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An economical approach to control **Moko** in banana





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Developing a critical mass of high calibre researchers

by Dr. Nicomedes P. Eleazar, CESO IV

Improvements in agricultural productivity lie mainly in the hands of producers who innovate. In turn, the success of these innovators relies on the quality of the technology that is produced by

research. For research to be able to do this, it must have a critical mass of scientists, researchers, and inventors who can provide scientific solutions to the challenges in agriculture.

According to former Agriculture Secretary and Senator, Edgardo J. Angara, "There is now measurable improvement but, we, as a country still trail in terms of innovation behind our neighbors, specifically, Thailand, Indonesia, Malaysia, and Singapore." He added that, "we lack the critical mass of scientists, researchers, and technologists who will generate new scientific knowledge, cultivate technological innovation, and enable the country to leapfrog into economic prosperity."

We have to arrive at an

adequate number of qualified scientists for conducting high quality research. Thus, the challenge before the National Research and Development System for Agriculture and Fisheries (NaRDSAF) is to create the much needed human R&D capital. Towards this, BAR sees graduate study in science and technology as key to the development of R&D manpower with adequate knowledge and as a breeding ground for innovation.

BAR seeks to inject more scientific talent into the research system with investments in graduate scholarships and its support for the conduct of graduate theses. Beginning in 2000, the bureau has been providing scholarships for researchers and technical staff of the NaRDSAF member-institutions to pursue MS or PhD degrees in agriculture and fisheries sciences, and related fields in 11 accredited Philippine universities. To date, BAR's Degree Scholarship Program has produced 99 graduates with 49 getting MS degrees, while 50 got their PhDs.

In addition to graduate

scholarships is BAR's financial assistance for the conduct of thesis or dissertation that address major concerns in agriculture and fisheries, of graduate students of NaRDSAF member-agencies in need of additional support.

In this issue of the *BAR R&D Digest*, we give the reader a sampling of the products of BAR's scholars contained in a dozen articles that feature graduate theses. Our scholars went through rigorous graduate studies in agriculture and fisheries and this is reflected in the quality of their work. Through these articles too, the bureau is showing that BAR delivers in its mission to improve the quality of the NaRDSAF's research manpower resource.

Interested readers and students wishing to know more details on the theses of BAR's scholars and thesis-supported graduate students may visit the bureau's library through the Scientific Library Services Section (SLSS), which is under the Applied Communication Division (ACD), of which copies of the BAR-supported theses are available for room reading. ###



BAR's Degree Scholarship Program: Raising the bar of excellence of the R&D workforce

by Jacob Anderson C. Sanchez

The most important resource of any institution is its human resource, hence the need to continuously harness and develop their capabilities and contribute to the growth and progress of the country.

Pursuant to Republic Act 8435 (series 1997) or the Agriculture and Fisheries Modernization Act (AFMA), which stipulates the need to strengthen the R&D capacities of the NaRDSAF, the Bureau of Agricultural Research (BAR), as the national coordinating agency for agriculture and fisheries R&D, established and instituted the Degree Scholarship Program (DSP).

Established in 2000, the DSP is a highly competitive, merit-based Institutional Development Grant (IDG) for the National Research and Development System for Agriculture and Fisheries (NaRDSAF) member-institutions composed of the Department of Agriculture (DA) national and regional R&D Centers, national and regional state universities and colleges, and Provincial Technological Institutes for Agriculture and Fisheries (PTIAFs). DSP aims to achieve maximum competency among NaRDSAF member-institutions to efficiently and effectively implement and manage R&D programs/activities in agriculture and fisheries.

BAR Director Nicomedes P. Eleazar stressed that the strength of any research institution depends on its having and maintaining the right people with the right skills to handle particular jobs; and that aside from R&D facilities, developing and strengthening human resources in R&D is a worthy investment for any institution.

The DSP is centered on producing a dedicated circle of experts who can deliver the needed scientific information and matured technologies in agriculture, fisheries, and other related fields. The scholars receive the best quality of higher

education in any of the following universities which are considered as the Centers of Excellence. Among them include the: 1) University of the Philippines (UP) System (UP Diliman, UP Manila, UP Los Baños, UP Visayas, UP Mindanao); 2) Central Luzon State University; 3) Visayas State University; 4) University of Southern Mindanao; 5) De La Salle University; 6) Ateneo de Manila University; and 7) Mindanao State University (MSU) System.

Scholars are entitled with a substantial budget for the conduct of their thesis/dissertation, enabling them to conduct basic/applied researches that can be translated to the development and commercialization of technologies.

From 12 pioneer graduates since its inception, BAR has already produced 99 graduates consisting of 49 MS (21 male, 28 female) and 50 PhD (18 male, 32 female). Thirty-two graduates are from DA national agencies while 67 came from both DA regional agencies and SUCs. On the other hand, there are 24 on-going scholars composed of 15 MS (9 male, 6 female) and 9 PhD (4 male, 5 female). Four on-going scholars are from DA national agencies while 20 are from both DA regional agencies and SUCs.

In 2012, BAR launched the Scholarship Program for UPLB Agriculture and Agri-Biotechnology Undergraduate students to increase the number of agri-fisheries R&D professionals. The program, now on its third year, has already supported 35 students, two of which graduated *magna cum laude*. The Undergraduate Scholarship is intended for financially incapable yet intellectual and well-rounded students. It provides financial assistance to BS Agriculture (BSA) and BS Agricultural Biotechnology (BS ABT) with specialization on priority fields

including soil science, entomology, and plant pathology. In 2014, BAR and DA Biotechnology Program instituted the Biotechnology Scholarship Grant for UPLB Undergraduate Students specializing in BS Agricultural Biotechnology (BS ABT). There are 15 ongoing scholars under this scholarship.

While BAR continues to build the competency of the Agri-Fisheries R&D sector, it has also developed a signature characteristic that made it stand out among other scholarships. Effective February 2015, the program has opened doors for applicants who are below 45 years old for MS degree, or 50 years old for PhD degree. This intervention by BAR is synonymous to saying that education exempts no age.

The increasing number of graduates and on-going scholars every year has been a good indicator that the program is heading in its right direction and is achieving its end goal.

But given the growing interest by the scientific community in applying for the DSP, BAR is facing challenges one of which is the need to increase the percentage of successful applicants. Hence, partnership with agencies from the DA is imperative to meet the demand in achieving agricultural competence that adheres with global standards. BAR realizes this need, and building the nation's agri-fisheries R&D framework is a key to unlock inclusive growth. ###

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DSP aims to achieve maximum competency among NaRDSAF member-institutions to efficiently and effectively implement and manage R&D programs/activities in agriculture and fisheries.

Saving nature's gift of **traditional rice varieties**

by Victoriano B. Guiam



Since the mid-1990s, the country has been experiencing diminishing sufficiency in rice. In order to spur agricultural production, in 2002, the Philippines enacted Republic Act 7900, better known as the High-Value Crops Development Act. The Act and related policies encourage agricultural intensification in response to declining agricultural output. However, the expanded use of high yielding crops can have adverse effects on agricultural biodiversity as the cultivation of indigenous crops is greatly diminished. According to the IRRI website, "Farmers adopt new varieties, and cease growing the varieties that they have nurtured for generations and eventually lose those varieties".

Conservation of traditional rice varieties

The country is part of the center of diversity in rice and its traditional varieties are still quite extensive. These are mainly farmers' varieties and landraces adapted to specific agroecological zones such as lowland irrigated paddy, lowland rainfed, upland, saline, and cool elevated areas. Over 5,500 traditional rice varieties (or TRVs) have been documented and collected from all over the country and more are still being discovered as a result of surveys (Altoveros, N.C. and T. H. Borromeo, 2007). The conservation of these varieties is imperative if the country is to make this resource available not only to the current generation, but also to the succeeding generations of Filipinos.

There are two types of conservation: *in-situ* and *ex-situ* conservation. *In situ* involves the management of biological resources in their natural environment where they can be exposed to changes in environmental conditions, allowing the evolutionary processes that shape genetic diversity and the adaptability of plant populations to continue to operate. While it is the most desirable conservation strategy, it is

not always doable due to its explicit requirements.

Ex-situ conservation is defined as the conservation of components of biological diversity outside their natural habitat and complements *in-situ* conservation. It is particularly useful when species habitats are already destroyed. Methods include storing genetic material in artificial environments such as genebanks and herbariums.

As IRRI puts it, "Future crop improvement needs the genetic variation from traditional varieties and related wild species to cope with the many biotic and abiotic stresses that challenge rice production around the world". The diversity of Philippine indigenous crops is being rapidly lost as a result of changing markets, farming practices, environmental degradation and other factors. The losses can happen even before they have been completely documented or studied by formal research. As a research area, understanding the status of the diversity of indigenous crops on-farm and in wild areas and how they are used and managed by people is important for these resources to be effectively and efficiently valued, used and conserved.

Characterization of upland traditional varieties

Crucial to the conservation of TRVs is their characterization. Accordingly, Mr. Saudi Dumo Mangindra of the DA of ARMM undertook a study titled, "On-Farm Conservation and Diversity Assessment of Traditional Upland Rice (*Oryza sativa* L.) Varieties in Lanao del Sur and Maguindanao Provinces" to determine the state of on-farm conservation by rice growers and genetic diversity of upland TRVs in the two provinces. Behavioral patterns in upland TRV conservation were also noted.

Many of the rice-growing areas where culture and tradition remain strong are potentially rich in agro-biodiversity. Plant genetic

resources, including rice varieties with good eating quality, multiple resistances to biotic stresses, and tolerance to abiotic stresses can possibly be found there. These areas also are home to ethnic minority groups with socio-cultural values that require unique heirloom or traditional varieties.

According to Mangindra, work on rice conservation has not been much in the southern part of the country. Few explorations for the collection and conservation of TRVs have ever been attempted. Studies on on-farm conservation are virtually non-existent. With modern rice varieties making inroads in the two provinces, it is important to know the status of traditional varieties and their displacement as the preferred varieties as inputs to future conservation plans.

Four municipalities each in Maguindanao (*Upi, Sultan Kudarat, Matanog, and Barira*) and Lanao del Sur (*Pagayawan, Calanugas, Ganasi, and Pualas*) were chosen for the study. These municipalities and corresponding barangays were selected based on the agricultural profile provided by their respective PAOs and MAOs, and the existence of upland TRVs in their areas.

The study made use of interviews, using a structured questionnaire, of 78 randomly selected upland TRV farmers from Maguindanao (42) and Lanao del Sur (36) as respondents. Focus Group Discussions and interviews of Key Respondents were also undertaken. For on-site agro-morphological characterization of upland TRVs, farms of those among the 78 respondents were selected.

Results of the study

Based on the data generated by the study, the levels of upland TRV conservation in Maguindanao and Lanao del Sur are moderately high with majority of the farmers maintaining more than one upland TRV without replacing the existing varieties. However, the potentials for conservation in both provinces are

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deemed low. The author attributes this to the displacement of upland TRVs as a result of human conflict or war.

Heavy losses in upland TRVs were experienced by the farmers in the affected municipalities particularly in the martial law years of the 1970s when they had to abandon their farms and their old varieties. Apparently, local diversity in rice has not recovered its pre-war status. Farmers resorted to whatever rice varieties were available when peace returned. Many of these were high yielding varieties (HYVs). In time, with the higher yields offered by HYVs, farmers came to favor these over the upland TRVs. Most of the respondents from Lanao del Sur said that they are now maintaining just one or two TRVs.

Socio-cultural factors and their relationship to farmers' potential to conserve

The relationship between socio-cultural parameters to level and potential for conservation of the farmers was determined. Results show that in Maguindanao, there is positive correlation of the language spoken by the farmers, length of residence in the village, and number of years engaged in upland rice cultivation to this potential. Farmers who had long experience in upland rice farming and those who have stayed in the village/community for a long time have a higher tendency to conserve upland rice on-farm. Gender, civil status, age, religion, tribe, migration, and education are not significantly correlated with farmers' potential to conserve upland rice on-farm.

In Lanao del Sur, age of the farmers is negatively correlated with the level of conservation with the younger farmers tending to conserve upland TRVs on-farm more than the older farmers as they bring in varieties from other communities. Farmer migration was found to be positively correlated with level of conservation because migrants also brought with them upland TRVs that replace lost varieties. Civil status, educational attainment, length of stay in the village, and number of years in rice cultivation are not significantly correlated with the level of conservation of the respondents.

In Maguindanao, barter or the exchange of upland rice varieties has a strong relationship to the level of conservation. Farmers who engage in the exchange of rice



The provinces of Maguindanao and Lanao del Sur still have high diversity in traditional upland rice varieties and have the potential for their conservation.

for commodities have a tendency to maintain varieties on-farm. Bartering of upland rice varieties for planting purposes increases the level of conservation. Barter also encourages farmers to maintain existing varieties. The giving of rice seeds was also found to be significantly correlated with the potential for conservation.

In Lanao del Sur, the selling of upland rice varieties was found to have a strong relationship to level of conservation. Lanao del Sur farmers usually sell their rice seeds to other farmers for planting.

Diversity assessment

A total of 105 upland TRVs were identified in the study sites. As yet, IRRI does not have these in its global germplasm collection and the author takes this to mean that traditional rice

germplasm diversity in Maguindanao and Lanao del Sur remains unique. Of the upland TRVs, 71 were found to be highly diverse in both qualitative and quantitative traits.

Conclusion/Recommendations

The provinces of Maguindanao and Lanao del Sur still have high diversity in traditional upland rice varieties and have the potential for their conservation. Unfortunately, threats to genetic diversity and conservation are present. The author therefore recommends the implementation of on-farm conservation programs in order to save the remaining varieties. As the study was limited by political instability in some of the production areas, further investigation is recommended for those areas in order to arrive at a more complete picture of local rice agrobiodiversity.

This article was based from an MS study titled, "On-Farm Conservation and Diversity Assessment of Traditional Upland Rice (*Oryza sativa* L.) Varieties in Lanao del Sur and Maguindanao Provinces" by Saudi D. Mangindra. He is a recipient of the Degree Scholarship Program of the Bureau of Agricultural Research. For more information on his study, you may send him an email at saudimangindra@gmail.com

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In 1981, the Bureau of Fisheries and Aquatic Resources (BFAR) through the Indo Pacific Fisheries Commission and the private sector introduced the river catfish (*Pangasianodon hypophthalmus*) as another source of food fish in the country. While breeding trials, risk assessments, and culture methods have been initiated, the river catfish was not immediately accepted as food, rather as a popular aquarium fish known as the freshwater hammerhead shark. However, its increasing demand in the global market has reinvigorated and brought back the interest of many fish farmers in the aquaculture industry to culture it once again as a food commodity.

Potentials of the river catfish

An inhabitant of the Mekong River, one of the largest and important fishing areas in the world, the river catfish has a long, latterly flattened body with no scales. It appears to have a uniformly grey color, but sometimes with greenish tint and silvery sides. Its flesh ranges from creamy white to orange, with a mild flavor and a medium firm texture.

The river catfish has already reached a number of countries, bearing the English names Sutchi catfish, iridescent shark-catfish, and striped catfish. The Laotians call it *Pa sooi* and *Pa sooi khaeo*, *Pla Sawai* among the Thais, *Pra* and *Trey pra* for the Khmers, and *Cá Tra* among the Vietnamese.

In the Philippines, it has also gained popularity as pangasius and cream dory. Within the aquaculture sector, the river catfish is considered as the third most important freshwater fish group (BFAR-Region 02, 2008). According to the Department of Trade and Industry (DTI), the Philippines' monthly importation averages at 600 metric tons, valued at US\$ 1.650 million, in order to supply the demand of the food industry.

It also shares a big portion of the global demand for fish resources. Vietnam, world's top producer and exporter of river catfish, produced 1.1 to 1.2 million tons for the year 2014. In 2015, production is forecasted to remain stable and exports are seen to reach US\$ 1.75-1.85 billion.



Pangasius

From aquarium fish to economically important food fish

by Anne Camille B. Brion

Due to its potential to offer higher profitability as compared to other cultured species, it is now also being cultured in other Asian countries including Bangladesh, China, India, Indonesia, Malaysia, and Myanmar, among others. For one, it is a fast growing species that can be harvested within a span of six months. Reaching more or less than a kilogram harvest weight, it also has a survival rate of up to 95 percent. In addition, it has a versatile feeding habit and can feed on vegetable trimmings, rotten fruits, snails, or even kitchen leftovers. As an air-breathing fish, it has the ability to thrive under poor water quality conditions or even in low dissolved oxygen levels.

Increasing production through artificial propagation

To cater to the growing demand for this fish species, large volumes of fry for grow-out farming are needed. Opportunities on high spawning performance and increased larval survival must be tapped to achieve targeted volumes.

In 2007, Frederick B. Muyot was awarded a grant through the Scholarship Program of the Department of Agriculture-Bureau of Agricultural Research (DA-BAR) while he was pursuing a Master's Degree in Aquaculture at the Central Luzon State University in Nueva Ecija. Working as a senior aquaculturist at the BFAR-National Fisheries Research

and Development Institute (NFRDI), his interest in fisheries, specifically on aquaculture, prompted him to initiate a study on "Artificial Propagation of River Catfish Using Different Hormone Combinations".

The study of Muyot sought to determine the effect of hormone combinations and larval rearing systems in the artificial propagation of river catfish. According to Muyot, the use of different hormone combinations and the application of greenwater system are seen to be effective mechanisms in propagating river catfish, yet, only limited studies on such areas have been done in the country. "This study aims to generate useful information on the

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induced spawning and larval rearing of this important fish species, and will serve as a guide to hatchery operators to increase their seed production," he said.

While the river catfish isn't the type to reproduce naturally outside of its natural habitat, its fingerlings are produced artificially, particularly through induced spawning. This involves injecting matured breeders about three years old with hormones to aid in stimulating reproduction.

To determine the effect of the different hormone combinations on spawning performance, Muyot combined the following: 1) luteinizing hormone releasing hormone analogue (LHRHa) with human chorionic gonadotropin (HCG) and domperidone (dom) to produce LHD; 2) salmon gonadotrophin hormone analogue (sGnRH α) with HCG and dom to create SHD; and 3) LHRHa with dom to make LD.

Results of the study found both LHD and SHD treatments to be effective and had better spawning performance as compared to LD. This was manifested by the higher number of stripped eggs and produced larvae in LHD and SHD than in LD. Fertilization and hatching rates in the three treatments, however, did not differ significantly from each other. Based on the computations for cost analysis, the study revealed that LHD and SHD were more cost efficient, and had higher gross sales and net gain than the LD.

Muyot also included in his study the effect of greenwater and clearwater rearing systems with different food types (Brachionus, Artemia, and Moina) on the growth and survival of river catfish larvae. The outcome showed that specific growth rate and absolute growth were significantly higher in larvae reared in the greenwater system and fed with combined Brachionus, Artemia, and Moina as opposed to the larvae reared in the clearwater system and fed with Artemia only. It also indicated that each of the three larval foods is important, such that the absence of one will significantly decrease larval growth. In terms of survival, higher rate was observed for larvae reared in the greenwater system. Each of the three food types was required by the larvae to achieve higher survival rate.

The use of greenwater system was also found to be more economically efficient. Though it entails higher production cost, the gross revenue and net gain were higher than using the clearwater system.

Researches such as this may serve as a vital tool in responding to the needs of local hatcheries on limited seed availability for grow-out farming. Endeavors that promote sustainable seed production must be supported and given attention as river catfish farming has the potential to be one of the most lucrative business enterprises in the country. ###

This article was based from an MS study titled, "Artificial Propagation of River Catfish Using Different Hormone Combinations" by Frederick B. Muyot of the National Fisheries Research Development Institute, Bureau of Fisheries and Aquatic Resources. He is a recipient of the Degree Scholarship Program of the Bureau of Agricultural Research. For more information on his study, you may send him an email at fredbmuyot@yahoo.com or call at telephone number: (043) 421-1465.

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members of any formal organization and attended no formal training related to their line of business, their competence in handling such business depended on the experience they have earned through a number of years in the business. In Filipino, we coin it as "pamanang negosyo" which has been handed down from generation to generation.

The home-based dairy entrepreneur impact

Women empowerment is always the primary call for small enterprises that involve women in the majority. In this undertaking, the most important change it brought these women was the fact that they have been regarded as significant members of their own communities. Apart from the self fulfillment they acquired through their involvement in this enterprise, they also became financially stable and independent, being able to send their children to school and even afford some luxury. Moreover, this involvement caused an improved social status for the women that led to positive attitudes from consistently acquiring and developing new skills, improving the welfare of the family, and a growing sense of belongingness as economically part of a society.

However, as in any enterprise, challenges are present and cannot be avoided. In the case of these home-based dairy entrepreneurs, it is their limitation in terms of financial management, as well as building linkages and networks with other stakeholders and organizations. These calls for development specialists in undertaking interventions that will help strengthen these women groups.

Even so, the impact of the home-based dairy enterprise cannot be discounted especially to the growing number of women entrepreneurs getting involved in it. In a world where issues on gender roles are unrelenting, it sheds some light that somehow, rural women, who are mostly expected to stay at home fulfilling their tasks as mothers and wives, can also avail of economic opportunities while still doing what they do best—by simply being wives and mothers. ###

This article is part of the dissertation of Dr. Liza G. Battad, one of the recipients of the Degree Scholarship Program of the Bureau of Agricultural Research. For more queries regarding the article, contact Dr. Battad at battadliza@yahoo.com

Some preliminary studies have suggested that it may be a powerful antiviral agent, and potent immune system enhancer. It is being tested as a possible treatment for certain types of cancer and conditions as serious as diabetes.



Aloe vera... from page 31

and development of blood cells. Among the important minerals found in Aloe vera are calcium, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, and zinc. These minerals are essential for good health and are known to work in synergistic combinations with each other, with vitamins and other trace elements.

Aside from vitamins and minerals, Aloe vera is rich with enzymes (help the breakdown of food sugars and fats), hormones (assist in healing and anti-inflammatory activities), sugars (i.e. glucose and fructose that provide anti-inflammatory activity), anthraquinones or phenolic compounds (aid in absorption from gastro-intestinal tract and have anti-microbial and pain killing effects), lignin (increases blood circulation), saponins (provides cleansing and antiseptic activity), sterols (antiseptic and analgesic), amino acids (basic building blocks of proteins in the production of

muscle tissue), and salicylic acid (work as a pain killer).

With the build-up nutrients and capability of Aloe vera both as natural healer for humans and growth promoter in poultry, it's not surprising that the scientific community finds interesting and effective uses of this wonder plant.

Some preliminary studies have suggested that it may be a powerful antiviral agent, and potent immune system enhancer. It is being tested as a possible treatment for certain types of cancer and conditions as serious as diabetes. Although promising studies such as this are still waiting validation, still, it's good to know that a house plant that is as common as the Aloe vera can create such potent effects. ###

This article was based from the dissertation titled, "Growth Performance and Sensory Evaluation of Broilers Supplemented with Aloe Vera (Aloe barbadensis) Extract in Drinking Water"

by Feliciano R. Bejar of the Samar State College of Agriculture and Forestry, San Jorge, Samar and Ms. Remedies P. Colapo of the University of Eastern Philippines, Catarman, Northern Samar. Mr. Bejar is a recipient of the Thesis Development Assistance Program (TDAP) of the Bureau of Agricultural Research. For more information on the study, you may send an email at bejar_43@yahoo.com or through mobile no. 0918-5582783.

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Amino Acid Chelates

alternative means to reduce mineral excretion in broiler and layer

by Diana Rose A. de Leon

Poultry needs balance nutrition in order to reach their optimal growth and development, thus ensuring stable, quality, and safe animal-derived foods for human consumption.

To maximize the benefits of nutrients to heighten the performance of animals, poultry raisers tend to oversupply some nutrient intakes, such as minerals, without considering its negative impact on the environment. Studies showed that excessive dosage of minerals in diets can lead to excessive mineral excretion that causes environmental pollution. Thus, several literatures pointed out a need to further conduct research to address the problem.

Dr. Marivic B. Mapesos-de Vera, a senior agriculturist from the Research Division of Bureau of Animal Industry (BAI), conducted a local study on the topic. In her dissertation titled, "The Efficacy of Amino Acid Chelates of Iron, Copper, Manganese and Zinc in Broiler and Layer Diets" she explored the use of amino acids chelates of iron, copper, manganese, and zinc in broiler and layer diets. Specifically, her study aimed to: 1)

determine the effect of chelation on the retention and excretion of iron, copper, manganese and zinc; 2) determine the effect of amino acid chelates of iron, copper, manganese and zinc on the performance of broilers and layers; and 3) evaluate the cost efficiency of using amino acid chelates of iron, copper, manganese and zinc in broiler and layer production.

Importance of microminerals

Nutrients such as carbohydrates, proteins, fats, water, vitamins, and minerals are essential to poultry for them to develop and function well. Normally, these nutrients are found in their feedstuffs and through supplementation.

Microminerals are needed for bone, egg shells, and blood cells formation, blood clotting, enzyme activation, energy metabolism and proper muscle function. Microminerals play a crucial role in many bodily functions since deficiency may result to metabolic disorders, poor growth rate, low egg production, low hatchability, and poor feed efficiency.

Supplementation of microminerals as premix in poultry diet is done to ensure the micromineral requirement of animals is met.

Micromineral absorption, bioavailability through chelation

On the research study of Dr. Mapesos-de Vera she pointed out that one way to minimize excessive mineral excretion is by using organic microminerals or chelated microminerals (CM). CM are known to improve absorption and bioavailability of microminerals in the body.

Bioavailability is defined in the study as the "degree to which an ingested nutrient in a particular source absorbed in a form that the nutrient is available at the tissue level rather than just at the dietary level". The more bioavailable a mineral becomes, the lower the dietary concentration needs to satisfy the nutritional requirement. Mineral absorption, on the other hand, is being influenced by the antagonistic relationship among and between microminerals. Another factor that

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limits the absorption is the limited ligand/escort availability. A mineral that is able to find an escort is absorbed and those that cannot are excreted.

Dr. Mapesos-de Vera also tackled the advantage and disadvantage of using either the inorganic or the organic forms of microminerals. Inorganic microminerals (IM) are commonly used because they are cheaper and readily available in the market compared to organic microminerals (OM). However, some literatures showed that OM are known to be better absorbed, utilized, and stored in tissues.

Chelation is one way to make microminerals more available to the body. In this study, it is a method wherein microminerals are bound to amino acids forming a protection so it can be readily absorbed by the body. Amino acids are ideal chelating agents because normally 95 percent of the amino acids are absorbed and are rapidly assimilated into the tissues.

Broiler and layer experiments

Two separate experiments were conducted by Dr. Mapesos-de Vera to determine the efficacy of amino acid chelates of iron, copper, zinc, and manganese in broiler and layer diets. The formulations of IM and CM premixes were based on the National Research Council standard nutrient requirement and recommendation of the manufacturer, for broilers and layers, respectively.

For broiler experiment, 240 day-old straight-run Cobb broiler chicks were distributed to five treatments with partial and complete replacement of IM with CM premix. The experiment showed that iron, copper, zinc, and manganese levels of the liver and tibia were not significantly affected with partial or complete replacement of IM with CM premix.

For layer experiment, 125 heads of 23 week-old Lohmann pullets were used in the study. Based on the result, the liver iron content was significantly decreased when 75 to 100 percent of the IM was replaced by CM premix in the diet.

For both broiler and layer diets, the micromineral excretion through the feces decreased consistently with increased replacement of IM with CM premix. Partial or complete replacement of IM with CM did not influence the broiler performance in terms of average body weight gain, feed consumption, feed efficiency, livability and dressing percentage; as well as the average egg production, egg weight, feed consumption, feed efficiency, weight gain and livability of layers, shell thickness and yolk color of eggs produced by the layers were not also affected.. Lastly, the partial or complete replacement of IM with CM premix in the diet shows a slightly increased in income over feed and chick cost of the broilers.

At the end, she recommended that poultry raisers use CM in broiler and layer diets to help reduce environmental pollution as it had no effect on

the performance an economics of broiler or egg production of layer. ###

This article was based from the dissertation titled, "The Efficacy of Amino Acid Chelates of Iron, Copper, Manganese and Zinc in Broiler and Layer Diets" by Dr. Marivic B. Mapesos-de Vera, a recipient of Degree Scholarship Program of the Bureau of Agricultural Research. For more information on her study, you may send her an email at mavic242002@yahoo.com

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Home-based dairy industry

an “extension of home” for women entrepreneurs

by Daryl Lou A. Battad

The role of women in the society has been among the center of controversies even up to this day. In the Philippine setting, women are generally expected to carry out responsibilities in the home more than in the workplace, thus raising intricacies in the gender issues of various interest groups to somehow uplift the women’s plight to equal opportunities especially in the economic zone.

In the rural areas, particularly in many agricultural communities, home-based entrepreneurship has leveraged in the light of empowering women without having to take the demands of house work and child rearing for granted. Both the public and private sector have brought about efforts in promoting a wide range of livelihood programs that would entice the participation of women in production and development.

The case of Bulacan women entrepreneurs

The province of Bulacan is making quite a reputation in its sweets and pastries delicacies. If there would be one famous product one can tell about Bulacan, *pastillas*

de leche can pass on top of the list. This industry holds sweet to rural women, especially in the municipality of San Miguel, Bulacan as it provided them opportunities to be involved in community-based economic activities, allowing them to be independent and skill-oriented. This is what the study on “Women Entrepreneurs in the Home-based Dairy Industry in the Philippines” was able to find out in identifying and analyzing enterprise modalities and women’s contribution to the growth and development of the home-based dairy industry.

Conducted by Dr. Liza G. Battad, chief of the Planning and Special Project of the Philippine Carabao Center (PCC), this local research specifically aimed to: 1) describe the structure of the home-based dairy industry and the different enterprise modalities it contains; 2) determine the socio-demographics, economics, and social characteristics and capacities of women; 3) identify the difference in enterprise modality in terms of women’s involvement, production, and management system, marketing and business performance; 4) analyze the relationship of

demographic-economics and psychosocial variables with home-based dairy enterprise performance and involvement; and 5) and assess the economic consequences of home-based dairy enterprise.

According to the women-respondents, production and marketing orientation were the basis in identifying the operation modalities in home-based dairy enterprises. They consist of large scale *pastillas* makers that have business contracts with institutional buyers, and small scale women processors whose market orientation is within their respective localities.

Driven by the need to address the insufficiency of their family income, these women-entrepreneurs agreed to get themselves involved in home-based dairy enterprise. According to them, this kind of enterprise tailored to their roles and responsibilities as wives and mothers. The convenience of staying home while attending to both domestic and entrepreneurial roles appealed to their functionality and sense of responsibility.

Although majority of the women-entrepreneurs were not

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The country is rich with indigenous and medicinal plants which are believed to have therapeutic benefits. Exploring the biodiversity of different plant species in addressing not only the basic nutrition it contains and provides, but also other health benefits such as natural antioxidants, has already begun.

Natural antioxidants are derived from many substances that can neutralize cell damaging free radicals in the human body. These consist of sulfur-containing amino acids and proteins such as lutein, cysteine and glutathione, uric acid and substances found from different plants and herbs. Fruits and vegetables are also great sources of antioxidants because they contain vitamin C, vitamin E, selenium and beta-carotene, among others. Although they are the best sources of antioxidants, the problem is that they are produced conventionally, which relies on the abundant use of chemical fertilizers and pesticides.

Studies revealed that those organically-grown vegetables have high antioxidants concentration than those that were produced inorganically. In tomato, the levels of quercetin and kaempferol in organically-grown plants were 79 percent and 97 percent higher, respectively, compared with plants grown by means of the conventional production system (Mitchell et al. 2007). Likewise, antioxidant activities in Chinese cabbage leaves, expressed as 2,2-diphenyl-1-picrylhydrazyl- and hydroxyl-scavenging activities and as iron (Fe²⁺)-chelating activity were higher by 92 percent, 40 percent and 36 percent, respectively, in the vermicompost:soil mixture (4:7 w/w) than those in pure soil treatment (Wang et al. 2010).

Higher antioxidants for organically-grown

Ampalaya

by Patrick Raymund A. Lesaca

Effect of soil organic amendments on ampalaya

Given the food value and medicinal potentials of ampalaya, there is a need to come up with cultural practices that would enhance its yield and functional properties. Fertilizer application is one of the most effective cultural management practices because soil fertility tends to decline with time, and soils are vulnerable to leaching, erosion and volatilization, the result could lead to nutrient depletion. Fertilizer

application can increase the amount of nutrients available to the plants. Moreover, increasing crop yield through fertilization takes into consideration the kind, rate and time of application and soil condition.

A study titled, "Comparative Effect of Soil Organic Amendments on the Growth, Yield and Antioxidant Content of Ampalaya (*Momordica charantia* L.)" by Marilou Mante-Benitez of the Visayas State University (VSU) was conducted to determine the comparative effects of soil organic amendments, (i.e. vermicompost, commercial compost, Bio-N) and inorganic fertilizer, on the growth, yield, and antioxidant contents of ampalaya (*Momordica charantia* L.). The study aimed to determine the influence of using different soil organic amendments and inorganic fertilizer on ampalaya leaf and fruit production. Specifically, it was conducted to 1) determine the effects of the different soil organic amendments and inorganic fertilizer, and 2) compare the effects of the different soil organic amendments and inorganic fertilizer on the antioxidant components of ampalaya leaves and fruits.

According to Benitez, a number of research studies revealed that organic farming ensures better yields at low cost and fetches more income. Organic manures (vermicompost, village compost, and town compost), slaughterhouse wastes, fish wastes and biofertilizers may be used as substitutes for chemical fertilizers for crop production. These materials once decomposed by microorganisms provided essential elements required for growth and development. In addition, organically grown crops contained higher levels of beneficial plant chemicals like polyphenols and other antioxidants than those produced inorganically. Some evidences indicated that organically grown plants are more nutrient-dense with higher antioxidant levels.

Few studies, however, have been conducted on the evaluation of the application of various soil organic amendments on the antioxidant components in ampalaya. The study investigated the effects of inorganic fertilizer and soil organic amendments

as well as the antioxidant properties: total phenolics, flavonoids, total tannins, percent lipid peroxidation and vitamin C in both fruits and leaves.

The results of this study, as articulated by Benitez, may be used to identify or recommend the potential organic inputs that may be used to improve the growth, yield and enhance the antioxidant properties of ampalaya.

Impact, conclusion and recommendation

Based on the experiments conducted, ampalaya responded favorably to the application of different soil organic amendments like vermicompost, Bio-N and commercial compost as reflected in the enhanced growth, yield and antioxidant contents of the plant compared to those under the no fertilizer treatment during the experiment.

Plant height, number of leaves, total leaf area, herbage yield and vine vigor increased significantly when applied with different soil organic and inorganic fertilizers as compared with those of the unfertilized plants. The total number and weight of fruits, and total number and weight of both marketable and non-marketable fruits were highest in plants given inorganic fertilizer. In terms of fruit size, the unfertilized plants produced the smallest fruits. According to the researcher, the incidence of deformed fruits was also noted in the control plants despite the bagging done on the fruits. The length, diameter and weight of fruits raised from the different soil-amended treatments were comparable with one another.

The level of antioxidants (total phenolics, total flavonoids, total tannins and vitamin C) was generally higher in ampalaya plants fertilized with organic composts compared with those applied with inorganic fertilizer. The antioxidant levels of the fruits harvested from vermicompost-treated plants were at par with those obtained from Bio-N treatment particularly in terms of total phenolics, tannins and flavonoid contents. In the leaves, the

antioxidant contents were generally higher in plants grown with Bio-N fertilizer than those supplied with either vermicompost or commercial compost.

The results of the study provided useful information on organic fertilization of ampalaya, which can be easily adopted by the farmers. Benitez, however, concluded that further research needs to be conducted to establish the relationship between nutritional content and the antioxidant components of the plant. Likewise, a similar experiment must also be conducted during the wet season with two or more croppings to evaluate the residual effect of vermicompost, commercial compost and Bio-N on the succeeding crops. A higher level of soil organic amendments than those used in the study or other types of organic composts and Ampalaya varieties may be tried. ###

This article was based from an MS study titled, "Comparative Effect of Soil Organic Amendments on the Growth, Yield and Antioxidant Content of Ampalaya (*Momordica charantia* L.)" by Marilou Mante-Benitez of the Visayas State University (VSU). She is a recipient of the Degree Scholarship Program of the Bureau of Agricultural Research. For more information, you may email her at benitezmarilou52@yahoo.com or mobile no: 0929-6710498 or 0915-1387461

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Evaluating CPAR

as an extension delivery system

by Liza Angelica D. Barral

It is the continuing initiative of the Bureau of Agricultural Research (BAR) to implement R&D programs that are responsive to the needs of the agriculture and fisheries sectors and cascade them at the grassroot level. Thus, in 1999, the bureau initiated the Community-based Participatory Action Research (CPAR), a location-specific research cum extension that deals with the improved farming systems technologies for specific micro agri-climatic environment within provinces or municipality.

To date, there are more than 200 CPAR projects that are being implemented all over the country which benefited more than 11,000 farmers. Given the notable strengths of the program, it is also imperative to assess its effectivity based on various aspects including planning, implementation, and management in order to ensure the attainment of its goals and objectives as well as to further improve the existing planning and implementation mechanisms established by the bureau. In 2007, Dr. Salimar P. Pandita, who was then the designated head of the Socio-Economic and Policy at the Department of Agriculture-Autonomous Region in Muslim Mindanao (DA-ARMM), was involved in the socio-economic aspects of the CPAR projects. While conducting research in preparation for her dissertation proposal, she thought of evaluating selected CPAR projects in ARMM five years after it was being completed. The researcher was even more curious of the end results of the program specifically on its implementation, management, and target beneficiaries. Since she was currently handling the projects, Dr. Pandita took advantage of the opportunity to successfully accomplish

her proposed study and at the same time to contribute to the successful implementation of the CPAR as a program. "Assessing it came in handy and applicable as I also have an easy access to information and reference of the conducted CPAR projects," Dr. Pandita explained.

Thus, Dr. Pandita pursued her dissertation study titled, "Effectiveness of Community-based Participatory Action Research (CPAR) as an Extension Delivery System in the Mainland Provinces of Autonomous Region in Muslim Mindanao". Specifically, her study sought to: 1) describe the socioeconomic profile of the farmer beneficiaries of CPAR projects; 2) determine the level of adequacy of project support services of CPAR in terms of input/production assistance, community participation, linkages with LGUs, participation of other agencies and sectoral groups; 3) determine the level of effectiveness of CPAR project as an extension delivery system in terms of technology transfer, active community participation, and strategies for enterprise and agribusiness development; 4) determine the influence of the socio-economic profile of the farmer beneficiaries on the effectiveness of CPAR as an extension delivery system; 5) determine the influence of the adequacy of the project support services on the effectiveness of CPAR as an extension delivery system; and 6) identify the problems encountered and needs in the implementation. A total of 88 beneficiaries served as respondents in the study and answered the structured questionnaires. The beneficiaries

cover three provinces in ARMM namely: Shariff Kabunsuan, Maguindanao, and Lanao del Sur. To identify the socioeconomic profile of the respondents, level of adequacy of project support services, and level of effectiveness of CPAR as extension delivery system, gathered data were analyzed using descriptive method.

Studying its every aspect

After evaluating the respondents' socioeconomic profile, results revealed that the project support services were slightly adequate. Further, the effectiveness of CPAR as an extension delivery system was considered as moderately effective. As to the socio-economic variables on the perceived effectiveness of CPAR as an extension delivery system, the variables, educational attainment, and annual income difference was found to have a significant influence on active community participation of respondents, as well as on strategies for enterprise and agribusiness development. The study also revealed that annual income difference has a significant influence on active community participation of respondents, as well as on establishing strategies for enterprise and agribusiness development. In terms of the influence of adequacy of project support services, it was identified that the input/production assistance and linkages with Local Government Units (LGUs) had significantly influenced technology transfer.

Other variables which included the participation of the community and the implementers

significantly influenced the active community participation and on establishing strategies for enterprises and agribusiness development.

One of the useful outputs presented in the study was the beneficiaries' perceived problems and issues which they have encountered during the implementation of CPAR projects. The respondents also provided recommendations to settle the given problems and issues which included lack of farm capital, farm equipment/facilities and quality seeds for planting, low price of products, lack of support in marketing products and limited livelihood assistance, lack of transport facilities due to poor farm to market roads, low sustainability rate, and peace and order problems.

Dr. Pandita recommended in the study that more emphasis should be given to enterprise integration and agribusiness development and management including market linkage and strategies for ensuring income increase and poverty reduction among farmers in the mainland provinces of ARMM.

Based on the research results, the Dr. Pandita concluded that the farmers perceived CPAR as moderately effective extension delivery system and needs to be strengthened by providing more comprehensive capability building assistance to farmers to help them improve their standard of living.

Research Impact

"As far as my study is concern, I think it provided a good reference in the planning and strategies on implementation of CPAR projects in our region," Dr. Pandita said when asked on how her study helped DA-ARMM in assessing the program's effectiveness. The researcher was delighted to share that there were improvements in the planning, implementation and management of CPAR projects as compared to the previous years.

"CPAR projects being implemented nowadays were more organized, smooth-sailing, needs-based, and adequately funded." The researcher also added that most of the issues/problems identified in the study were addressed, however further attention should be given in order to increase farmer's production and marketing. "Our farm to market roads and peace and order were satisfactory improved and we have lots of programs for capability building and trainings for farmers now. And as I have mentioned, there really has more funds coming in our regions for programs under agriculture."

Upon hearing about the National Technology Commercialization Program or NTCP, which is another banner program of BAR, Dr. Pandita was hopeful that the remaining issues and problems will finally be addressed.

"It's a good thing that marketing and business should be given emphasis better, since after production, one has to sell its products for profit and increase income."
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This article was based from the dissertation titled, "Effectiveness of Community-based Participatory Action Research (CPAR) as an Extension Delivery System in the Mainland Provinces of Autonomous Region in Muslim Mindanao" by Dr. Salimar P. Pandita, a recipient of Degree Scholarship Program of the Bureau of Agricultural Research. For more information on her study, you may send her an email at: ms_salimar@yahoo.com or through telephone number: (064) 552-2315 or mobile: 09213886066.



An economical approach to control Moko in banana

by Victoriano B. Guiam

Moko and Bugtok are two of the most serious diseases of bananas in the Philippines. While they are two distinct diseases, they are caused by the same bacteria, *Ralstonia solanacearum*. Moko appears as wilt in the Cavendish variety which is exported by the country while *Bugtok* is seen as the discoloration and hardening in the fruit pulp and mainly affects cooking bananas like Saba and Cardaba.

The disease appears in banana at all growth stages. As a soil-borne pathogen, the organism enters the plant through its corm via wounds and cuts which can be caused by cultural practices, soil insects or nematodes, abrasive particles in the soil or other mechanical factors. Under favorable conditions, root-to-root contact facilitates the spread of the disease. The disease organism can also be transmitted by insects such as thrips through the male inflorescence.

The soil-borne version of *R. solanacearum* which causes Moko disease is harder to control as it persists in the ground and will affect succeeding banana crops. In Cavendish banana plantations, a common management strategy considered effective for controlling Moko disease is the burning of the infected mats on-site with rice hull. However, the effectiveness of this practice is not known with certainty and this was the subject of inquiry of a graduate thesis conducted in eastern Mindanao.

Thesis study on the effects of heat on the Moko pathogen

Rice hull is the preferred fuel for burning infected mats as it is cheap and burns for a long time. The amount of time that the heat of burning is applied is important in the eradication of the Moko pathogen. However, how much rice hull and how long heat has to be applied for the treatment to be effective was not known. For his MS thesis, Mr. Darwin M. Apistar, (previously with the DA-Regional Field Office in CARAGA, now with the private sector), undertook the study titled, "Survival of *Ralstonia solanacearum* (E.F. Smith) Yabuuchi, et al after Rice Hull Burning as Management Strategy for Moko Disease in Banana (*Musa sp.*)" in 2007-2008. Basically, the study looked into the survival characteristics of *R. solanacearum* after applying different heat levels using 15, 25, and 40 bags of rice hull burned on the infected mats (4m²); the time deemed safe for replanting after the heat treatment; and the effect of planting another crop, sorghum, during the interval between banana crops (during the fallow period after implementation of eradication measure) on *R. solanacearum* population.

From the point of view of the growers, the timing of replanting after burning the infected mats is important. If done too early, re-infection may occur as enough of the pathogen may survive. With planting done later, loss of economic opportunity may be

incurred. The fallow period may be as short as three months or can take as long as two years. The volume of rice hull to use is critical in efficiently disinfecting the soil and in controlling pathogen population.

It's a belief among growers, albeit scientifically untested, that planting of sorghum in sites of infection helps reduce Moko incidence, delaying its return or preventing it from coming back altogether. The study thus, included an investigation on the effects of sorghum on *R. solanacearum* population in the soil and if it prevents re-infection of succeeding banana plants.

Conduct of the study

The study was carried out in two commercial plantations, one in Agusan del Norte and another one in Davao City. In each site, areas of 2x2 meters for each test mat (corm) were used. A third site in Bukidnon was added to the experiment on the effectiveness of rice hull burning. When the growing plants exhibited the full signs of Moko disease after inoculation with *R. solanacearum*, they were cut close to the ground and the mats burned (eradicated) following a commercial banana plantation eradication protocol with amount of rice hull modified to 15, 25, and 40 bags of rice hull as fuel.

Soil samples were collected at various times - before eradication and at 1, 3, and 6 months after eradication - to study the vertical and horizontal recovery of bacterial distribution (based



on observations that in naturally infected soils, the nearer a point is from the host, the greater the number of *R. solanacearum* that can be recovered). Vertical distribution of the pathogen was determined by recovering the organism at depths of 0-20 cm, 21-40 cm, and 41-60 cm from the soil surface. On its horizontal distribution, tests were taken at distances of 0, 1, and 2 meters from the center of the eradicated mats. Monitoring for re-infection was done in the course of one year at 1, 3, and 6 months with the use of clean test plants. These times were selected to correspond to the number of months when the affected area is deemed safe for replanting.

For the evaluation of the disease-preventive property of sorghum, a trial was set up using pots in a greenhouse in CARIARC in Trento, Agusan del Sur from June to November of 2008. Tests for soil inoculated with *R. solanacearum* were done at first harvest of sorghum and one month after first harvest.

Significant results of the study and recommendations

The study verified the effectiveness of heat treatment using rice hull at 15 bags, 25 bags, and 40 bags in reducing bacterial population. Results showed that pathogen population declines with

time if heat is effectively applied. The study also verified that there is no difference in amounts of rice hull normally used by commercial banana growers to fuel the burning of infected mats, with Agusan del Norte at 25 bags and Davao City plantations at 40 bags of rice hull.

Increasing the number of bags only became significant in reducing bacterial population in the first month after rice hull burning at the 20 cm depth. It was also found that heat generated was significantly high when 40 bags were used, generating 312.78 oC and 340.56 oC in the first and second days but even this did not show any significant difference on the survival of bacteria compared with the other treatments. Statistical analysis showed that pathogen population was almost similar in both horizontal and vertical distribution.

The study noted that the number of bags to use is of less importance than efficient burning of rice hull. By efficient burning, this means that it must

not be disrupted and should be continuous to allow heat to penetrate to the deeper soil levels. Loosening the soil around the infected mats with a spade will facilitate heat penetration to lower soil layers. The presence of the pathogen declined after the application of strong heat to the soil. While some of the pathogens remained after burning, these were limited by the extent of sterilization done and the presence of environmental factors favorable for the bacteria to multiply and initiate re-infection. Apparently, 15 bags of rice hull are not enough as one test plant exhibited signs of Moko after replanting was done a month after mat eradication. Taking a longer time before replanting could be more effective with the use of 15 bags or use more bags for prolonged burning.

The conduct of the study was done under certain constraints and limitations that have to be considered, this being a thesis and

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Employing participatory evaluation to generate

CPAR project outcomes

by Anne Camille B. Brion

Reaching to provinces and municipalities all over the country, the Community-based Participatory Action Research (CPAR) is one of the programs of the Bureau of Agricultural Research (BAR) that continues to bring significant changes in the lives of farmers, fisherfolk, their families, and the communities.

CPAR is a location-specific research cum extension activity that focuses on improving farming system technologies within a province or municipality. True to its name, it encourages the shift from traditional to technology-based farming system through community-based approach. By merging research initiatives with active community participation and involvement, members of the community become empowered, thus leading to improved productivity and profitability.

In 2007, Dr. Leonarda A. Londina, now the manager of the Eastern Visayas Integrated Agricultural Research

Center (EVIARC), studied two CPAR sites in Abuyog and Capoocan, Leyte as part of her PhD degree in Rural Development. Her dissertation sought to generate project outcomes from these sites using participatory evaluation (PE). According to her, a number of approaches to program evaluation exist. However, a participatory approach is closer and more consistent with the goals of CPAR projects in Eastern Visayas as it provides for the active involvement of the program's stakeholders. "It is within this premise that the use of participatory evaluation in generating CPAR short-term project outcomes could serve as the best tool," Dr. Londina said.

Through interviews, focus group discussions, experience sharing of key informants, spill over maps, cropping pattern timelines, bio-resource flow, benefits ranking, and problems assessment, the study was able to generate outcomes from the

two projects.

One of which was the change in the capacities of the project stakeholders, specifically their internal and social competence. In the case of the development workers and program implementers, the learning process allowed them to gain valuable insights in implementing projects in a holistic manner. They saw how the participatory nature of CPAR can be instrumental in building a community that is self-reliant and independent. It also allowed them to appreciate the important roles that they play in technology transfer.

As for the farmer-cooperators, introducing them to diversified farming systems led to improved practices which they adopted in their respective farms. This enabled them to generate additional sources of income and transformed them into business entrepreneurs. In addition, the technical and social skills taught to them in various capability-building activities gave them self-confidence, thus, they

were able to share what they know to their fellow farmers, engage in formal discussions, and participate in technical fora. At the community level, establishment of development projects and amenities were facilitated through the representation of CPAR farmer leaders to the municipal level. One example was the establishment of the Barangay Technology Information Center of CPAR Abuyog which serves as a repository of knowledge products developed by the farmers themselves.

Along with the change in capacities were the changes in farm productivity. This was seen as a result of the farmers' adoption of the CPAR technologies introduced to them. Upon practicing a more varied farming production system, corn yield in Abuyog was able to increase from 0.9t/ha to 3.5 t/ha, while yield in Capoocan reached to as high as 4.8 t/ha. These positive changes in yields pave for an increase in the income of the farmers in the two CPAR sites by 33 percent.

Aside from the project outcomes, an important output of the evaluation was the community's formulation of an action plan for the inclusion of CPAR in the barangay development plan. More importantly, it led to the development of the "12-step participatory evaluation protocol" which Dr. Londina's study recommended as a guide to be used in the evaluation of other CPAR sites. To achieve a total participatory approach, the evaluation process should involve the: 1) definition of the evaluation goal, 2) identification of the PE Team members, 3) planning of the logistical and administrative arrangements, 4) developing the visual framework of the evaluation, 5) developing data collection instruments, 6) gathering of data using identified PE tools, 7) analyzing information collected, 8) formulating the lessons learned, 9) team assessment of the evaluation process, 10) summarizing the evaluation findings and lessons learned, 11) developing an action plan based on the evaluation findings, and 12) writing the evaluation report.

Dr. Londina shared that the participatory approach employed in the evaluation process of the CPAR projects generated insights and learnings that are important in the conduct of further project evaluation. "Participatory evaluation enabled the stakeholders to learn from the dynamic nature of the evaluation process. For one, the farmers who usually serve as information providers took the challenge as evaluators and experienced the other side of the evaluation process. This kind of evaluation manifests teamwork and facilitates knowledge sharing among the participants," she explained. ###

This article was based from the dissertation titled, "Generating Project Outcomes through Participatory Evaluation: The Case of CPAR in Eastern Visayas" by Leonarda A. Londina, a recipient of Degree Scholarship Program of the Bureau of Agricultural Research. For more information on her study, you may send her an email at nardslon2004@yahoo.com or telephone number: (053) 321-7379.

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not a regular agency research project. For one thing, the rice hull in the site in Bukidnon failed to burn continuously because of heavy rains that led to its ineffectiveness in reducing *R. solanacearum* population. This tends to negate the opposite findings in Agusan del Sur and Davao City, thus a generalization on the number of bags to use cannot be done with certainty with the data available from the three study sites.

As planned, only six months were given for observations after mat eradication. In the course of the study, indications are that this time duration is not enough for a thorough characterization of *R. solanacearum* after mat eradication. Some agroclimatic conditions could not be factored in with the results owing to technical limitations. Finally, the volume/area of the soil medium of infected mats studied was also limited to 4 m². A further, more in-depth investigation is warranted.

Conclusions/Recommendations

Rice hull burning of infected mats might be the most economical approach to Moko control. However, it does not assure total protection from re-infection. While bacterial population will decline after rice hull burning, there is a chance that enough of it will remain within the six months from mat eradication to infect new plants depending on the efficiency of burning and the presence of environmental factors conducive to bacterial growth. Research for fallow periods extending beyond 6 months shall be needed to come up with more accurate recommendations.

The planting of sorghum after mat eradication had no effect on the population of *R. solanacearum*. Mr. Apistar cited the planting of corn or Tagetes (French marigold) as a possibly more effective measure for banana plantations as these have been demonstrated by other researchers to be able to reduce soil-borne bacteria. The addition of organic matter in elevated amounts was previously shown by other investigators to also cause a decline in *R. solanacearum* population and it may thus be feasible to incorporate the practice into the fertilizer management regimen of the banana plantation.

According to Mr. Apistar, quarantine should always be observed to prevent the establishment of the Moko pathogen in the plantation. This is still the banana farmer's most dependable defense against Moko outbreaks. ###

This article was based from an MS study titled, "Survival of *Ralstonia solanacearum* (E.F. Smith) Yabuuchi, et al after Rice Hull Burning as Management Strategy for Moko Disease in Banana (*Musa sp.*)" by Darwin M. Apistar. He is a recipient of the Degree Scholarship Program of the Bureau of Agricultural Research. For more information on his study, you may send him an email at dmapistar@yahoo.com

Highlighting the role of agri officers in **DA'S RICE PROGRAM**

by Patrick Raymund A. Lesaca



The Department of Agriculture (DA) has envisioned a modernized agri-fishery sector through sufficiently addressing the local food demands and advancing quality products for the international market. To be at par locally and internationally, specific interventions such as production and processing technologies, technical assistance and trainings to farmers and fisherfolk as well as the provision of R&D funds must be given top priority. These are also imperative to ensure the sustained growth of the sector.

But what about the role that the city and municipal agriculture officers play in the whole scope of the food production cycle?

Role of City and Municipal Agriculture Offices

In 2006, Ms. Rosemarie D. Quito-Joson of the DA-Regional Field Office (RFO) 3, conducted a study titled, "Performance of the City/Municipal Agriculture Offices (C/MAOs) and Productivity of Farmers in the Hybrid Rice Commercialization Program" to determine the significant effects of the performance of C/MAOs to the

productivity of farmers.

To execute the study, the researcher utilized three variable models, namely: independent variable (IV), moderate variable (MV), and dependent variable (DV); and factored in, as leverage, the Hybrid Rice Commercialization Program (HRCP) of the government to quantify its effectiveness. The researcher likewise zeroed-in on the HRCP components in terms of a) seed subsidy, b) hybrid rice technical briefing, c) techno-demo, d) techno-caravan, e) soil analysis, and f) provision of brochures and flyers. The study was limited to the five largest hybrid rice producers in the province of Nueva Ecija namely: Cabanatuan City, San Antonio, Llanera, Zaragoza, and Talavera. Chosen from these municipalities for the dry cropping season were 2,251 farmers, with at least one hectare of land of which, 225 farmers served as the respondents of the study representing 10 percent of the total population.

The primary independent variable was the C/MAOs' performance level in terms of percentage accomplishment on HRCP components, level of technical support and assistance

rendered and number of farmer-adopters on hybrid rice technology. The dependent variable was farmers' productivity based on cost, yield, net income and return on investment (ROI) per hectare. The moderating variables were demographic profiles of the farmers (age, gender, highest educational attainment, family size, land holding, years engaged in farming, and years engaged in hybrid rice production), which, as the researcher have theorized, might influence the performance of the C/MAOs to the productivity of the farmers.

Relevance of benchmarking

The study described the demographic profile of the respondents, while the level of performance was measured in terms of accomplishment on the HRCP components. The productivity was measured in terms of cost, yield, net income, and ROI per hectare.

Result showed that the average age of farmers is 50 and majority of them are males comprising of 181 (80.44 percent). This portrays that farming is still



practiced by more matured men. Most of them have gone to secondary education with an average family size of five. Majority are also owners of the land they till. The average years engaged in farming and in hybrid rice production is 24 and 2, (mt), respectively.

In terms of the HRCP components, the C/MAOs obtained an average performance rating of 110 percent on seed subsidy; 120 percent on hybrid rice technical briefing; 110 percent on techno-demo; 120 percent on techno-caravan, 126 percent on soil analysis, and 159 percent for the provision of brochures/flyers. These proved that LGUs became active and successful in their role as direct coordinators and promoters to farmers of the hybrid rice program. Further, results of the multiple regression analysis revealed that the level of performance of C/MAOs in HRCP significantly affects the productivity of farmers in terms of cost, yield, net income and ROI per hectare. The demographic profile of the farmer-respondents significantly influences the effect of C/MAOs performance on farmers' productivity.

Benefit from the study

According to Joson, the study can benefit the DA-Central Office; DA-RFO 3, R&D agricultural institutions; provincial government of Nueva Ecija, including the C/MAOs in the province. The study could enlighten various stakeholders on the real status of the program specifically on the implementation stage. This would also capture the attention of officials concerned on fund allotment leading to the allocation of counterpart fund for the HRCP, or any other future programs of DA, which could improve the performance of the agriculture sector.

Considering the influence of demographic profile, two variables (soil analysis and numbers of farmer-adopters on dry season) were found to significantly influence the relationship between level of performance and cost per hectare of farmers. Taking the variables jointly, a significant influence by the demographic profile evoked an effect on the C/MAOs' performance and on the cost per hectare of farmers.

Results of the regression analysis revealed that hybrid rice technical briefing has high significant effects on cost, yield, net income, and ROI per hectare, techno-demo produced high significant effects on cost and significant effects on yield per hectare, number of farmer-adopters evoked high significant effects on cost and significant effects on ROI per hectare while technical skills/expertise produced significant effects on ROI per hectare. Taking them jointly, high significant effects were achieved on cost, yield, net income and ROI per hectare.

During the time of the research study, the average cost of production incurred by farmers per hectare is P 32,817.87. The average yield of hybrid rice is 7.13 MT, with an average net income of P 34,311.64. The Rate on Return (ROR) is 107.14 percent.

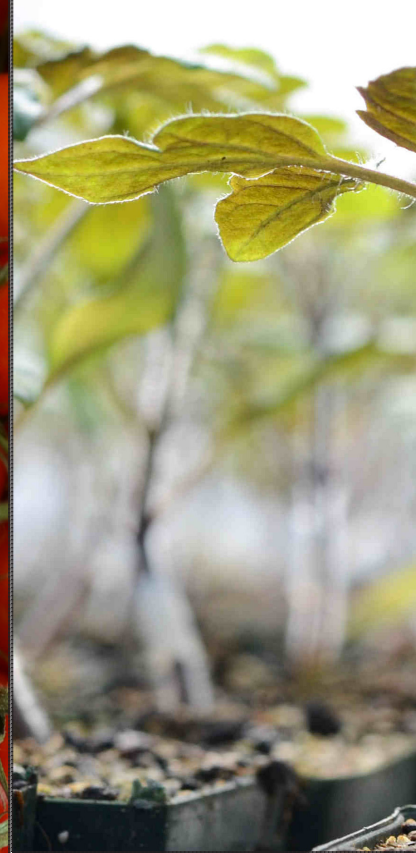
To date, in the Nueva Ecija, the average yield of rice per hectare is 7.74 MT. Production cost per hectare is P 35,000 (quite high due to inflation as compared as to the year of study). Gross income is P 96,580 or an equivalent return rate of 276 percent.

The researcher recommended that the national government, through the DA and LGUs, must sustain, improve, and strengthen the implementation of DA programs. This could be done by allocating additional fund for all the activities involved in the program. In addition, farmers must be regularly monitored to determine the root causes of any problem and to anticipate any troubles that may arise. Program advocates and other concerned government agencies should not stop sourcing additional funds from foreign and local funding agencies.

In as much as performance level go a high value and has significant effect to productivity, there is a need to re-visit existing policies in boosting the morale of agriculture employees such as giving them more incentives and long-season trainings locally and abroad to increase capability building. This will make them highly competitive in dealing with the different problems encountered by farmers in the field. Sharing their technical expertise will make farmers not only producers but also scientists and economists in the field of agriculture.

Allocation of funds for the provision of inputs must be sustained since most of the farmers do not have enough capital to produce hybrid rice. This is the reason why most farmers were not able to venture on hybrid rice production. The government must also prioritize R&D activities in the field of agriculture to conduct further studies in lessening the cost of production on the part of farmers, so that the program can attract more farmer adherents of the program by bringing higher yield with minimum cost of inputs. ###

This article was based from an MS study titled, "Performance of the City/Municipal Agriculture Offices (C/MAOs) and Productivity of Farmers in the Hybrid Rice Commercialization Program" by Ms. Rosemarie D. Quito-Joson of DA-Regional Field Office 3. She is a recipient of Degree Scholarship Program of the Bureau of Agricultural Research. For more information on her study, you may send her an email at: rosequito_darfu3@yahoo.com.ph or through mobile number: 0917509 4724.



Producing

Tomatoes have various uses in our daily cooking life, thus it is important to have a readily available stocks no matter what the season is. Unfortunately, tomato is a seasonal crop. There is therefore a much needed technology that can provide a year-round supply of vitamin-rich tomatoes.

One of the growing concerns for the production of off-season tomato is providing a conducive growing condition. Environmental factors including high temperature during night time, frequent rains, and strong wind currents affects or could alter the fertilization, fruit setting could result to high mortality. Other concern includes presence of pests and diseases.

A dissertation study titled, "Performance of Grafted Cherry Tomato (CHT501) as affected by Plastic Mulch and Different Nutrient Sources During Wet Season Cropping" was conducted by Norman G. De Jesus of the Pampanga Agricultural College (PAC) to

pilot trials for *kamlong* (grafted tomato) and controlled release fertilizer (CRF) in lahar area. then

The grafted cherry tomato seedlings were evaluated at the Ornamental Horticulture Research Area of Benguet State University (BSU), La Trinidad, Benguet. Parameters used for evaluation included growth, yield performance, and postharvest quality during wet season cropping under open field and greenhouse condition. The study also aimed at determining the best nutrient source and the effect of plastic mulch on the growth and yield of grafted tomato.

The *kamlong* seedlings were procured from the Tarlac College of Agriculture (TCA), through Dr. Tessie Boncato, while the CLSU-CRF was obtained through Dr. Clarita P. Aganon. "Under greenhouse condition, mulching of grafted cherry tomatoes with silver gray plastic resulted to significantly taller plants at 90 DAT," de Jesus said. Results also revealed that mulching

reduced number of days to flowering and increase in the number of fruit pickings, and fewer number of fruits/kilo.

Mulching is a method of spreading insulating materials over the soil surface. This is purposely done to conserve soil moisture, regulate soil temperature or maintain a more uniform soil temperature. "Reduce soil erosion as a result of decreased surface runoff and its shield effect to striking raindrops and suppresses weed growth. Those plants that were mulched had tallest height, longest number of fruit picking days, and biggest size of fruits," de Jesus explained.

As for the best nutrient source, the yield per plant and computed yield of grafted cherry tomato was significantly enhanced by the different nutrient sources. CLSU-CRF treated plants produced the highest yield per plant with 1.546 kg, followed by osmocote with 1.471 kg as presented in his dissertation.



off-season **cherry tomato** through **kamlong**

by Ma. Eloisa H. Aquino

"Chicken manure applied plants produced 1.129 kg per plant which was higher as compared with those taken from recommended rate (RR) NPK as IF, pigwaste slurry and the control. Consistently, CLSU-CRF, osmocote, and chicken manure fertilized plants produced higher yields with 30.917 t/ha, 29.417 t/ha and 22.583 t/ha, respectively," Dr. de Jesus shared.

Pampanga State Agricultural University (formerly PAC) grows *kamlong* during wet season for the purpose of demonstration and for income generating projects (IGP). Few farmers used to grow conventional tomato during WS because of highly sensitivity of said crop to waterlog and heavy rain conditions and such reasons makes the price very high during WS.

Now there are quite a number of farmer-entrepreneurs who are engaging in off-season tomato production using *kamlong* or grafted

tomatoes, specifically from Sta Rita, Lubao, Guagua, Floridablanca, Mabalacat, Arayat, among many others. "It can be emphasized that most of these farmers are organic farmers who are making use of processed animal manure especially chicken manure," Dr. De Jesus shared.

Mr. Richie B. Basa and his fellow cooperative members in Mabalacat, Pampanga, are growing conventional tomato during dry season (DS) and *kamlong* during WS. A common observation among them was the tolerance of *kamlong* to virus (or Namamarako) when planted during WS.

"It's inevitable to sustain the technology to make fresh tomatoes available during wet season and to ease the price of such. PSAU intends to intensify the production of *kamlong* by putting propagating chambers at ALIAS center," said de Jesus.

"This paved way to my continuous support and advocacy to in promoting organic agriculture in the region," he shared. The Pampanga State Agricultural University had established a center called Alternative Low-Input Agriculture System (ALIAS CENTER), whose primary mandate is to promote organic agriculture, which includes organic grafted tomato or *kamlong* and other organic production inputs. ###

This article was based from a PhD thesis titled, "Performance of Grafted Cherry Tomato (CHT501) as affected by Plastic Mulch and Different Nutrient Sources during Wet Season Cropping" by Norman G. de Jesus of the Pampanga State Agricultural University. He is a recipient of the Thesis Dissertation Assistance Program of the Bureau of Agricultural Research. For more information on his study, you may send him an email at normandejesus2005@yahoo.com or at telephone no: (045) 343-4394.

Aloe vera extracts

effective growth enhancer in broiler

by Rita T. dela Cruz

The poultry industry has been a consistent performer in the Philippine agriculture sector. In fact, the Philippine Statistics Authority (formerly BAS) reported that in 2014 the agriculture grew by 1.83 percent and much of its growth was contributed by the production increment in the poultry sector, the so called "bright spot of agriculture".

But given its consistent and steady increase of production, the future of the poultry sector still greatly depends on the availability of cheap feed sources and improvements in production and marketing efficiency.

In broiler production, which comprises of at least 80 percent of the poultry meat requirement of the Filipinos, the demand is already high. The industry could hardly make up with the requirement due to high prices of commercially and imported feeds. Thus, the poultry industry is continuously looking for means to lessen their cost of production.

One option is to look for alternative source of feed supplement that is both cheap and effective. Feed sources that are organic and readily-available are also great factors to consider.

Effect of aloe extract to broiler

In looking for an alternative source of feed supplement, one study did not search any farther. It looked at the Aloe vera (*Aloe barbadensis*), one of the most commonly-available house plant in the garden, as a potential feed source to boost the growth of broiler chickens. This spiky, succulent, and perennial plant is traditionally-grown as accents for landscaping and is used for its medicinal value. The juice from its thick, spiny-edged, and fleshy leaves are well-reputed for its natural healing effect especially in treating skin conditions. It has anti-

inflammatory properties, which may have explained why it has been known to lessen the pain and swelling associated with itches and burns.

Many of the medicinal uses of Aloe vera are well-known if not a common knowledge to most. What is less known, however, is its uses in poultry, particularly as growth enhancer to broiler.

In the dissertation titled, "Growth Performance and Sensory Evaluation of Broilers Supplemented with Aloe Vera Extract in Drinking Water" conducted by Mr. Feliciano R. Bejar of the Samar State College of Agriculture and Forestry and Ms. Remedios P. Colapo of the University of Eastern Philippines, Northern Samar, they studied the effect of Aloe vera extracts in the growth of chickens.

To test the claim of Bejar and Colapo, they've conducted a 42-day experiment to study the growth performance of 90 broilers whose drinking water was mixed with aloe vera extract. The chickens subjected to this study were randomly distributed into five Aloe vera extracts treatments, namely: 5 ml, 10 ml, 15 ml, 20 ml per gallon of drinking water, and plain water as control. The method followed a complete randomized design (CRD), which was replicated three times.

In order to determine if the Aloe vera extract indeed created an effect on the growth of the chickens, the researchers used five parameters to measure growth performance of broilers: 1) body weight, 2) feed consumption, 3) feed conversion ration, 4) water consumption, and 5) return of investment. They also determined sensory evaluation of the broilers given the drinking water

supplemented with the Aloe vera extract. A sensory evaluation was conducted to evaluate the meat for its color, desirability, intensity, texture, tenderness, juiciness, and general acceptability.

Aloe vera leaves were first subjected to toxicity test at the Philippine Rootcrops Laboratory in Leyte before juice was extracted. Results showed no effect to the chicken fed. Researchers found that all animals subjected to this particular study became more active after receiving the aloe extracts.

Result of the 42-day experiment showed that the final weight and gain in weight of the broilers were significantly affected by the Aloe vera extract supplementation. Broilers that were given with aloe extracts as drink supplement (5-20 ml) significantly improved their growth rates compared to those broilers given plain water, which showed the lowest final weight and gain in weight.

In terms of feed consumption, broilers that were given the 15 ml and 20 ml of aloe extracts in their drinks rated the highest (average of 3387.78 g and 3148.89 g, respectively) while those given the plain water rated the least (2737.22 g). This result, according to the researchers implied that the final weight and gain in weight were strongly influenced by the feed intake of the chicken.

Meanwhile, no significant results were found in the feed conversation ratio (FCR) of broilers although numerically, those chicken given the aloe extracts showed slightly better FCR than those given plain water. Likewise, Aloe vera supplementation did not significantly affect the carcass and sensory characteristics of the broiler meat, retaining the acceptability, and

salability of the product.

For the dressing percentage (weight of the carcass and organs after the treatment was applied), again, those that were given the Aloe vera supplementation command the highest dressing percentage while those that were unsupplemented ranked the least. This means that the heavier the final weight, the better is the dressing percentage in chickens.

For the economic competency, analysis showed that chicken whose drink was supplemented with Aloe vera extracts showed the best return of investment among the treatments with 7.5 percent return of investment (ROI).

What is in Aloe vera?

Aloe vera is not only a natural healer, it's also a growth enhancer in poultry. Hearing that, one might think, it's too good to be true. Essentially, the leaves of Aloe vera are often for external uses only, they are not meant to be taken in. But with the study of Bejar and Colapo, it's became clear that it's safe for animal intake. Thus, it is important to know what's in the Aloe vera that makes it both a natural healer and a growth promoter in chickens.

Physically, the leaf of an Aloe vera is composed of three

layers. The first layer contains a clear gel, which is contained within the cells of the generous inner portion. Then there's the anthraquinones contained in the bitter yellow sap of the middle leaf layer and the fibrous outer part of the leaf that serves a protective function.

The content of the aloe vera leaf is just 0.5 - 1.5 percent solid, with an average pH value of 4.55. This solid material contains over 75 different nutrients including vitamins and minerals.

Aloe vera is rich in vitamins and minerals. Specific vitamins include: Vitamin A (Beta-Carotene), Vitamin B1 (Thiamine), Vitamin B2 (Riboflavin), Vitamin B3 (Niacin), Vitamin B5, Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, Vitamin E, Choline, and Folic Acid. The vitamins A, C, and E are responsible for the aloe's antioxidant activity while vitamin B and choline are involved in amino acid metabolism and vitamin B12 is required for the production



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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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The International Rice Research Institute (IRRI) has been assisting the Department of Agriculture (DA) in its Food Staples Sufficiency Program (FSSP). One of the initiatives under the partnership is the "Heirloom Rice Project" which aims to enhance productivity and livelihood and conserve *in situ* on-farm of a number of farmer-preferred heirloom/traditional, climate-resilient rice varieties by increasing their productivity through technologies, processes, and management options to smallholder groups and model enterprises. The project was featured in the IRRI-DA-National Museum declaration of two Manansala paintings on agriculture in the possession of IRRI as "National Cultural Treasures" at the National Museum. *Photo by RTDelacruz*



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