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CERDAF Approves 16 NIRDEAPs

Sixteen out of 22 national research and development, extension (RDE) networks will start implementing their new agenda and programs as another year begins in 2001. This developed after the Council for Extension, Research and Development in Agriculture and Fisheries (CERDAF) approved their National Integrated Research Development and Extension Agenda and Program (NIRDEAP) last November.

The NIRDEAPs are based on the 'one system, one program' approach under the Agriculture and Fisheries Modernization Act (AFMA), which provides for a unified system of RDE priority setting and program implementation at the national and regional levels.

Approved NIRDEAPs include rice, corn, coconut, legumes, fibercrops, plantation crops, root crops, vegetables, fruits, ornamentals, livestock and poultry, capture fisheries, aquaculture, fisheries postharvest and marketing, biotechnology, and agricultural engineering. The remaining six networks are still to be presented and approved on the second CERDAF meeting on 2001.

The NIRDEAP embodies the integrated thrusts and directions for agriculture and fisheries RDE and contains priority programs for a five-year implementation period. As provided in the AFMA, the NIRDEAP was drafted by members of the National Research and Development System in Agriculture and Fisheries (NaRDSAF) and the National Extension System for Agriculture and Fisheries (NESAF) with inputs from the private/industry sector.

New NIRDEAPs

Rice

The new R&D program for rice will improve the synchronization of technology components, fill-up missing links of packaged technologies, directly address the pressing problems of farmers, avoid lag phase from release to adoption of technologies, expand multi-disciplinary assessment and formulation of research problems, and develop more location-specific technologies.

Corn

The Corn NIRDEAP will address the production and post-production problems and needs of three types of corn grown in the country, specifically, the yellow, white, and special types. Aside from these, issues on the socioeconomic dimensions of the producers and industrial sectors and further utilization of technologies/information by end-users will be explored.

Specifically, R&D projects on yellow corn will be based on the provisions and concept of the strategic agriculture and fisheries development zone (SAFDZ) of the AFMA. For white and special corn types, R&D projects will focus on the development of an appropriate farming systems approach and market strategies, respectively.

Coconut

The Coconut RDE agenda aims to make the coconut industry globally competitive, profitable for the stakeholders, yet ecologically-sustainable through efficient production, processing and marketing systems. This will involve five programs, namely: crop improvement, coconut-based farming systems, marketing and processing, research and development, socioeconomic and policy advocacy, health and nutrition, and institutional strengthening.

Legumes

Three main RDE themes will support the expansion of mungbean, peanut, and soybean production in the Philippines: quality seeds, improved production efficiency, and assured market. Thus, for the next five years, the Legume Program will focus on providing production, storage and utilization package of technology (to develop a dynamic legume industry), and develop new knowledge technology and products (to add value to legumes).

Fibercrops

The Fibercrops NIRDEAP addresses the raw material needs and development of the fiber-based industry such as cordage, pulp and paper, fibercraft, and textiles.

Plantation Crops

As the second most important commodity to oil, coffee is a priority crop for development under the Plantation Crops Network. Some of the priority projects include varietal improvement, coffee arabica and excelsa development program, and pest and disease management.

Root Crops

Expansion of the root crops industry requires more than technology development and transfer. Provision of adequate support services and favorable policies are vital to the development of the industry. The development framework focuses on enhancing productivity, farm efficiency, and product value through the development of relevant technologies, infusion of appropriate technologies, providing adequate credit, infrastructure and policy support, and by forging linkage among growers, markets, and users.

Vegetable

The vegetable industry will strive to increase its capability in supplying the needs of the local market and part of the export market through equitable, sustainable, globally-competitive and environment-friendly systems of production, post-production, and marketing technologies.

Fruits

Banana, durian, pineapple, and mango will be the focus for development under the fruits agenda and programs. The strategies will include the development of techniques to increase yield, productivity, farm efficiency, product innovations, and a closer link between production and market.

Ornamentals

The Ornamental RDE program covers three groups of commodity lines, namely: cutflowers, cut and containerized foliage plants and flowering pot plants, and landscaping materials. The industry's needs will be pursued along six themes: sustained productivity and increased profitability through cost-efficient production system; quality enhancement through post-production systems improvement; human and environment-friendly pest management systems; biodiversity conservation; investment strategies; and promotion of appropriate and sustainable technologies.

Livestock and Poultry

The agenda and program will anchor on three main themes: genetic improvement of animals; production management and animal health; post production technology and livestock development; and policy technology promotion and capability-building.

Capture Fisheries

To effectively manage a sustainable fishery sector, the agenda and programs for Capture Fisheries will focus on two areas: integrated management of coastal and inland waters and offshore fisheries development.

Aquaculture

The Aquaculture NIRDEAP will have six major program themes: improvement of aquaculture systems; development of improved strains and new species for aquaculture; reduction of environmental impacts of aquaculture; establishment of database for aquaculture resources; formulation of appropriate regulations and policies for aquaculture; and extension.

Post-harvest and Marketing

The research program was

See NIRDEAPs, page 2

DA Launches Biotech Program under PL480 Fund

Subsequent to the signed law under the R.A. 8435 or the Agriculture and Fisheries Modernization Act (AFMA) of providing 4% of the total R&D budget for biotechnology, the Department of Agriculture (DA) recently launched the Philippine Agriculture Fisheries Biotechnology Program under the Public Law 480 Food for Peace Program Loan Fund. This five-year program is aimed at putting into place a policy and regulatory framework for the safe use and commercial application of biotech products in the country. Likewise, it aims to enable the DA regulatory agencies to implement their specific regulatory functions with respect to these products; enhance the institutional capacity of the cooperating research centers; facilitate application of DNA-based technologies; and upgrade the institutional capability of DA through studies, trainings, and educational opportunities.

The DA Biotech Program has five sub-components, namely: Policy Analysis and Advocacy; Institutional Development and Capacity Enhancement; Research and Development; Risk Analysis, Assessment, Management and Communication; and Biotechnology Commercialization.

The program is set to start as soon as the PL480 2000-01 fund is released. Meanwhile, support in the form of a start-up fund was requested from the Livelihood Enhancement for Agricultural Development (LEAD) Program of the National Agriculture and Fisheries Council (NAFC) to expedite the implementation of the biotech program.

Two memorandum of agreements (MOAs) were signed on 22 December 2000 to implement the activities of the LEAD-funded project. A P13-million grant was released to UP Los Baños (UPLB) for the institutional capacity enhancement of the DA regulatory agencies. The support covers the establishment of laboratories, procurement of necessary equipment for the detection of genetically modified organisms in plants, plant products and feeds, and provision of corresponding training and capability-building of the required personnel. The support also allows UPLB-BIOTECH to purchase a DNA sequencer to facilitate the in-depth analysis of the genetic make-up of an organism. DA has identified the UPLB-BIOTECH to be among the accredited research institutions in the detection of transgenics. Also part of the signed agreement was the P7-million grant awarded to UPLB Foundation Inc. to institutionalize the Program Implementation Unit, Steering Committee and Technical Committee, which are necessary for the efficient and effective implementation of the DA Biotech Program. Likewise, computers and peripherals shall be provided to the DA Policy Analysis Service (DA-PAS) and the Bureau of Agriculture and Fisheries Products Standards (BAFPS) to facilitate research, coordination and communication on biotech policy issues and establish national food standards for transgenics. Presently, the UPLB Foundation Inc. has received a total of P2.1 million as part of the initial release.

The program is in its initial phase of implementation, which includes the preparation of the Manual of Operations for the management, coordination, monitoring and evaluation of different components of the program; convening the Steering Committee; and establishment of the Technical Committees. The initial proposal submitted to the Department of Budget and Management is set for review to make it more responsive to the needs and activities for the year 2001. *(Rita T. dela Cruz)*

Genetic Engineering Delays Ripening in Papaya and Mango

Through modern biotechnology or genetic engineering, researchers from the Institute of Plant Breeding (IPB), College of Agriculture at the University of the Philippines Los Baños enhanced two of the country's major fruit crops, papaya and mango to delay their ripening traits. Fruits with longer shelf lives can be now exported to more distant countries, making them more in-demand to the local market. They stay fresh longer without special refrigeration or other storage conditions.

The process was done by cloning the ripening-related enzymes (specifically, the ACC (1-Aminocyclopropane-1-Carboxylate) synthase genes) from ripe fruits of local varieties of papaya and mango. This was conducted by the research team of Drs. Antonio C. Laurena and Evelyn Mae Tecson-Mendoza, Amy Bernardo, and Marie Sol P. Hidalgo. The process of genetic engineering involved putting the ACC synthase gene in antisense direction (opposite the usual direction) in a piece of DNA vector that contains elements, which regulated the expression of the gene. Dr. Laurena's team prepared this vector containing the ACC synthase gene, also called a gene construct.

At this point, the team of Dr. Pablito Magdalita, Dr. Violeta N. Villegas, and Bessie Yabut-Perez delivers the gene construct to plant tissues such as those of papaya by accelerated particles in an instrument called a particle gun. Because the ACC synthase gene is in antisense direction, production of ethylene is suppressed particularly at the ripening stage, thus, the ripening of the fruit is delayed.

In the P2 containment laboratory at IPB, small plantlets of papaya produced by this process are now in culture. They are eventually hardened and grown in special insect-proof screenhouse at the IPB compound and their fruits are evaluated for the delayed ripening trait. For mango, the ripening-related gene of ACC synthase has been cloned while somatic embryogenic tissues of mango var. *Carabao* have been obtained. The delivery of the gene construct into mango tissues by particle bombardment is scheduled to take place within this year.

This biotechnology project was funded by the Department of Science and Technology (DOST)-Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) and the Australian Centre for International Agricultural Research (ACIAR). This was done in collaboration with the University of Queensland's Plant Genetic Engineering Laboratory under Dr. Jose Ramon Botella. *(Evelyn Mae Tecson-Mendoza, IPB, UPLB)*

(For more information, please contact Dr. Violeta N. Villegas, Director or Dr. Evelyn Mae Tecson-Mendoza, Program Leader, IPB Plant Biotechnology Program, College of Agriculture, UPLB, College, Laguna or call at telephone nos. (049) 536-3304 or 536-2298)

Enzyme Extraction of Essential Oils

Essential oils are chemicals that form the odoriferous essences of a number of plants. They are derived from parts of a plant, which can be the flowers, fruits, leaves, roots, or bark. Essential oils have been used since history. In ancient Assyria, Babylonia, Israel and other civilizations, essential oils were possessions. They were used as perfumes, added to cosmetics or mixed with other ingredients to create conditions for religious offerings, anointing kings or embalming the dead.

Today, essential oils are enjoyed and used more extensively than ever. Modern cosmetic and perfume industries depend on essential oils to create fragrant products. Soap and detergent manufacturers use large amounts of essential oils. Food manufacturers need essential oils to impart flavor and delicate aroma to beverages such as coffee, tea, juice, sodas, wines, liquors, canned sauces and soups, bottled condiments, confectioneries, and other food products. Due to these applications, there is a huge demand for essential oils worldwide.

However, there is not enough supply to meet domestic and industry needs. In our country, most of the essential oils available in the market are imported and they command staggering prices. A 15-ml bottle of essential oil costs an average of P100-165.

The National Institute of Molecular Biology and Biotechnology (BIOTECH) in UP Los Baños, Laguna addressed these problems by developing an extraction method for essential oil that is more efficient than the conventional procedures like steam distillation. Through this method, BIOTECH hopes to develop local production of essential oils and help the country save and earn dollars. The method uses an enzyme called *pectinase* to extract the essential oil from a plant material. This is more efficient since it can derive 1-3% yield, double than extracted using other methods, depending on the plant material. This technology was created through the leadership of Dr. Teresita M. Espino.

Most of the essential oils available in the market are extracted using steam distillation. In steam distillation, fresh or dried botanical material is placed in the plant chamber. Pressurized steam is generated in a separate chamber and circulated through the plant material. The heat of the steam forces the intercellular pockets that hold the essential oils to open and release them. As the essential oils are released, they evaporate and travel into a condensation chamber. As the steam cools, it condenses into water and the essential oils form a film on top of the water. The oil is then decanted or skimmed off the top.

Although steam distillation takes a shorter period of time, most of the active components in the essential oils are destroyed because of the heat. Enzyme extraction uses no heat. Plant materials are just chopped or cut into smaller pieces and the enzyme is added. The resulting distillate, an aqueous solution of the extracted oil, enzyme and plant fibers, undergoes solvent extraction to obtain the essential oil. An organic solvent such as petroleum ether, ethanol, or hexane is added to the solution. The solvent combines with the oil and forms a separate layer on top of the aqueous solution. The essential oil is then isolated from the organic solvent through evaporation. With the use of enzyme extraction, the active components of the essential oils remain intact, thus producing quality and stable extracts. It is also cheaper if used in large-scale production. In addition, the enzyme used is produced locally using indigenous raw materials and is readily available in BIOTECH. *(Marianne Medina, BIOTECH, UPLB)*

(For more information, please contact Marianne Medina at tel nos. (049)536-1620, 536-2721/23/25)

Small Farmers...

recovery; traders' concerns to bring fresh produce in the market; and consumers' concerns for healthier produce. Examples include a high-solid tomato, long shelf-life carnations and Vitamin A rice. Each GE crop variety is unique and possesses properties different from other GE crop varieties. However, due to the novel method of developing a GE crop variety, concerns have been raised on possible risks of these crop varieties to human health and the environment. Hence, each GE crop variety being developed undergoes a series of tests. Only food crop varieties that pass toxicity and allergenecity tests are eventually commercialized. Hence, GE plants with reported adverse allergenic and health effects are not commercially grown; frequently mentioned are a soya plant with the brazil nut gene, the GE potato fed to rats with adverse effects, etc. Possible adverse environmental effects of GE crops loss of populations of non-target organisms, production of superweeds, creation of novel pathogens, and others are mitigated by risk management schemes.

Some interest groups have made it their agenda to spread unwarranted scenario about the adverse effects of GE crops to human health and the environment. Several agencies have therefore commissioned scientific review bodies to study these issues. The review bodies commissioned by the European Union, the US National Academy of Sciences and the Vatican Pontifical Academy similarly concluded that current commercial GE crops do not pose risks more than conventionally bred crops and that foods derived from GE crops do not pose a serious threat to public health. The U.N. Food and Agriculture Organization (FAO) said biotechnology offered the potential to boost crop yields in the developing world, as long as precautions were taken to protect people's health and the environment. GE technology is thus considered a major tool to achieve the goals of AFMA of increasing farmers' incomes and profitability, and of sustainable agriculture.

Noting that the environmental and health safety of GE crops is due to a rigid regulatory framework adopted by countries growing these crops, DA has formulated guidelines governing the importation, production and sale of transgenic crops in the Philippines. These guidelines have been subjected to a series of public consultations in Mindanao, Visayas and Luzon; and are currently being revised to incorporate suggestions gathered. In addition, the Department has in place a biotechnology program that aims to strengthen the capability of its various agencies for risk analysis and regulation of biotech products, to develop GE crops for resource-poor farmers, to improve research facilities and manpower, and to formulate and advocate the policies for the safe and appropriate use of biotechnology. The Department finds it unfortunate that due to misinformation on GE crops being actively disseminated by foreign-funded groups, a few local government units have adopted policies against biotechnology to the detriment of the farmers in their locales. Some farmer groups, led by a 3,000-member farmer associations federation in General Santos City who have monitored the first Bt corn trial in the country, are lobbying the Department to facilitate the introduction of GE crops for production. *(Saturnina C. Halos, Ph.D. Senior Project Development Adviser, Bureau of Agricultural Research)*

DA-BAR Grants P34.4-M to Biotech RDE Network

Recognizing the potentials of biotechnology in improving the agriculture and fishery sectors of the country, BAR allocated a total of P34.4 million for the Biotechnology RDE Network. The Biotechnology RDE Network is one of the 22 established networks of the National Research & Development System for Agriculture and Fisheries or NaRDSAF. The main program of the network aims to develop and promote the adoption of new production and post-harvest technologies to increase productivity and profitability of selected farm and fishery commodities. Likewise, the program is targeted to minimize the environmental impact of farming and fishery practices, to manage biodiversity, and to help develop science based policies.

Under the year 2000 funding, a total of P20 million was allotted to five priority projects, which included researches in agricultural, industrial, and marine biotechnology. These projects were

- Detection of genetically-modified organisms in plants and plant products (National Institute of Molecular Biology and Biotechnology (NIMBB-UP Diliman)
- Development of banana *Musa sp.* transformation system for the production of transgenic banana with viral genes conferring resistance (NIMBB-UP Diliman)
- *Tobamovirus* and *Potyvirus* diseases of tomato and squash: management through the use of plants expressing virus genes (Department of Plant Pathology (DPP)-UPLB)
- Diagnosis of *Heamophilus p.* using PCR-based detection system (College of Veterinary Medicine (CVM-UPLB)
- Development of molecular diagnostic kits, vaccines, and probiotic mix in improving shrimp hatchery productivity (NIMBB-UP Visayas)

Aside from these five priority Biotechnology R&D projects, BAR supported the implementation of nine on-going high impact projects (HIPs) worth P14.4 million. Three of these projects are being handled by the National Institute of Molecular Biology and Biotechnology (BIOTECH) in UPLB; while two projects on policy analysis and vaccine production are being undertaken by the UPLB College of Public Affairs and DPP. In marine biotechnology, two projects are being implemented by NIMBB-UP Visayas, one on human health biotechnology by NIMBB-UP Manila, and one on aquaculture biotechnology by NIMBB-UP Diliman.

HIPs are projects of national significance expected to produce results for utilization of farmers within three years. These projects address the immediate needs of the industry, requiring an interdisciplinary approach to meet established goals within a specified timeframe. *(Rita T. dela Cruz)*

NIRDEAPs...

developed as a response to the issues and concerns raised in various consultations with the fishery industry members. The issues reflect the concerns of the whole fishery post-harvest sector from handling, processing, storage, marketing, and distribution. It is applied to priority commodities such as finfishes, crustaceans, mollusks, and seaweeds.

Biotechnology

The NIRDEAP is organized in accordance with four major objectives: improving productivity and profitability, protecting the environment, search for useful genes and providing scientific bases for regulation and policy decisions. The extension component includes promoting popular awareness and developing capability to provide services in relation to biotechnology.

Agricultural Engineering

The Agricultural Engineering NIRDEAP will anchor on the implementation of the National Agricultural Mechanization Plan to develop and promote appropriate agricultural engineering technologies. With the Mechanization Plan, the network is now targeting to increase the current farm power level to 1.0 hp/ha in the short term, and 4.0 in the long term. *(Thea Kristina M. Pabuayon)*

(Some portions were lifted from the NIRDEAPs submitted to BAR.)

Transgenic IR72: Hope for the Rice Farmers

Among the issues and constraints facing the rice industry in our country, the high infestation of pests and diseases is considered as the major threat in rice production. Various studies have shown that poor pest management, coupled with indiscriminate use of inorganic pesticides and herbicides, brought about a drastic decrease in the annual yield of rice. One of the identified rice pests that causes headaches to our local farmers, particularly in the provinces of region I, II, and III is the Bacterial Leaf Blight (*Xantomonas oryzae pv.*). BLB is a water-borne disease that infects rice plants when droplets carrying the pathogenic bacteria land on leaf wounds caused by factors such as heavy rains and typhoon winds. The bacteria often attack the leaf margins and leaf tips, leaving translucent lesions. These lesions may elongate and extend into the middle of the leaf. Infected plant leaves will turn yellow to brown and eventually die.

Rice leaf sheat infected by leaf blight

Scientists found out that rice plant is more susceptible to the said disease especially under high temperature and humidity and when nitrogen fertilizer is applied.

Plant biotechnology advancements offered a solution to this worsening issue through genetic improvements in crops that could not be addressed with conventional plant breeding.

To make sure that this technological breakthrough would be available to poor farmers, the Philippine Rice Research Institute (PhilRice) in Muñoz, Nueva Ecija introduced the Bacterial Leaf Blight Rice (BLB) or technically known as transgenic IR72. The transgenic IR72 is a genetically-modified organism (GMO) that contains a Xa21 gene. This cloned gene is a short segment of DNA present within the rice genome which contains protein that has the ability to combat bacterial leaf blight. The gene was extracted from a wild variety of palay, which usually thrives in grassy and unproductive areas. According to experts and scientists in this field, aside from its high resistance to BLB, IR72 seedlings may have higher yield than the usual varieties and it requires less amount of agricultural inputs such as inorganic fertilizers and pesticides.

The Xa21 gene has long been used in seedling preparation to produce viable and vigorous planting materials.

PhiRice experts are planning to conduct a field test using the seedling of IR72 to determine its level of tolerance and resistance to BLB. They also assured farmers that this transgenic rice is safe to humans, animals, and environment. *(Mary Charlotte O. Fresco)*

(For more information, please contact PhilRice, Maligaya, Munoz, Nueva Ecija, tel. no. (044)456-0354)

13 Sacks of Palay for P60

For Mang Urso Agbada, his P60 went a long way. It earned him 13 additional sacks of palay. Mang Urso is one of the many farmers who benefited from using BIO-N on his rice crop. "BIO-N did not only increase my harvest," attests Mang Urso who is a rice and vegetable farmer in Paete, Laguna, "but it also helped me save costs on chemical fertilizers."

Mang Urso first heard about BIO-N in an outreach seminar conducted by BIOTECH in Paete. Researchers from the Institute introduced an array of bio-products that can help farmers increase their harvests. "BIO-N caught my interest because the product is applicable to rice," narrates Mang Urso. "But I did not expect much. I only bought two packets thinking that it was like the chemical fertilizers usually promoted by sales agents of private companies – too much promise but less, sometimes disappointing results," Mang Urso stated.

But after applying BIO-N to his rice seedlings, Mang Urso was immediately impressed.

BIO-N is an organic fertilizer for rice and corn developed in BIOTECH, UPLB. It is a microbial inoculant made with a bacterium called *Azospirillum*. It helps the plant fix nitrogen from the atmosphere and was made through the leadership of Dr. Mercedes Garcia.

Nitrogen is one of the main nutrients required by plants. Although the atmosphere is composed of 78% nitrogen, plants cannot readily utilize the gas as nutrient. It has to be converted into a form that can be used by the plants. Traditionally, farmers apply chemical nitrogen like urea to their crops. But sometimes, chemical fertilizers do more harm than good. Synthetic fertilizers can make the soil acidic, degrading its fertility. In the long run, it can pollute the soil, air and water table. Aside from these, most of the chemical fertilizers available in the country, particularly urea, are imported. With the current peso-dollar exchange rates, the prices of these fertilizers are exorbitant for farmers.

What's the advantage then of using BIO-N? BIO-N provides the nitrogen needed by plants without harming the environment. The *Azospirillum* in BIO-N converts the nitrogen from the atmosphere into a form that can be readily used by the plant. Rice and corn plants become robust with BIO-N. Furthermore, since microorganisms, like bacteria, are natural components of the environment, BIO-N does not damage the soil. Most of all, it helps increase the harvest.

And the cost? It is cheaper than chemical fertilizers because it is made from local materials. The bacterium in BIO-N can be found in the common *talahib*. Farmers can save a considerable amount by substituting or supplementing BIO-N with chemical nitrogen. A bag of urea now costs P400. A pack of BIO-N only costs P30 and is enough to apply to 20kg. of rice or 3kg. corn seeds. In one hectare, a farmer will need only five packs of BIO-N. "With BIO-N, I noticed that my rice plants were healthier, greener, and the grains heavier," Mang Urso avers. "To prove the effects of BIO-N. I planted two croppings of rice – on one I applied the two packs of BIO-N," he stated. "When harvest time came, I realized that I should have applied BIO-N to both of the croppings," Mang Urso declared. "I got 13 more cavans of palay from the cropping applied with BIO-N; and for a farmer like me, these additional 13 cavans are a lot of help," Mang Urso stated. BIO-N has been tested in different parts of the country: Isabela, Ilocos Provinces, Laguna, Mindoro, Quezon, Bicol, and Cebu. In addition to increased harvests, farmers from these areas concur that BIO-N does not make their lands itch as chemical fertilizers do. It is also easy to use. *(Marianne Medina, BIOTECH, UPLB)*

(For more information, please contact Marianne Medina at tel. nos. (049)536-1620, 536-2721/23/25).

Small Farmers' Gain from GE Crops Higher than those of Commercial Farmers

Small-scale cotton farmers in South Africa planting Bt cotton obtained higher increases in yields than their commercial counterparts. Bt cotton, a cotton variety developed through genetic engineering(GE) and protected from insect attacks, reported increased yields ranging from 18-28.8% in the 1997-98 Bt cotton trials with small farmers reporting the higher increases of 28.8% compared with commercial growers of 18% and 23%. This should come as a surprise to many detractors of the GE technology who have been predicting all along that small farmers will not benefit from the technology. This report reinforces findings that farmers are the biggest beneficiaries of the GE technology.

A series of economic analysis made by American scientists on the question of who gains the most from the GE technology showed that the biggest gainers are the farmers. The analyses also showed that economic benefits of the GE technology accrue to all stakeholders: the farmers, the patent holders (some aspects of the GE technology are covered by patents), the seed producers, the consumers, and the rest of the world (where the crops are exported). Among the many reasons why farmers plant GE crops include higher profits, decreased pesticide use, cleaner grains, increased yields, and a simpler and more flexible weed control program. The major GE crops being planted in commercial quantities nowadays are either bred to contain the Bt gene or a herbicide-tolerant gene. The Bt gene confers protection from a specific insect pest. The planting of a Bt crop is associated with decreased pesticide use and cleaner grains. In China, as much as an 80% decrease in pesticide use has been reported with Bt crops. In the USA, farmers planting Bt cotton used 450,000 kgs. less pesticide in 1998. Another major crop with the Bt gene is corn. Planting Bt corn is beneficial only in cases when the population of its insect pest, the corn borer, is very high. But consumers also benefit from Bt corn since this contains less cancer causing-substances compared with non-Bt corn. Corn farmers in General Santos City, Philippines noted that non-target insects survive on Bt corn unlike the total devastation to all insect populations brought about by chemical pesticide sprays.

The major crop with a herbicide-tolerant gene is the soybean and its adoption is also associated with less herbicide use. However, the major reason farmers are adopting herbicide-tolerant crops is because these require only a simple and flexible weed control program. Environmentalists find herbicide-tolerant crops compatible with sustainable agriculture since these crops allow zero tillage, thus preventing loss of top soil - a common erosion problem with conventional agriculture.

There are other GE crops in the market and many varieties are currently being developed. While earlier varieties are bred to address farmers' concerns like insect pests, later varieties address processors' concerns to increase processing

See Small Farmers, page 2

Bagoong Alamang Beneficial to Human Health?

Fish or shrimp paste condiment, locally known as *bagoong*, is almost inseparable from *manggang hilaw* and other traditional Filipino delicacies. It persists and remains to be part of our regular diet and is used as a flavor extender in the preparation of some types of indigenous foods. However, several misconceptions on health hazards arise from the fact that bagoong is prepared from the wet-treatment of fish or shrimp fry with adequate amount of salt over a long period of time.

Unknown to many, *bagoong alamang* (*Acetes sp.*) contains a relatively high level of an essential fatty acid technically known as docosahexaenoic acid (DHA), a polyunsaturated fatty acid that has beneficial effects on animal and human health.

This is among the salient findings of a collaborative study conducted by Dr. Nemesio Montaño of the Marine Science Institute (MSI) in UP Diliman and Dr. Victor Gavino of the Department of Nutrition, University of Montreal in Canada entitled *Polyunsaturated Fatty Acids of some Traditional Fish and Shrimp Paste Condiments of the Philippines.*

The researchers assessed the content of polyunsaturated fatty acids in six types of shrimp and fish paste condiments namely: *dalagang bukid, dilis, padas*-1, *padas*-2, *terong,* and *alamang* in the Philippines. The samples' water, salt (NaCl), ash and fat content were analyzed through some chemical processes in order to determine which of these samples contain the highest proportion of polyunsaturated acid.

Significant results of the study revealed that among the six fish and shrimp paste condiments analyzed, *bagoong alamang* represents the highest source of DHA. The DHA is a fatty acid essential for neural development in infant during its first few years. The acid components also perform a vital function in brain and retinal development. Surprisingly, it also plays an important role in preventing stroke, heart disease, arthritis, and non-dependency on insulin for diabetic persons. This fact may be attributed to the presence of essential water-binding solutes such as proteins, peptides and carbohydrates. The presence of these water-binding solutes lowers the water activity, thus limiting the growth of microbes. This is the principle why fish and shrimp condiments have long shelf-life even when refrigeration is not uniformly available and where ambient temperature is tropical. In general, all the fish and shrimp condiments analyzed contained polyunsaturated acids at measurable amounts or proportions. *(Mary Charlotte O. Fresco)*

(For more information, please contact Dr. Nemesio Montaño, MSI, UP Diliman, tel no. (02) – 927-2693)

Filipino Scientists Clone Mango and Papaya Genes

Filipino scientists have recently cloned and characterized the ripening-related genes of papaya var. *Kapoho Davao Solo* and hybrid *Sinta*, and mango var. *Carabao*. This was the first instance that plant genes have been cloned by Filipino researchers and was registered at an international databank. The DNA sequences of the aforementioned genes have been registered at the Genbank, a member of the International Nucleotide Sequence Database Collaboration. Other members included the DNA Databank of Japan and the European Molecular Biology Laboratory. The two genes for the ACC synthase of papaya var. *Kapoho Davao Solo* were cloned at the University of Queensland during an on-the-job training of Filipino researchers headed by Drs. Antonio Laurena and Pablito Magdalita of IPB in UPLB as part of a collaborative research project with Dr. Jose Botella. Meanwhile, the ACC synthase genes for papaya hybrid *Sinta* and mango var. *Carabao* were cloned and characterized here in the country through IPB. The cloning was participated in by a pool of researchers from the Institute headed by Ms. Marie Sol Hidalgo and Ms. Amy Bernardo. The ACC synthase is a key enzyme in the production of ethylene needed for the various stages of plant development including fruit ripening. The cloning technology allows isolation and identification of genes of important traits thereby using these for producing high value crops like what these Filipino researchers have recently embarked on.

The cloning and characterization of the ripening-related ACC synthase genes of papaya and mango were part of the project entitled, *Control of Ripening in Papaya and Mango by Genetic Engineering* which was funded by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development-Department of Science and Technology (PCARRD-DOST) and the Australian Centre for International Agricultural Research (ACIAR). *(Evelyn Mae Tecson-Mendoza, IPB, UPLB)*

(For more information, please contact Dr. Violeta N. Villegas, Director, or Dr. Evelyn Mae Tecson-Mendoza, Program Leader, IPB Plant Biotechnology Program, College of Agriculture, UPLB, College, Laguna at telephone nos. (049) 536-3304 or 536-2298)

The Biotechnology Network

The network consists of various state colleges and universities currently undertaking or has potential to undertake biotechnology RD&E activities. The lead institution is the National Institute of Molecular Biology and Biotechnology, University of the Philippines Los Baños.

Composition of Network
- UP Los Baños (UPLB)
- UP Diliman (UPD)
- UP Visayas (UPV)
- UP Manila (UPM)
- Benguet State University (BSU)
- Visayas State College of Agriculture (VISCA)

Network Coordinator:
Dr. Saturnina Halos
Team Leader:
Dr. Reynaldo dela Cruz (UPLB)

Core Technical Team:
- Dr. Cynthia Hedreyda (UPD)
- Dr. Narceo Bajet (UPLB)
- Dr. Helen Molina (UPLB)
- Dr. Augusto Serrano (UPV)

Farmer-Industry Advisory Committee
1. Menandro Maleon (livestock)
2. Jelson Que (biologicals)
3. Efren Bautista (organic fertilizer)
4. Charito Sebastian (livestock/crops)
5. Dawn Jumandre (tilapia/bangus)
6. Eliseo Pera (rice/HVCC)
7. Zacarias Sarian (agriculture)

Philippine Ag-Biotech: How Far Have We Come

The Philippines started its biotechnology program 20 years ago. The agricultural biotechnology researchers concentrated mainly on the production of biocontrol agents, soil amendments, food and beverages, and development of tissue culture methods. During this time, biotechnology was able to produce ag-biotech products that could replace environmentally-hazardous agrochemicals such as biofertilizers, biopesticides and biocontrol agents. Moreover, plant and animal diseases can be detected earlier and more accurately with biotech-derived diagnostic kits. Animal diseases are being prevented using biotech-derived vaccines and antibiotics. Plants such as orchids, banana, makapuno, and potato can now be readily and widely propagated using tissue culture techniques. Through embryo transfer and estrus synchronization, technology improvement of stocks of cows and carabaos are now possible. The type of research undertaken was mostly conventional biotechnology, which does not include molecular biology approaches.

It was only in 1998 that high-level biotechnology researches were pursued through increased support from the government. Five cloning and genetic engineering projects were conducted, among which were the transgenic banana and papaya resistant to banana bunchy top virus (BBTV) and papaya ringspot virus (PRSV); delayed ripening of papaya and mango; development of Asiatic corn borer-resistant corn (Bt Corn); development of a marker-assisted breeding in coconut; and modification of fatty acid composition of coconut oil using molecular techniques.

The National Institute of Molecular Biology and Biotechnology (BIOTECH) in UP Los Baños continued to provide leadership in agricultural, forestry, industrial, and environmental technology as well as other research institutes such as the Institute of Plant Breeding (IPB), Institute of Biological Sciences (IBS), Institute of Animal Science (IAS), Institute of Food Science and Technology (IFST), and the College of Forestry and Natural Resources (CFNR). On the other hand, three other biotechnology institutes, established by the UP System were created to focus on industrial biotechnology: BIOTECH in UP Diliman, human health biotechnology for UP Manila and marine biotechnology for UP Visayas.

Outside the UP system were research institutes and centers such as the Philippine Rice Research Institute (PhilRice), Philippine Coconut Authority, Cotton Development Authority, Bureau of Plant Industry, Bureau of Animal Industry, and the Industrial Technology and Development Institute which were also involved in biotechnology R&D.

PhilRice is currently developing rice varieties through genetic engineering, which are resistant to important diseases such as sheath blight and tungro. BIOTECH, in collaboration with PhilRice, is engineering stem borer, brown planthopper, and green leafhopper resistance in rice. On the other hand, IPB is engaged in developing papaya varieties through genetic engineering with delayed ripening trait and resistance against the papaya ringspot virus.

New agri-biotech products are being developed for those crops that would continue to flourish in saline soils, could survive with less water and nutrients, could extract pollutants, and produce industrial polymers. Also, there are new grains that could reduce the incidence of harmful *E. coli* in beef cattle and the incidence of *Salmonella* toxins in poultry to produce healthier animals. *(Rita T. dela Cruz)*

(For more information, please contact BIOTECH at UPLB, College Laguna, telephone nos. (049) 536-1620 or 536-2721 or 2725)

National Integrated RDE Agenda and Program for Biotechnology

Modernizing the agricultural sector will help achieve developmental goals such as food security, people empowerment, and sustainable agriculture. This modernization entails transforming agriculture from a resource-based to a technology-based industry, an aim parallel to the provisions of the Agriculture and Fisheries Modernization Act (AFMA) of 1997.

The National RDE Program on Biotechnology, a program aimed at promoting R&D activities in biotechnology, was formulated to achieve this goal.

The program's objectives include:
- Promote the adoption and novel production of postharvest technologies
- Minimize the harmful environmental impacts of farming and fishery practices
- Manage biodiversity
- Develop science-based agricultural policies

The RDE Agenda
- Increase level of production and profits of farmers and fisherfolk
- Protect the environment
- Save and maintain biodiversity of plants, animals, fishes, and other organisms
- Undertake supportive policy studies and adopt pro-active advocacy strategies
- Promote effective information, communication, and education system

The RDE Programs

A. Sub-Program on Crops Biotechnology
- Development and evaluation of molecular tools for rapid and accurate diagnosis and prevention of diseases
- Identification and isolation of resistance genes for major pests and diseases and other useful genes
- Development of molecular tools for genetic manipulation

B. Sub-Program on Livestock Biotechnology
- Develop molecular tools for rapid diagnosis of diseases and prevention of epidemics in livestock
- Identification and isolation of resistance genes for major pest and disease and other useful genes
- Develop molecular tools for genetic manipulation

C. Sub-Program on Fishery Biotechnology
- Develop molecular tools for rapid and accurate diagnosis and prevention of epidemics in fisheries
- Biological control of major fishery diseases

D. Sub-Program on Environmental Biotechnology

Develop culture systems for the production of farmer-friendly biocontrol/soil condition agents and bioremediation agents to make such production system profitable, sustainable, and attractive to local investors

E. Sub-Program on Genomics

Develop and apply molecular marker system for identification of different plant cultivars, animal, and fishery varieties that can hasten the selection process in breeding to provide accurate information on the genetic diversity of breeding population

F. Sub-Program on Socio-economics, Policy, and Technology Transfer
- Risk assessment of biotechnology products
- Ex-ante analysis of biotechnology products and processes
- Science-based biotechnology policies
- Technology transfer to farmers, fisherfolks, and industry

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