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Philippines:

Drama and Communication Behind Asia's First Commercialized Bt Corn

Jenny A. Panopio and Mariechel J. Navarro

The Philippines has the distinction of being the first and only Asian country to grow a major biotech crop for food, feed, and processing - that of Bt corn MON 810 approved for commercialization in 2002. A core of dedicated scientists, political support, a working regulatory system, and collaborative efforts of both public and private sectors in the development and commercialization of the technology now enable farmers to benefit from it.

Biotechnology research and development (R&D) officially started in 1979 with the establishment of the National Institutes for Microbiology and Biotechnology (BIOTECH), renamed the National Institutes for Molecular Biology and Biotechnology at the University of the Philippines Los Baños

COUNTRY PROFILE

PHILIPPINES

The Republic of the Philippines is a country of 7,107 islands in Southeast Asia. It is bounded on the north by the Luzon Strait, on the west by the South China Sea, and on the south by the Celebes Sea. It has an estimated population of 92 million and is the 12th most populous country in the world.

The agricultural sector has an important role in this developing country. The agriculture sector accounts for 18% of the total Gross Domestic Product (GDP) as of 2009. In the same year, about 12.04 million people or 34% of the total employment were in the agriculture sector (BAS, 2009b).

Thirty-two percent of the total land area constitute agricultural land. Of this, 51% and 44% are arable and permanent crop lands, respectively. Major crops include rice, corn, sugarcane, coconut, banana, abaca, and tobacco. Rice and corn are major food staples while coconut, mango, pineapple, and banana are contributors to the nation's income (BAS, 2009a).

(UPLB) in 1990. In 1997, the UP System set up three other biotechnology research institutes in its campuses in Manila, Diliman, and Iloilo. Hence, R&D in biotechnology for agriculture, medicine, industry, and fisheries were strengthened (Padolina, 2000; and Halos, 2000). On hindsight, the first director of UPLB BIOTECH, Dr. Emil Javier, noted that at that time it was still not yet possible to manipulate genes with precision, he had a vision that "the new biology had many more applications beyond plant breeding" (Navarro, 2009). It was this visionary streak that made possible the institutionalized support for the development of biotechnology in the country.

In the mid-nineties, some 20 major institutions in the government and private sector and several institutes within these centers were already engaged in research. Government institutions included the Department of Science and Technology (DOST) and its attached agencies such as the Industrial Technology Development Institute (ITDI), and Philippine Nuclear Research Institute (PNRI); the Department of Health (DOH); Department of Agriculture (DA) and its research arm such as the Philippine Rice Research Institute (PhilRice), Philippine Coconut Authority (PCA), and Sugar Regulatory Administration (SRA); and the Department of Environment and Natural Resources (DENR). Other institutions were the Central Luzon State University, Benguet State University, and the Visayas State University (dela Cruz and Navarro, 1994). Initial activities

especially by UPLB BIOTECH were in the fields of applied microbiology. Not much activity was being done in molecular biology and genetic engineering until the early 1990s despite an early realization of the importance of biotechnology in national agricultural development (Padolina, 2000).

Scenario for Modern Biotechnology

The Philippines recognized the potentials of modern crop biotechnology, particularly genetic modification (GM) technology, in addressing food security concerns, increased income, environmental integrity, and agricultural modernization through the packaging of the National Biotechnology R&D Program for Agriculture, Forestry and Natural Resources spearheaded by the DOST's Philippine Council for Agriculture Forestry and Natural Resources (PCARRD). This program was approved in 1997 by the Legislative-Executive Development Advisory Council (LEDAC) and was billed as "Biotechnology: Pole-vaulting Philippine Agriculture in the 21st Century." The projects implemented under this program focused on top priority crops namely coconut, papaya, mango, banana, and corn. Jointly funded by the DOST, DA, and PCARRD, the program was implemented in 1999 by the UPLB Institute of Plant Breeding (IPB) and the PCA-Albay Research Center. Aside from the R&D support, DOST and PCARRD also invested on non-degree training for researchers involved in the projects.

At the same time, PhilRice also identified biotechnology in addressing the country's rice sufficiency and global competitiveness through the development of genetically engineered rice with resistance to certain pests and diseases and tolerance to certain abiotic stresses. The International Rice Research Institute (IRRI) collaborates with PhilRice on several of these rice biotechnology initiatives.

In 2004, plant biotechnology took the limelight with a research agenda dominated by tissue culture and micropropagation, biocontrol, diagnostics, molecular marker technologies, and genetic engineering. Research efforts were focused on developing transgenic banana with resistance to bunchy top virus and papaya resistant to ringspot virus; delayed ripening of papaya and mango; rice resistant to bacterial blight and tungro virus and rice with

improved nutritional characteristics; corn with resistance to Asiatic corn borer; and coconut with high lauric acid content (Hautea and Escaler, 2004).

Public sector research initiatives through modern crop biotechnology applications continue to expand to other crops and important traits. These include virus disease-resistant sweet potato, bunchy top virus-resistant abaca, and multiple virus-resistant tomato. Favorable progress has been made on pro-vitamin A rice and Bt eggplant which have both passed confined field trial evaluation in 2009. Soon, these two public sector products will see commercial approval after successful multi-location field trials and safety assessment.

Table 1 summarizes the current modern crop R&D initiatives in the country indicating the implementing research institutions and R&D status.

Table 1. Modern crop R&D initiatives being implemented by research institutions, Philippines

Crop	Trait	Implementing Agency	Status
Rice	Pro-vitamin A	IRRI, PhilRice	Confined field trial
	High-Zinc	IRRI	Laboratory
	Drought resistant	IRRI	Greenhouse
	High-Iron	IRRI	Laboratory
	3-1 rice (provitamin A, tungro and bacterial blight resistance)	PhilRice	Greenhouse
Sweet Potato	Virus-resistant	UPLB-IPB, VSU	Laboratory
Papaya	Delayed-ripening	UPLB-IPB	Field trial
	Virus-resistant	UPLB-IPB	Confined field trial
	Delayed-ripening and virus-resistant	UPLB-IPB	Greenhouse
Abaca	Virus-resistant	UPLB-IPB	Laboratory
Eggplant	Insect-resistant	UPLB-IPB	Multi-location trial
Tomato	Virus-resistant	UPLB-IPB	Laboratory

Government Support

A crucial factor in the development of biotechnology in the country is strong political will and commitment by the government. In 1990, a Master Science Plan was drawn up by DOST. It identified biotechnology as a high priority sector and one of the 15 leading edges to catapult the country into a newly industrializing country by 2000. That same year, the National Committee on Biosafety of the Philippines (NCBP) was created by Executive Order 430, issued by then President Corazon Aquino, to review and monitor R&D involving genetically modified organisms (GMOs). Specifically, the NCBP was established to implement the national biosafety system, particularly overseeing compliance with biosafety policies and guidelines by all institutions. It was organized as an inter-department committee of the DA, DENR, DOH, and DOST.

Political support for biotechnology was sustained through various presidencies. In 1997, President Fidel Ramos approved the Five-Year Crop Biotechnology Program involving coconut, corn, mango, banana, and papaya. This was followed by the enactment of the Agriculture and Fisheries Modernization Act (AFMA) which stipulates that biotechnology should be part of the agricultural R&D budget. The law which includes a biotechnology provision, specifically provides that of the P20 billion first year budget appropriated for AFMA, 10% shall be allocated and disbursed for R&D, of which 4% shall be used to support the Biotechnology Program. Under President Joseph Estrada's term, the institutionalization of biotechnology in government programs was materialized.

In 2001, President Gloria Macapagal-Arroyo articulated in a policy statement that "We shall promote the safe and responsible use of modern biotechnology and its products as one of several means to achieve and sustain food security, equitable access to health services, sustainable and safe environment, and industry development." In 2000, the DA launched the Philippine Agricultural and Fisheries Biotechnology Program under the Public Law 480 for Peace Program Loan Fund. It aimed at putting into place a policy and regulatory framework for the safe use and commercial application of biotech products in the country. This program established the DA Program Implementation Unit (DAPIU) which oversees the implementation

of activities related to policy and advocacy, institutional development and capacity enhancement, research and development, risk analysis, assessment management, communication and biotechnology commercialization (BAR Digest, 2000). In 2002, the DA Secretary issued Administrative Order No. 8 (A.O. 8) which serves as the guideline for the importation and release into the environment of plants and plant products derived from modern biotechnology (Ramirez, 2009; Peczon, 2009; and Halos, 2000).

Current major government funding agencies are the DOST and DA. Under DOST are PCARRD, Philippine Council for Advanced Sciences Research and Development (PCASTRD), and Philippine Council for Industry and Energy Research and Development (PCIERD). The Bureau of Agricultural Research (BAR) of DA organized the Biotechnology RDE Network in 1999 composed of several research institutions to implement a national agricultural biotechnology agenda and program. The network conducts research on basic sciences and problems that cut across various commodities.

Private Sector and International Support

Several non-governmental organizations (NGOs), private agencies, and international academic institutions also recognized the importance of biotechnology intervention in the Philippines. Thus, they provided financial, technology transfer, and know-how to Philippine public sector agencies.

IRRI, one of the centers of the Consultative Group of International Agriculture Research (CGIAR), works closely with PhilRice in the development of rice varieties with improved traits. Biotechnology research collaboration started with marker-assisted breeding for blast and bacterial blight resistance and currently in submergence tolerance. Collaborative transgenic research includes pro-vitamin A Golden Rice, high-zinc and iron rice, drought-resistant rice and tungro virus-resistant and bacterial blight-resistant rice. IRRI and PhilRice, though its public and private donors, are able to partner in these activities.

Initiatives in the Philippines on development of virus-resistant papaya and delayed-ripening papaya are part of the public-private partnership through the technology brokering done by the International Service for

the Acquisition of Agri-biotech Applications (ISAAA). ISAAA established the Papaya Biotechnology Network in Southeast Asia and facilitated the proprietary transfer of the technology of Monsanto for the virus resistance, and Syngenta for the delayed-ripening technology to five countries namely: Philippines, Indonesia, Malaysia, Vietnam, and Thailand. Aside from technology transfer, the network members were also trained on product R&D, biosafety and risk assessment, intellectual property, and biotech communication. Local partners in the Philippines for this network are UPLB and PCARRD.

ISAAA, together with PCARRD, also provides technical and training support for the virus resistance development in sweet potato. This ongoing transgenic research is being implemented by UPLB IPB and VSU.

Since 2005, the U.S. Agency for International Development (USAID)-funded consortium of public and private institutions, the Agricultural Biotechnology Support Project II (ABSP II), has also been providing support through R&D funding, capacity building on regulatory and risk assessment, socio-economic impact studies, and support for biotech outreach and communication. Initially, the ABSPII provided support to the virus-resistant papaya, Bt eggplant, and multiple-virus resistant tomato product development. On top of this, the USAID country mission also provided considerable funding to these modern crop biotechnology R&D efforts.

ABSPII collaborated and brokered the Fruit and Shoot Borer-resistant Bt eggplant technology from Maharashtra Hybrid Seed Company (Mahyco), an Indian private firm, and licensed it out royalty-free to UPLB for public R&D. Aside from the technology licensing, Mahyco also provided specialized training and technical assistance in the Bt eggplant product development.

GM/Biotech Crops Status of Adoption

Biotech/GM crops are considered to be one of the fastest crop technology adopted in the Philippines. Upon the initial approval for the commercial propagation of Bt corn MON 810 in 2002, a total of 10,000 hectares were planted with the Asian corn borer-resistant corn in 2003. Adoption of biotech corn tremendously increased through time as new traits were approved and

introduced in the market. In particular, the herbicide tolerant-corn (Roundup Ready) and stacked trait corn (Bt and RR) were both propagated in 2005. About 330,000 hectares of biotech corn (combined traits) were planted by about 125,000 small-scale corn farmers in 2009. Of the total yellow corn area of 1.28 million hectares planted in 2009, 25% comprised GM/biotech corn.

As shown in Figure 1, biotech/GM corn adoption also widely spread throughout the country. Initial adoption was made in Luzon, the northern part of the Philippines, and quickly spread out in Mindanao, the southern part of the country. However, some reluctance on biotech corn adoption is being experienced in the Visayas region due to issues related to organic farming. The Visayas region is being groomed as the "organic bowl" of the Philippines.

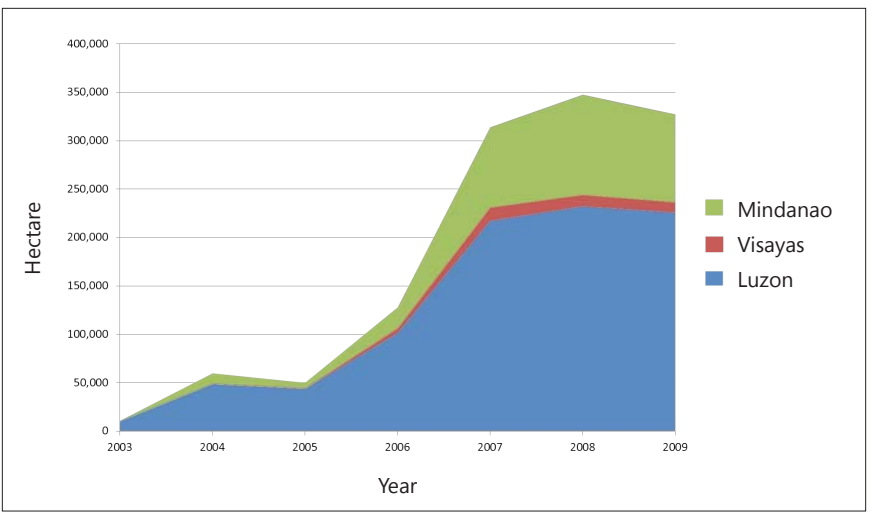

Figure 1. Philippine adoption of biotech corn by major island (Source: SEARCA BIC, data from DA-BPI)

To date, the Philippines has 61 approved events for the direct use and importation of biotech crops for food, feed, and processing for crops such as corn, alfalfa, soybean, potato, and squash. Seven approvals have been made for commercial propagation, four of which were single trait while three approvals were on stacked traits. From 2005 to 2009, 33 GM corn hybrids were

approved by the National Seed Industry Council for import. Similarly, two stacked trait events are currently being evaluated in the field testing stages.

The Bureau of Plant Industry (BPI), DA under Administrative Order 8 (A.O. 8) has also approved 11 proposals for field trials since its implementation in 2002. Papaya with delayed ripening trait and eggplant with resistance to fruit and shoot borer (FSBR)/Bt are public sector products which have reached this advanced level of safety assessment.

Biotechnology Awareness

Amidst developments in the biotechnology arena, it is inevitable that attention is focused on stakeholders or the so-called attentive publics who are directly or indirectly affected by the technology. Individually and as an entity, they determine the direction and depth of the biotech debate and ultimately the technology's acceptance, adoption, and sustainability.

In 2003, Juanillo interviewed various stakeholder groups to determine their understanding, perception, and attitude towards biotechnology in the Philippines. These groups included consumers, businessmen, policy makers, farmer leaders, extension workers, journalists, scientists, and religious leaders. Findings of the study reveal that stakeholders had above moderate interest in biotechnology. At least 70% of policy makers, businessmen, and extension workers believed that biotechnology is good for Philippine agriculture. Majority of respondents viewed agricultural biotechnology as having moderate to high benefits, and do not pose high risk to public health and food safety. Stakeholders gave themselves moderate ratings on their understanding of science and knowledge about agricultural biotechnology. Research institutes were viewed as being concerned about health and safety issues on agricultural biotechnology, and most stakeholders perceived rather highly university scientists at par with consumer advocacy groups and NGOs as being concerned about the same issues. Journalists, businessmen, policy makers, and scientists tend to gather information on biotechnology from both mass media and interpersonal sources much more frequently than other stakeholders do. Moral and ethical issues of biotechnology were perceived to have as much influence on judgments on biotechnology followed by cultural considerations.

The Juanillo study was conducted prior to the commercialization of Bt corn. By 2005, the Philippines had already planted the biotech crop for almost three years over several seasons. Hence, Torres et al. (2006) conducted a study with the following specific objectives: 1) describe the socio-cultural characteristics of the various stakeholders in agricultural biotechnology; 2) identify their information sources; 3) find out their understanding and perception of and attitude towards agricultural biotechnology; and 4) determine the relationship between socio-cultural factors and stakeholders' understanding and perception of and attitude towards agricultural biotechnology. The findings of the study show that majority of stakeholders had favorable perception and attitude towards agricultural biotechnology. Older stakeholders with higher education tend to perceive agri-biotech favorably. They had low exposure to information sources on agri-biotech. But when they accessed information, they used both mass media and interpersonal communication. University scientists were the most trusted information sources. Regardless of whether these are mass media or interpersonal sources, information sources relate positively with level of understanding and attitude towards agri-biotech.

The Asian Food Information Center (AFIC) did a consumer study in 2008. It sought to provide insights on how consumers perceive the use of biotechnology to produce foods and how likely consumers are to accept the various benefits of biotechnology-derived foods. Results indicate that Philippine consumers were knowledgeable and positive about food biotechnology. Consumers largely believed that biotechnology crops have the potential to deliver high quality, nutritional food. A large majority indicated that they accepted biotechnology as a way to increase the production of food staples and to supply sustainable food. Awareness about plant biotechnology was high and positively correlated with favorability and acceptance of biotechnology to produce food. A vast majority would be ready to purchase food produced through biotechnology for specific benefits. More than 90% of the consumers would likely buy cheaper rice or rice with an increased nutritional value (like a higher vitamin A content) produced through biotechnology. Consumers expressed an equally high (greater than 90%) likelihood of buying biotechnology-derived food such as cooking oil with reduced level of saturated or trans fats or fresher and better tasting tomatoes. Consumers were also very positive towards plant biotechnology if the technology is related to sustainable food production.

Similarly, PhilRice together with Sikap/STRIVE Foundation conducted a survey with 200 respondents on the perception of public agri-biotech generation, protection, and commercialization among researchers of DA (Beronio et al., 2008). The survey was the first to focus on determining the opinion of DA scientists and researchers on agri-biotech and intellectual property rights (IPRs), and the knowledge gaps on IPRs under the Philippine setting, particularly in public agri-biotech R&D institutions. Moreover, the survey also sought to identify the initial impacts of the DA IPR policy on the generalization and commercialization of agri-biotech in the country. Some of the major findings reveal that majority of the respondents had common understanding and definition of biotechnology and associated it with modern biotechnology. More respondents indicated that the generation of biotech products is beneficial by helping to produce improved/better quality products. Their major concern in biotech products development was its environmental impact. Majority of the respondents said that agri-biotech R&D results need to be commercialized.

It can be gleaned from these studies that there is an environment for biotechnology to thrive in the Philippines, as a concept, or in the form of acceptance of its products mainly on the strength of its perceived benefits that outweigh its risks. However, availability of information and awareness of sources is crucial for their decision making.

Case Study: Bt Corn

Next to rice, corn is the second most important crop in the Philippines with yellow corn accounting for 70% of livestock mixed feeds. Domestic demand, however, cannot be met due to the extensive damage by the Asian corn borer. The introduction of Bt corn MON 810 in the Philippines in December 2002 may well be a glimpse into the past and future possibilities of crop biotechnology. The Bt corn has a certain gene from a naturally-occurring soil bacterium *Bacillus thuringiensis* var. *kurstaki*. This gene codes for a delta-endotoxin, which when eaten by a specific target insect such as the Asian corn borer and other lepidopteran pests, disrupts the insect's digestive system by developing lethal holes on the insect's mid-gut.

Figure 2 shows the timeline that it took biotech corn to eventually reach commercialization and other related developments. It spans seven years of rigid scientific study and evaluation, with both the public and private sectors involved in R&D, and in the conduct of a transparent science-based debate.

Since the Monsanto-developed MON 810 was designed to produce a protein toxic to the European corn borer (*Ostrinia nubilalis*), it was necessary to determine if it would also work with the Asiatic corn borer (ACB) (*Ostrinia furnacalis*). Monsanto's subsidiary, Cargill Philippines, collaborated with the Institute of Plant Breeding (IPB) of UPLB and sought the approval of the NCBP to study the efficacy of MON 810 against the ACB under screen house conditions. The study demonstrated the corn line's effectiveness and further study was made to verify its efficacy under field conditions. The chosen experimental farm was a 500-square meter area in General Santos City, South Cotabato. The limited confined field test provided ample data to merit approval by the NCBP to conduct a two-season multi-locational confined field test for MON 810 to establish its efficacy against the ACB and other Lepidopterans under varying climatic conditions. The multi-locational field tests enabled the generation of important local data which Monsanto submitted with its MON 810 dossier to the BPI in October 2002.

After a series of reviews done by several government agencies and a DA-designated scientific and technical panel composed of three scientists and the BPI director, MON 810 became the first biotech crop to be approved for propagation, direct use for food and feed, and for processing in the Philippines. Eventually, four more GM corn events were approved for commercial propagation, insect resistant Bt 11, herbicide tolerant RR corn, herbicide tolerant RR GA 21, and stacked-trait (RR and Bt) corn. These other GM corn entries have been given permits for commercial propagation (Cariño, 2009).

The technology generated much controversy precisely because it was the first time that a GM crop was introduced and being a product of a multinational firm added fuel to the otherwise 'neutral' commodity.

Figure 2. Timeline for biotech crop to reach commercialization

Unfolding Drama on Bt Corn

While the regulatory and scientific process that Bt corn took for its eventual commercialization seemed straightforward and uneventful, a lot of drama and controversy unfolded at various stages. This situation necessitated planned and deliberate communication efforts among various stakeholders. It was a foray into an environment where technical issues were downplayed and focus was on moral, cultural, and/or ideological concerns. Issues about health risks, social consequences, and moral dimensions elevated biotechnology into a social phenomenon, hence, stirring public debate. In fact, objections against genetically modified organisms (GMOs) by anti-biotech groups more often targeted Bt corn. Hence, the drama that Bt corn underwent is used to illustrate the importance of communication in this section. The technology ceased to be 'neutral' and had its fair amount of controversy resulting in a polarized and emotional debate among various stakeholders.

Some of the "dramatic" events that happened include:

- heated debates on the use of GM crops in the tri-media;
- uprooting of Bt corn in field test site in South Cotabato by civil society groups;
- hunger strike at the DA;
- protests by religious sector and other stakeholders concerning the planting of Bt corn;
- B'laan tribe safety controversy;
- passage of resolution for either ban on field trials or moratorium on planting of Bt corn by legislators and local government units (LGUs); and
- banning of biotech corn entry in the Negros province.

Heated Debates on the Use of GM Crops in the Tri-Media

Mass media's ability to effect cognitive change among individuals as well as to structure their thinking stresses its power to selectively choose what people read, see, or hear. An analysis of a decade of print media reportage of agricultural biotechnology in the Philippines (Navarro et al., 2010) shows that majority of biotech articles from 1999 to 2009 have been generally positive to neutral. A total of 1,436 articles on the topic were published in three top

national English newspapers (*Manila Bulletin, Philippine Star, and Philippine Daily Inquirer*) with *Manila Bulletin* accounting for 51%. News coverage was marked by occasional peaks brought about by dramatic and controversial events which triggered attention, but not long enough to sustain interest. These events however, managed to "prime" certain perspectives or public opinion with certain cues like the use of fear appeal (urging food manufacturers not to use GMOs), highlighting hunger strikes or stakeholder protests, use of visual tactics (showing an angel and devil with the latter holding GM products), and choice of words and catchphrases (demonseeds, superweeds, tinkering with nature). The number of biotech articles increased when there was a specific event of interest. For example, in May 2002, articles were written mostly on the hunger strike of civil society groups at the DA against the planting of GM crops.

Just about the time Monsanto submitted an application for the field bioefficacy verification of MON 810 against the ACB, heated debates on the use of GM crops were featured in the print media, radio, and television. While scientists explained the scientific basis of risks and benefits of the technology, anti-biotech groups used the tri-media to forward allegations that baldness, infertility, and homosexuality are potential consequences of using the technology.

A least understood technology was aggravated by media's attempts at defining the concept through visual imagery that evoked concern, fear, and uncertainty. Examples include:

> *(GM food) will result to millions of dead bodies and sick children, physical deformities and disease cluster. It can cause homosexuality and mental retardation. (Manila Bulletin, March 15, 2004)*

> *GM crops and "frankenfish" will result to widespread contamination, irreversible damages. (Philippine Star, October 24, 2004)*

Nevertheless, the use of this type of imagery declined through time. Eventually, most articles dealt with issues related to public accountability or governance, discoveries and scientific work, and social progress in relation to the use of technology.

Uprooting of Bt Corn in Field Trial Site

Arthur Baria, a former program head of Monsanto's Regulatory Affairs, Scientific Outreach and Industry Affairs, gave an eyewitness account of this event which occurred on August 29, 2001 (Baria, 2009):

> *"Just like in a movie, hundreds of people apparently belonging to radical cause-oriented groups, had just destroyed one of the NCBP-approved multi-location trials for Monsanto's MON 810 Bt corn. It was a very swift attack. All the Bt corn plants were destroyed in minutes and trashes were all over the area where moments before, sturdy plants were growing.*
>
> *It was evident that the activity was planned to apparently scare the proponents and people supporting the trials. According to witnesses, the perpetrators were in a U-shaped formation prior to the attack and receiving instructions from somebody with a megaphone. Suddenly, the leader commanded the rallyists to destroy the plants and in minutes, all plants including the border rows which were not Bt corn were gone. Then, as swiftly as they appeared in the area, the rallyists disappeared. Residents noticed that the perpetrators were apparently not from the area since they did not know anyone from the group."*

Baria discussed the technical, social, ethical, and religious issues raised by the anti-GMO groups, arguments which were "delivered in highly emotional and even provocative language." Among the non-technical issues raised were: the concept of genetic engineering as unethical and "anti-God", and the possibility of abnormal or mutant food being produced. These issues were raised in public fora and consultative meetings where scientists either chose not to dwell on them or requested for proof of these allegations. The science community stressed that since their job is to verify the scientific validity of claims, they are in the best position to know if any science-based information on 'mutant' food is available.

Hunger Strike at the Department of Agriculture

Members of the Southeast Asian Regional Institute for Community Education (SEARICE), Philippine Greens, and Greenpeace protested against the

commercial release of Bt corn by holding a month long hunger strike in front of the DA office in May 2003. They demanded a moratorium on the commercialization of the crop in the country, a thorough review and approval process for Bt corn, and a nationwide campaign to ask farmers not to plant Bt corn. Or if they have done so, to uproot the plants immediately. The strikers were affiliated with the Network Opposed to Genetically Modified Organisms! (NO GMOs!). Attempts to meet with President Gloria Arroyo was denied but then Agriculture Secretary Luis Lorenzo Jr. held two dialogues with the strikers but remained non-committal to the moratorium. The strikers eventually stopped the hunger strike when the two government officers left on official trip to the U.S. although the protesters believed they had succeeded in generating awareness of the Bt corn issue (PANNA, 2003; SPAN, 2003).

Former Agriculture Secretary concurs with government sector on support to Bt corn.

In a video interview (ISAAA, 2004), Secretary Lorenzo said that "it did get a lot of media attention. You try to get the emotion to die down and look at everything from an objective, factual basis. Many times decisions are based on emotional or political reasons. I think we have to listen more to the science, objective factual basis for decisions." The newspaper *Today* (May 18, 2003) reported Secretary Lorenzo as saying that he would not give in to the demands of the protesters because it would "cause mob rule" and that there was a process to observe. He asked them to file a petition for reconsideration, but stressed that after six years of review, there was no convincing information that the crop could pose harm to people and the environment.

Protests by Religious Sector and Other Stakeholders

Newspaper accounts of various stakeholder protests documented the saga of Bt corn. One example is that of 200 farmers in Mindanao protesting at the Central Mindanao University against the field testing of Bt corn. Farmers who belonged to the Kilusan Magbubukid sa Pilipinas, MASIPAG, Bagong Alyansang Makabayan, and other militant groups formed an alliance to conduct a massive information drive in the island on the "ill effects of GMOs." Activists alleged that the government was supporting GMOs "being promoted by transnational companies that are already monopolizing agriculture" (Cantral-Albasin, 2001). In Isabela province, about 300 church leaders and militant group members staged a lightning rally in front of Monsanto marketing office in Cauayan City and staged a noise barrage to drum up opposition against the ongoing Bt corn field tests. The protesters burned a giant paper mâché bug which they said represented Monsanto. Fr. Gregorio Uanan, chancellor of the Diocese of Ilagan and a member of the anti-GMO Multi-sectoral Alliance of Isabela, was quoted to have said that "the proponents of the field tests are ignoring public health and the safety of the people." At that time, field trials were being conducted in three villages of Isabela which the protesters said were being done without a provincial board approval. Monsanto officials explained that they had the necessary permits from the NCBP (Villamor, 2001).

A few years later, *Today* newspaper (May 18, 2003) gave an account of a call by 150 farmers and priests attending the Peasants-Clergy Conference organized by the Social Action Center of the Archdiocese of Jaro, Iloilo "to individually and collectively oppose the sale and propagation not only of Bt corn but all GMO programs."

B'laan Tribe Safety Controversy

A petition was submitted to the provincial health officer of South Cotobato in August 2003 concerning health concerns of some of its residents from Barangay Landan, Polomolok. Copies of the petitions were provided to the provincial governor and the media. In October 2003, Dr. Terje Traavik, scientific director of the Norwegian Institute of Gene Ecology, obtained blood samples from 38 farmers in the area coming from the B'laan tribe. He

presented his findings in February 2004 at a side event of the 7th meeting of the Conference of Parties of the Convention on Biological Diversity in Bangkok, Thailand where he was quoted by Reuters to have said, "We are absolutely sure it's a reaction to being exposed to the Bt maize." In the following month, the Norwegian scientist stated in a series of press conferences in Manila that: "My research showed that the footprints of Bt toxin were found in the blood samples" and cautioned that Bt corn could be harmful to human health.

With these allegations, the scientific community led by medical experts from the University of the Philippines Manila, conducted a series of dialogue and fora for the city council and provincial health officers to clear the safety issues and challenged Dr. Traavik on the technical soundness of his study. With no full report presented, an international group of scientists issued a statement condemning his scare tactics. South Cotabato health officials later clarified the claims that the respiratory infection in the area had been a common illness for the past few months due to viruses causing respiratory tract infection as well as neuromuscular disorder, systemic viral infection, and diarrhea (Peczon, 2009).

In relation to this issue, other scientist groups also came out supporting the government's adoption of biotechnology such as the Women Association of Scientists in the Philippines, Philippine Association for the Advancement of Crop Science and Technology, Crop Science Society of the Philippines, and the Philippine Society for Biochemistry and Molecular Biology, among others. Similarly, Bt corn adoption was also highly backed by the Philippine Maize Federation, the country's biggest organization of corn farmers (*Philippine Star*, 2004).

Resolution to Ban Field Trials and Call for Moratorium on Planting of Bt Corn

The Pesticide Action Network Updates Service reported that several bills were submitted to Congress seeking to regulate genetically engineered (GE) crops. The resolutions sought to limit the introduction of GE crops and investigate alleged corporate influence over the government approval process for Bt corn (PANNA, 2003). SEARCA BIC (2002) said that the anti-GMO advocates

filed petitions to the LGU, House of Representatives, Senate, and Supreme Court to halt the field trial. Congressional resolutions and Senate bills were filed although the Supreme Court eventually dismissed the petition for lack of merit. Examples of these resolutions include Bill No. HR 1287 calling for "a moratorium on the field testing of GM corn in the country; Bill No. SB 1313 sponsoring an "Act declaring illegal the release of GMO and substances into the environment and for other purposes"; and Bill No. HR 552 directing the committee on health to "conduct an inquiry into the entry in the country of GMOs, their use in our food products and the extent of danger that they pose to the public" (Biotech TWG State-of- the-Art).

While the Bt corn story unraveled many "behind-the-scene" moments until its commercialization, events continued to unfold. In August 2005, the Governors of Negros Occidental and Negros Oriental signed a Memorandum of Agreement on the establishment of the "Negros Organic Island." To ensure that the Island can maintain this status and to prevent what proponents perceived as contamination of standing crops from GM varieties, the Negros Occidental Provincial Board passed in April 2007 Ordinance No. 007 Series of 2007 declaring a ban on living GMOs from entering the province despite a national policy giving the nod to the field testing and commercialization of GMOs. This scenario was again highlighted when the governor of Negros Occidental created an ad hoc committee to find a win-win solution to the call to lift the ban of GMOs entering the province. A series of public consultations on the proposal were organized with both public and private sector players sharing insights on the proposal. Some biotechnology advocates urged government officials and the public to be more open to other information on GMOs while anti-biotech groups reacted otherwise.

In related developments, Greenpeace activists dressed as chickens circulated a petition, prepared by Greenpeace and the Hotel and Restaurants Association of Negros Occidental (HRANO), urging the Sangguniang Panlalawigan not to amend the ban on GMOs and instead work on implementing rules and regulations towards an Organic Negros Island. The petition was signed by farmers, students, business owners, workers, consumers, and other citizens of Negros. HRANO, composed of all the major hotels and restaurants in the province, announced last September 16, 2009 the partnership with Greenpeace and its stand on the controversial ban. The tug-of-war continues.

Biotechnology R&D and Parallel Communication Activities

The biotech perception in the country and the anti-GMO activities of various stakeholders provided the backdrop by which academic and government institutions decided to collaborate on an information and communication campaign on biotechnology in 1998. The DOST Biosafety Guidelines were also being developed which necessitated public consultations around the country. Members of the committee and some scientists were involved in the information dissemination campaign. Public sector, particularly the University of the Philippines System, and the DOST through its sectoral councils initiated biotech communication activities. Efforts were geared at introducing the concepts of biotechnology to the general public with the intent of preparing a favorable environment once a product is made available in the market. BIOTECH in UPLB, for example, had several products in the pipeline, mostly biofertilizers and industrial by-products that had to be introduced to consumers and potential end-users. The DOST took interest as it is the primary funding source for research activities in the University. UPLB collaborated with the DOST councils to hold technology awareness workshops, produce popular materials, and conduct research to determine the status of biotechnology in the country, and develop a manpower and institutional database for easy access. An example of popular material developed by PCARRD was a comics on Bt corn and biotechnology which is mainly targeted for farmers and the general audience.

SEAMEO Regional Center for Graduate Study and Research in Agriculture-Biotechnology Information Center

In 2000, SEARCA BIC was established and assumed a major role in deliberate science communication activities for a better awareness and understanding of biotechnology. Based in Los Baños, Laguna, Philippines, the BIC was one of the three initial centers of ISAAA's information network in Southeast Asia. Generally, the BICs serve as a hub for current science-based information on agricultural biotechnology; support the national program on agricultural biotechnology by providing strategic information for decision making; act as information broker among various stakeholders; coordinate with regional and national network nodes on the exchange, processing, packaging, and

distribution of agricultural biotechnology information; and synthesize and package science-based information using appropriate formats for various stakeholders.

SEARCA BIC is at the forefront of promoting safe and responsible use of modern biotech practices through science education and communication and capacity enhancement activities. It also distributes biotechnology and biosafety information to various stakeholders both in the Philippines and in the Southeast Asian region through multi-media such as:

- *Printed information, education and communication (IEC) materials.* Information on biotechnology are developed and packaged into appropriate formats (comics, primers, posters, mentor's kit, brochures) tailored to target stakeholders. BIC also translates available biotech materials to different local languages to expand its reach. These include brochures and comics on Bt corn on topics such as alternate hosts of the corn borer and Bt corn and insect diversity.
- *BIC website (www.bic.searca.org)*. This provides general information on biotechnology through news, events, photos, downloadable documents, and proceedings from seminars/workshops.
- *BIC e-news service*. This is an electronic news service offering biotechnology-related news and events, and a discussion board as venue for members to share and exchange information. E-group members increased from 35 in 2000 to about 50,000 members in 2010.

In promoting a learning culture on agri-biotechnology, SEARCA BIC further organizes and coordinates trainings, study visits, farmer exchange programs, workshops, fora, media outreach and education activities, consultations, and other similar activities in the Philippines. These serve as platforms for objective discussion on biotechnology and the issues and concerns surrounding it, including biosafety. Some of the capacity building efforts of BIC in relation to biosafety and food safety include training-workshops for regulators and researchers involved in plant biotechnology on food safety and environmental risk assessments, regulatory framework governing GM/biotech crops, risk communication and communicating biosafety and biotechnology issues, and emerging issues such as intellectual property rights.

An important activity undertaken by the BIC is media monitoring and analysis. The mass media plays a vital role in influencing the public of its acceptance and perception of biotechnology. Hence, the BIC assesses how the news portrays agri-biotechnology in major Philippine broadsheets. BIC monitors the number of articles published on biotechnology for a given period, categorizes them by tone (positive, negative, or neutral), and analyzes them in terms of subject matter content.

Innovative board game (K Quest) gets a thumbs up from media practitioners.

Other communication activities include the development of radio plugs, CD-based documentary, and use of Internet-based media (Tababa et al., 2008). ISAAA and the SEARCA BIC also developed a board game called K (Knowledge) Quest which simulates the process that a biotech crop undergoes from laboratory to eventual commercialization in farmers fields. This is used in workshops with media, students, and faculty to highlight the long process it takes to assure safety of a product.

SEARCA co-published two monographs with ISAAA, on *Public Understanding and Perception of and Attitude Towards Agricultural Biotechnology (Philippines and Indonesia)* by C. S. Torres, et al. (2006) as well as two books: *The Unfolding Gene Revolution: Ideology, Science, and Regulation of Plant Biotechnology* by E.T. Rasco (2008) and *Projected Impacts of Agricultural Biotechnologies for Fruits and Vegetables in the Philippines and Indonesia* by G. Norton and D.M. Hautea (2009).

Multi-sectoral Coalition of Biotech Advocates

Other partners entered the scene to complement efforts. A multi-sectoral coalition of biotech advocates from academe, farmers' organizations, industries, church, media, and scientific community was established to promote the safe and responsible use of modern biotechnology. Initially known as the Biotechnology Association of the Philippines, Incorporated, it is now referred to as the Biotechnology Coalition of the Philippines (BCP). Together with DA Biotechnology Program Implementation Unit and other partners, the consortium developed the national capacity building program in biotechnology. An example is a training workshop on National Biosafety Frameworks and Implementation which paved the way for a series of risk assessment workshops for biotech regulators in the country. Aside from the regulatory capacity building initiatives, BCP is also involved in organizing information, communication and education (IEC) campaigns grounding biotechnology in the Philippines especially during the height of the protests of anti-biotech groups (Panopio and Lapitan, 2009a).

The alliance of DA, PCARRD, BCP, SEARCA BIC, and scientists from local universities trail blazed the information drive on biotechnology. Several country-wide information activities were conducted to increase awareness and engender public acceptance of biotechnology. Different communication mechanisms were done to strengthen the favorable environment for biotechnology. Though not institutionalized, the alliance paved the way for the formation of a multi-stakeholder umbrella of biotechnology agencies for a national biotechnology communication program. The alliance, in particular, was involved in the country-wide consultations with regard the framing of policy that will govern the release of GM crops in the country. Through various outreach activities and communication efforts, A.O. No. 8 was approved for implementation in 2002.

Much later in 2005, the Biotechnology for Life Media and Advocacy Resource Center (BMARC) was established to provide a multi-media and multi-sectoral approach to public information campaign on biotechnology. The consortium is composed of the DA Biotech Program Office (DA-BPO), SEARCA BIC, BCP, PCARRD, and the J. Burgos Media Services Inc. Seasoned writers comprised BMARC which is responsible for sifting through a great mass of data about

biotechnological processes, innovations, and discoveries with critical importance to agriculture (Go, 2008).

The bi-monthly Biolife magazine published by BMARC started in 2005 and features recent developments in Philippine biotechnology as well as answers to issues related to the technology. Several issues of this magazine have been disseminated to various government offices, private corporations, academe, media outlets, and among farmers and entrepreneurs in the country. Electronic copies of the past issues can be downloaded from the websites of Biotech for Life and SEARCA BIC.

BMARC also pioneered the *Gawad Galing* (Excellence Award) for biotech journalism to recognize Filipino science journalists who have written outstanding and well-researched biotechnology news and features, and have popularized biotechnology through their news reports. The award was later named "The Jose Burgos, Jr. Awards for Biotech Journalism" to honor the late Filipino journalist turned farmer, Jose Burgos, Jr. Since its inception in 2005, participation in this annual award has grown each year with more newspapers and other media outlets carrying news releases (Panopio and Lapitan, 2009b).

Committed to promote biotechnology down to the grass roots, DA together with ISAAA supported the Biotechnology Course for LGUs spearheaded by J. Burgos Media Services. The course development and piloting were part of the capability building efforts of DA to educate the local chief executives and concerned agricultural officers of the vast potential and benefits of modern biotechnology. The developed course was an offshoot of the Memorandum of Understanding (MOU) on Biotechnology Information Education and Technology Exchange Cooperation signed on July 1, 2005. This is a partnership committed to building the capabilities of LGUs in applying biotechnology for local development (Villavert, 2006). The course helped LGUs in appreciating biotechnology and harnessing meaningful projects and programs for long-term sustainability (Fernandez et al., 2007).

Efforts of the Academic Community

The academics and scientists got out of their laboratories and comfort zone and started to contribute to communication efforts related to biotechnology.

Being perceived by stakeholders as the most credible source of information, university professors and researchers from the academe and research institutions joined in science-based information exchange and other fora related to modern biotechnology. On top of these efforts is the National Academy of Science and Technology (NAST), the country's recognized premier and advisory body on science and technology (S&T). National scientists and academicians have been in the forefront of debates related to issues and concerns of agri-biotechnology and are often quoted by media practitioners. The academy also organizes or co-organizes national events, round table discussions, exhibits, scientific sessions, and fora on S&T with emphasis on biotechnology. It also publishes biotechnology materials such as the monograph on *Modern Biotechnology and Its Role in Philippine Agriculture*. NAST also supports the annual launch of ISAAA's report on the Global Status of Commercialized Biotech/GM Crops where its current President, Dr. Emil Q. Javier, often gives commentary on biotech initiatives in the country (Navarro, 2009).

Several state colleges and universities in the country also did their part in the education of various stakeholders and in the dissemination of factual and science-based information related to biotechnology. They spearheaded efforts to enhance academic curriculum, prepare a teacher's manual, and improve capacities of teachers in biotech education and teaching. Some of these innovative activities undertaken are described below:

- UP Diliman through the National Institute of Molecular Biology and Biotechnology (NIMBB) implemented a project to encourage and train teachers and administrators of Philippine state universities and colleges to institute a general education biotechnology course or to integrate topics on biotechnology in currently offered biology subjects in cooperation with DA and the Commission on Higher Education. NIMBB also organized the conduct of the National Biotechnology Quiz contest for high schools in cooperation with partners.
- In 2005, the University of the Philippines Mindanao, through the support of DA PIU and ISAAA, initiated the institutionalization of biotechnology education through the conduct of several biotech course development workshops which resulted in the inclusion of a general biotech course in the college curriculum. This general

education course uses teaching modules which are now being adopted by several universities all over the country (e.g., Central Mindanao University, University of Southern Mindanao, Central Luzon State University, Rizal Technological University, and Cavite State University).

- The Fil-Tribe or Filipino Teachers Recognizing the Importance of Biotechnology Education was launched during the 1st National Biotechnology Education Conference for Teachers in November 2009. The group spearheaded by UP Diliman's NIMBB is composed of university and secondary level teachers of biology and biotechnology-related subjects. It aims to improve instruction of biotechnology at various educational levels.
- In 2010, an undergraduate course on agricultural biotechnology was initiated by UPLB to meet the needs for human resource development on biotechnology and sustain and enhance interest on agri-biotech research and development.

Scientific and Professional Organizations

Professional organizations and academic societies also played an active role in biotech communication by highlighting biotechnology and its role in agriculture, environment, health, and the Philippine society and economy during their annual scientific conferences and congress. To enhance the awareness of university and secondary students on biotechnology, student organizations such as the UPLB Genetics Society, UPLB Cell Biological Society and UPLB Chemical Society collaborate with other institutions such as SEARCA BIC and ISAAA in organizing learning events such as interactive study groups, seminars, fora, conferences, exhibits, laboratory tours, quizzes, and essay contests. These student-facilitated events are held periodically to contribute to the dissemination of science-based information, showcase latest advances in the field, and develop the potentials of today's youth in the field of modern biology and biotechnology (Amano, 2009).

Religious Sector

Strong statements from the religious sectors recognizing the benefits of biotechnology in addressing food security and agricultural problems also

contributed in reducing the fears associated with adopting biotechnology. Reverend Father Noli Alparce, a prominent supporter of agricultural biotechnology from the Roman Catholic Church, was actively involved in the IEC program of DA. According to him, *"Biotechnology is moral because it addresses problems of poor farmers and it has a lot of potential in positively impacting humanity."* He believed that the use of appropriate communication tools, such as ISAAA's video documentary on farmer's experiences in planting Bt corn in the country, enabled him to persuade non-believers of the technology (Panopio, 2009).

Private Sector

The seed companies from the private sector were the first to apply for field trials and commercial release in the country of GM/biotech crops. As such, they participated actively in general biotechnology education and product-specific marketing and communication. Monsanto Philippines, being the proponent of the first GM crop MON 810, faced a vast number of issues and concerns as regard the safety, long term effects, and benefits of the new technology. The company arranged for field trial visits by scientists and other stakeholders, particularly farmer groups, to personally see the Bt corn's performance against the insect pest. Through these first hand experiences, the effectiveness and potential benefits of the new technology were easily disseminated to the different target groups, particularly the farmers.

Industry associations such as CropLife Philippines served as the private sector's contribution to the plant science industry through its promotion of modern agricultural technology, including the products of modern biology. In collaboration with BCP and other government institutions, farmers' exchange programs and commercial field tours became regular avenues for discussion related to adoption of biotech corn.

Farmer Groups

The Asian Regional Farmers Network or ASFARNET was conceived by farmers from India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam who participated in a capacity building workshop on "Farmer to Farmer: Sharing Experiences Related to Agricultural Biotechnology" held in Manila and

Asian farmers visit Bt corn fields in the Philippines.

Cagayan de Oro City, Philippines in 2003. Through a series of interactive lectures on biotechnology, visits to field trials and actual farmers' fields planted to Bt corn, the workshop helped increase Southeast Asian farmers' awareness of the challenges and policy issues facing agricultural biotechnology. Farmers from India, the Philippines, and the U.S. shared their experiences in planting GM crops and how they have benefited from the technology.

ASFARNET Philippines was established as a country network which serves as a communication center for accessing and disseminating ASFARNET programs and activities to farmers and organizations in the country. It is composed of farmers and concerned stakeholders from various associations in the country committed to help address food security, sustainability, and farming profitability. The network has been active in empowering farmers by providing them factual information on modern technologies and increasing their awareness about biotechnology.

Together with the Philippine Maize Federation Inc., SEARCA BIC, DA, private sectors, and international organizations, a series of national and regional farmers' conferences was spearheaded by ASFARNET Philippines to enable the farmers to make an informed choice on what technology to adopt. In 2009, the organization made a declaration that the safe and responsible use of biotechnology offers solutions to the alleviation of agricultural problems. It is convinced that the immediate development and utilization of

biotechnology and GMOs would contribute to increasing the productivity of agricultural lands for increased food, feed, and fiber security; controlling pest and diseases; developing new consumable products; and tapping renewable energy source.

Regulators Share

Regulators also have a role in assuring the public that policies are in place to ensure that any product of genetic engineering passes through rigorous safety assessment before it is allowed to be planted in farmer's field or be made available in the market. Regulators from DA, DOST, and its attached agencies undertook biotech training courses and together with technical experts, participated in debates and dialogues related to issues and concerns on biotechnology to provide the details of the assessment and invoke transparency. DOST established the Biosafety Clearing House website to update the public on the status of GM research and development as well as status of approvals of products derived from genetic engineering. Similarly, the BPI-DA also made available a website which provides the policies and guidelines for the release and importation of these products. Status of the adoption, insect resistance management, monitoring, and approvals for multi-location trials, propagation and direct use for food, feed, and processing can be downloaded from its website.

Media Partnership

Enhancing media's awareness and understanding of the issues and concerns as well as regulations on agricultural biotechnology helped in promoting science-based and responsible reporting among media practitioners. Through continuing media outreach and education efforts, informed/balanced articles, features, and stories were published and aired through the various media. In September 2010, SEARCA, ISAAA, and the Philippine Science Journalists Association, Inc. (PSciJourn) signed an MOU to uphold the role of science, particularly agri-biotechnology education and communication, in agriculture development. The media also committed to undertake continuous learning activities to empower and make them more confident in engaging the public in scientific undertakings.

These multi-stakeholder efforts on biotech IEC led to the institutionalization of Biotech Week every last week of November as a national activity of exhibits, symposia, dialogues, and media awards. The annual event, usually spearheaded by the DOST and DA, is being supported by other government departments such as the Departments of 1) Education, 2)Environment and Natural Resources, 3) Health, 4) Interior Local Government, and 5) Trade and Industry. The national celebration is attended by thousands of stakeholders such as scientists, environmentalists, health enthusiasts, entrepreneurs, decision makers, development advocates, farmers, and students.

Multi-stakeholders' efforts on education and advocacy campaign for the safe and responsible use of the technology remains. Capacity building approaches, visits to the trial sites, scientific dialogues, media conferences, development of factual and science-based information and its information dissemination are continuously being pursued. These strategic communication efforts have been proven to be successful in Bt corn. It is with high hopes that with the continuing education and outreach, and based on the vast experience of the country in science-based assessment of GM crops, good science will prevail and the promises of this public sector technology will be reaped by its intended users.

Lessons Learned: Implications for Science Communication

Tababa et al. (2008) reflects on their eight years as a pioneer BIC in the country. Lessons were gained "which are worth passing to those who are interested to implement information centers whose objective is to increase the public awareness and understanding of science-based technologies." These lessons are enumerated below.

- Leverage partnerships and networks with international and local organizations as well as local authorities to advocate biotechnology concerns.
- Integrate biotech activities into the existing programs of the partners; use events of government agencies and private companies as springboards in promoting the Center's purpose.

- Educate the media as frontliners through the coordination of study tours, seminars, and workshops; study work habits of media practitioners to factor them in the design of media activities.
- Build message credibility through scientists' involvement in biotechnology through seminars, workshops, and study tours.
- Establish consistency in messages by featuring basic concepts in biotech, applications and benefits, environment and food safety, as well as economic, social, and ethical concerns.
- Clear controversies by releasing a statement or facilitating a dialogue with concerned parties to give an objective view of the issues being raised.
- Regularly connect with and get feedback from clients through the tri-media and face-to-face interactions during dialogues, seminars, and workshops.
- Anchor process documentation, social marketing, and conflict management as part of the operational framework and incorporate these at the beginning of the project.
- Find meaning of biotech in the worldview of farmer-leaders by giving them a venue to share their success stories to other farmers.
- Nurture relationships and goodwill with partners through team building and other bonding activities so that they will be perceived as friends in an environment of mutual trust and camaraderie.

Baria (2009) zeroes in on his experiences as part of the private sector in the introduction of Bt corn in the Philippines. He noted that "a lot of lessons have been learned from the struggle to establish structures and protocols to determine the biosafety of products of modern biotechnology in the country." The values and lessons learned are as follows.

- There is heightened information when evidence-based reasoning of scientists is made available and appreciated by various audiences. In contrast, anti-biotech groups that use generalized statements are ill-prepared to argue their case thoroughly in the absence of concrete scientific proofs.
- Calm reasoning by resource persons in public fora and other venues adds credibility in contrast to the over-eagerness and aggressiveness of anti-biotech personalities.

- The value of multi-sectoralism in keeping with a conscious and deliberate effort to reach out to stakeholders contributes to the transparency and involvement of key players.

Father Noli Alparce (Panopio, 2009) underscores the importance of continuing IEC campaign in educating policy makers and their staff about the potential and benefits that can be obtained from adopting biotechnology. Peczon (2009) counts on continuing information dissemination activities, strengthening regulatory system, obtaining necessary access to support services, and creating a national biotechnology roadmap which substantially meets the requirements of stakeholders so that biotech crops in the Philippines could reach commercial release.

As other biotech products make their way towards possible commercialization, communication challenges continue. Nevertheless, lessons have been learned from the deployment of the first biotech crop which can serve as guideposts. These include the need to focus on:

- Functional science-based and transparent regulatory system prior to commercialization
- Identification/recognition of key stakeholders and their specific roles and expectations
- Inter-institutional involvement in all stages of the evaluation process
- Continuous monitoring of public understanding and knowledge and opinion
- Proactive communication activities to lead to an informed debate
- Strengthened capacities of stakeholders in communicating biotechnology so that they can convey messages effectively
- Key messages anchored on the technical soundness of the technology and the health, environmental, social and economic benefits
- Multi-delivery channels and multi-communication approaches to reach various stakeholders effectively
- Continuing support and funding for biotech communication outreach activities and research from government, NGOs, and other institutions involved in agricultural development
- Strategic partnerships as the way forward in expanding reach and maximizing use of limited resources

- Integration of communication activities as part of the technology/ product development framework

Summary

The Philippine experience in getting a biotech crop approved for commercialization took almost 10 years from laboratory to farmers' fields. It took a bold step at a time when other Asian countries were still grappling with research activities, institutionalizing a functional regulatory system, vacillating between unclear government pronouncements, and thriving under a media environment that focused more on the uncertainties of the technology. As a pioneer in this area, the country has many lessons to share with other developing countries that are potential biotech adopters. Foremost is the awareness of crucial key elements for the technology to be accepted and adopted. These include strong political support, a vigilant scientific community, a well-informed media, and a dynamic collaboration among public and private sectors.

Various efforts were done to consolidate the participation of stakeholders (e.g., scientists, academics, government regulators, media practitioners, and farmers) in science communication initiatives. Hence, awareness and understanding of biotechnology were initiated at various levels and aimed at different audiences so that all stakeholders became part of the process. An appreciation for science communication at the start of technology development until commercialization helped make easier what could have been a rough road to navigate. The entry of other potential biotech crops in the country is evident and proponents are invigorated by lessons learned, strategies tested and validated, and communication approaches that will further enhance acceptance of the technology.

References

Amano, Noel. 2009. The UPLB Genetics and Cell Biological Societies: Sharing Biotech Information to Students. *In* Communicating Crop Biotechnology: Stories from Stakeholders. ISAAA Brief 40. Edited by M. Navarro. ISAAA: Ithaca, New York. pp. 143-146.

Asian Food Information Center (AFIC). 2008. Clear Support for Food Biotech by Consumers in the Philippines. http://www.afic.org/foodbiotechnology.php?news_id=844&start=0&category_id=3&parent_id=3&arcyear=&arcmonth; Full executive summary at http://www.afic.org/consumerresearch.php?news_id=819&start=0&category_id=25&parent_id=25&arcyear=&arcmonth (Accessed December 7, 2009).

Biotech TWG State-of-the-Art. Status of Different Bills Related to Biotechnology. http://www.pcarrd.dost.gov.ph/Biotech1/policies%202.html (Accessed December 17, 2009).

BAR Digest. 2000. DA Launches Biotech Program Under PL 480 Fund. October-December 2000.

Baria, Arthur. 2009. Communicating Biotechnology: The Bt Corn Experience in the Philippines. *In* Modern Biotechnology and Agriculture. STRIVE (Society Towards Inherent Viability for Enrichment) Foundation. Los Baños, Laguna, Philippines. pp. 55-68.

Beronio, Roilo, Leonardo Gonzales, Jane Payumo, Caezar Angelito Arceo, Recille Galvez, and Elaine Joshi. 2008. Commercialization of Agricultural Biotechnology in the Philippine Public Research and Development Institutions. Philippine Rice Research Institute. Science City of Muñoz, Nueva Ecija, Philippines.

Bureau of Agricultural Statistics (BAS). 2009a. Facts and Figures on Philippine Agricultural Economy, 2009. http://countrystat.bas.gov.ph/index.asp?cont=factsandfigures (Accessed November 8, 2010).

Bureau of Agricultural Statistics (BAS). 2009b. Recent Developments in the Philippine Agricultural Economy. http://www.bas.gov.ph/?id=agri_dev&cat=home (Accessed November 8, 2010).

Cantral-Albasin, Grace. 2001. Farmers Say They Won't Benefit from GMO Crops. Philippine Daily Inquirer. Media release, October 17, 2001.

Cariño, Flerida. 2009. After MON 810: The Expanded Toolbox. *In* Modern Biotechnology and Agriculture. STRIVE (Society Towards Inherent Viability for Enrichment) Foundation, Los Baños, Laguna, Philippines. pp. 55-68.

Claparols, Antonio. 2004. Of Frankenfish and GM Plants. *Philippine Star.* Media release, October 24, 2004.

Department of Agriculture – Bureau of Plant Industry. Approvals on GM Crops for Propagation and for Direct use. http://www.biotech.da.gov.ph (Accessed November 8, 2010).

Department of Agriculture - Bureau of Plant Industry. Biosafety Regulation.http://www.biotech.da.gov.ph/ (Accessed December 7, 2009).

Dela Cruz, Reynaldo and Mariechel Navarro. 1994. Country Papers: Philippines. *In* Biotechnology Applications in Agriculture in Asia and the Pacific. Asian Productivity

Organization. Tokyo, Japan. pp. 294-302.

Fernandez, L.M. et.al. 2007. Making a Difference: Success Stories and Best Practices on Biotechnology in the Philippines. Department of Agriculture Biotechnology Program Implementation Unit, Quezon City.

Go, Ian. 2008. 2008 Jose G. Burgos Jr. Biotech Yearbook. A Special issue of Bio-life Magazine.

Halos, Saturnina. 2000. Agricultural Biotechnology in the Philippines. *In* Proceedings of the Regional Conference on Agricultural Biotechnology. Fortune Hotel, Dindaeng, Bangkok, Thailand. http://www.bic.searca.org/; and http://www.bic.searca.org/seminar_proceedings/bangkok-2000/I-country_papers/halos.pdf (Accessed December 7, 2009).

Hautea, Randy and Margarita Escaler. 2004. Plant Biotechnology in Asia. AgbioForum. Vol. 7, No. 1&2: 2-8.

International Service for the Acquisition of Agri-biotech Applications (ISAAA). 2004. Asia's First: The Bt Corn Story in the Philippines. ISAAA Resources: Biotechnology Videos. http://isaaa.org/resources/videos/btcorn/default.asp (Accessed November 8, 2010).

Juanillo, Napoleon Jr. 2003. The Social and Cultural Dimensions of Agricultural Biotechnology in Southeast Asia: Public Understanding, Perceptions, and Attitudes towards Biotechnology in the Philippines. International Service for the Acquisition of Agri-biotech Applications (ISAAA) and the University of Illinois at Urbana Champaign, USA. 95 pp.

Manila Bulletin. 2004. GMO 'Scare Campaign' Deplored, Farmers, Scientists Back Biotech. Media release, March 15, 2004.

Navarro, Mariechel (Ed.) 2009. Emil Q. Javier: Trail Blazing Biotech in the Philippines. *In* Communicating Crop Biotechnology: Stories from Stakeholders. ISAAA Brief No. 40. ISAAA: Ithaca, New York. pp. 81-84.

Navarro, Mariechel, Jenny Panopio, Donna Bae Malayang, and Noel Amano Jr. 2010. Print Media Reportage of Agricultural Biotechnology in the Philippines: A Decade's (1999-2009) Analysis of News Coverage and Framing. International Service for the Acquisition of Agri-biotech Applications, Los Baños, Laguna, Philippines.

Norton, George and Desiree Hautea. 2009. Projected Impacts of Agricultural Biotechnologies for Fruits and Vegetables in the Philippines and Indonesia. International Service for the Acquisition of Agri-biotech Applications (ISAAA) and the SEAMEO Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA). Los Baños, Laguna, Philippines. 184 pp.

Padolina, William. 2000. Agricultural Biotechnology: Opportunities and Challenges

for the Philippines. Discussion Paper Series No. 2000-27. Philippine Institute for Development Studies. Makati City, Philippines.

Panopio, Jenny. 2009. Fr. Emmanuel Alparce: The Morality of Genetic Engineering. *In* Communicating Crop Biotechnology: Stories from Stakeholders. ISAAA Brief No. 40. Edited by M. Navarro. ISAAA: Ithaca, New York. pp. 134-136.

Panopio, Jenny and Rochella Lapitan. 2009a. Biotechnology Coalition of the Philippines: Advancing Biotechnology through Partnerships. *In* Communicating Crop Biotechnology: Stories from Stakeholders. ISAAA Brief No. 40. Edited by M. Navarro. ISAAA: Ithaca, New York. pp. 147-150.

Panopio, Jenny and Rochella Lapitan. 2009b. Edita Burgos: Revolutionizing Media's Role in Biotech Advocacy. *In* Communicating Crop Biotechnology: Stories from Stakeholders. ISAAA Brief No. 40. Edited by M. Navarro. ISAAA: Ithaca, New York. pp. 39-44.

Peczon, Benigno. 2009. National Biotechnology Policies and Realism: Overcoming Challenges in Implementation. Asian Biotechnology and Development Review. Volume 11. Number 2: 45-53.

Pesticide Action Network North America (PANNA). 2003. PANNA: Hunger Strike Against Bt Corn in Philippines. Pesticide Action Network Updates Service (PANUPS). http://www.panna.org/legacy/panups/panup_20030523.dv.html (December 16, 2009).

Philippine Star. 2004. Prove Claims, Scientists Dare Anti-GMO Activist. Media release, March 21, 2004

Ramirez, Dolores. 2009. The R&D to Commercialization Continuum: Biosafety Risk Assessment of Bt Corn (MON 810). *In* Modern Biotechnology and Agriculture. STRIVE (Society Towards Inherent Viability for Enrichment) Foundation. Los Baños, Laguna, Philippines. pp. 1-20.

Rasco, Eufemio, Jr. 2008. The Unfolding Gene Revolution. International Service for the Acquisition of Agri-biotech Applications (ISAAA) and SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA). Los Baños, Laguna, Philippines. 306 pp.

SEAMEO Regional Center for Graduate Study and Research in Agriculture-Biotechnology Information Center (SEARCA BIC). 2002. A Second Look at the First Bt Corn Field Trial in the Philippines. Feature Articles. http://www.bic.searca.org/feature/bic-btcorntrial.html (Accessed December 17, 2009).

Solidarity Philippines Australia Network (SPAN). 2003. Anti-GMO/Bt Corn Protesters End Hunger Strike. KASAMA Vol. 17, No. 2. April-May-June 2003. http://cpcabrisbane.org/Kasama/2003/V17n2/AntiGMO.htm (Accessed December 18, 2009).

Tababa, Sonny, Lorna Calumpang, Rochella Lapitan, and Dione Baracol. 2008. Grounding Science Communication: Experiences and Lessons from the Biotechnology Information Center (BIC) in the Philippines. Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA). University of the Philippines Los Baños, Laguna, Philippines.

Today. 2003. Iloilo Farmers, Priests Support Anti-Bt Corn Hunger Strike. Media release, May 18, 2003.

Torres, Cleofe, Madeline Suva, Lynette Carpio, and Winifredo Dagli. 2006. Public Understanding and Perception of and Attitude Towards Agricultural Biotechnology in the Philippines. College of Development Communication, University of the Philippines Los Baños, SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), and the International Service for the Acquisition of Agri-biotech Applications (ISAAA). 100 pp.

Visaya, Villamor Jr. 2001. 300 Protesters Rally in Isabela to Stop Field Tests of GMOs. *Philippine Daily Inquirer*. Media release, October 20, 2001.

Villavert, T. 2006. Biotech Course to Initiate LGU Capability Towards Development Innovations. Philippine Information Agency (PIA). http://www.thenewstoday.info/2006/04/12/biotech.course.to.initiate.lgu.capability.towards.devt.innovations.html (Accessed November 8, 2010).