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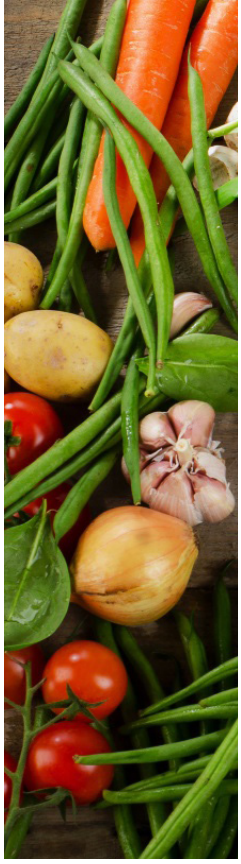

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BAR R&D Digest is the official quarterly publication of the Department of Agriculture-Bureau of Agricultural Research (DA-BAR). A staff bureau of DA, it was established to lead and coordinate the agriculture and fisheries research and development (R&D)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

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

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

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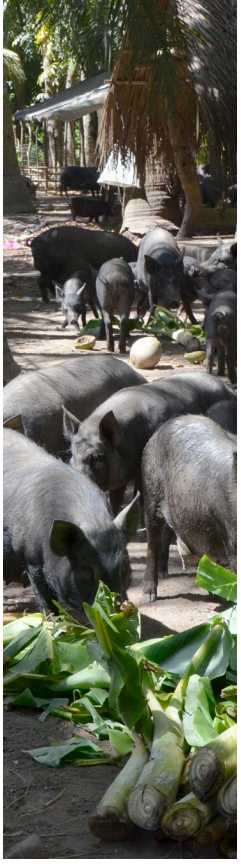

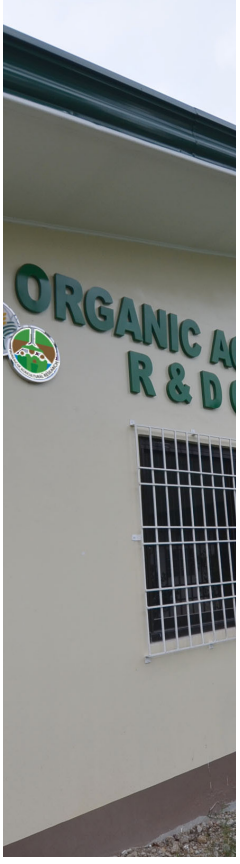

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Intensifying organic farming through R&D-generated technologies

Dr. Nicomedes P. Eleazar, *CESO IV*

Ever since the passage of Organic Agriculture (OA) Act in 2010 (Republic Act 10068), various programs, projects, and initiatives on organic farming have been implemented, cutting across all sectors of agriculture.

The Bureau of Agricultural Research (BAR), as the mandated national focal agency for the research and development (R&D) of OA, has been supporting and funding various projects and initiatives that are geared towards coming up with viable technologies that can be used by the industry.

In 2011, BAR, in consultation with various stakeholders, crafted the "Organic Agriculture Research Development and Extension (OA RDE) Agenda 2012-2016" that became the basis for implementing organic agriculture RDE projects. Consequently, a refined version of the agenda, "OA RDE Agenda 2017-2022" was drafted, this time, putting more emphasis on the validation of available technologies, and tools and practices on organic agriculture.

Five years (2012-2017) since BAR started funding OA projects, the program is able to fund 85 completed projects and 82 on-going projects. Completed projects are able to generate technologies from its applied researches; production and post-production technologies for commercialization; and establishment of R&D facilities.

Nine projects on organic agriculture R&D are featured in this issue of the BAR R&D Digest. These projects were able to specifically generate technologies that can be used by the farmers and the organic farming sector as a whole.

One of them tackles on the use of entomopathogenic nematodes (EPN) to control pest infestation in organically-produced salad vegetables. EPNs are microscopic, threadlike worms that invade the host insects through natural openings killing it within 24-48 hours. They rapidly feed on the vegetable insect pests disintegrating their tissues making them an excellent potential biocontrol agent.

Still on pest management strategies, a project was implemented specifically for the organic production of strawberry and citrus in the Cordillera. The strategies and interventions developed address infestation of different pests which occurs mostly during the dry months, a critical period of flowering and fruit development for both crops.

Organic produce has shorter shelf life as opposed to its conventionally-produced counterpart. This negatively affects its marketability which could mean loss of income for farmers and traders of organic produce. To address this, an initiative was implemented to develop technologies for maintaining the quality and ensuring safety of organically-grown fruits and vegetables during harvesting, postharvest handling, storage and marketing.

Central to organic farming is producing the organic seeds. Production of organic seeds on a much larger proportion must respond to the demands of the organic farming industry. It was on this ground that a project was conducted to contribute to the sustainable supply of organic plant materials. It targets the establishment of a national organic seed production program by setting up organic seed production areas while broadening science-based knowledge on organic seed production technologies.

A study that looks into the chemical contaminants and microbial pathogens of organically-grown versus conventionally-grown crops was also featured in this issue. The study lies on the claim that organically-grown produce are more or less chemically and microbiologically safer than the conventionally-grown produce, as there hasn't been any study conducted to prove or refute this.

Meanwhile, two studies on organic chicken and native pig were discussed in this issue. The study on organic chicken looked into developing natural sources of methionine, and other essential amino acids for native chicken organic supplemental feeds. Methionine is a sulfur-containing amino acid (AA) that is essential for maintaining the viability of poultry to remain productive and is vital for different functions in the body. Meanwhile, the second study looks into a "one health approach" in rearing native pigs. It aimed to study and identify the bacteria and parasites that exist in native pigs, including the factors in the production system and rearing practices that lead to their abundance and prevalence.

This issue also focuses on the OA R&D Centers funded by the bureau in pilot sites around the country. These Centers are established to promote relevant and significant technologies and interventions on organic farming and equip the regions with the hope of reaching out to more farming communities in promoting this sustainable practice. ###

Promoting agro-ecosystem health through **organic agriculture**

by Patrick Raymund A. Lesaca

The Food and Agriculture Organization defines organic agriculture as a holistic production management system that promotes and enhances agro-ecosystem health. It emphasizes the use of management practices in preference to the use of off-farm inputs by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system.

Signed into law in 2010, the Republic Act 10068, known as the Organic Agriculture (OA) Act, is a state policy that promotes, propagates, further develops, and implements the practice of organic farming in the country addressing farm productivity, depletion of natural resources, and health benefits of both farmers and consumers.

Section 5 of the Act envisions the institutionalization of a comprehensive OA Program with research and development (R&D) as one of its components to improve areas of production, technology support, development of organic market industry and delivery of support services, implementation of capability programs, and farmers' participation in various R&D activities.

The Bureau of Agricultural Research (BAR) is tasked under Section 20 of RA 10068 to lead and coordinate among executive agencies including strategic agricultural-based state universities and colleges (SUCs) and private organizations to develop, enhance and support, and consolidate activities related technologies for the formulation and implementation of a unified and integrated organic agriculture RDE plans and programs from the national to the field level. Part of the task is for BAR to organize an OA Research and Development and Extension (RDE) network and call for the establishment of a national, regional and provincial organic RDE centers that can be integrated as a major component of the existing RDE centers of the Department of Agriculture (DA) and other stakeholders.

Several activities has already been established including the planning, coordination, implementation, and monitoring of OA research programs; establishment and maintenance of database and information system on OA R&D programs; and creation of an inter-agency committee to oversee and monitor national RDE programs.

In 2011, in consultation with various stakeholders, BAR crafted the "Organic Agriculture Research Development and Extension (OA RDE) Agenda 2012-2016" that became the basis for implementing strategies that filled in the identified gaps in RDE activities. It also allowed all projects to be aligned with the program directives of the National Organic Agriculture Program (NOAP) of DA. Subsequently, a refined version of the agenda, "OA RDE Agenda 2017-2022" was drafted putting more emphasis on the validation of available technologies, and tools and practices on organic agriculture. The agenda also serves as a reference in planning and implementing RDE programs and projects for the medium-term.

Since its implementation, BAR OA Program has supported the development of technologies from applied researches including organic seed production, pest and disease management, crop production, and soil management; and post-production related technologies for commercialization.

Through the OA Program, technologies have been developed from applied researches, which focused on organic seed production, pest and disease management, crop production, and soil management; and the post-production related technologies for commercialization. These OA projects are being implemented by DA and its regional field offices, bureaus and attached agencies, various SUCs, and selected non-government organizations.

To date, there are 85 completed projects and 82 on-going projects on OA. The funded researches include studies on organic seed production, organic soil amendments, pest and disease management; livestock and poultry; policy and economic analysis and recommendations that serve as a guide for the enhancement of the OA program. In addition, several production and post-production related technologies were commercialized, which focus on the development of enterprises and improvement of agriculture and fisheries related industries for OA. These include the development and promotion of products from organically-produced crops such as coffee, Nipa palm sugar, sweet sorghum, Arius fruit; native cattle, native pig, native chicken; and promotion of different cropping intervention and technologies. BAR also funds research facilities, which are strategically situated nationwide to cater to organic farmers and increase awareness on the importance of organic farming. ###

People have often associated eating organically-grown salad greens with healthy eating. And since leafy greens and vegetables are eaten fresh, quality of the produce becomes a high-priced assurance both for farmers and consumers.

Consumers buy vegetables that are not only safe to eat, but are also free from damage. Health-conscious as they are, consumers are also meticulous. They don't go after the quantity alone, but also the quality of the produce. For salad vegetables in particular, consumers want them fresh and clean, with fewer holes, creases, and wilt.

This applies for farmers too. Quality is an important measure in selling vegetable produce. Even if a farmer is selling organically-grown vegetables, if it's not in good quality, he won't be able to command a high price leading to more losses.

A major constraint to growing organically-produced salad vegetables is insect pest infestation resulting to major reduction both in yield and quality of the crops.

In organic farming, a widely accepted method to control pest infestation is through botanical spraying. But this was proven to be lacking as well, if not ineffective in some cases. Various approaches and techniques are being tried in combination with the spraying of botanicals and plant concoctions to make it more potent against pests without compromising its effect on the environment.

Fighting pests in organic salad veggies with EPN

by Rita T. dela Cruz

> **Consumers buy vegetables that are not only safe to eat, but are also free from damage. Health-conscious as they are, consumers are also meticulous. They don't go after the quantity alone, but also the quality of the produce.**

One technique that is currently being tried by a group of researchers from the Cebu Technological Univeristy (CTU)-Barili Campus is the use of entomopathogenic nematodes (EPN) to control pest infestation in organically-produced salad vegetables. The project, "Identification of Indigenous Entomopathogenic Nematodes as Effective Biological Control Agent Against Common Insect Pests of Selected Organically-Grown Salad Vegetables in Cebu," was led by Maria Lima Pascual of CTU-Barili Campus and was funded by the Bureau of Agricultural Research (BAR) through the National Organic Agriculture Program.

What are entomopathogenic nematodes?

According to Dr. Pet Roey Pascual, co-project leader, EPNs are soil-borne microorganisms that feed on their host. They are microscopic and they look like threadlike worms that invade in the host insects through natural body openings (i.e. anus, mouth, etc.). Once inside the host, they release a symbiotic bacterium, which is held in the nematode's intestine, killing the host within 24-48 hours. These EPNs rapidly feed on the host cadaver disintegrating its tissues until it is totally dispersed and gone. This particular characteristic make them an excellent potential biocontrol agent against vegetable insect pests.

Since EPNs are found in soil, they serve as good indicator that the soil is in good condition. "Naturally, if the soil is in good condition, it is less exposed to inorganic chemicals, then there is a bigger chance that we can get EPN," Dr. Pascual explained. He added that, EPNs possess a unique combination of attributes such as broad host range, high virulence, long term efficacy, easy application, easy mass production, compatibility with most chemicals, and are environmentally safe which make them ideal components of insect pest management system.

EPN is one technology that has been available for some time. In fact, advance countries like the United States and Europe have already been using it for quite awhile. "Even in Asian countries like Korea and Thailand, they are also using EPN to control insect pests in vegetables. In the Philippines however, this method has not been fully tapped and optimally tried by our farmers. And this is mainly due to lack of awareness of the farmers on the technology. If we can bring this technology to the knowledge of the public, particularly those who are into organic farming, then more people will benefit from it," Dr. Pascual said.

Results of the project

Essentially, the CTU-BAR project has two components: 1) studying the ecology, biology, and

pathogenicity of EPNs; and 2) determining the compatibility of EPN with different organic management practices like wood vinegar under greenhouse condition, use of microbial inoculants, application of organic fertilizer, and mulching.

Since the project specifically studied on EPNs that are indigenous in the area, the group collected samples from various farms in Cebu. Based on the result of morphometrics, from the 17 samples collected, there were four species of nematodes (Heterorhabditis) identified: *Heterorhabditis indica*, *Heterorhabditis taysearae*, *Heterorhabditis bacteriophora*, and *Heterorhabditis marelatus*. From the four species, *H. bacteriophora* and *H. taysearae* are widely distributed in Cebu province. "Having this information, we thought of how we can use this at the farmer's field," said Dr. Pascual.

"What we really want is to promote EPN in combination or in complementation with other existing technologies such as the use of IMO, wood vinegar, organic mulching, vermicomposting, etc. Most farmers are already practicing either one or two of these organic pest management systems, but if partnered with EPN, which they can just apply once or twice a month, then it will be less laborious but more effective," he explained.

Results of the study showed that when tested under greenhouse condition, 2-4 cadavers are effective in controlling insect pests but if combined with wood vinegar, two cadavers will be enough and effective. Meanwhile, when tested in the field, results found that EPN is effective if partnered with kakawate wood vinegar. For organic fertilization, EPN is effective if combined with composted cow manure. It was also found effective in combination with microbial inoculants. However, using mulching in combination with EPN was not found as effective because the population of the nematodes declined due to their immobility in the covered soil.

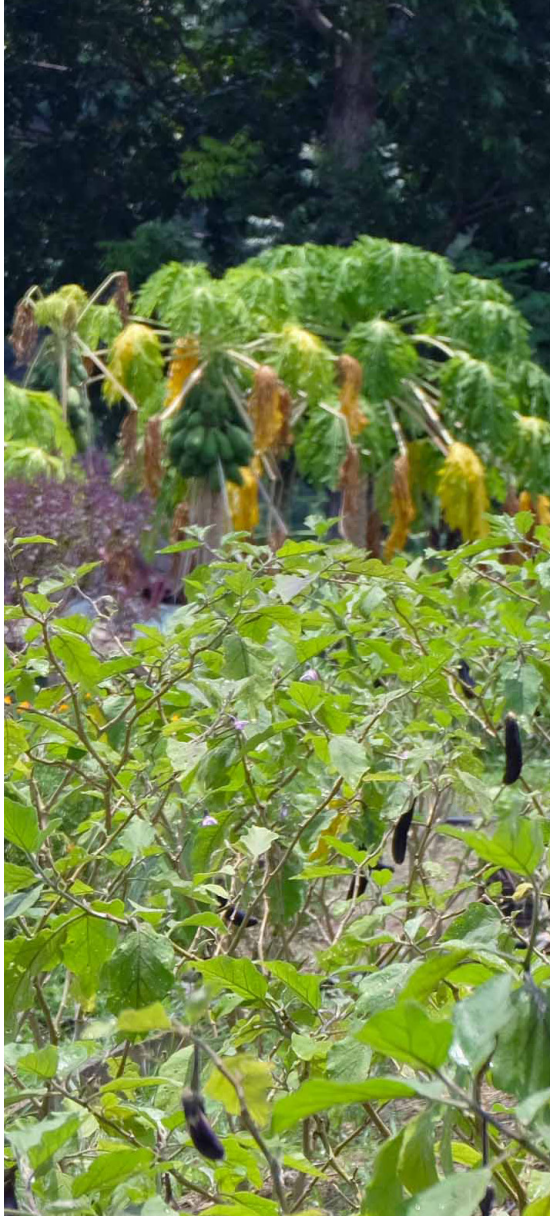
Impact of the EPN technology

In general, if EPN is used in combination with other existing cultural management practices, results of the leaf damage using VQR (visual quality rating) showed that there will be less 50 percent leaf damage in the plant. This means, it is 50 percent better if farmers use EPN rather than no management practice is applied.

"The leaves are cleaner, with fewer holes so farmers can market their produce at a relatively higher price. At the same time, consumers are assured since the produce are organically-grown therefore free from any harmful chemicals and are safe to eat," said Dr. Pascual.

Abeth Lawat, one of the project adopters, has attested to the benefit of using EPN. She is already using IMO and *kakawate* wood vinegar. She tried applying EPN to eggplant as a trial and then went on to other leafy salads like lettuce and kale and found that there was less infestation and the leaves were clean. "Before I don't know anything about EPN but when I learned about it, I was encouraged to use it because it's easier and simple to do," said Lawat.

When asked on what's next for EPN, Dr. Pascual said that "the technology is relatively new to Filipino farmers so now that the project has been completed, we want to train more farmers on the EPN technology, and at the same time, disseminate this technology through conferences and seminars not only here in Cebu but the whole region. We want more farmers to be aware of this technologyand use it to profit them." ###



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Knowing the potentials,limitations of organic produce and farming

by Rena S. Hermoso

In the recent years, organic produce has been gaining attention from the public for its nutritional benefits and being pesticide-free. However, the public must also realize that organic produce has its own set of potentials and limitations. While it is important to know the benefits of consuming organic produce, it is also equally important to learn its limitations to mitigate its negative effects and maximize its full potential.

Limitations of organic produce

Just like how pesticide residue or contamination threatens the safety of conventionally-grown produce, microbial contamination is the threat to the safety of organically-grown produce. This is primarily due to the use of animal manure in organic production. More so, microbial contamination cannot just occur during the production stage but in every stage of the handling-distribution chain.

Organic produce has shorter shelf life as opposed to its conventionally-produced counterpart. Reduced shelf life negatively affects its marketability which could mean loss of income for farmers and traders of organic produce.

Therefore, the challenge of the newly developing organic industry in the country is to deliver "organically-grown fruits and vegetables that have same safety, quality and shelf-life as their conventionally-grown counterpart," said Dr. Dormita R. Del Carmen, university researcher, Postharvest Horticulture Training and Research Center-University of the Philippines Los Baños (PHTRC-UPLB).

Efforts to improve organic produce

Headed by Dr. Del Carmen and funded by the Bureau of Agricultural Research, the research project aimed to develop technologies for maintaining the quality and ensuring safety of organically-grown fruits and vegetables during harvesting, postharvest handling, storage and marketing.

To do this, the research team of Dr. Del Carmen gathered baseline information on the supply chain, and on the consumer preferences and buying habits for organically-grown fruits and vegetables. They also identified critical points where quality is lost and microbial contamination occurs in harvest and postharvest handling chain, tested the efficacy of different sanitizers, and optimized other postharvest treatments for organically-grown produce. Using these information, they identified postharvest interventions and treatments to enhance the quality, ensure safety, and extend the shelf life of organic produce. These were then translated to information education and communication (IEC) materials (i.e. technical papers, posters, technical bulletin, extension flyers, and training manual). Training on proper postharvest handling was

conducted and IEC materials were disseminated and shared with the organic practitioners, agricultural technicians, other researchers, and industry stakeholders.

In the same study, Dr. Del Carmen said that microbial contamination can be prevented by following the Sanitation and Standard Operating Procedures (SSOP) and Good Manufacturing Practices (GMP) in the Code of Practice for Organic Produce set by the Bureau of Agriculture and Fisheries Standards.

What's in store for us?

Although organic farming has been institutionalized through the Republic Act No. 10068 (otherwise known as Organic Agriculture Act of 2010), the industry still faces many challenges (e.g. consumers' preference for lower priced conventionally-grown fruits and vegetables, uncertainty of the supply and demand, etc.) according to Dr. Del Carmen.

Despite these challenges, organic farming has a lot of potential and benefits. Aside from the health and nutritional benefits of organic produce to the consumers, it also "benefits small and marginal farmers because the processes involved require external inputs," as said by Senator Loren Legarda in the explanatory note for the then senate bill of Organic Agriculture Act of 2010. She also said that it could also support rural employment because it may be labor-intensive.

More so, she also mentioned that by adopting the then proposed measure, "the government adopts organic agriculture as a sustainable program that will redound to the economic benefits of farmers while ensuring the health of our people and sustainability of natural resources in our country." ###

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More organic seeds, More organic farmers

by Daryl Lou A. Battad

The increasing demand for organic produce in the market requires a significant demand for organic seed producers and farmers. The transition from conventional to organic farming has substantially hastened due to the equally growing health conscious consumers.

It was on this ground that Dr. Herminigilda A. Gabertan and her team at the Bureau of Plant Industry-Los Baños National Crop Research and Development Center (BPI-LBNCRDC) came up with an initiative to contribute to the sustainable supply of organic plant materials through the project, "Development of Organic Seed Production System for Lowland Vegetables and Field Legumes at BPI-LBNCRDC and Strengthening Partnership in CALABARZON, MIMAROPA, and Bicol Regions."

With the Philippine Organic Agriculture Act of 2010 otherwise known as Republic Act 10068 coming in full circle, the project team saw that in order to realize the full potential of organic agriculture, farmers would first and foremost need to have access to readily available planting materials. Consequently, disaggregated organic seed production sector, limited research studies on organic seed production, and lack of guidelines on organic seed registration are among the identified issues on the Organic Agriculture Program.

BPI, with its mandate and as the lead implementer of this project, targets to establish a national organic seed production program by setting up organic seed production areas at BPI, broadening science-based knowledge on organic seed production technologies, and strengthening the partnership of the Department of Agriculture with identified organic coordinators and stakeholders.

The project, funded by the Bureau of Agricultural Research (BAR), specifically aimed to evaluate seed yield, increase seed production, secure organic seed certification, and establish partnership among organic agriculture stakeholders.

Establishment of seed production areas

The project devoted a 1.5-hectare of land for organic seed production which was divided into eight farm units for open field production with four greenhouses and two screenhouses. Citronella, lemon grass, marigold, oregano, and celosia served as insect repellents. The area also made use of vermicompost to fertilize the soil.

Selected National Seed Industry Council (NSIC) approved varieties and promising lines of pole sitao, cowpea, mungbean, and tomato were evaluated based on their ability to thrive under organic conditions.

Crop maintenance includes the use of plastic mulch, vermicomposting, and organic nutrient supplements. Coconut-based soap dissolved in water along with blended citronella leaves was also used as spray to minimize infestation of pests such as aphids and leafminers.

For organic nutrient supplement, *madre de cacao* or *kakawate* leaves were used to produce Fermented Plant Juice (FPJ); and ginger for Oriental Herbal Nutrient (OHN). These fermented plant juices were mixed with water and sprayed on crops at least twice a week from germination to fruiting stage to supply crops with essential nutrients such as nitrogen, phosphorus, and potassium (NPK) to stimulate better plant growth.

In a single year alone during implementation, the project produced 469.27 kilograms of seeds or 3.527 tons per hectare from all crops. In addition, positive return on investment (ROI) was obtained by the highest yielder varieties of cowpea (BPI-Cp3), pole sitao (PSB

In a single year alone during implementation, the project produced 469.27 kilograms of seeds or 3.527 tons per hectare from all crops. In addition, positive return on investment (ROI) was obtained by the highest yielder varieties of cowpea (BPI-Cp3), pole sitao (PSB Ps2), mungbean (NSIC Mg14), and tomato (BPI-Tm9). These results manifest the potential of organic seeds in the market.

Ps2), mungbean (NSIC Mg14), and tomato (BPI-Tm9). These results manifest the potential of organic seeds in the market.

On 24 June 2013, a total of 1.28 hectare and 645 kilograms of organic seeds were granted an organic certification by the Organic Certification Center of the Philippines (OCCP). It then carried the OCCP seal, "Organic-in-Transition."

Building partnerships

Following the successful results, the project established partnership with the Organization for Industrial, Spiritual, and Cultural Advancement (OISCA) in the province of Quezon; the Madrigal Foundation, Inc., and the Christ Life Community (CLC) in Camarines Sur. It also partnered with the Department of Agriculture-Palawan Research and Experiment Station (DA-PRES).

OISCA, an international organization founded in 1963, advocates environmentally sustainable development through a holistic approach emphasizing the interconnectedness of agriculture, ecological integrity, and human spirit. In Quezon province, OISCA has satellites in Sariaya, Tayabas, and Lucban. Among the three branches, the project was able to establish partnership with OISCA Lucban with 22 organic adopters and an area of 3,000 square meters.

On the other hand, the Madrigal Foundation, a non-government organization (NGO) located in San Fernando, Camarines Sur, is an advocate of organic farming in the Bicol region. The organization's organic farm has 5.8 hectares, which is utilized for livestock, fishpond, and vegetable production. For this project, a total land area of 2,000 square meters was allotted for seed production. With favorable results from the project, the organization expanded its organic production area to two hectares.

Also an organic advocate NGO situated in San Fernando, Camarines Sur, CLC provides programs and opportunities for technological complementation in environmental education development, community empowerment, and human resources development to help close the technology gap between the local community and the government. The organization provided a total area of 2,000 square meters for this project, which later on expanded to four hectares because of the success in production and market.

Lastly, the DA-PRES, a government agency in Palawan which is responsible for the promotion of growth and development of the local agricultural sector in Palawan, committed an area of 5,000 square meters for organic seed production project.

To massively promote these technologies generated, harvest festivals and several trainings were conducted in all production sites, inviting farmers, researchers, and other stakeholders interested in organic agriculture.

According to project leader, Dr. Gabertan, these accomplishments have furthered motivated the team to continue its efforts in disseminating these technologies while building more partnerships in different areas in the Philippines. With the market expanding for organic produce, this initiative shall find its way to more farmers and consumers alike. ###

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Pest management strategies for organic strawberry and citrus

by Ma. Eloisa H. Aquino

The agro-climatic condition of a place is often associated with a particular fruit that is abundantly growing in that locality. For instance, the mere mention of the Cordilleras, with its highlands and cold weather, the first few things that immediately come into mind are strawberries and citrus.

"Fruit production is presently one of the major sources of income in the Cordillera and strawberry and citrus are among the high-value fruit crops in the region," affirmed Maritess A. Alimurung, researcher and project leader from the Bureau of Plant Industry-Baguio National Crop Research Development and Production Support Center (BPI-BNCRDPSC).

Strawberries are mostly grown in Benguet and part of Baguio City and some farmers are now starting to grow in other municipalities of Benguet (Atok, Buguias, Kibungan, and Mankayan) and Mountain Province (Bauko and Sagada). Meanwhile, citrus with its wider cultivation, can be seen in the Cordillera and other regions in the country.

"Varieties which are mostly National Seed Industry Council (NSIC)-registered are being mass propagated at BPI-BNCRDPSC and different growers are getting planting materials for rehabilitation and establishment of new citrus orchards both under backyard and commercial scale," Alimurung said.

Farmers are reaping the fruits of good income because of the favorable climate and established good cultural management practices but due to pest infestation coming, quality and volume of produced fruits are being compromised.

"Infestation of different pests like mites, whiteflies, thrips, aphids, fruitflies and fruit bugs is presently a major problem on both strawberries and citrus. High infestation occurs during the dry months which are also the period of flowering and fruit development of both fruit crops," Alimurung explained.

Thus farmers resort to the use of synthetic pesticides because of high pest infestation especially during

the flowering and fruit development stage. "With the present pest problem affecting strawberry and citrus production and the different factors contributing to the continuous or permanent infestation and severe damage of the pests, different strategies are needed for better management of the different pests. At present organic crop production is being promoted and practices to promote organic fruit production must be evaluated," she added.

With this premise, a team of researchers from BPI- BNCRDPSC conducted a project to identify effective pest management strategies for organic production of strawberry and citrus in the Cordillera. The initiative was funded and supported by the Bureau of Agricultural Research.

Four studies were conducted to manage population and damage of white grubs of snoutbeetle (*Metapocyrtus (Trachycyrtus)* spp.) attacking both strawberry and citrus, two spotted mites (T*etranychus urticae* Koch) on strawberry and citrus red mites (*Panonychus citri*). Effect of fungal biological control agents *Metarrhizium anisopliae* and *Beauvaria bassiana*, agricultural oil sprays, wood vinegar and botanical extracts were evaluated on mites. Beauveria and Metarrhizium isolates MA-RB and MA-RBB were found more effective among the isolates tested.

It was found that soil application of these fungi, one week before transplanting and follow-up application one month after transplanting, significantly reduced population and damage of white grubs that were feeding on the roots. Spraying of the fungus late in the afternoon using 300 to 400 g fungus grown in cracked corn mixed in 16 li water also reduced population of mites and application at early pest population are more effective.

Spray oils, wood vinegar and plant extracts evaluated against two spotted mites on strawberry and red mites on citrus significantly reduced population and damage. Mineral oil at 1-1.5 percent rate of application, hot pepper and ginger extract at 30 to 40 ml per li water applied every 1-2 weeks were more effective. Application during late afternoon controlled build-up of mite's population and resulted to lower degree of damage and higher marketable yield on strawberry and better growth of citrus seedlings.

Evaluated products/practices that were considered compatible with organic production are now being promoted through developed IEC, during trainings on organic production in the region and also to individuals or groups who are availing of fruit planting materials at BPI-BNCRDPSC. Results of the project were also presented in different scientific conferences for wider technology dissemination and promotion. ###

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Organically-grown vs conventionally-grown crops:

Ensuring quality, safety and longer shelf-life

by Patrick Raymund A. Lesaca

An emerging challenge in organic agriculture is to ensure that organically-grown fruits and vegetables equate to safety, quality, and longer shelf-life of produce. While the Organic Agriculture Program hopes to increase farm productivity while cut expenses on imported farm inputs at the same time, one of its most important aspect is the health benefits of both the farmers and consumers.

Chemical residues from pesticides and fertilizers, including heavy metals, have been implicated to have toxic effects on humans and are detrimental to soil ecology. Food-borne microbial pathogens are believed to be the most frequently occurring hazard in the nation's food and water which could be originating from the farm itself especially if organic fertilizers used were not properly processed. Cost-effective interventions are necessary to prevent, control, or eliminate microbial pathogens on fresh and minimally-processed food products.

Food quality and safety evaluation of organic food products should include not only physico-chemical and residue analysis, but also assessment of potential microbiological hazards both in organically-grown and conventionally-grown produce.

A group of researchers from the Institute of Molecular Biology and Biotechnology-University of the Philippines Los Baños (BIOTECH-UPLB) conducted a project study to evaluate the food quality and safety of organically-grown and conventionally-grown crops in two types of soil; and assess the crops in terms of their chemical contaminants and incidence of microbial pathogens. The project was intended to validate the presence of microbial pathogens in the edible portions of organically-grown crops, and assess the quality of soil after two years of growing crops in conventional method compared with organic agriculture practices.

The study, "Food Quality and Safety Evaluation of Organically Grown Crops Versus Conventionally Grown Crops in Two Types of Soil" was funded by the Bureau of Agricultural Research and led by Dr. Lorele C. Trinidad of UPLB-BIOTECH. The premise of the study lies on the observation that, no available up-to-date information on the extent or level of contaminants present in organic and conventional produce (both chemical and microbiological) that could support or refute the claim that organically-grown produce are more or less chemically and microbiologically safer than the conventionally-grown produce. Hence, investigation of the chemical and microbial qualities of both the organically-grown and conventionally-grown produce must be done to ensure safety of the consumers and of the general public.

Specifically, the objective of the study aimed to assess the food safety of conventionally-grown versus organically-grown crops in terms of chemical contaminants (heavy metals and pesticides) and

The project was intended to validate the presence of microbial pathogens in the edible portions of organically-grown crops, and assess the quality of soil after two years of growing crops in conventional method compared with organic agriculture practices.

incidence of microbial pathogens (Salmonella and E.coli). The study involved two problem soil types: acidic and clay types in the uplands of Majayjay, Laguna; and in the lowland lahar-laden soil of Bacolor, Pampanga.

A site was established in Brgy. Bitaoy, Majayjay, Laguna for management of conventional agricultural practice and for planting of organic crops. Selected crops including lettuce, cucumber, tomato, and bell pepper were planted. Meanwhile, in the lowlands of Bacolor, Pampanga the soil is lahar-laden, thus, amendment with compost and coco coir was necessary to increase its water absorption and holding capacity. Levels of Nitrogen (N), Phosphorus (P), Potassium (K) and organic matter

content were also initially increased. Heavy metals such as lead, copper, zinc, chromium, cadmium, mercury, manganese, titanium were monitored in soil through X-ray florescence (XRF) spectrometry, a non-destructive analytical technique used to determine the elemental composition of materials. The selected crops planted were ampalaya, okra, eggplant, and stringbeans.

Both sites were evaluated for chemical and microbial analyses, and partial reports conducted by the team of researchers yielded the following observations: There was an inconsistent trend in the N, P, K level and organic matter content of the soil after harvest due to the occurrence of typhoons and floods, which may have washed out a significant amount of surface soil. A year or two was not sufficient to determine significant change in the soil quality due to organic or conventional farming system. A much longer time is recommended for this kind of study considering also the seasonal fluctuations.

The microbial population in soil and the edible portions of harvested crops was analyzed using standard methods. Presence of microbial pathogens such as E. coli O157:H7 and Salmonella was also monitored after harvest. Actinomycetes are the most abundant bacteria in stable soils, yet, they are rarely reported on vegetable products. On the other hand, lactic acid bacteria are rarely found in soil per se, but they are significant parts of the bacterial biota of plants and plant products. The prevalence of microbial pathogens in some of the vegetable samples may be

due to the improper processing of chicken manure and other organic wastes used as compost. Salmonella and E. coli are enteric microorganisms usually found in the intestinal tract of animals. Edible portions of the crop may be contaminated with the mentioned bacteria through contact with the compost or with the contaminated soil.

Other than determining chemical contaminants and incidence of microbial pathogens, the project also geared toward the development of technologies for maintaining the quality and ensuring the safety of organically-grown fruits and vegetables during harvesting, postharvest handling, storage and marketing.

Postharvest technology researches focused on: 1) determining safety of the produce from microbial contaminants (determination of chemical or pesticide contaminants was not included) along the various points in the supply chain; 2) physico-chemical characterization and determination of quality changes of organically-grown produce, which were also compared with conventionally-grown counterparts; 3) maintaining the freshness of the produce and extending shelf-life (Modified Atmosphere Packing, organic acids for disease control, packaging, ripening); and 4) minimizing postharvest disease.

The results, in the form of new information or technology protocols, generated from the research studies were then translated to information education and communication materials (IEC) and disseminated and shared with the actors, both the direct and indirect players of the organic fruit and vegetables supply chain namely, the growers or organic practitioners, agricultural technicians, fellow researchers and other industry players.

Eight awareness training or capability building programs on postharvest handling of organically-grown fruits and vegetables were provided to organic practitioners in response to the needs of the industry. Most of these were in cooperation with the municipal LGUs through the agriculture office. One training program was conducted with Alter Trade Corporation, the project cooperator in the conduct of postharvest research on organic banana. A training manual was also prepared based on the training programs conducted. Evaporative cooler crates and an upscale design were provided by the project to selected vegetable producers and traders, and growers' association, who also served as cooperators of the project.

While there were a number of postharvest researches conducted during the project duration, more researches are still needed to be done on organic fresh fruits and vegetables. The changing climate greatly affected the organic production and consequently, the availability of supply became the limiting factor in the conduct of research during the span of the project. Moreover, other organic production systems in Luzon and outside of Luzon area, and the many other types of fresh fruits and vegetables grown organically have yet to be studied.

Several factors can affect the nutritional quality of crops and a well-designed and controlled study is necessary to be carried out. It has been pointed out that, to carry out a valid comparison between organic and conventional food products, it is required that plants should be cultivated in similar soils and under similar climatic conditions. To obtain representative results, it is recommended that the same crop is repeated several times throughout a long-term study.

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A "one health approach" for Philippine native pigs

by Anne Camille B. Brion

Native pigs are known to possess traits that make them favored by the farmers and the consumers alike. These include, among many others, their ability to thrive even in adverse conditions and their healthy, flavorful meats. With such attributes, there has been a growing demand for native pigs, especially for *lechon* and *lechon de leche*, commanding a competitive price and increasing the income of local farmers.

The rearing of native pigs usually involves a low-cost production system employing organic strategies. With the changing of the climate, farmers and growers are confronted with challenges on detection, control, and management of diseases associated with native pig production. "The diseases can be viral, bacterial, or parasitic in nature – with the latter two being the most common," said Dr. Vachel Gay V. Paller of the Institute of Biological Sciences-University of the Philippines Los Baños (IBS-UPLB). "Some of the important and useful information that could be used in rearing pigs are the gastrointestinal microbial flora and parasite fauna that animals harbor, as well as their biology and ecology," Dr. Paller added.

It is for these reasons that Dr. Paller, together with her colleague, Dr. Rina Opulencia embarked on a project that aimed to study and identify the bacteria and parasites that exist in native pigs, including the factors in the production system and rearing practices that lead to their abundance and prevalence. "Knowing which bacteria or parasite is present and from where they originate would be helpful in maintaining not only the overall health of the native pigs, but the farm as well. Its significance lies in ensuring not only the health of our native pigs, but of the farmers, growers, consumers, including the environment. This is what we consider as the one health approach" Dr. Paller explained.

Under the project, native pig samples were collected from farms in the province of Quezon which are practicing low-cost/organic production systems. Internal organs of weanling to market-aged pigs were collected and examined in the laboratory. Tests include microscopy intended for the presence of bacteria and parasites; and molecular detection for the identification of specific species present in the system of the native pigs, including the soil and water samples collected from the farms.

Preliminary findings showed detection of bacteria such as E. coli and Salmonella from majority of the pig and environmental samples collected. Some potential factors attributed to this were the lack of hygienic farming practices among the farmers.

As for the presence of parasites, all the native pig samples were positive for presence of intestinal helminths, protozoan parasites, and other coccidian. In addition, protozoan parasites such as *Blastocytis*, *Cryptosporidium* and *Giardia* were found contaminating water samples from the farms. "These parasites are considered emerging water-borne pathogens that originate from animals and infective to humans," Dr. Paller said.

Also, from the 48 soil samples collected from the native pig backyard farms, 93.80 percent were positive for parasites and other nematode larvae. Soil contaminations, according to Dr. Paller, may be associated with risk factors such as free-range, sub-standard confinement farming management; improper waste disposal; utilizing manure as fertilizer; and presence of other domesticated and wildlife animals which could act as parasite hosts.

While the project is still continuing, Dr. Paller said that results derived from the project will provide useful information in the development of effective management strategies, especially for those who are into low-cost, organic native pig production. In particular, these may be deemed valuable in the aspects of organic feed formulation and good agricultural practices for native pig production that will address the health of pigs, farmers,

Salmonella

E. coli

photos from: http://www.livemint.com and cdc.gov

> *Preliminary findings showed detection of bacteria such as E. coli and Salmonella from majority of the pig and environmental samples collected. Some potential factors attributed to this were the lack of hygienic farming practices among the farmers.*

and the environment.

Dr. Paller furthered that the findings derived from the project, once completed, will aid in livestock health and production, specifically in planning and promoting preventive and control measures with respect to parasite infections in native pigs. The project leader also acknowledged the need for further studies to help in the improvement of management strategies dealing with microbial and parasitic diseases, especially in organic production systems.

"Ultimately, with this project, we want to maximize the potentials of our native pigs through proper care and management to avoid diseases caused by bacteria and parasites. If our native pigs are healthy, we can be assured of the quality of its meat, which translates to better marketability and profit for our local farmers," Dr. Paller concluded.

With funding support from the Department of Agriculture's Bureau of Agricultural Research, this undertaking was made possible through collaboration with UPLB's College of Veterinary Medicine and College of Agriculture and Food Science, Bureau of Animal Industry's National Swine and Poultry Research and Development Center, and the provincial and municipal agricultural offices of Quezon. ###

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Natural response to methionine challenge in organic native chicken feed

by Victoriano B. Guiam

Commercial poultry feed and the raising of organic poultry do not mix.

Republic Act 10068, better known as the Philippine Organic Agriculture Act of 2010, disallows the use of synthetic inputs in the practice of organic agriculture as these may pose harm to consumers, the environment and the farmers themselves. Most of the poultry feed formulations found in the market do not comply with the Act as these have, as one of their contents, the synthetic form of the essential amino acid, methionine, making them incompatible with organic poultry production, more so for native chicken breeds.

Methionine in the poultry diet

All amino acids are vital to animal health. However, some cannot be produced by them and must therefore be obtained from the diet. These amino acids are technically referred to as essential amino acids. For poultry, methionine is one of these.

Methionine is a sulfur-containing amino acid that is essential for maintaining the viability of poultry to remain productive. It is vital for different bodily functions. A deficiency generally leads to poor feed conversion, retarded growth in meat birds, and reduced egg production in layers and breeders. This can also be seen in the curling of toes. Methionine, along with another sulfur-containing amino acid but non-essential amino acid, cysteine, is critical to feather formation as it is a major component of feathers. According to Jacob (2013), the lack of methionine in the diet results to bare spots, poor feather growth and increased feather pecking in the attempt to obtain enough of this vital ingredient. An increase in feather pecking in a flock can lead to cannibalism, agitation, and other behavioral issues which can lead to high mortality rates.

In "Synthetic Methionine and Organic Poultry Diets" by Dr. Jacquie Jacob, it was cited that the

use of synthetic amino acids in poultry diets is highly controversial in organic agriculture. The basic commercial poultry ration, which can be a simple corn-soybean blend, does not contain enough methionine. As it cannot be biologically produced by poultry, synthetic methionine (a colorless or white crystalline powder that is soluble in water) is generally added to commercial poultry feed. In the U.S., its inclusion is temporarily allowed in organic poultry diets pending the discovery of a natural substitute and is strictly limited to specified levels.

The hunt for effective natural sources of methionine

The increasing demand for organic agriculture (OA) products, locally and even regionally, puts growing pressure on producers to deliver. As compliance with Philippine OA standards and requirements is a must for bonafide OA producers, the search is on for suitable natural ingredients that can supply the methionine in the kind and amounts needed by poultry that are within the economic and technical reach of growers.

In the Central Philippine University in Iloilo City, researchers led by Dr. Jaime C. Cabarles, Jr., Dean of the university's College of Agriculture, Resources and Environmental Sciences (CARES) embarked on a project, "Development of Natural Source as Alternative to Synthetic Methionine for Native Chicken Organic Supplemental Feed Production," that started in 2015 with funding support from the Bureau of Agricultural Research (BAR). The goal is to develop natural sources of methionine and other essential amino acids for native chicken organic supplemental feeds. While it focuses on native chicken, good project results can help the rest of the organic chicken industry meet the standards set by RA 10068.

In an interview of Dr. Cabarles, he said that there is hardly any feed available that can be called organic. The local poultry feed industry relies heavily on synthetic methionine needs. According to statistics from Dr. Cabarles' study, the level of its importation has been growing. In 2005, it was already at six million kg and by 2011, it had reached 10.7 million kg. The value of the latest figure available (2013) is Php 2.04B. It is thus easy to see that finding a good substitute for synthetic methionine makes economic sense. Efforts along this line shall lead to poultry feed that is organic in the true sense of the word and which will be available in the quantity needed by organic chicken growers.

In his study, Dr. Cabarles noted that research for natural sources of methionine have been carried out abroad. These include the use of herbals but the outcomes

have been deemed as ineffective. The use of probiotics and microorganisms looks promising as some researches along this line have shown favorable results.

According to Dr. Cabarles, another path tried out to providing poultry with the needed proteins and amino acids was increase of the protein level in feeds. However, this has led to unfavorable externalities of environmental pollution and poses greater risk of the proliferation of pathogenic microorganisms with the increase in uric acid and ammonia produced by poultry farms.

Free range rearing of chicken, particularly for the native kind, does not have the problem of synthetic methionine in feed as the birds can get their requirement from eating a variety of food from their environment that can include insects, worms and greens. However, as pointed out by Dr. Cabarles, once the organic poultry grower decides to go commercial scale with the rising demand for naturally-grown chicken, he may not have the natural resources needed for a more intense level of production.

With hindsight obtained from the experiences of earlier researchers, Dr. Cabarles and company undertook the formulation, testing and production of natural sources of methionine and other essential amino acids for the organic production of native chicken. They have worked with leguminous crops such as *malunggay* and *ipil-ipil*; field grains such as cowpea, mungbean, and pigeon pea; corn and corn bran; sweet potato, fruit puree, whole yeast; whole eggs, dried fish amino acid, and biotech products, among others, in various combinations. The results so far have been impressive as the amino acids of their formulation were found to be comparable with those of commercial feeds.

The initial hurdles of the project have been overcome. In the interview of Dr. Cabarles, he expressed optimism that that they will be able to come up with good recommendations once studies comparing their formulation with commercial feeds are completed.

Reference:
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Organic Agriculture R&D Centers:

Equipping the regions with technologies and interventions

by Ephraim John J. Gestupa

In 2013, the Bureau of Agricultural Research (BAR), through its Institutional Development Division, convened for a meeting with representatives from the regions, namely: Ilocos, CALABARZON, Eastern Visayas, Zamboanga Peninsula, and SOCCSKSARGEN. It was agreed in this meeting that starting that year, BAR will be releasing funds for every region in the country to have their own Organic Agriculture (OA) Research and Development (R&D) Centers, initially with the four that was present in the meeting. These pilot sites were selected so that there will be OA hubs accessible across the three major zones in the country, Luzon (Region 1 and 4A), Visayas (Region 8), and Mindanao (Region 9 and 12).

Why the need for an OA R&D Centers?

Cited in the National Organic Agriculture Act of 2010, OA has the means to "cumulatively condition and enrich the fertility of the soil, increase farm productivity, reduce pollution and destruction of the environment, prevent the depletion of natural resources, further protect the health of farmers, consumers, and the general public, and save on imported farm inputs."

Traditional agriculture practices, while it has so far done the work of achieving food security for Filipinos, have also been responsible for the country's increasing Greenhouse Gas (GHG) Emissions. Plant areas that naturally absorb carbon dioxide in the air are cleared out and converted into farming areas while the soil loses its ability to store CO2 the more its being used for planting crops. As our farmers are trying to meet the demand for food, our natural resources are slowly being depleted and climate change becomes more evident.

With organic agriculture, farmers are presented with an alternative practice that helps transform the whole agricultural industry into becoming more sustainable. According to the International Federation of Organic Agriculture Movements, OA "affordably captures carbon from the air and effectively stores it in the soil in high levels for long-periods, it integrates trees, hedgerows and pastures into farming systems to increase carbon capture and biodiversity, and reduces greenhouse gas emissions and fossil fuel use through an appropriate combination of organic fertilizers, cover crops and less intensive tillage."

As the lead agency of the Department of Agriculture in charge of coordinating R&D efforts on organic agriculture, BAR set out to fund the establishment of Organic Agriculture R&D Centers in every region so that the practice can be further promoted to farmers and fisherfolk.

Promoting OA technologies and interventions

It's a common misconception among Filipino farmers that organic agriculture is costly and labor intensive. Further aggravating this negative perception is the inadequate location-specific technologies and information on organic farming. OA centers equip regional offices facilities and support services responsive to the needs of stakeholders while simultaneously promoting OA as a tool for prolonging the productivity of farming areas.

After the meeting in 2013, BAR came up with a template floor plan for the regions to follow in building their center. These included as the basic equipment commonly used in OA R&D as well as facilities for more specific organic agriculture practices such as vermicomposting, organic livestock raising and aquaculture. Aside from R&D facilities, the centers also include office spaces, dormitories and open fields that will serve technical staff conducting OA research initiatives.

As of 2017, all regions, with the exclusion of the NCR and the Negros Region, have already completed or have ongoing projects aimed at establishing their own OA R&D Centers.

In the Cordillera region, the Organic Agriculture R&D Center features a climate-resilient multipurpose facility with a green building design. The establishment of the OA center located in Dontogan, Baguio City responds to a number of recommended strategies towards further developing the Cordillera as niches of semi-temperate organic

NMACLRC's Organic R&D Center located in Malaybalay, Bukidnon

foods and eco-tourism destinations. CAR's OA center also showcases beekeeping and rabbit raising as viable component enterprise in organic production systems.

The OA center in the CALABARZON region is located at the Animal Research Compound of STIARC (Southern Tagalog Integrated Agricultural Research Center) in Marawoy, Lipa City. This region has potential to serve as a focal area for the production of organic vegetables, fruits, and other commodities. Its geographical proximity to Metro Manila provides its farmers and traders distinctive advantage as they are able to bring freshly harvested organic commodities at minimal cost.

STIARC, through its Animal Research Unit is maintaining facilities for vermiculture and vermicompost production. These existing facilities will be expanded and integrated with the proposed OA center. Also, aquaculture will be integrated as additional component in showcasing organic agriculture.

Located in Sual, Pangasinan is DA-ILIARC's (Ilocos Integrated Agricultural Research Center) Integrated Satellite Station where the region's OA center was built. The multipurpose building is part of a compound serving as an organic farm model. It features an upgraded organic fertilizer production center and an eco-park with a highly diversified ecosystem with the proper documentation of the floral and faunal communities. The OA center is also an avenue for stakeholders to learn about the sustainable production of native chicken, pigs, and ducks.

As the food basket of Mindanao, NMACLRC's (Northern Mindanao Agricultural Crops & Livestock Research Complex) OA center provides farmers and traders with an advantage by delivering fresh harvested organic commodities at minimal cost.

With NMACLRC's strategic location along the Cagayan de Oro-Malaybalay highway, the center has become a rigorous venue for consultations, meetings, seminar-workshops, batches of field trips and big events of national scope. This gives the research center the necessary means to deliver information and services particularly on organic agriculture- especially through research-generated technology on organic grains, vegetables and livestock. The center is also put up to strengthen NMACLRC's position as an Organic Agri-tourism destination in the province of Bukidnon.

In the last quarter of 2017, BAR was also able to inaugurate OA R&D centers at the research stations of Region 11 (Davao region) and 12 (SOCCSKSARGEN).

With OA centers established in every region, BAR has moved on to supporting state universities and colleges (SUCs) in establishing their own centers. As of now, institutional grants have already been given to Aklan State University in the Panay region as well as the Southern Luzon State University-Ayuti campus.

With OA centers being funded and established all across the country, BAR hopes to reach out to more farming communities in promoting this sustainable practice. These past few years, people have witnessed the rise of a more health-conscious consumer constantly on the lookout for organic produce. This puts the farmers in a strategic position to help preserve our natural resources as well as promote to the general public a healthier lifestyle as they continue practicing organic agriculture. ###

Launching of the "Compendium of Bureau of Agricultural Research (BAR)-funded Projects under the National Organic Agriculture Program (NOAP) 2011-2016" during the 14th National Organic Agriculture Congress held on 23-26 October 2017 in Cagayan de Oro City. The publication features organic agriculture projects implemented by various agencies including the Department of Agriculture's staff bureaus, attached agencies, and regional field offices; state universities and colleges, and selected non-government organizations from 2011 to 2016 and were given funding support by BAR. It features applied researches, information on production and post-production related technologies, as well as the development and promotion of products from organically-produced crops and native animals. *(Photo by PRLesaca)*

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