

OUTCOME 1

#AgriTayo Science-Based Know How to Raise Agricultural Productivity



Department of Science and Technology

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FOREWORD

Science Nation. The phrase is not an apt description for our country of 7,107 islands. Not yet.

The key to make the Philippines a real “Science Nation” is information. With information, programs and technologies developed or funded by the Department of Science and Technology (DOST) – as well as other locally crafted technologies which help solve the country’s multi-sectoral problems - become known among Filipinos in all corners of the archipelago, thus pushing them to avail or to take advantage of these science-based innovations to uplift their lives.

When such information is cascaded to the Filipino everyman – every Juan and Maria, including those in the so-called “laylayan ng lipunan” - a lot of things are on cue to take place:

Farmers will become more productive and earn more, small enterprises will grow, thrive and be more competitive, industries will be revitalized, technopreneurship will be more prevalent and employment will increase via the Business Process Management (BPM) sector, government services will become more responsive, healthcare services will improve and become more accessible to more Filipinos, opportunities for S&T education especially among the underprivileged will become more available, and the citizenry will be armed with more effective strategies for disaster preparedness and strategies.

What I had just mentioned are the DOST 8 Outcomes – eight specific targets that the Department aims to achieve in the long run via the following sectors: Agriculture (Outcome 1), Enterprise (Outcome 2), Industry (Outcome 3), IT-BPM (Outcome 4), E-governance (Outcome 5), Health (Outcome 6), Education (Outcome 7), and Disaster Preparedness (Outcome 8).

This compendium of seven publications is a tool for delivering such vital information. It presents to you how DOST and its 8 Outcomes address the current problems in each of these sectors, and thus help contribute to the Philippines’ economic resurgence. Six of these seven publications tackle one DOST Outcome each, while the seventh publication focuses on both Outcomes 4 and 5.

In short, this collection is a veritable showcase of the Department’s various initiatives across these eight sectors, with stories of ordinary Filipinos whose lives have been touched by the possibilities that S&T has to offer. These stories – encapsulated in news and feature articles – were written by information officers from the different DOST agencies. The articles capture in a nutshell the pivotal role of S&T in a nation’s journey to progress and prosperity and why, therefore, S&T should not be taken lightly by any nation, much less a developing country such as the Philippines. S&T, on the contrary, should be at the forefront of government efforts to drive the country forward

and sustain this horizontal trajectory. S&T therefore, should not take the backseat.

This particular publication – titled **#AgriTayo Science-Based Know-How to Raise Agricultural Productivity** focuses on DOST's Outcome 1 which is Agriculture. For this outcome, DOST aims to provide science-based know-how and tools that will enable the agricultural sector to raise productivity to world-class standards. In order to achieve the expected outcome, various strategies are being employed, including the harnessing of cutting-edge technologies, adoption of best practices and proven technologies, and localization of mechanization. Said strategies may be implemented through various actions such as addressing S&T gaps in major stages of production of agriculture, aquaculture, and livestock. Specific to these are planting materials/broodstock, crop management/grow-out management, harvest and post-harvest, processing, and value adding.

Indeed, information is one of the starting blocks for the country's successful run toward being the definitive Science Nation that it should be. For it is only through complete, accurate, comprehensible, and timely information that mass or public awareness is generated. If the public is aware

of scientific and technological developments, they now know how to improve their lives, and thus take action to make this a reality. If there is action, S&T then gets the chance to show off its full capability: rolling its veil of magic across the sectors, over the entire nation, to wrap the entire Philippine population with the bountiful fruits of harnessing its S&T resources. All these, for the welfare and the future of the Filipino.

I humbly invite you to read the stories in this publication and in all of the other six publications as well. In reading these, not only will you get a sense of S&T's importance to a nation, you will also learn how S&T can actually touch your life and that of your family, how it can help you fulfill your dreams, keep you safe and healthy, and allow you to touch other people's lives as well.

Reading these stories will make you realize that S&T has always been a part of our lives and will always be. All we have to do is acknowledge it, use it, and maximize it.

When we do, we're well on our way to becoming a



DR. ARISTOTLE P. CARANDANG

Chief, Communication Resources and Production Division
Department of Science and Technology-Science and Technology Information Institute (DOST-STII)

MESSAGE

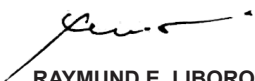
Agricultural productivity is a major issue that will confront the next generation of Filipinos as our nation addresses the need to ensure food security. Thus, a roster of development initiatives and scientific solutions to pressing problems have been implemented by DOST's Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) thereby empowering our farmers, fishermen, and other stakeholders in the agricultural sector.

This publication showcases the many interesting news and stories documenting various interventions like the pest control and management of coccolisap; development of improved abaca varieties; enhanced goat milk production

technology; use of bamboo as alternative timber material, among others.

By publishing these stories, we hope to contribute in promoting science and technology as a means to achieving progress on a wider scale. Each success or failure is a living testament to how science and technology become the solution to a problem and the prime mover in uplifting the lives of our people.

As one leafs through the pages of this book, we are positive that you will not only be entertained but also be engaged. By reading these stories we will fully appreciate what science and technology can do to make our world a better place to live in.



RAYMUND E. LIBORO
Assistant Secretary

MESSAGE

The Department of Science and Technology's (DOST) information arm – the Science and Technology Information Institute (STII) – is proud to present “#AgriTayo Science-Based Know-How to Raise Agricultural Productivity” for Agriculture, a collection of inspiring, relevant, and interesting stories of ordinary men and women around the archipelago whose lives have been changed by science and technology (S&T) and the people who have helped make this possible. Side by side with these stories are informative articles about DOST-developed technologies and its various initiatives poised to elevate the Filipino's standard of living in ways that only an all-encompassing game changer can do. That game changer is of course, S&T.

“#AgriTayo Science-Based Know-How to Raise Agricultural Productivity” for Agriculture is part of a compendium chronicling the DOST 8 Outcomes – or eight thrusts for the Philippines as it fulfills its mandate to “provide central direction, leadership and coordination of scientific and technological efforts and ensure that the results therefrom are geared and utilized in areas of maximum economic and social benefits for the people.”

This particular publication, the first in the compendium, is all about Outcome 1 which is geared towards Agriculture. To achieve its plans and vision for Philippine agriculture, DOST aims to develop science-based technologies and programs that will empower the farmers allowing

them to maximize the bounty of this land and therefore, be more productive, earn more, and make life better for themselves and their family. Some of these efforts are detailed here, giving the readers a bird's eye view of how DOST is navigating its roadmap for Philippine agriculture with S&T resources as its well-oiled wheels.

Yet, Industry is just one of its 8 Outcomes. The others are: **Enterprise** (Outcome 2), **Industry** (Outcome 3), **IT-BPM** (Outcome 4), **E-governance** (Outcome 5), **Health** (Outcome 6), **Education** (Outcome 7), and **Disaster Preparedness** (Outcome 8).

Together, DOST's projects across these 8 Outcomes will help keep the country on course, and keep its desired results on target.

For this end, STII will keep on churning timely, accurate, and easy-to-understand information to help make the DOST mission complete. After all, it is through information via publications such as this that scientific and technological advancements – key ingredients for national development – are made known to policy makers, leaders, and the general public who are ultimately the beneficiaries of well-utilized S&T resources.

May the reader find this publication useful – for his daily life, his education, his work and livelihood, his family, for the present, and most of all, for his future.


RICHARD P. BURGOS
 Director, STII



DOST-TAPI awards grant for improved water hyacinth harvester

By MA. LUISA S. LUMIOAN, DOST-STII

Seeing water hyacinth both as a problem and opportunity, researcher Engr. Joel P. Sadol of Central Bicol State University of Agriculture is set to make an improved water hyacinth harvester to benefit farmers, fisherfolk, and handicraft makers in Buhi, Camarines Sur, through the assistance of Department of Science and Technology-Technology Application and Promotion Institute (DOST-TAPI).

Under DOST-TAPI's Technology Based Enterprise Development (TBED) Program, Engr. Sadol received a grant amounting to P247,000 for the development of a water hyacinth harvester with improved efficiency in harvesting and reducing fuel consumption.

Aside from managing water hyacinth which is a perennial threat in Lake Buhi, the harvester provides opportunities for livelihood as well. Harvested water hyacinth

can be made into baskets, matting, fertilizers, handicraft, and other products, said Engr. Sadol who built an earlier model likewise funded by DOST through the Philippine Council for Industry, Energy and Emerging Technology Research and Development.

Water hyacinths often clog waterways and degrade water quality since they block sunlight and prevent photosynthesis, thereby lowering the level of oxygen in the water.

DOST-TAPI's TBED program encourages the development of new or improved technologies that may have potential for commercialization. Research and development institutes, state universities and colleges, and government offices are qualified to avail of this assistance.

For more information about TBED, you may contact the Provincial Science and Technology Center or DOST Regional Office in your area.



Bamboo: Timber alternative bends toward farmers' success

By MEREYLL KYLA P. IRADER, *DOST-PCAARRD*



The Philippines is fortunate to have bamboo growing abundantly almost everywhere. While this plant is available outright in every community, science and technology can further enhance its growth performance and ensure the sustainability of its supply, with bamboo being aptly considered as an alternative to timber.

The Department of Science and Technology's Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD), through its Forestry and Environment Research Division, has identified bamboo among its priority commodities. Throughout the years, there are a good number of technologies that address various concerns on bamboo, specifically on its propagation and plantation management.

Among these technologies are propagation via branch cutting from 3 to 4-year-old culms, and one-node culm cutting; clump management and suitable cultural treatments for two bamboo species: giant bamboo (*Dendrocalamus asper* Schultes f.) and "kawayan tinik" (*Bambusa blumeana* J. A. & A.H. Schultes f.).

Branch cuttings from 3 to 4-year-old culms are the best planting materials for giant bamboo propagation. At least 10 branches can be collected from one culm. Each collected branch should have 2-3 nodes and live buds. The branch cuttings develop sprouts 7-10 days after potting. Proper care and maintenance are observed until the potted branch cuttings are ready for outplanting. Usually, the potted propagules are ready for outplanting in 3-4 months or longer.

"Kawayan tinik" propagation is done through one-node culm cutting. The whole

culm selected for propagation is segmented into one-node-culm cutting. One-node cutting are cut out from the mother culms containing an equal portion of the lower (below the node) and upper (above the node) internodes of about 4-6 cm. After one month, rooted cuttings with sprouts are exposed to full sunlight for growth improvement. In 6-12 months, the potted cuttings are ready for outplanting.

Clump productivity should be regularly improved through clump management or maintained to hasten sustained shoot/culm yields. This could be attained through the application of regular tending operations, which includes cleaning, thinning, mounding, mulching, and fertilization.

Existing old bamboo clumps can also be rehabilitated/rejuvenated through sanitation cutting, cleaning, or fertilizer application. This offers a quick and cheap means of increasing the supply of bamboo.

These methods are widely adopted by farmers and nursery owners growing and selling bamboo for livelihood in Regions 3, 4-A, 6, and 10 and beginning to be replicated by other individuals and business owners throughout the country.

PCAARRD's partnership with the regional units of the Department of Environment and Natural Resources and state universities and colleges made these technologies possible.

The research and development initiative on bamboo propagation technique manifests the goal of PCAARRD and DOST as a whole in maximizing science and technology potentials to attain sustained growth.

DOST supports initiative for early detection of diarrhea in pigs

By **S&T MEDIA SERVICE**, *DOST-PCAARRD*



Almost half of the pre-weaner pigs suddenly excrete yellowish watery diarrhea. The same alarming picture can be seen in neighboring pens, wherein almost seven out of 10 piglets in a litter die.

“What infection has caused this unsightly scene to my farm?” a farmer thought while recalling the events that transpired during the recent days before the disease struck his farm. The ghastly disease progression displayed in front of him may just send him off the roof. Trying to muster composure, the farmer recounts his earnings from the prior sale of the healthy finishers and the impending losses that are about to unfold right before his very eyes.

This horrendous sight is common among piggery farm owners as their animals experience bouts of gastrointestinal infections. Unfavorable incidents such as these, as experienced by our local swine producers, are replete with losses and economic impacts brought about by animal diseases. If only the pathogen has been detected before the animals exhibit the clinical symptoms, the battle can be considered as already half won.

There is good news, however.

Animal health researchers from the College of Veterinary Science and Medicine of the Central Luzon State University (CLSU) have developed a diagnostic test kit that would be able to detect and diagnose one of the most virulent viral gastrointestinal infections in pigs, the porcine epidemic diarrhea or simply, PED.

A technology utilizing nucleic acid amplification of target pathogenic organisms of

swine respiratory and gastrointestinal infections to detect the presence of the infective agent in just half an hour has been developed. Other procedures take several hours to detect the diseased animal.

Due to its high specificity in detecting the diseased animals harboring the target pathogen and high sensitivity in ruling out healthy or non-diseased animals, Loop-mediated isothermal amplification or LAMP is currently being employed in the development of the PED RT-LAMP Test Kits.

LAMP technology produces tremendous copies of the target gene sequence in as short as 30 minutes. The nucleic acid amplification can be carried out using simple and less expensive equipment like a simple thermostat or water bath. LAMP is very comparable to the Enzyme-Linked Immunosorbent Assay (ELISA) kit and polymerase chain reaction (PCR) kit but is less affected by presence of non-targeted DNA or inhibitory molecules because of its high specificity and sensitivity.

Commercialization of the PED RT-LAMP Test Kits will greatly improve the welfare of the swine population and the local swine industry as a whole.

The technology on the early detection of diarrhea on swine with the use of PED RT-LAMP Test Kits is only one of the many research and development initiatives on livestock concerns supported by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD).



Improved abaca poised to propel PH as top exporter

Weaving more opportunities into farmers' lives

A baca, known worldwide as Manila Hemp, is an economically important crop indigenous to the Philippines. It is the lifeblood of more than 200,000 farming families from 56 abaca growing provinces in the country.

Abaca is also a top export commodity of the country with an average of US\$80 million annual export earnings. In global trade, it boasts of high demand as raw material for cordage, textile, handicrafts, and specialty papers.

Just recently, it found its niche in the automobile industry as the “strongest natural fiber material” for dashboards and car interiors.

Supplying 85 percent of the total world abaca fiber production, the Philippines prides itself as the world’s top producer of abaca fiber. Despite its dominance in the world market, however, the country is confronted by the reality that abaca remains a poor man’s crop. The small farmers get meager income from abaca production, and this eventually forces them to shift to other crops.

Confronted by these concerns, coupled with many industry problems, abaca production in the country declined in the past years. As Ecuador

tails behind in terms of production and with Indonesia's aggressive abaca reforestation program, the Philippine abaca industry is put in a precarious situation. If not addressed, the Philippines might lose its leadership in the abaca global scene in the future.

The government, through the Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) and its partners, is pushing several S&T interventions to address poor technology adoption of farmers, lack of high-yielding and virus-resistant planting materials, and prevalence of pest and diseases – most notorious of which is the abaca bunchy top virus (ABTV).

One of the major initiatives is the development and promotion of improved abaca varieties to strengthen commercial production.

After many years of research and field tests, researchers from the University of the Philippines Los Baños (UPLB) led by Dr. Antonio G. Lalusin were able to develop high-yielding and ABTV-resistant abaca hybrids. These hybrids are more vigorous, could produce a yield of 1.56 mt/ha/yr, and give 20-30 percent higher fiber recovery than traditional varieties.

Since traditional varieties are very susceptible to the dreaded ABTV disease, the new resistant hybrid abaca of UPLB is considered very promising in rehabilitating abaca plantations affected by the ABTV disease.

The high-yielding and ABTV-resistant hybrids project is an R&D initiative under

PCAARRD's Industry Strategic S&T Plan for Abaca. Specifically, it is expected to contribute in achieving a higher fiber yield from 0.527 mt/ha to 1.2 mt/ha and increased fiber recovery from 1 percent to 1.5% percent by 2020.

The project on abaca production is a collaborative work among UPLB, Visayas State University, University of Southern Mindanao, Bicol University, Western Mindanao State University, University of Southeastern Philippines, Caraga State University, and Catanduanes State University.

Currently, the research team is now mass producing and promoting the use of hybrids in major abaca producing provinces such as Sorsogon, Catanduanes, Leyte, Southern Leyte, Northern Samar, Western Samar, Davao Oriental, Davao del Sur, Surigao del Sur, and Sulu. Once fully commercialized, 1,568 hectares of abaca farms is targeted for rehabilitation out of the project.

By rehabilitating abaca farms with high-yielding and virus-resistant hybrids, PCAARRD and its partners hope to usher more and better opportunities for the local farmers, processors, and other industry stakeholders. Through the adoption of these UPLB hybrids, the government aims to ease the plight of poor abaca farmers and help improve their income and social status.

As competition for leadership in abaca production tightens, the government takes on the challenge of stepping up the game in the global market and keeping pace with other rising abaca producing countries.



Sweet Potato Beef and Shrimp
with Lemon Juice, Main Dish
Entry by STI Team 6



Entry by Team 1 from VSU

FIESTA time for rootcrops

By **ESPIE ANGELICA A. DE LEON**, *DOST-STI*

Artistically crafted booths selling an assortment of items, dancers in gaily decorated costumes, sports tourneys, contests for the young and old alike, a dog show, a parade, gaggles of people excitedly milling about, and a festive atmosphere pervading the air.

Oh, and don't forget the cassava, sweet potato, yam, taro and a host of other rootcrops which provided a bonus: great food finds to satisfy the palates and keep the bodies healthy.

Sounds like fiesta time?

It was indeed a fiesta for rootcrop farmers and rootcrop industry stakeholders as the Farming and Industries Encounters through the Science and Technology

Agenda or FIESTA, an initiative of the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), got underway at the Visayas State University (VSU) in Baybay, Leyte from July 31-August 11, 2015.

FIESTA is an event-based technology transfer modality which promotes S&T for more profitable and competitive business ventures for micro, small, and medium

enterprises (MSMEs) in the agriculture, aquatic and natural resources sectors.

Held in conjunction with VSU's 91st Founding Anniversary, the latest FIESTA highlighted the value-added qualities of rootcrops as business venture commodities of micro, small and medium enterprises (MSMEs). Post-Yolanda accounts revealed the critical role of rootcrops in the sustenance of survivors as these were the only agricultural



Dance Festival



Parade



products left after the fierce typhoon destroyed much of Leyte's agricultural lands.

FIESTA's main event was a Rootcrops Technology Forum with the theme "Rootcrops Innovation for Health and Inclusive Growth." The forum gathered farmers, extension workers, academicians, students, government and NGO representatives, and members of media to update them on the health benefits of rootcrops, current technological innovations and other trends for the improvement of farming and enterprises, as well as industry issues.

The panel of speakers were composed of nutrition scientist Dr. Trinidad P. Trinidad of the University of Santo Tomas; Dr. Dilberto O. Ferraren, Prof. Algerico M. Mariscal, Dr. Daniel Leslie S. Tan and Dr. Julie D. Tan of VSU's Philippine Root Crop Research and Training Center; Susan Q. Empeynado, senior agriculturist in Dapitan City LGU; Doc Marlene B. Agabon, owner-manager of Nutri-pros in Antipolo; and Mr. and Mrs. Arnold Labunog, proprietor of Jojie's Bakeshop in Tagbilaran, Bohol.



Dog show



Rootcrops Technology Forum

Another much awaited event was the Dance Festival held on August 10 at the VSU Lower Oval, which transformed the area into a bevy of colors and a show of artistic skills and terpsichorean abilities. Performers from VSU Alang-Alang, VSU Tolosa, and VSU Main College of Education wowed the audience with the visual impact of their dancing and colorful themed costumes as they performed dances reflecting how each of the three towns survived the challenges posed by floods and pests in order to reap the bounty of their harvests.

Another interesting event was the Rootcrops Cookfest, competed by a team from the SLSU-Sogod Southern Leyte State University composed of HRM students; two

teams from the Systems Technology Institute (STI) in Ormoc, Leyte; and three teams from VSU.

Team 6 from STI won by a landslide by garnering the top plum in all three categories: Main Dish (Sweet Potato Beef and Shrimp with Lemon Juice), Side Dish (Sweet Potato Chips with Mango Salsa) and Dessert (Sweet Potato Cheesecake). First place went to Team 1 from VSU while second place went to Team 5 of STI.

FIESTA's focus on rootcrops is just one among a series of select focus commodities highlighted in each segment of PCAARRD's FIESTA program. Past segments featured seaweeds and sardines, among others.



Expert calls for review of Water Code in DOST-NAST forum

By **ESPIE ANGELICA A. DE LEON**, *DOST-STII*

University of the Philippines-Visayas Political Science Professor Dr. Rosalie A. Hall is lobbying for a review of the Philippine Water Code, among others, during a recent Science Legislative Forum (SLF) on water trans-boundary issues conducted by the Department of Science and Technology-National Academy of Science and Technology (DOST-NAST) at the House of Representatives.

“Water is not a free good,” Dr. Hall said in her talk, emphasizing that water is technically owned by the state and therefore people have legal rights to utilize and develop the resource through permits or concessions.

Titled “Water Scarcity Amidst Plenty: Trans-boundary Issues,” the SLF aimed to present the water governance issues which include the need for a science-based water-allocation process, institutional arrangements for market-based mechanisms for trading of water permits, and platform for conflict resolutions.

Among other things, the Water Code of the Philippines seeks to establish the basic principles and framework relating to the appropriation, control and conservation of water resources, achieve the optimum development and rational utilization of these resources, define the extent of the rights and obligations of water users, and adopt a basic law regarding the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources and rights to land related thereto.

Among Dr. Hall’s other recommendations were the establishment of water data, requirement of public consultation prior to issuance of water permits or conclusion of contracts for water transfers, a platform to

tackle water-transfer cases, and education of local level water actors or players on the rules regarding bulk water sale and market trade of water permits.

Another speaker, Dr. Seville D. David, Jr., executive director of the National Water Resources Board (NWRB), lamented the lack of knowledge on the authority and power of NWRB in terms of exercising its mandates in regulating water resources and resolving various water-related conflicts. The upside is that the government, according to Dr. David, is now considering the issuance of an Executive Order that seeks to strengthen the NWRB by expanding its manpower and addressing its lack of science-based decision-making power.

Meanwhile, Engr. Virgilio L. Bombeta, division manager of the Water Resources Development Division of the Local Water Utilities Administration, suggested that authorities should also look into possible introduction of invasive species in water basins that would destroy biodiversity.

In addition, Engr. Bombeta introduced the concept of “safe yield” which refers to the quantity of water that goes to recharge the water system. Said quantity of water should be the only quantity to be extracted to avoid degradation of water quality, said Engr. Bombeta.

Organized by DOST-NAST and the University of the Philippines in partnership with the House of Representatives Committee on Science and Technology, the SLF was attended by congressmen led by Hon. Victor J. Yu, chair of the House of Representatives Committee on Science and Technology, and staff members of various House Committees.



CSI infestation on coconuts.



Adult CSI.

That voracious insect pest called coconut scale insect. Above photo shows coconut fruits infested with coconut scale insect (*Aspidiotus* sp. Signoret), one of the most damaging pests of coconut and other palms. Equipped with specialized mouthparts for sucking, this small yet terribly voracious pest feeds on sap directly from the tree's vascular system. CSI's feeding causes yellowing or chlorosis, wilting, premature nutfall, and low yield. Experts explain that as CSI sucks the sap and injects toxic enzymes, these results to discolored leaves and deformed plant tissues. Usually a minor pest of young coconut in nurseries, CSI is also a destructive pest to mature coconut palms. As they settle on the leaves, they continuously suck the sap that is essential for the growth of the crop. Coconut plantations in Batangas attest to how menacingly destructive CSI can become. Having been first noticed in three barangays of Tanauan in 2011, CSI has spread in nearby coconut farm towns of Sto. Tomas, Laurel, Malvar, Lemery, Agoncillo, and Balete. Being in the forefront of the battle against CSI, the Philippine Coconut Authority (PCA) sees the need to fast track the mitigation of pest infestation and slow down the rate of infestation to allow the recovery of severely damaged palms. (Ricardo R. Argana, S&T Media Service)

Time's up Cocolisap: Using science-based know-how to combat pest

By ARJAY C. ESCONDO, DOST-STII

Coconut plantations in Batangas Province have fallen prey to the wrath of coconut scale insect (CSI) when it spread to several towns in the province and eventually affected nearby provinces of Laguna, Quezon, and Cavite.

Known locally as “cocolisap”, the CSI is one of the most damaging pests of coconut and other palms. Equipped with specialized mouthparts for sucking, this pest feeds on sap directly from the tree’s vascular system, causing yellowing or chlorosis, wilting, premature nutfall, and ultimately low yield.

The Department of Science and Technology (DOST), together with Philippine Coconut Authority (PCA), Department of Agriculture – Regional Crop Protection Center (DA-RCPC) IV-A, University of the Philippines Los Baños, sees the need to fast-track the mitigation and slow down the rate of infestation to allow the recovery of severely damaged palms. This objective forms part of the backbone for DOST’s Outcome 1 – Agriculture.

Contributing an estimated \$2 billion net foreign earnings and providing livelihood to some 3.5 million coconut farmers, the coconut industry is headed to a downfall if CSI’s severe infestation remains unabated according to experts.

Mixed populations, new species found

Researchers initially identified the scale insect as *Aspidiotus destructor*, a species that is endemic to the country. However in 2014, DNA markers showed that a new species, *Aspidiotus rigidus* is present in a mixed population together with *A. destructor*. As an introduced species, there are no known current natural enemies, and presence of new species called for new strategies in combating the spread of pests.

DOST Sec. Mario G. Montejo emphasized that it was critical to know the identity of the pest first to have an effective control. “By zeroing in on science, its approach and using cutting-edge technologies, we can find solutions to these problems, and we are

confident on these protocols developed by the Task Force”, he added.

S&T in action

Addressing the urgency of the CSI concern, the Emergency Research and Development Response Program and Management of Coconut Scale Insect Task Force has pushed for the development of systematic and immediate R&D strategies to manage CSI infestation.

The program highlights the importance of sustainable science-based integrated pest management strategies to manage the spread and control the damage of the pest through various initiatives. These include the Development of Crop Care Strategies Against Coconut Scale Insect (Project 1); Ecological Studies on the Potential Biological Control Agents of CSI (Project 2); and Biological Control Strategies Against Coconut Scale Insect (Project 3).

These projects seek to showcase the crop care strategies to control CSI infestation in selected sites; determine the biological requirements of natural enemies of *A. rigidus* that would enhance its effectiveness as biological control agents; and effectively mass produce the biological control agents and effectively manage CSI infestation, respectively.

Establishment of Management Protocol and Efficacy Assessment

In response to Executive Order No 169 mandating government agencies to formulate and implement emergency measures to control and manage the spread and damage of CSI, the following S&T-based Integrated

Pest Management Approach to Manage the CSI Infestation was recommended.

Moreover, assessment projects are underway to assess the efficacy of area wide treatment using satellite imagery through Rapid National Biosurveillance and Early Warning System for Coconut Scale Insect to be led by the UP-DREAM LiDAR team. Biosurveillance system will use its satellite remote sensing capability to fast-track CSI monitoring and come up with early warning system.

Meanwhile, initiatives such as the “Study of the Ecological Systems” is a project involving the use of environment-controlled facility to look into the biology and relationships of crops and their pests/diseases and how they react to changes in climatic conditions, led by researchers from UPLB. Also underway is the science-based approach on “Identification, Risk Assessment, and Rapid Response to Invasive Pest Species of Agricultural Importance” by experts from De La Salle University.

Science and Technology-based Farm Project

Another strategy toward meeting the challenge of DOST’s Outcome No. 1 is Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development’s (DOST-PCAARRD) Science and Technology-based Farm Project or STBF. An initiative under the Techno Gabay Program, STBF selects a farm or enterprise to be used as a showcase of science and technology’s (S&T) effectiveness in improving the income of farmers.

One of those selected is the peanut farm owned by Roger Salvador of Barangay Arubub in Jones, Isabela. Farming has been and still is a lucrative business to him through the years. Already in his 60s, Roger was able to send his three children to college to earn their degrees.

Salvador used to plant corn. But later, he was convinced that it was more advantageous to plant peanuts. He conforms to the approximate comparative computation of the Department of Agriculture (DA)-Cagayan Valley Integrated Agricultural Research Center – a peso invested in corn production would give a P24 gain, while a peso invested for peanut production would give approximately 64% or P64 return. He approximated that with five cans of shelled peanuts planted to a half-hectare land, he could harvest as much as 15 cavans of unshelled peanuts. This, he has proven to be true.

Another was the small ruminant (SR) enterprise of Josue S. Balderama, Jr. from Nararagan, Ballesteros, Cagayan.

Mang Josh, as he is fondly called, pioneered some developmental techniques in SR farming, namely 1) establishing forage fences for livestock feeding, 2) integrating cattle and sheep into the citrus orchard with cattle and sheep, which led to 3) the

replication of his orchard in other farms in the town.

Then, PCAARRD chose his slaughter goat technologies to be showcased in a Science and Technology-based Farm (STBF) Project for the production of slaughter goats. He started with 30 upgraded does and a full-blooded Boer buck. He crossbred the does with the purebred Boer buck, weaned the offspring early (three months), and practiced integrated parasite control. Despite the unpredictable weather, none of his goats died. All were bigger and heavier, and had more kids.

In recognition of his efforts and invaluable contributions to the agricultural development in his municipality, he earned a Gawad Saka Award as farmer scientist for goat production in 2006. Contributing to his award was the unprecedented success of his STBF.

Roger's and Mang Josh's success as farmers are two of the many similar experiences of farmers emanating from the gains of Science and Technology Community-Based Farm (STCBF) to provide science-based know-how and tools that enable the agricultural sector to raise productivity to world-class standards. (With reports from Ricardo R. Argana, S&T Media Service, PCAARRD)

Secrets of the sweetest and juiciest mangoes revealed

By CHRISTIE A. SURAR, DOST-PCAARRD



During the last five years, there has been a decline in the production of mangoes due to pest and disease affecting plantations all over the country. Of the more than 550 metric tons produced in the country in 2010, only about 10 percent were exported apparently for failure to meet quality standards.

But now, secrets to ripening of the sweetest and juiciest calcium carbide-free mangoes have been revealed!

Thanks to the technology called automated hot water treatment (AHWT) for mangoes, developed by the Mariano Marcos State University (MMSU). Through the AHWT, the problems of mango growers who have been losing about 30 percent of their harvest due to anthracnose and stem-end-rot

(diseases of ripening mangoes) can now be resolved.

The first of its kind in the country, the AHWT guarantees clean, latex-free, sweet, and juicy mangoes with longer shelf life.

Through a P1.5-million research grant from the Department of Science and Technology (DOST), the design and development of the AHWT was spearheaded by Thomas Ubiña, and other technical experts from MMSU namely, Samuel Franco, Willen Mark Manzanas, Romaric Ascaño, Dr. Gliceria Pascua and Prof. Maria Luisa Gabriel.

According to Ubiña, the technology was designed to help mango producers increase their income by reducing the cost of post-harvest handling. Aside from enhancing the flavor and appearance of the mangoes, the technology also significantly lowered the occurrence of mango diseases compared to untreated mangoes.

The AHWT is a user-friendly machine with easy-to-adjust temperature and speed settings. It is energy efficient and has the capacity to isolate immature mangoes when they float at the conveyor filled with lukewarm water. The production cost of the AHWT is about P425,000, but according to Ubiña, the amount can still be reduced for commercialization.

The machine can treat as much as 1,361 kilograms of mangoes for one-minute immersion at a treatment cost that ranges from 20 centavos to P1.00 per kilogram.

With continued innovation and technology advancement, DOST hopes to help more micro, small and medium enterprises to become competitive in the global market. In addition, the University of the Southeastern Philippines (USEP) will be coming up with an integrated automatic sorting and packaging line as take-off point from the research and development gaps of this technology. The

USEP project that will end in May 2014 will be conducting several tests to determine the best interaction of temperature and time of immersion of the material for optimum effect.

The project "Design and Development of an Automated Hot Water Treatment for Mango" was recipient of the second prize award in the Research and Development (R&D) Category during the recently concluded National Symposium on Agriculture and Aquatic Resources Research and Development held at the headquarters of DOST's Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development in Los Baños, Laguna. The said award was conferred during the Council's R&D Exhibits and Awarding Ceremonies held recently at Sofitel Philippine Plaza Manila in Roxas Boulevard, Manila.

The R&D awards are conferred on individuals and institutions who have helped shape the country's agricultural landscape.



DOST to boost goat milk production

By MARIA LUISA S. LUMIOAN, DOST-STII

The Department of Science and Technology (DOST) through the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development is set to spur the local dairy goat industry via its National Dairy Goat Science and Technology (S&T) Program.

Compared to cow's milk, goat milk is said to have higher nutritional value, is highly digestible, and causes less allergenic reaction because it lacks alpha-s1-casein protein. Found in cow's milk, alpha-s1-casein protein is linked to allergic response in some individuals. Goat milk is also popular as an ingredient in beauty products because of its naturally occurring alpha-hydroxyacids—a good skin exfoliant.

To maximize these benefits, the National Dairy Goat S&T Program will address the issues that hinder the full growth of the dairy goat industry in the Philippines, namely, limited access of smallholders to good dairy goat breeds, absence of feeding guides for milking goats, increased prevalence of mastitis or intramammary infections in dairy goats, and the lack



of standards on the production of goat milk-based products.

By selecting the best performing dairy breeds suited to the country and by providing appropriate nutrition for them, the program aims to increase milk production to 150% by 2017. Smallholders shall be given access to these breeds via artificial insemination through the local goats and buck loan program.

In addition, an effective control protocol against mastitis will be developed. Considered as one of the greatest problems faced by the industry, mastitis can reduce milk volume and alter its composition, lower its hygienic value, and impair the processing of quality milk.

In three years, the program is expected to result in an initial increase of 60 % in does that can be milked, a reduction of 37% in subclinical mastitis incidence, and herd build-up of at least 58% from the deliberate infusion of good breeds in the countryside.

Program Leader Dr. Emilio Cruz of Central Luzon State University revealed that for an initial capital of P40,000, a dairy goat farmer can buy 3 breeder goats and earn P223,440 for 7 lactations in 5 years. In contrast, a cattle/carabao entrepreneur with the same amount of money can only buy one animal and earn less than P200, 000 for the same period.

If one goat dies, the farmer can still continue earning for the two remaining stocks,

while if the carabao dies, the owner loses all of his investment, he added.

Moreover, goat milk has higher commercial value than cattle or carabao milk. In Region III, raw milk is sold at P70 per liter to processors who will pasteurize, bottle, label and sell them in commercial stands at P150 per liter.

"All these advantages make goat production and goat dairying nowadays popular, propelling farmers to venture into such business and giving impetus for us at DOST to pour in investments to address the gaps in goat research and development," said Secretary Mario G. Montejo in his message during the Memorandum of Agreement signing between DOST and its partner institutions. These are Isabela State University, Central Luzon State University, Bohol Island State University, Department of Agriculture-Regional Field Office-VIII and University of the Philippines-Mindanao.

"Ultimately, this will propel an increase in milk production in backyard and commercial farms and the availability of healthier milk in the market," Montejo said.

In 2012, the country imported 1,995,410 metric tons of milk. Meanwhile, local production was merely 18,400 metric tons, of which only 1.4% was produced by goats. On the other hand, the National Dairy Authority 2013 data shows that there are around 3.67M goats, with dairy goat population at only 6,379 heads.





Bountiful harvest. DOST Secretary Mario G. Montejo (rightmost) and Senator Cynthia A. Villar (2nd from right) hold a bountiful harvest of rice stalks during the field test of the carrageenan fertilizer additives in Brgy. Balatong B, Pulilan, Bulacan. Also in photo are Pulilan Mayor Vicente ‘Enteng’ Esguerra and Sec. Montejo’s spouse, Mrs. Maritz O. Montejo. (Photo by Gerardo Palad, S&T Media Service, DOST-STII)

Farmer boosts rice production through DOST seaweeds technology

By JOY M. LAZCANO, DOST-STII

Pulilan, Bulacan- Mang Noel Mauricio, a rice farmer in this agricultural municipality, has seen many rice fields damaged badly by typhoons in the past. However, he has never seen such an occurrence when rice crops did not stoop down amidst a raging typhoon.

"Kung makikita ninyo, yung mga katabing palayan namin, lahat yan nakayuko. Nagtatanong nga ang aking mga kapitbahay kung ano ang inilagay ko daw sa palayan ko doon sa tabing-kalsada, ang sabi ko ay yung ibinigay sa akin ng DOST (If you will look at the adjacent rice fields, all of their crops are

bent. My neighbors have been asking what kind of fertilizer I used. I told them it was from DOST)," exclaimed Mang Noel.

Mang Noel is the owner of the two-hectare ricefield in Pulilan, Bulacan that was the subject of a product test for a rice fertilizer additive made out of carrageenan developed by experts from the Department of Science and Technology (DOST) and National Crop Protection Center-University of the Philippines-Los Baños (UPLB-NCPC).

Carrageenan is a substance mostly made up of carbohydrates bonded together which are extracted from edible seaweeds and



Mang Noel during the interview

commonly used as thickener and stabilizer for food or binder in personal care products.

Mang Noel also noted another difference in his crops as they reach the end of the crop cycle just before harvest when leaves usually become dry: "Makikita nyo, kulay berde pa ang ibang dahon, maganda yan kasi ibig sabihin nyan, patuloy pa rin ang potosentisis o yung paggawa ng pagkain ng pananim (If you will look at the crop, some of it still has green leaves, which is good because it means the photosynthetic activity is continuous.)."

The fertilizer additive, called Carravita for carrageenan and vitamins, helps rice crops develop stronger stem structure and stimulate growth. It also gives more grain yields compared to normal planting procedure according to Dr. Gil L. Magsino of UPLB-NCPC. It was initially introduced to more than 100 rice farmers in the municipality recently.

Dr. Magsino added that carrageenan as fertilizer has been used unsuccessfully in the past but through modern technology, experts were able to degrade it into nanoparticle size to make it more absorbable by crops.

He explained further that using Carravita by combining 20ml per liter per hectare and three to six bags of fertilizers, will produce a yield with a grain weight of 65.4% and a panicle length of 3.5 up to 12.5%.

More importantly, Carravita provides crops with more resistance to diseases such as Rice Tungro and Bacterial Leaf Blight (BLB).

Rice Tungro disease is caused by the combination of two viruses which are transmitted by leafhoppers. It causes leaf discoloration, stunted growth, reduced tiller numbers and sterile or partly filled grains.

BLB, on the other hand, caused by the *Xanthomonas oryzae* pv. *Oryzae*, results in wilting of rice seedlings, yellowing and drying of leaves.

Because Carravita is made from edible seaweeds, it is safe for humans and is guaranteed to be earth-friendly when sprayed on the crops.

Moreover, Mang Noel Mauricio added that the Carravita has other characteristics that help in the growth of the rice crops. "Mabuti itong gamit sa tingin ko kasi yung mga

mabubuting kulisap ay nai-engganyo sila doon sa mga palayan. Meron kasing mga kulisap na nakakatulong sa paglago ng mga pananim na palay (I think this [Carravita] is good because it entices friendly bugs that help in the growth of the rice crop.)”

Currently, UPLB-NCPC is continuously developing the product as positive results are seen on the project’s multi-location trials.

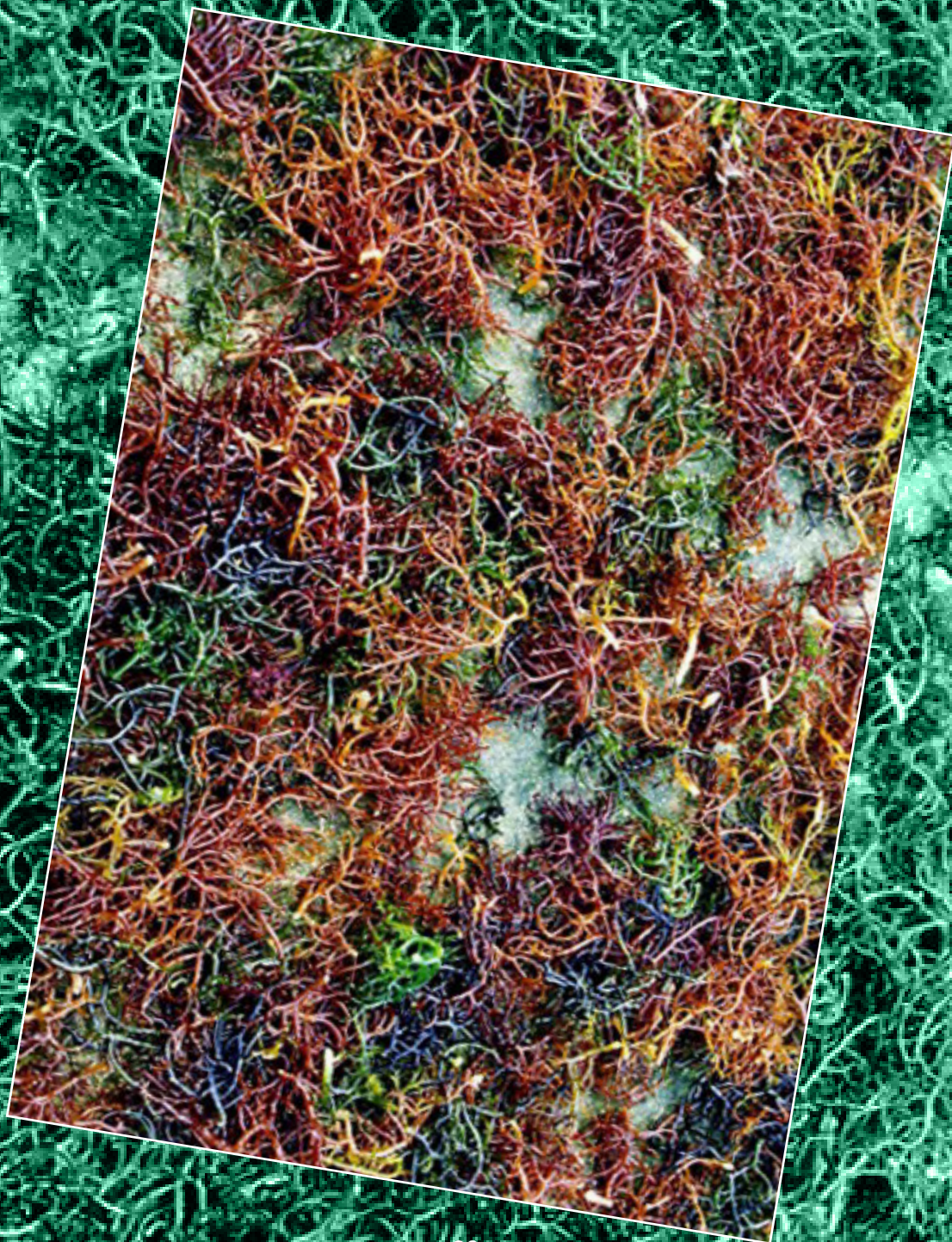
DOST Secretary Mario G. Montejo, who was present during the field presentation, was greatly elated by the results. Montejo expressed his hope that after the development of the product, DOST can initially fund its production so that farmers across the country can avail of it for free.

“Tinitingnan din natin kung maaari itong gamitin sa iba pang mga pananim gaya ng manga at mga gulay dahil kailangan nating patuloy na mapalago ang industriya ng agrikultura (We are also looking into the possibility of using this for other crops like mango and vegetables because we need to support the growth of the agriculture industry),” said Montejo.

Meanwhile, Senator Cynthia Villar, chair of the Senate Committee on Agriculture and Foods went to see the crops that were ready for harvest. She encouraged farmers to continue producing agricultural products for the country. “The sector that will sustain our food production are not the corporate farms,” the Senator said, “but farmers like you who own family farms.”

Carrageenan’s use as plant promoter was first studied by DOST’s Philippine Nuclear Research Institute (PNRI) through a research done several years ago. The research showed that when used as foliar fertilizer, PNRI’s carrageenan-based plant growth promoter can improve plant photosynthesis and enhance nutrient absorption of the roots.

The research and development for the product is supported by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, another DOST agency.



DOST's fertilizer additive from seaweed to reach more farms

By MA. LUISA S. LUMIOAN, DOST-STII

After the promising result of multi-location field trials of carrageenan fertilizer additive, the Department of Science and Technology (DOST) will be partnering with the Department of Agriculture (DA) to further expand its use according to DOST Secretary Mario G. Montejo in a recent press conference.

The said field trials showed that carrageenan, when added to fertilizer, can help make rice crops stronger, give more yield, and be more resistant to diseases, among others. Carrageenan is a substance extracted from edible seaweed.

This research on using carrageenan as fertilizer additive was based on an earlier study conducted by the DOST's Philippine Nuclear Research Institute (PNRI) which organized the said press conference.

In the said research, carrageenan was subjected to irradiation to degrade the substance into minute particles so that it can be absorbed by the plants optimally.

The DOST and DA target to further test the technology in around 4,000 hectares of farms for the next cropping season.

Montejo also revealed that PNRI is developing precision farming methods using

nuclear techniques to determine the right amount and timing of fertilizer application at different growth stages of crops, as well as optimizing irrigation scheduling to help lessen cost of inputs for the farmers.

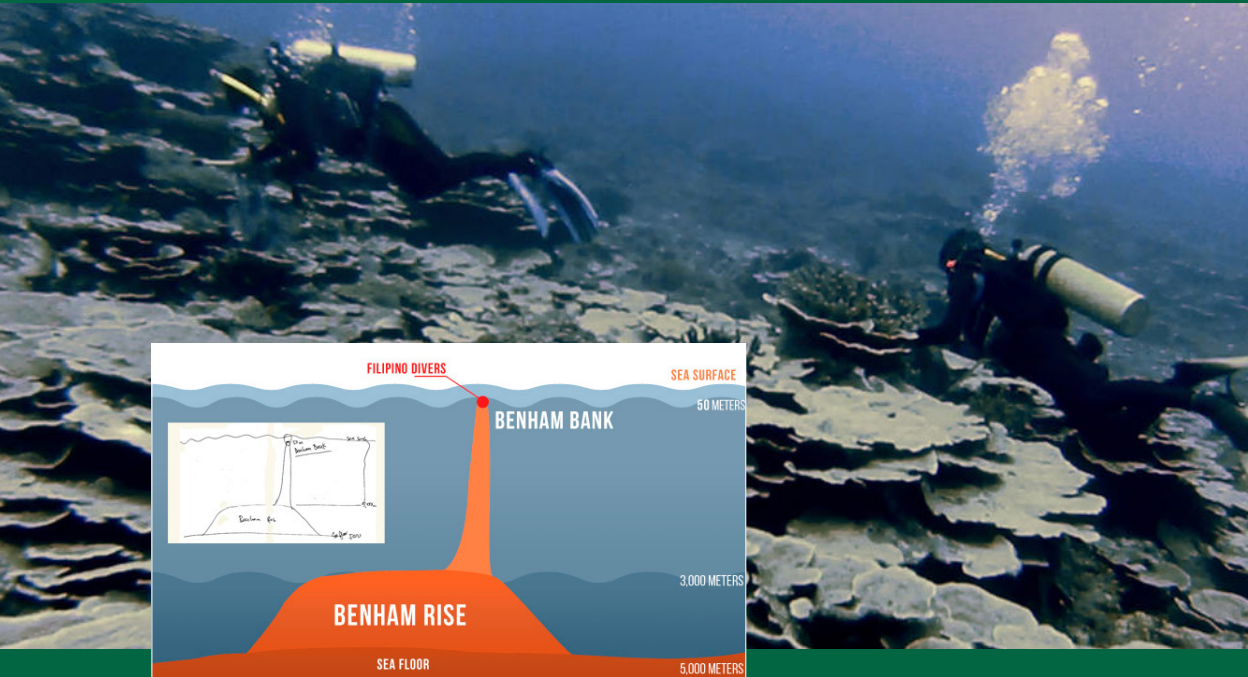
PNRI's studies have shown that timely and proper fertilizer application can increase fertilizer efficiency by up to 70 percent. In addition, appropriate irrigation scheduling can minimize losses by around 25 percent.

"These are just two samples of how atoms or nuclear technology can be harnessed for peace and development," said Montejo.

The Science Secretary also announced the holding of the third Philippine Nuclear Congress from December 7-9 at the Diamond Hotel Manila.

With the theme "Meeting Challenges through Nuclear Science and Technology for Sustainable Growth," the said congress will feature local and international experts who will discuss the current status of the peaceful use of nuclear science in the fields of agriculture, health and medicine, industry, environment, as well as nuclear safety, security and safeguards.

All eyes on Benham Rise



From May 3-18, 2014, Filipino scientists aboard the research vessel M/V BFAR conducted oceanographic exploration and surveys at Benham Bank, the shallowest area of Benham Rise with a depth of 50 meters. The objective was to determine the resources available in the territory for future economic benefits.

The initiative, dubbed "Exploration, Mapping, and Assessment of Deep Water Areas," was funded by the Department of Science and Technology's Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD).

It was a collaboration of the UP Marine Science Institute, UP National Institute of Geological Sciences, UPLB – School of Environmental Science and Management, and Department of Agriculture-Bureau of Fisheries and Aquatic Resources. The project was likewise backed by researchers, scientists and seasoned dive specialists from UP Mindanao, UP Baguio, Xavier University, Ateneo de Manila University and the local diving industry.



The Philippines was given sovereignty over the Benham Rise Region when, on April 12, 2012, the Commission on the Limits of the Continental Shelf of the United Nations adopted in full the country's declaration of the Benham Rise as part of the Philippine

Extended Continental Shelf.

Benham Rise covers a seabed area of 135,506 sq km. within which emerges the peak of an isolated seamount, one among over 30,000 seamounts found in the world's oceans.

Seamount habitats can be biodiversity hotspots because of available substrates for macrophyte and invertebrate recruitment and settlement, abundance of food, and the interaction of dynamic currents with the supply of nutrients from the deep.

To assess the biological features and resources of the Benham Bank Seamount and contribute to the efforts of documenting deep-water biodiversity in the Philippines, the pioneering research project was implemented.

Results of the survey will contribute to resource planning and management as well as scientific understanding of this globally significant area, thus benefiting the scientific community, government line agencies tasked to manage the resources, and the general public.

At the same time, knowledge about Benham Bank Seamount's biodiversity may be linked to the productivity of the entire Benham Rise Region which had already been the site of fishing activities even before the country was awarded its claim.

"Exploration, Mapping, and Assessment of Deep Water Areas," is just one among several R&D projects on aquatic concerns supported by PCAARRD.

Project NOAH sows seeds for agri use: Going beyond disaster preparedness and hazard identification

By RODOLFO P. DE GUZMAN, *DOST-STII*

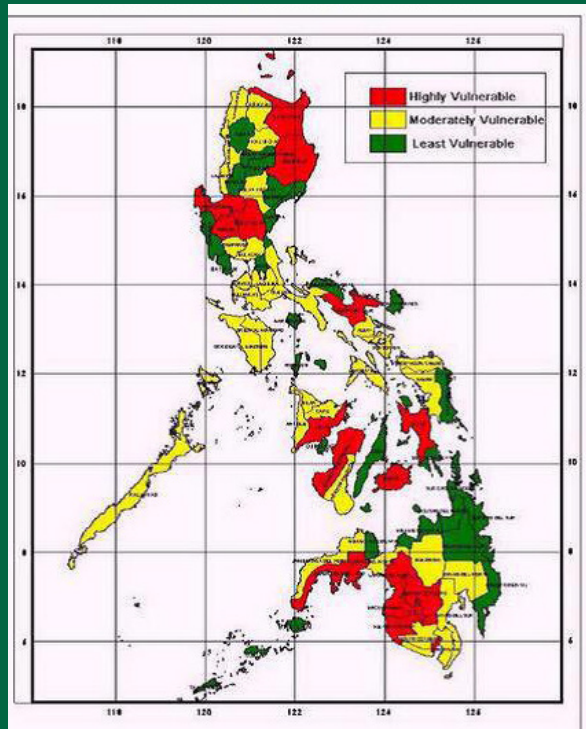
The Department of Science and Technology's (DOST) Nationwide Operational Assessment of Hazards or Project NOAH has been very effective in aiding local government units and the general public in terms of disaster preparedness and mitigation through its digital platform.

The website, www.noah.dost.gov.ph, which provides timely weather and hazard information, is easily accessible to users.

Flood forecasting with the use of flood hazard maps generated from the component project of NOAH, referred to as Disaster Risk and Exposure Assessment for Mitigation or DREAM, is an important feature in the NOAH website. Through DREAM, unsafe and safe areas for evacuation or relocation in the event of floods are identified.

In 2014, two years following its launch in Marikina City on July 6, 2012, Project NOAH has morphed into a different form of information vehicle: Project NOAH's weather data are now being utilized as a tool for agriculture.

You heard it right: Project NOAH is going beyond disaster mitigation. It is now churning out data and information that can help farmers increase productivity by



El Niño vulnerability map for rice.

knowing when to plant and where to plant.

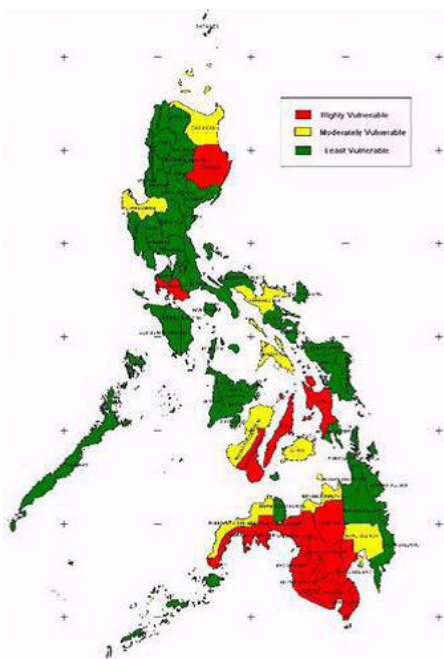
The Weather Information Integration for System Enhancement or WISE is a component of Project NOAH. It enhances the existing 5-day forecast given by the Philippine Atmospheric, Geophysical and Astronomical Services Administration or PAGASA to a 7-day forecast.

By extending the weather forecast time coverage, farmers can now plan ahead and adjust planting schedules to avoid possible hazards like typhoons, floods and drought. In short, WISE provides critical information in determining the best time for planting and harvesting specific crops like rice and corn.

During the Agri-Aqua Forum held last July 27, 2014 during DOST's recently concluded National Science and Technology Week at the SMX Convention Center, "smart agriculture," the government's initiative in addressing climate change adaptation, took prominence.

Dr. Erika Mari Macapagal of NOAH-WISE delivered a presentation by colleague Dr. Gay Jane Perez titled "Drought and Crop Assessment and Forecasting or DCAF."

Dr. Macapagal showed the drought vulnerability maps for the country's two major crops: rice and corn. The color-coded map identified areas highly vulnerable to drought represented by color red, moderately vulnerable by color yellow, and least vulnerable by color green.



El Niño vulnerability map for corn.

For rice, the highly vulnerable areas include Central Mindanao, Central Luzon, Bicol, Iloilo and Negros. On the other hand, the least vulnerable is Northeastern Mindanao.

For corn, the highly vulnerable areas include Zamboanga, half of Eastern Mindanao, Cebu and Batangas. On the other hand, almost the entire area of Luzon including Mindoro, Palawan, Panay Island and Eastern Mindanao were identified as least vulnerable.

Also presented were crop classification maps

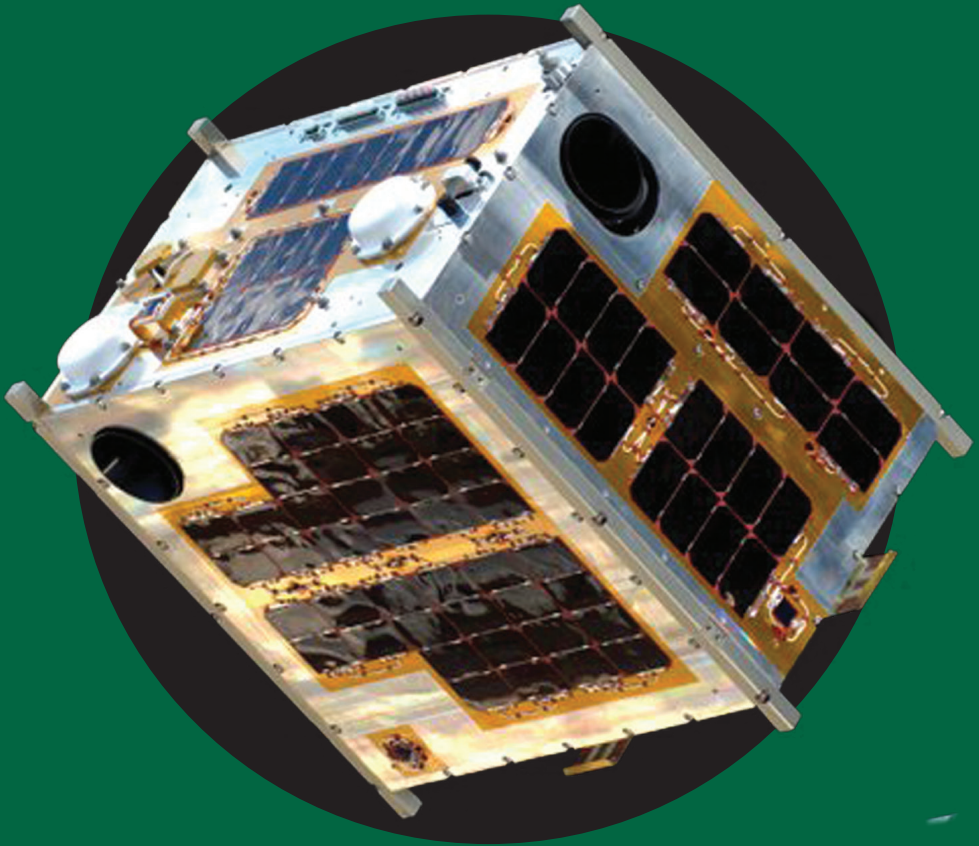
for coconut, sugarcane, abaca and tobacco.

By making this information available, Project NOAH-WISE is able to give farmers the flexibility in choosing the right crop for a particular season, thereby minimizing their losses when drought comes.

Dr. Macapagal also briefly discussed the parameters they were using to assess drought events. These include data on rainfall, soil moisture, temperature and vegetation cover.

Likewise, the NOAH-WISE project aims to come up with seasonal forecasts of up to six months in advance.

Once completed, this information will greatly help those in the agricultural sector – from individual farmers to corporate agricultural ventures -- in programming their planting activities, thereby minimizing loss and increasing production.



DIWATA

By RODOLFO P. DE GUZMAN, DOST-STII

As a landmark project of the Department of Science and Technology (DOST) through the Philippine Council for Industry, Energy and Emerging Technology Research and Development, the first Filipino-made microsatellite is poised to fly high in the next two months.

This microsatellite uses cutting-edge technology, and was designed and assembled by Filipino scientists and engineers on a comprehensive training on satellite technology at Japan's Tohoko and Hokkaido universities.

Named after Filipino mythological character, Diwata (“fairy”), the first Filipino built microsatellite, weighs just 50 kilograms but the benefits are indeed heavyweight.

Just like other countries around the world, this satellite technology will greatly improve the capability of our national weather agency, the DOST-Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) to make accurate forecasts and weather monitoring that is crucial in agriculture. The data that will be generated by Diwata will enable PAGASA to predict extreme weather systems like the El Niño phenomenon that can dramatically affect agricultural productivity, crop yield, and threaten food security.

PAGASA's forecasting will greatly improve because of more available data at its disposal.

“By investing in our intellectual resources, harnessing the best minds in our country, we developed Diwata to provide our people the opportunity to reap the many benefits it offers aside from information critical to agriculture because these same data can be used to monitor our forest cover and natural resources, implement a responsive disaster risk management program like Project NOAH, enhance water resources management systems and improve weather monitoring and forecasting,” added Montejo.

Diwata was sent to the United States, either in Florida or California, by JAXA for its launch to be carried to the International Space Station that will orbit the earth 400 kilometers up in space.

"We at the DOST believe that this is a big step forward to attaining technological self-reliance by harnessing the power of science, technology and innovation. The talents of our own scientists are working for our people and we are confident that the benefits of DIWATA will boil down to improving the lives of Mang Juan and Aling Maria in the long run," concluded Montejo.



DOST IV-A officials, partners, media guests and stakeholders were shown this catamaran-type buoy located in Lipote River in Mataasnakahoy, Batangas City during the 52nd anniversary celebration of the DOST regional office last November 20, 2015.

This equipment is part of the Department's SENTRY or Sensing Environmental Parameters through Telemetry project which aims to improve water quality monitoring and assessment in Batangas Province.

DOST launches SENTRY to guard over water quality of Batangas

By **ESPIE ANGELICA A. DE LEON**, *DOST-STII*

Monitoring and assessment of water quality in Batangas Province has been given a boost with the launching of the Department of Science and Technology's (DOST) SENTRY, or Sensing Environmental Parameters through Telemetry, during the celebration of DOST IV-A's 52nd anniversary in Mataas na kahoy, Batangas last November 20, 2015.

SENTRY is a system which deploys devices for real-time automated data acquisition to help avoid fish kill and other adverse effects of poor water quality. These devices are sensors which come in the form of catamaran-type buoys. To be gathered are data on the water's acidity, turbidity, and total suspended solids or particles larger than two microns.

The first of these sensors, launched during the said occasion, is installed along Lipote River which had fallen prey to water pollution coming from the upstream. The sensor will serve as a virtual round-the-clock sentry that will stand guard over particles flowing from the upstream which will pollute the river.

These data will be transmitted, on a per hour basis, to a website which consolidates all other water quality information gathered from various monitoring agencies. Datalogging and communication technologies are provided by DOST's Advanced Science and Technology Institute.

Among others, SENTRY is also capable of warning concerned regulatory agencies if a particular data is nearing its critical level. It can also disseminate bulletins and advisories from the Department of Environment and Natural Resources (DENR), Bureau of Fisheries and Aquatic Resources (BFAR), and Environmental Management Bureau (EMB) to local government units (LGUs), fish cage owners and other stakeholders.

SENTRY is an initiative of the regional offices of DOST, DENR, BFAR, and EMB, as well as Batangas State University which handled the design and fabrication of the buoys, Mataas na kahoy LGU, and Pusod, Inc. – an organization devoted to the protection and enhancement of ecosystems in the Philippines.

During the launch, DOST Undersecretary for Scientific and Technological Services Dr. Rowena Cristina L. Guevara lauded SENTRY as a collaborative project, calling it as an illustration of "bayanihan in science and technology."

"This is what they call the tri-sector approach," said Guevara, referring to the participation of the public, private, and academe sectors in the project.

"When these three [sectors] join hands, we can go far," she added.

SENTRY will be replicated in other areas and rivers draining into Taal Lake, specifically polluted rivers and coastal villages, among others.

The patience of Job: Technology saves the jackfruit

By DEMOCRITO Z. MAGPANTAY & NOEL A. CATIBOG

S&T Media Service, DOST-PCAARRD

and MELPHA M. ABELLO

Agriculture Magazine



Science and technology practices, when applied properly in managing a farm, can result in the success of a farmer. In the case of the Magsasaka Siyentista Job Abuyabor, it does not only mean his success, but also the success of other farmers.

As the Magsasaka Siyentista of the Visayas Consortium for Agriculture and Resources Program, he is tasked to share jackfruit technologies and management methods that he has already adopted in his farm which is treated as a research laboratory. One

Through technology, good farming practice, and patience, Job Abuyabor was able to rescue his jackfruits from pests. Now he is into jackfruit processing and has provided livelihood even to farmers' wives.

of these practices is addressing the presence of destructive pests like the fruit borer by applying *Metarhizium anisopliae* spray suspension (MSS), a technology developed by Dr. Carlos dela Cruz of the Department of Agriculture- Regional Integrated Agricultural Research Centers (DA-RIARC) and Dr. Ruben Gapasin of the Visayas State University (VSU).

Dehydrated jackfruit

Developed as an offshoot of the three-year project of the DOST and PCAARRD entitled Jackfruit Regional R&D Program for Region VIII that started in 2008, the MSS project involved VSU and the DA Regional Field Unit 8 through the DA-RIARC station in Abuyog, Leyte.

Metarhizium anisopliae is a fungus that grows naturally in the soil and causes disease in various insects by acting as a parasitoid. Thus, MSS fights fruit borers by causing the parasite to acquire a disease.

The MSS is prepared by mixing *M. anisopliae* spore cultures with soap solution. It is sprayed to flower buds, flowers, and fruits when the fruit borers start to infest the tree. The spray is continually applied until the fruits are ready for bagging.

The pests fruit borer and fruit fly caused damages that brought a 40 to 50 percent decrease in Abuyabor's income, so he welcomed the development of the MSS that

gave him a ray of hope for his jackfruits.

Abuyabor sprays MSS daily on flower buds as they emerge up to 42 days. On the 42nd day, Abuyabor bags the fruit with plastic for the next 88 days and harvests it on the 89th day.

With the MSS technology, Abuyabor has doubled his harvest of jackfruit and he continues to reap more from the technology.



Job Abuyabor, a Magsasaka Siyentista, together with his harvest of EVIARC Sweet, which is reputed to be a superior variety in terms of sweetness and aroma.

MSS as a complement to good agricultural practices

Aside from the MSS technology, Abuyabor credits his abundant harvest of jackfruit to the application of good agricultural practices in his 7.8-hectare farm along Maharlika Highway in Barangay San Isidro, Mahaplag, Leyte.

He learned these practices as a member of the Mahaplag Jackfruit Growers Association, one of the recipients of the DA's "Plant Now Pay Later" distribution scheme in Region 8.

Applying fertilizer, providing drainage, and pruning were the practices he learned from DA. Abuyabor said that newly planted

seedlings and non-bearing trees must be provided with nitrogen while bearing trees should be provided with phosphorous and potash combined with organic fertilizer. For bearing trees, he applies the fertilizer before flowering and right after harvesting.

Moreover, proper drainage can help avoid the incidence of disease in the farm, particularly Phytophthora. After building drainage canals and practicing sanitation, he also performs ringweeding and underbushing every three months. He also learned that injecting phosphonate and chemical



Job Abuyabor shows off his harvest of jackfruits.

Chitosan spray will manage the infestation of Phytophthora in his farm.

Abuyabor also learned this technology as a cooperator in the study conducted by the DA, VSU, DOST-PCAARRD, and the Australian Centre for International Agricultural Research.

Maintaining the jackfruit tree is important through the practice of pruning in his farm. He removes unproductive and disease-damaged branches to allow more sunlight to penetrate.

Moreover, he controls the number of fruits per tree that will develop during fruiting season. Only one fruit per foot of tree height is maintained to allow bigger fruits to develop. As such, Abuyabor only allows 10 fruits to be produced per tree.

Improving the jackfruit market

With over 14,419 hectares planted to jackfruit and with 51,713 metric tons harvested annually, the Philippine jackfruit industry is lucrative. Region 8, with its favorable soil and weather conditions, is ranked as the 10th top jackfruit-producing region in the country. However, VSU, in its supply chain analysis in Eastern Visayas, reported that there are currently issues

such as low yield per tree, low maintenance of jackfruit plantation, high incidence of pests and diseases, unstable price during the fruiting season, and presence of more intermediaries along the jackfruit supply chain. These issues resulted in a shortage of jackfruit production in the region in as much as 8,784 fruits per month.


This concern is now being addressed through S&T interventions by the S&T Community-Based Farm (STCBF), a technology transfer modality of DOST-PCAARRD, which will upscale the application of S&T interventions for adoption by jackfruit farmers in the region. It will also provide the raw material requirements of the TechnoMart (TM) project.

The STCBF and TM projects are fruits of the collaboration of the VSU, DA- Eastern Visayas Integrated Agricultural Research Center, and five local government units in Leyte.

Abuyabor was identified as the entrepreneur for the dehydrated jackfruit which is his venture into jackfruit processing. Through this venture, he hopes to create new livelihood for the community, especially for the wives of the jackfruit farmers.

Using S&T-based interventions, this native chicken project provides livelihood, lifeline, and lifestyle option to inmates who are preparing for new lives outside prison bars.

A taste of freedom to “kakosa”: A lifeline to mainstream society

A photograph showing a large number of native chickens, likely Zampanos, in a sandy enclosure. In the background, there are palm trees and a wooden structure made of bamboo or similar material. The scene is outdoors and appears to be a farm or a breeding area.

Science-based production of Zampanos native chicken by the San Ramon inmates.

Cascading the fruits of R&D to the countryside to change the lives of people is the ultimate dream of any researcher. It takes a lot of effort and resources, though, to disseminate or promote technologies or innovations to change mindsets and ways of farmers, encourage them to adopt these, and finally help them increase their productivity and income.

For livestock and poultry, it is well recognized that this subsector contributes significantly to the growth of the agricultural sector. In fact, livestock is not a mere likelihood, but a livelihood, a lifeline, and a lifestyle.

Raising the quality of native chicken

In the Zamboanga Peninsula, a project titled Evaluation of the Sustainability and Profitability of Zampen Native Chicken (also known as 'Joloano') Production as Source of Livelihood in Rural Communities is underway. The project is led by the Western Mindanao State University (WMSU), through Dr. Teresita Narvaez, Western Mindanao Agriculture and Aquatic Resources Research and Development Consortium (WESMARRDEC) director.

The project is a component of a DOST-PCAARRD- supported native chicken program titled Purification, Improvement and Sustainable Utilization of Native Chicken Strains in Bohol, Bicol and Zamboanga Peninsula.

The project adopts the technologies and protocol developed by WMSU on management of the Joloano native chickens-- from

hatching, day old, hardening, and up until the birds are ready for breeding; selecting and purifying the strain; and developing the health protocol and feeding management system.

Soaring beyond the coop

With these science and technology-based interventions at hand, including promotions done, about the potentials of Zampen native chicken, the demand for the strain to meet the local needs in Zamboanga Peninsula has grown. In fact, there is demand even from other provinces and regions of the country.

The project has created awareness and instilled appreciation among local government units, the Department of Agriculture, academe, and even NGOs in Zamboanga Peninsula, where, for many years, this resource



PCAARRD Executive Director Rey Ebor shows his skills in classifying native chicken through the breast.



MOA signing with San Ramon Penal Colony Officer-in-Charge Emmanuel Narvaez, BUCOR official Marlon Morales, WMSU President Milabel Ho, with PCAARRD Livestock Research Division (LRD) Director Edwin C. Villarar (left).

of native chicken was not given importance.

The project, with all its benefits and potential in giving hope and direction to people, caught the interest of the San Ramon Penal Colony management. The penal colony, a 30 to 45-minute ride away from the city, is adjacent to the project site at the WMSU campus in San Ramon, Zamboanga City. In no time, the penal colony, with the support of the Bureau of Corrections, started a livelihood project that used the results of R&D on native chicken production.

Chicken gives a taste of freedom

Project beneficiaries are inmates or the “kosas” who are about to complete serving their sentence within one to three years. Earlier sentenced and detained for robbery, murder, kidnapping, and other crimes, most of them came from the National Bilibid Prison in Muntinlupa.

For the inmates, the livestock project is a lifeline—a link to the outside world that will eventually help them start over with their lives. Through the project, they were equipped with knowledge and skills that will help them start afresh once they are finally released.

Particularly, the inmates learned how to raise native chicken. It is not surprising that most of these inmates already have the basic know-how and yet are very much trainable and enthusiastic because they have experienced raising chicken (gamefowls, range chicken, or broilers) in their provinces.

Ultimately, livestock will become a lifestyle to inmates who choose to go by it.

The inmates will get a monetary share from the stocks sold initially to WMSU, but they will be required to market the stocks produced from the penal colony. When they

are about to be released, they will be provided with a starter package of breeders to serve as their "*pabaon*" or parting gift. This gift will help them start a new life should they prefer this option.

The WMSU researchers will make sure that through the package of technology developed, the stocks sold as breeders will meet the standards set by the project for the market. This will assure quality in terms

of predictability in performance as well as sustainability in supply. The livelihood project with the inmates is expected to address the production of stocks to satisfy the growing demand for native chicken.

With this project, the "*kakosas*" of San Ramon Penal Colony, while still detained, can already breathe the air of freedom and prepare for a better life through science and technology.



Dr. Villar interacts with the inmates about the project

Fighting Fusarium wilt

By SHARIE AL-FAIHA A. ABUSTAN, GRETCHEN O. NAS & ROSE ANNE K. MANANGHAYA
DOST-PCAARRD



A banana plantation in Matilo, Nabunturan, Compostela Valley Province, was planted with seven Fusarium Wilt resistant GCTCV somaclones. The project Adaptability Trial of Seven CTCV Somaclones Against Fusarium Wilt (Foc) is under the program, S&T Management approaches against Fusarium Wilt on ‘Cavendish’ in Mindanao.

Davao, with its rich volcanic soil and climate suitable to fruit trees, has been battling a disease that has been ravaging hectares of Cavendish banana plantations since 1997: Panama disease or Fusarium wilt. Being the second largest banana exporter in the world and with banana as one of the biggest dollar earners in the country, the Philippines' banana export may suffer due to the prevalence of this disease in the region.

Addressing Fusarium Wilt

Fusarium wilt is a disease caused by a soil-borne pathogen, *Fusarium oxysporum f. sp. cubense* (Foc), which could thrive in the

soil for years, causing banana plants to wilt and making the plantation unproductive.

Fusarium wilt has four races, with races 1 and 4 affecting bananas.

However, tropical race 4 (TR4) is a more important concern because it greatly affects the Cavendish variety being exported by the Philippines.

To address this challenge, the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD) in 2005 funded surveys of banana-growing areas for Fusarium infection as part of the S&T Anchor Program (STAP) for Banana. In Luzon and Visayas, the



A bunch of healthy Cavendish bananas were products of the Fusarium Wilt-resistant GCTCV somaclone.

provinces surveyed include Camarines Sur, Quezon, Laguna, Oriental Mindoro, Isabela, Quirino, Nueva Nizcaya, and Negros Oriental. In Mindanao, the survey covered Compostela Valley, Davao del Sur, Davao del Norte, Davao Oriental and Davao City.

Out of the survey, PCAARRD developed maps of the disease incidence in Luzon and Visayas areas in collaboration with the National Mapping and Resource Information Authority. Surveys showed that the Latundan variety was most infected. On the other hand, in Davao, there was no reported incidence in Davao del Sur and only a low level incidence was reported in Davao del Norte and Davao Oriental. Also in Davao, infection was most severe on VCG1213/16, a Cavendish variety.

To lower the disease incidence in the field, growers used a commercial microbial fertilizer at the banana nurseries. However, it was later determined that the most effective method in battling Fusarium wilt was the use of resistant varieties.

Fusarium Wilt-resistant varieties identified

To address the concerns of the Cavendish industry on Foc TR4, DOST-PCAARRD together with the Southern Mindanao Agriculture and Resources Research and Development Consortium (SMARRDEC), Bureau of Plant Industry – Davao National Crop Research and Development Center (BPI-DNCRDC), University of Southeastern Philippines (USEP), and the University of the Philippines Los Baños (UPLB) evaluated seven giant Cavendish

tissue culture variant (GCTCV) somaclones under farmer's field condition. This was under the program "S&T Management Approaches Against Fusarium Wilt (*Fusarium oxysporum* f. *spcubense* (Foc)) on Cavendish in Mindanao", which was implemented from 2012 to 2015.

The GCTCV somaclones originated from the Taiwan Banana Research Institute (TBRI) and were made available to the Philippines for research purposes by the Bioversity International as the overall coordinator for the Banana in the Asia Pacific Network (BAPNET). The GCTCV somaclones tested were GCTCV 105, 106, 119, 215, 218, 219, 247.

The various GCTCV somaclones were monitored in a hectare of each farmer's field. Eight farms selected the GCTCV 218 and 219 which were planted in a bigger scale. GCTCV 219 showed very high degrees of resistance across locations while GCTCV 218 still showed varying degrees of resistance across locations but provided good hand formation and is also acceptable to the export market based on initial trial shipment done in China and the Middle East.

Effective management of the disease

Aside from the identification of wilt-resistant Cavendish variants, the research team developed a package of technology effective in managing the disease.

Three microbial agents, Vesicular Arbuscular Mycorrhiza (VAM), Effective Microorganisms (EM), and *Trichoderma harzianum*, were identified as potential control

for the disease. After testing against Foc under greenhouse and field conditions, the three microbial agents successfully reduced Foc TR4 field incidence.

T. harzianum has controlled Fusarium wilt by 65 percent in GCTCV 218 while EM reduced the disease by 64 percent. There is no disease observed on GCTCV 219, proving its strong resistance against Foc. EM reportedly reduced the Fusarium wilt disease by 63 percent, while the combination of VAM and *T. harzianum* controlled the disease by 67 percent across locations in Grand Nain, a highly susceptible Cavendish variety typically grown for export.

Currently, the research team is refining the methodologies in applying the microbial agents in the plants to increase their effectiveness.

Regaining ground in the global market

With several banana growers in Davao growing the moderately resistant GCTCV 218 and highly resistant 219, the growers need to pass the export standards of foreign countries as an important step to regain the country's position in the global market.

Recently, both somaclones passed the export standards of China and the Middle East. Some growers have already harvested export quality fruits and eventually started exporting abroad.

Through the adoption of technologies generated in the program, DOST-PCAARRD and its partners hope to help the industry regain its strong footing in the global market

scene. Specifically, it is hoped to support the growers in rehabilitating their farms and, consequently, ensure good harvest and income.

The technologies are intended for the local growers and exporters in Cavendish-growing areas in Mindanao, particularly Regions 9 to 12.

Resistant varieties seen to benefit Davao farmers

In one of the farmers' fields where GCTCV 218 and 219 were tested and monitored, Natividad Cruz shared that resistant varieties as form of assistance were better than giving them cash and farm inputs. When Fusarium wilt ravaged her 17-hectare banana plantation and turned it to yellow, only two hectares were spared from the wilt.

With the resistant varieties, she noted that there had been significant change in her farm – from “nothingness to plentiful.” She also observed that the Grand Nain later showed some degree of resistance which she attributes to the presence of GCTCVs 218 and 219.

As the technologies are further refined, DOST-PCAARRD and its partners are hoping to see more farmers who can benefit from the technology. When more farmers are able to take advantage of the planting materials with GCTCV 218 and 219, the banana export industry is expected to rise again and farmers can also claim, like Cruz, that their plantations can turn from nothing to plentiful.



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