.

The bureau was also able to establish linkages among stakeholders locally and internationally for the purpose of enhancing the quality of the produce and management practices of Filipino rubber farmers and researchers. Through its efforts, the Philippines became a member of the International Rubber Research and Development Board (IRRDB) from which the country has acquired much knowledge and advances in rubber research and technology.

Another key player in rubber R&D is the Philippine Rubber Research Institute (PRRI) of the Zamboanga Peninsula Integrated Research Center (ZAMPIARC) located in Zamboanga Sibugay which was established to provide technical support to the government's rubber program. It provides facilities and equipment to aid in the production of quality planting materials and rubber products in the Philippines.

Revving up the rubber industry

The incessant demand for rubber in the world market has been a major driving force that guides the government, especially the Department, in continuously strengthening and expanding the rubber industry in the Philippines. Its directions have come to focus on increasing export of higher value processed and finished rubber products while supporting the national poverty alleviation program through enhanced farm productivity.

Rubber development strategies now revolve on production, industrialization and product development, and export market development. The rubber program of the DA targets: 1) increase in rubber farm productivity with cost efficiency achieved through the use of yield-enhancing and other new technologies; 2) promote farm investments to expand rubber areas and increase processing scale; 3) enhance value-adding and quality of rubber and rubber products; (4) increase in the income and sustainability of the farmers, processors, and other stakeholders; and (5) modernize and expand the local processing and development of rubber products for the domestic and export markets.

The global rubber market is so inviting that the country cannot afford to be left behind knowing that the resources we have are enough to make it one of the leading producers of rubber. The investments made by the government in intensifying rubber production are a good start. ###

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Business Opportunities and Health Benefits from Indigenous Plants

by LIZA ANGELICA D. BARRAL

The Philippines is distinguished as the seventh most biologically diverse country in the world. In fact, the country is internationally known to be a source of medicinal plants, functional foods, natural food dyes, tropical fruit flavors, and essential oils. Thus, the country is capable of producing value-added materials from local biodiversity and, eventually, trading of high quality products.

Due to its economic potential, research and development (R&D) is a very important tool, not only for producing and marketing high quality and effective products from medicinal plants but also to boost the Philippine's alternative healthcare industry. Likewise, through R&D, the country can conserve its biodiversity and document promising medicinal plants and other sources of natural ingredients.

Indigenous Plants for Health and Wellness Program

In response to the need for R&D agenda for the industry, the Indigenous Plants for Health and Wellness Program was launched by the Department of Agriculture (DA) through the Bureau of Agricultural Research (BAR). The program is also in line with Proclamation No. 1280 issued in 2007 declaring the month of October as the "National Health and Wellness Tourism Month".

The IPHWP looks into the potential of the Philippine biodiversity particularly the plant species and conventional food crops with health-promoting potentials, to properly utilize and conserve these plant resources. Further, the program helps improve the health and wellness of each and every Filipino through natural but effective

products.

In 2013, BAR supported two IPHW projects under the bureau's National Technology Commercialization Program (NTCP) and two others as basic and applied research. Presently, there are eight ongoing projects three of which are funded under NTCP and five are basic/applied researches.

Creating Business Opportunities from Various Medicinal Plants

Before the advent of technological advances when conventional medicine was born, our elders were already practicing traditional medicine by using available plants and other crops for the treatment of various ailments like fever, cough, colds, diarrhea, skin diseases, etc. Up to the present time, some individuals are still patronizing alternative medicine which they have proven to be efficient and effective without any harmful side effects as compared to synthetic drugs in the market.

To support conservation efforts with regard to Philippine biodiversity and to help preserve the indigenous knowledge and traditions through marketable technology, Green Rescue Organic Association Incorporated (GRO), a barangay-based rural enterprise headed by Ms. Lucia D. Dalisay and which is located in Tiaong, Quezon proposed a project to BAR titled, "Technology Utilization and Promotion of Developed Products from Indigenous Plants". This was approved under the Indigenous Plants for Health and Wellness Program through BAR's National Technology Commercialization

Program (NTCP).

Specifically, the research project aims to: 1) locate popular traditional and alternative health care practitioners (TAHC) in the Southern Tagalog Region, Philippines; 2) extract from the TAHC practitioners important information with regard to medicinal plants; 3) learn the most important medicinal plants they use by plant category; 4) learn the most common ailments treated with medicinal plants; 5) conserve the most important ones identified from the survey in community-based nurseries; 6) develop high quality natural products from the medicinal plants; 7) test the market potential of the developed natural products; and 8) establish community-based nurseries and plantations as sources of raw material for interested parties.

Project Milestones

The project team located TAHC practitioners in Southern Tagalog Region and conducted a series of surveys. After data collection, they made a count and classified the medicinal plants identified by the TAHC practitioners. The researchers then identified the most common medicinal plants used by the TAHC Practitioners by category (e.g., trees, shrubs, herbs, vegetables, spices or plantation crops) as well as the diseases reportedly cured by the medicinal plants.

In terms of the mode of administering health treatments, TAHC practitioners were found to prefer decoction, poultice and infusion. Based on the surveys, patients who used these were very satisfied (37.70 percent) because they fully recovered within 1-2



days. When asked the reasons why some plants are not used anymore, majority of the TAHC practitioners said that the plants are either not found anymore, seasonal, not common, or are hard to find. Also part of the researchers' questionnaires delves on the reasons for other patients' high preference for synthetic drugs over alternative healing methods and noted the comment of most of the TAHC practitioners that synthetic drugs are readily available. As for the reasons for the continued TAHC practice, majority of the practitioners said that synthetic drugs are more expensive and have more side effects.

After data gathering, the researchers recognized the efforts of TAHC practitioners in preserving the old traditions of healing with the use of medicinal plants. The research also revealed that some of the practices have scientific basis and, therefore, a select number of these plants qualify for commercialization.

Project Accomplishments

As the recipient of the technology provided by Dr. Estela Taño of Department of Agriculture-Quezon Agricultural Experiment Station (DA-QAES), the GRO was able to create new lines of natural products in 2011 like native guava soap, turmeric natural healing cream, turmeric multipurpose tea, native ginger body massage cream, native ginger tea, native guava jam, rosemary

capsule, and tamarind multipurpose concentrate.

Guava soap naturally smoothens the skin which tightens the skin pores and even lightens dark spots while turmeric cream easily dries wounds, removes toxins, and relieves itchy skin due to insect bites. Native ginger cream relieves muscle and nerve pains and is also applicable for swellings, cramps and skin infections due to insect bites. Rosemary capsules alleviate body aches and headaches due to fever, cough and colds.

To effectively promote the products, GRO has direct involvement in various commercialization activities by participating in local and international trade fairs and exhibits and in establishing direct dealers. The project team also successfully established two community-based nurseries and organic plantations of native guavas, turmeric, native ginger and coconut in Tiaong, Quezon and in Mt. Banahaw. Also, a simple community-based processing house was established with complete water system specifically for manufacturing coco jam, turmeric and native ginger products.

GRO is also recognized with a grant of a License to Operate (LTO) by the Food and Drug Administration (FDA) as one of only two organic

product processors established in Tiaong, Quezon for processing eight natural products.

In 2012, turmeric natural healing cream and turmeric tea were awarded as among the "Best New Products" during the 8th Agriculture and Fisheries Technology Forum and Product Exhibition.

As a barangay-based rural enterprise, the GRO also generated working opportunities in Tiaong, Quezon. As of now, there are at least seven workers hired by its processing laboratory aside from the on-call workers. In addition, one farmer couple exploring the potentials of the business was trained on field operations and processing.

Indeed, the project team has been successful in spreading the Package of Technology (PoT) for processing and producing natural and organic products. As proof, the GRO has established proper market positioning which gives it the edge over other competitors in the mainstream market. ####

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Biotechnology R&D

Providing Options for Food Production and Security

by WILSON G. VILORIA II

With its goal of providing sufficient, safe, healthy and affordable food for the rapidly growing population of the country, the Department of Agriculture (DA) is looking at Biotechnology Research and Development (R&D) as one of the best options to address the issues of food security and poverty reduction.

By developing new technologies on crop production, fisheries, livestock, and even microbial biotechnologies and new breeds of crops that can withstand the harsh effects of pests, diseases, and even climate change, R&D institutions can provide better options to farmers and fisherfolk to increase their income and profit and address the challenges head on.

The Philippine Agriculture and Fisheries Biotechnology Program supports R&D on four major areas: 1) genomics and molecular technologies in support of plant and animal breeding (marker assisted selection, genetic engineering and gene cloning; 2) DNA fingerprinting and disease diagnostics (for plant variety protection, quarantine, disease diagnostics; 3) development of biopesticides and biocontrol agents; and 4) *In vitro* culture for rapid propagation of disease-free and high-quality planting materials, and discovery production of important bio-active natural products and ingredients.

The program is mandated to promote agricultural development and growth through increased productivity by: 1) providing a policy framework, 2) helping direct public investments, and 3) partnering with local government units (LGUs) in developing support systems and structures that would ensure that the benefits of agricultural development do reach the poor particularly those in the rural areas.

Biotech as Key to Increase Production

With the mission of modernizing the Philippine agriculture through the optimal use of biotechnology, the program aims to utilize the tools of biotechnology as an alternative means to improving the productivity of local agriculture towards food security and sustainable development.

The program has three main components: policy research and advocacy; institutional capacity

enhancement; and information, education and communication (IEC).

The Policy Research and Advocacy component supports the analysis and formulation of national policy directions and thrust on agri-biotechnology including policy research studies that will facilitate policy and priority setting. Institutional Capacity Enhancement assists in the development of the infrastructure of government agencies and support research service



institutions in regulating and monitoring agri-biotech research, development, and commercialization and to strengthen the capacities of government institutions involved in risk assessment, risk management and risk communication of agri-biotechnologies. The last component, which is the IEC, assists institutions in the development of capacities in communication and education towards public awareness and acceptance of agri-biotechnology.

BAR's Role on Biotechnology Program

The DA Biotech Program Implementation Unit handles the day-to-day operations of the Program, and oversees all supported projects. The Program is managed by a steering committee, technical committees, and program implementation unit. The Steering Committee is an inter-agency committee chaired by Usec. Segfredo Serrano. The committee sets the thrust and direction of the Program. There are four technical committees for the major components of the Program. The technical committees serve as an advisory group and technical evaluators of all supported projects.

The Bureau of Agricultural Research (BAR) was tasked to facilitate the funding of projects approved for implementation by the Steering Committee. BAR and DA Biotech PIU are in close coordination in this regard.

From 2011 to 2013, BAR facilitated the release of funds to projects that fall under various categories namely: applied biotechnology research, regulatory research, capacity building, program administration, and IEC/policy advocacy. Within that period, 26 projects supported by the DA Biotech Program have been completed and 59 are ongoing.

One noteworthy biotechnology project was funded in 2013 titled, "DNA Fingerprinting, Molecular and Morphological Characterization of Abaca Accessions at the NARC Germplasm Collections" implemented by the ViSCA Foundation for Agricultural and Rural Development,

Inc. (ViFARD) based in Baybay, Leyte. The objective of the study was to characterize the germplasm collections of *Musa textilis* Nee through DNA fingerprinting.

Pursuant with the DA Thrust of Sustainable Agricultural Development, the project team, led by Dr. Ruben Gapasin, gave their full effort so that DNA fingerprint data of abaca accessions at the NARC-VSU Germplasm which would be available together with more molecular markers linked with morphological, other agronomic characteristics and disease resistance for use by abaca breeders, plant conservationists and other researchers.

Biotech Roadmap

To strategically position the Philippine agriculture and tap its full potential, a 10-year roadmap for agricultural biotechnology was crafted. Specifically, the roadmap is ensuring food and fiber security through improvement of the competitiveness of Philippine agri-fisheries products as well as targeting the world market for natural ingredients. The R&D agenda/program of the roadmap is currently at the final stages of the review and updating. It is scheduled to be presented to the Program Steering Committee and finalized in the first quarter of 2014.

The first major objective is ensuring food and fiber security through improvement of the competitiveness of Philippine agri-fisheries products. One of its sub-objectives is the applications of bio-processing to integrate whole crop processing for improved product recovery. Rice, coconut, abaca, seaweeds, tilapia, agri-fishery products and wastes are the priority commodities in this sub-activity. The rationale supporting this is that integrated processing can extract as many commercial products from traditional agricultural produce.

Another sub-objective deals with the applications of modern biotechnology to improve crop, livestock and fishery productivity. The world's experience of ten years or more with genetically modified crops ably demonstrates the effectiveness of genetic engineering in improving crops. Thus, genetic engineering should be able to provide

long term solutions to some of our major crop production problems.

The rationale behind targeting the world market for natural ingredients is that the Philippines is recognized as the seventh most biologically diverse country in the world. This biodiversity is a huge resource that can be exploited using biotechnology to create new products and new industries to satisfy the growing demand for natural ingredients for nutraceutical, cosmeceutical and pharmaceutical applications in humans and animals. *Malunggay, banaba, duhat, atswete*, pineapple, papaya, pili, mango, rice bran, seaweeds and marine bioactives and species listed in the Philippine pharmacopeia are the priority crop plants/commodities of the said major objective. They also want to evaluate expansion of essential oils such as peppermint, lemon, citrus oil, lemon grass, pachoili, ilang-ilang and others.

In order to achieve their goals and objectives, the following major strategies that encompass all of the objectives were identified: 1) Biotech Research and Commercialization 2) Support to Policy Formulation 3) Institutional Capacity Enhancement 4) Information, Education and Communication.

Addressing the problem on food security and production remains a great responsibility carried by the Department on its shoulders. But by choosing the path of countless possibilities paved by Agriculture and Fisheries Biotechnology R&D, DA is taking a huge step closer to reaching our goals of providing a better life for Filipinos today and the future generations. ####

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Securing food, promoting health with Soybean

by LEILA DENISSE E. PADILLA

Soybean is heralded all over the world as a wonder crop because of its resilience, versatility, and its nutritive value. Locally known as *utaw*, soybean has been widely utilized for animal feed but it has become a reliable crop with a great potential in helping alleviate hunger and poverty in the Philippines.

To optimize soybean's potentials, the Department of Agriculture (DA) through its Soybean Program has been promoting the production and processing of soybean nationwide through enabling of farmers with sufficient resources and techniques to create a sustainable and competitive soybean industry.

As the lead agency of DA for research and development (R&D), the Bureau of Agricultural Research (BAR), together with High Value

Commercial Development Program (HVCDP), and concerned agencies and institutions, led the crafting of the roadmap titled, "Building Sustainable Soybean Industry in the Philippines (2010-2014)".

With the roadmap's vision of "productive farming communities that unite as providers of healthy and nutritious food to Filipinos and the neighboring Asian countries through building strong community-based sustainable production units and establishment of a viable soybean processing industry through public-private partnership initiatives," BAR supports the implementation of soybean R&D initiatives of regional partners nationwide.

Organic Soybean Production

With the support of BAR,

the Regional Field Unit 3, the Central Luzon Integrated Agricultural Research Center (CLIARC) implemented the project titled, "Development of Commercial Organic Soybeans in Central Luzon".

Implemented in 2011, the project aims to: 1) make available organic seeds of recommended varieties, 2) showcase organic soybean production to target growing communities, and 3) conduct training on soybean production and processing.

"With the strong participation of private cooperatives, particularly the Golden Bean and Grain Producer's Cooperative, we are targeting 4,300 hectares by 2014-2015 in Region 3. This goal can be attained by proper training both for soybean production and its processing by stakeholders, developing the seed

system, conducting information campaign on the nutritional values of soya, organizing farmers into associations, and encouraging strong private sector participation,” explained Dr. Arthur Dayrit, project leader.

Promoting a healthier community with soybean

Since Central Luzon is considered the rice hub of the Philippines, encouraging farmers to venture also into soybean was a challenge. It was resolved through a series of information campaigns conducted to promote the significant benefits of soybean production.

“Its seeds contain approximately 40-45 percent protein, 20-25 percent edible vegetable oil, and a significant amount of vitamins A and E, as well as minerals and micronutrients making it a valuable component in many food items both for humans and for animals,” stated the proponents in the project’s annual report.

Soybean is also beneficial to the environment since it is a nitrogen-fixing plant that enables it to help sustain soil vigor and eliminate pests. As a short-term and sun-loving legume, it can thrive amidst the impacts of climate change without jeopardizing its nutrient quality.

Highlights of success

For this year, the 2000-square meter on-station seed production site has yielded 150 kilograms of organic soybean seeds. Each project site has established on-farm techno-demo cum production with an area similar to that of the on-station site. To encourage farmers to plant soybeans, 900 kilograms of seeds were initially distributed to farmers and associations.

To promote the benefits of soybean production, technical briefings were organized in Cabanatuan, Pampanga, Zambales, Balanga, Malolos, and Tarlac.

Capacity building trainings on soybean production and processing were also conducted to educate agricultural extension workers and farmer-partners.

In September 2013, a farmer’s field day was held in Cabanatuan City which was attended by farmer-partners and members of the Golden Bean and Grain Producer’s Cooperative. A month after, a consultative meeting for the soybean roadmap for CY

2014-2016 was organized in Nueva Ecija, which laid the commercial production targets for soybean production.

Future plans

Based on the 2014-2016 soybean roadmap, 17,300 hectares will be planted in Central Luzon by 2016. The regional breakdown of the hectareage of commercial production targeted by year is shown in the table below:

Commercial Production Targets				
REGION 3 Cluster-Province	Year			Total
	2013-2014	2014-2015	2015-2016	
Nueva Ecija	200 ha	1,300 ha	3,500 ha	5,000 ha
Aurora & Bulacan	100 ha	1,000 ha	3,000 ha	4,100 ha
Bataan & Pampanga	100 ha	1,000 ha	3,000 ha	4,100 ha
Tarlac & Zambales	100 ha	1,000 ha	3,000 ha	4,100 ha
Total Area	500 ha	4,300 ha	12,500 ha	17,300 ha



“To encourage farmers to venture in soya production, it is important to first inculcate in their minds the nutritive value of the said crop, another is [to let them know] that there are government support

services that can be tapped like initial seed sourcing and technical and marketing assistance,” said Dr. Dayrit when asked on how to motivate other farmers to plant soybean. ###



R&D: Providing the Cutting Edge... *from page 5*

collaboration with the India-based International Crops Research Institute for Semi-Arid Tropics (ICRISAT) and the DA-HVCDP.

Apiculture. Beekeeping, or apiculture, has been identified by the DA as one of the sunrise industries that have great economic potential for which BAR has intensified its support. As one of the priority commodities under the DA-HVCDP, the conduct of beekeeping R&D interventions have been facilitated by BAR to develop the potentials of this prospective industry.

Soybean. Recognizing soybean's valuable contribution to food security and human nutrition, as well as its potentials in the local and foreign markets, the Philippine Soybean Roadmap for 2010-2014 titled, "Building a Sustainable Soybean Industry in the Philippines", was crafted by the DA to promote community-based and sustainable soybean production in the country.

With BAR as the focal agency for research, the RDE program for soybean aims to establish knowledge-based and farmer-friendly research facilities for soybean production and development in strategic production areas in the country, and build strong partnerships with the private sector for the processing and marketing of soy-based products in both the local and foreign markets.

Breadfruit. With initiatives from the DA, through BAR, a carbohydrate- and energy-rich crop, breadfruit, has been identified for further research and development. Breadfruit is being promoted for its potential as a staple crop along with corn grits, saba, adlai, sweet potato, and cassava. This program is in sync with the DA's Food Self-Sufficiency Program which aims to provide options for Filipino consumers on what to serve on their table other than rice.

BAR has assisted the DA and its units in the crafting and mapping of the development roadmaps and in the setting of the RDE agenda for prioritizing funding support of the new programs. For BAR, these programs represent the wave of the future of agriculture and for which the bureau stands ready to meet the challenges presented to research.

A lot of faith is being placed on the capability of BAR and the many researchers and scientists working under the national R&D system for agriculture and fisheries in delivering the technology and research outputs that are required by the various DA programs. With its dedication and vigor in RDE efforts towards the success of the DA programs, BAR assures the DA and its clientele that this trust is well placed. ###

Commercial bioethanol...from page 19

provides yield from three cropping seasons in a year compared to sugarcane which takes 11 months resulting to a faster return of income. Sweet sorghum has comparative advantages to sugarcane as a raw material especially for farmers who want to earn income faster and gain more profit. "Farmers can earn as much as 70,000 pesos a year, half of which can be earned in four months, with the rest attainable in only 90 days as sweet sorghum can be ratooned," shared by Prof. Demafelis. Farmers can also sell the crop's grains, which can be as much as six tons/2 cropping/yr that can be processed into food and feed. A kilogram of its grain can be sold at 13-15 pesos.

This activity was carried out by the sweet sorghum team from UPLB including, Professor Rex B. Demafelis, project Leader; Dr. Emmanuel G. Samson of UPLB-CA Research and Training



Station at La Granja, La Carlota City, Negros Occidental; and Dr. Cecilia B. Pascual of the Institute of Plant Breeding, UPLB. This initiative was in collaboration with Mr. Jerelu Ganancial, City Agriculturist officer, and his staff; and through the supervision of experts on sweet sorghum led by Dr. Heraldo Layaoen, formerly of

the Mariano Marcos State University (MMSU) in Batac, Ilocos Norte.

Over the years, BAR, together with other R&D institutions, has been working with prospective investors and businessmen who have expressed interest in the development of biofuels in the country and will continue to do so in the foreseeable future. ###

BAR R&D Digest is published quarterly by the Department of Agriculture-Bureau of Agricultural Research (DA-BAR). As the staff bureau of the Department, BAR 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 National Research & Development System for Agriculture and Fisheries (NaRDSAF).

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

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Organic Vegetable Production in Ifugao

A project titled, "Community-based Participatory Action Research on Organic Vegetable Production" is being implemented in Asipulo, a vegetable growing community in Ifugao. The project aims to increase production and profit through efficient application of improved farming technologies and to adopt sustainable, ecologically-sound, and economically-viable production system. Funded by DA-BAR, the project is being implemented by the Provincial Agriculture Environment and Natural Resource Office of Lagawe, Ifugao.



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