Biotech Corn in the Philippines:
A Country Profile

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ISAAA
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Summary

In 2014, the area planted to biotech corn in the Philippines is projected to increase to 831,000 hectares, up 5% from the estimated hectares of biotech corn in 2013 of 795,000. Notably, the area occupied in 2014 by the stacked traits Bt/HT corn is 761,000 compared with only 712,000 hectares in 2013 and occupying 92% of total biotech corn hectares in 2014. This reflects the preference of farmers for stacked traits and the superior benefits they offer over a single trait. The number of small resource-poor farmers, growing on average 2 hectares of biotech corn in the Philippines in 2014 was estimated at 415,000 up significantly by 17,500 from 397,500 in 2013. Farm level economic gains from biotech corn in the Philippines in the period 2003 to 2013 is estimated at US$470 million and for 2013 alone at US$92 million.

Biotech corn adoption in the Philippines increased at an average of 5% annually since it was planted in 2003. The Philippine regulatory system established since 1992, revised and updated in 1999, 2002, and 2006 with various amendments and supporting memoranda set the adoption of biotech corn in the Philippines. Research institutions that were established to conduct research on biotechnology have been amply supported by government and international sources. Scientists and government continue to support biotech crop research in the Philippines with locally-developed biotech crops in the pipeline: beta carotene-enriched rice, insect resistant eggplant and cotton, and virus resistant papaya. Farmers and farmer leaders express support for biotech crops and share their stories on how they are benefiting from the technology.

Philippine Backgrounder

Population: 94.9 million
GDP: US$225 billion
GDP per Capita: US$2,370
Agriculture as % GDP: 13%
Agricultural GDP: US$41.1 billion
% employed in agriculture: 33%
Arable Land (AL): 5.4 million hectares
Ratio of AL/Population*: 0.3
Major crops:

- Sugarcane
- Corn
- Pineapple
- Coconut
- Banana
- Mango
- Rice
- Cassava

Commercialized Biotech Crop: Bt/HT/Bt-HT Corn

Total area under biotech crops and (%) increase in 2014: 0.813 Million Hectares (+2.2%)

Increased farm income for 2003-2013: US$470 million

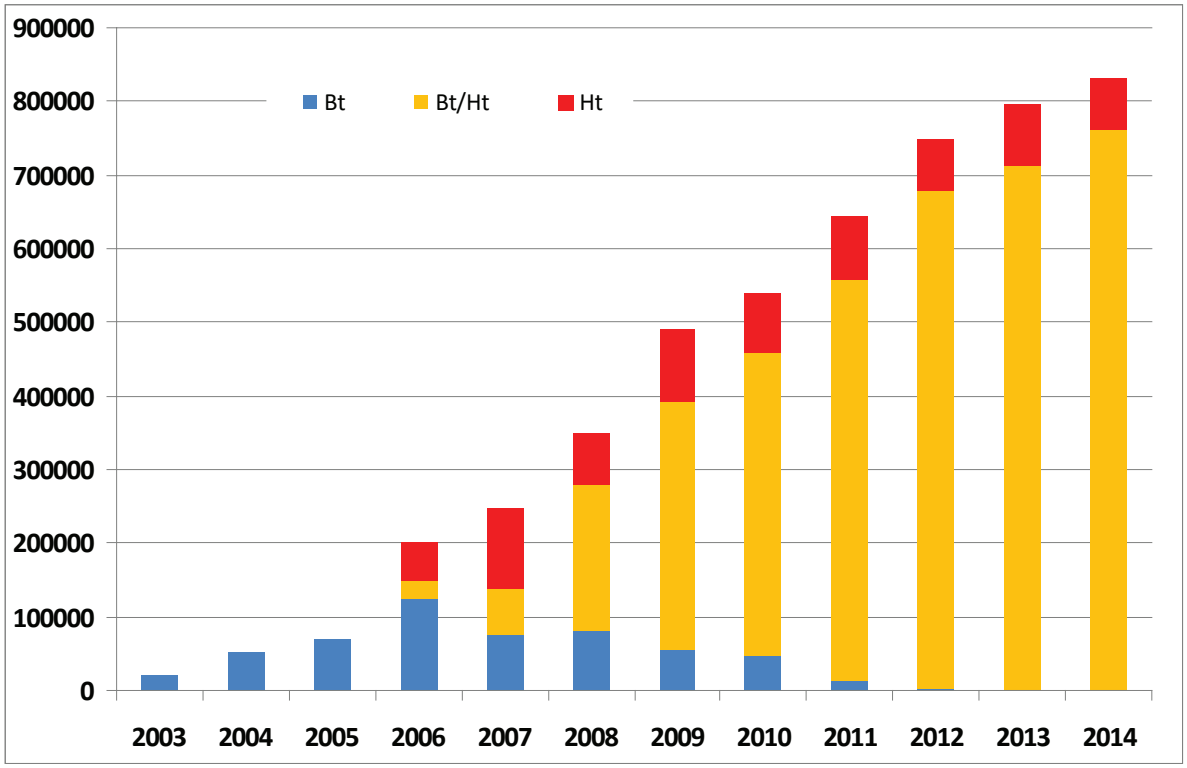
**Ratio: % global arable land / % global population*

Adoption of Biotech Crops

Adoption of biotech corn in the Philippines has increased consistently every year since it was first commercialized in 2003. The area planted to biotech corn was projected to significantly increase in the wet and dry seasons in 2014 to reach 831,000 hectares, up 5% from the 795,000 hectares of biotech corn in 2013 (Figure 1). Notably, the area occupied by the stacked traits of Bt/HT corn has continuously increased every year reaching 761,000 hectares in 2014, compared with only 721,000 hectares in 2013, up by a substantial ~6%, reflecting the preference of farmers for stacked traits and the superior benefits they offer over single trait. This shift in farmers' preference from single trait corn to those with combined traits has been observed since the introduction of stacked-traits in 2006.

Total hectarage planted to the single trait Bt corn declined to 32% from 2008 to 2009, to 76% in 2012, with a total of only 3,000 hectares. In 2013 and 2014, no single trait Bt corn has been planted. Single trait herbicide tolerant (HT) corn was planted on 70,000 hectares in 2014, which is only 8.4% of the total biotech corn planted in the country, 14% lower than the previous year. On a percentage basis, biotech yellow corn has consistently increased by about 5% of the total yellow corn hectarage every single year since 2003, reaching the highest ever level of 63% in 2014 (up from 62% in 2013). Consistent with the experience of other biotech corn growing countries, the year-by-year steady increase in adoption of biotech corn reflects the significant and consistent benefits generated by biotech corn to farmers in the Philippines.

Figure 1. Increase in Hectarage of Biotech Corn in the Philippines and Proportion of Commercialized Traits, 2013-2014



Source: Compiled by ISAAA, 2014

The number of small resource-poor farmers, growing on average 2 hectares of biotech corn in the Philippines in 2014, was estimated at 415,000 up significantly by 17,500 from 397,500 in 2013.

Thirteen events of biotech corn are approved for commercial planting since 2002 (Table 1). In addition, 75 biotech crops and products are currently approved for direct use as food, feed and for processing include alfalfa, canola, cotton, corn, potato, rice, soybean, and sugar beet (Table 2).

Table 1. Approval of Biotech Corn Events in the Philippines, 2002-2014

Event	Trait	Year of Approval/Renewal
MON810	IR	2002/2007
MON863 x MON810	IR	2004
NK603	HT	2005/2010
Bt11	IR	2005/2010
MON810 x NK603	IR/HT	2005/2010
GA21	HT	2009
Bt11/GA21	IR/HT	2010
MON89034	IR/HT	2010
MON89034 x NK603	IR/HT	2011
TC1507	HT	2013
TC1507 x MON 810	HT/IR	2014
TC1507 x MON 810 x NK 603	HT/IR	2014
TC1507 x NK 603	HT	2014

*IR: Insect Resistance; HT: Herbicide Tolerance *Source: Compiled by ISAAA, 2014*

Table 2. Approvals for Food, Feed and Direct Use, 2003-2014

Crop	Number of Events
Alfalfa	2
Argentine canola	1
Cotton	7
Corn	46
Potato	8
Rice	1
Soybean	9
Sugar beet	1

Source: DA-Bureau of Plant Industry-Biotech Core Team, December, 2014

Development of Other Biotech Crops

The Philippines continues to be in the forefront of biotech research and commercialization in the region, as well as a model for science-based and thorough regulatory policy. Biotech corn has been planted since 2003 and the country is gearing up for the possible commercialization of products of public-private sector collaboration such as Golden Rice, Bt eggplant, virus resistant papaya and Bt cotton.

Golden Rice (GR) is a biotech rice biofortified with provitamin A beta carotene, being developed by the Philippine Rice Research Institute (PhilRice) and the International Rice Research Institute (IRRI). IRRI reports that as of March 2014, the research, analysis and testing of beta carotene-enriched Golden Rice continues, in partnership with collaborating national research agencies in the Philippines, Indonesia, and Bangladesh. The first generation Golden Rice (GR1) was first tested in advanced field trials in IRRI in 2008 but due to low beta carotene, a second generation of Golden Rice event R (GR2-R) introgressed into selected mega varieties were field tested during the wet season of 2010. At PhilRice, confined field tests of advanced GR2 introgressed lines were conducted from February to June 2011. Selected lines were subjected to multi-location field trials in 2012 and 2013 for three seasons to: 1) evaluate the agronomic and product performance under Philippine field conditions; 2) produce grains and other plant materials that will be used for the various tests required to complete the biosafety data requirements; 3) obtain data for environmental biosafety assessment; and 4) produce grains that will be used for a nutritional study to be conducted, if Golden Rice receives the biosafety approval in the Philippines. It was expected that regulatory data required for biosafety approval for direct use could be submitted in 2013, to be followed later for an application for propagation. An eventful uprooting of one of the sites of the Golden Rice field trial by some 400 activists took place on 9 August 2013. This was during the third season of the multi-location field trial.

Preliminary results of the conducted multi-locational trials are mixed. While the target level of beta-carotene in the grain was attained, its yield was, on an average, lower than yields from comparable local varieties already preferred by farmers. Thus, an important goal of the multi-location trials was to test whether the agronomic performance of the new rice variety would be acceptable to farmers. Hence, the new objective of increasing yield became the focus of the current research to include other versions of GR2 such as GR2-E and others. At IRRI, the Golden Rice trait is being bred into mega varieties to get suitable advance lines, and once attained, the series of confined field trials will resume. IRRI and its research partners remain committed to developing a high-performing Golden Rice variety that will

benefit both farmers and consumers. The important mission of the Golden Rice project – to contribute to improving the health of millions of people suffering from micronutrient deficiency – demands that every step and aspect of the scientific study of Golden Rice produces good results. IRRI and all the participating organizations continues to rigorously follow all biosafety and other regulatory protocols in continuing the research to develop and disseminate the Golden Rice (IRRI, 24 March 2014).

The project is being supported by the Bill and Melinda Gates Foundation through a grant to IRRI. Other support came from the Rockefeller Foundation, USAID, and the Philippine DA Biotechnology Program.

The fruit and shoot borer resistant Bt eggplant project is led by the Institute of Plant Breeding of the University of the Philippines at Los Baños (IPB-UPLB), with the technology donated royalty-free by the Maharashtra Hybrid Seeds Company Limited (MAHYCO) through a sublicense agreement. The proponents already completed the field trials of promising open-pollinated and hybrid varieties in the approved multi-location trial sites in Luzon and Mindanao in October 2012. The multi-location field trials have already generated most of the required data for biosafety assessment by the Philippine regulatory agency. Field trials of isoline non-Bt hybrids and open-pollinated varieties were conducted in six trial sites in Luzon, Visayas and Mindanao for purposes of selecting candidate lines for variety registration to the National Seed Industry Council. Data generated from these trials clearly indicated that Bt eggplant provides an environmentally benign alternative to the current excessive use of chemical insecticide in local eggplant production. In addition, higher marketable yield potential and lower percentage eggplant fruit and shoot borer-damaged fruits were obtained compared to the hybrid check.

In May 2012, Greenpeace and other anti-biotech environmentalists and politicians lodged a petition to the Supreme Court calling for the imposition of Writ of Kalikasan and issuance of a Temporary Environmental Protection Order (TEPO) opposed to the conduct of the Bt eggplant field trials. The respondents include government agencies such as the Environment Management Bureau of the Department of Environment and Natural Resources and the Bureau of Plant Industry and Fertilizer and Pesticide Authority of the Department of Agriculture. Other respondents include the University of the Philippines Los Baños, UPLB Foundation, Inc., and ISAAA, to name a few. The petition was remanded by the Supreme Court to the Court of Appeals which heard the case, with the respondents jointly filing arguments against the petition. After almost a year of proceedings, the Court of Appeals issued a decision on 17 May 2013 granting the petition for a Writ of Kalikasan against the Bt eggplant field trial. It principally anchored its decision on the precautionary principle, and directed the respondents to cease and desist from conducting the field trials.

The respondents filed a motion for reconsideration. But on September 20, 2013, the Court of Appeals re-affirmed its previous decision. The respondents then appealed the case to the Supreme Court and are doing their best to attain an immediate and acceptable conclusion.

According to academia, industry and local government sources, the Bt eggplant case and the vandalism of the Golden Rice tests have provided the incentive for local stakeholders and scientists to coordinate educational outreach activities to promote the safe and responsible use of biotechnology.

Biotech papaya with delayed ripening and papaya ring spot virus (PRSV) resistance, also being developed by IPB-UPLB, has already been tested in confined field trials in 2012. Another field trial is being planned to be conducted in a larger area, pending release of regulatory approvals and research funds.

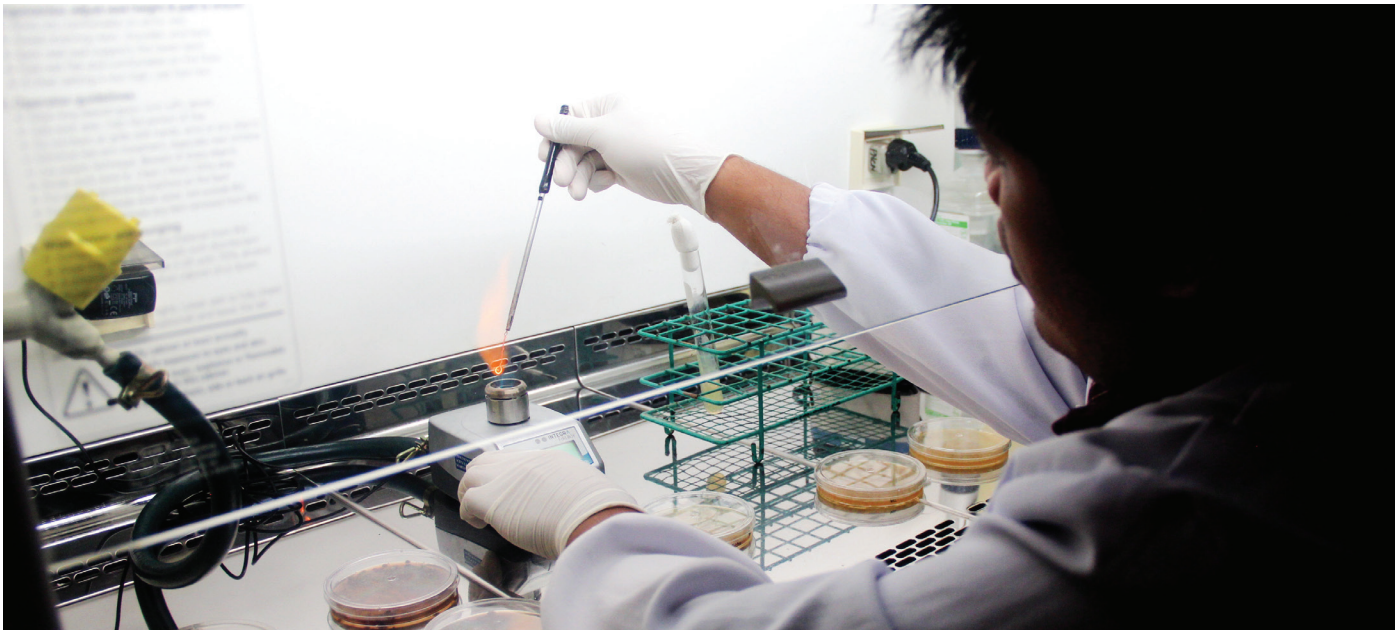
Bt cotton is being developed by the Philippine Fiber Development Administration (PhilFIDA, formerly the Cotton Development Authority).

The technology, provided by Nath Biogene Ltd. and the Global Transgene Ltd. from India was tested for the first time in a confined field trial in 2010, started multi-location field trials in 2012, and in 2013, data to complete regulatory dossiers, were collected for commercialization purposes within two years' time. In mid-2014, the bioefficacy of Bt cotton hybrids against the cotton bollworm were reaffirmed in another field trial.

Initiatives in other crops include the development of a virus resistant sweet potato through collaborative activities between the Visayas State University (VSU) and IPB-UPLB and the initial efforts to generate transgenic lines of virus resistant abaca (*Musa textilis*) by the Fiber Industry Development Authority (FIDA) in collaboration with the University of the Philippines. The Philippine Department of Agriculture -Biotechnology Program Office and the Department of Science and Technology have both been very supportive of research and development activities on biotech crops and have been eager to support products that will emerge from the public sector R&D pipeline for commercialization in the near term.

Institutions Conducting Biotech Research

Research and development on biotechnology was recorded as early as 1979 with the establishment of the National Institute of Molecular Biology and Biotechnology (BIOTECH, formerly National Institutes for Microbiology and Biotechnology) at the University of the Philippines Los Baños campus. The UP System then established three similar institutes in the UP campuses in Manila, Diliman, and Iloilo, strengthening research and development in agriculture, medicine, industry and fisheries. Other government-funded research agencies, and state universities and colleges slowly developed their biotech capacities in the mid-90s. The government research agencies include the following Department of Agriculture-attached research agencies: PhilRice, Philippine Coconut Authority (PCA); PhilFIDA; the Department of Science and Technology (DOST) and its attached agencies: Industrial Technology Development Institute (ITDI), and Philippine Nuclear Research Institute (PNRI); the Department of Health (DOH); and the Department of Environment and Natural Resources (DENR). State universities and colleges include the Central Luzon State University, Benguet State University and the Visayas State University (Panopio and Navarro, 2011). Some private universities have also developed biotech research capacities for thesis students by the mid-2000s such as Ateneo de Manila University, University of Sto. Tomas, and De La Salle University.



Biotech Regulation

Philippine biotechnology regulations are well respected for being thorough, science-based, and transparent, and are looked upon as a model by other developing countries. The Philippine biotechnology regulatory system was formalized through the issuance of Executive Order No. 430 in 1990, establishing the National Committee on Biosafety of the Philippines (NCBP). The biotechnology regulatory regime is embodied in the DA's Administrative Order No. 8 (DA AO 8) issued in April 2002. To ensure human, food, feed, and environmental safety, DA AO 8 requires science-based risk assessments to be conducted in accordance with internationally accepted bodies such as the Cartagena Protocol on Biosafety (CPB), the Codex Alimentarius Commission, the Organization for Economic Cooperation and Development, and the Food and Agriculture Organization of the United Nations. DA AO 8 derives legal basis from the Philippine Plant Quarantine Law of 1978, the Agricultural and Fisheries Modernization Act of 1997, existing mandates of both the Bureau of Animal Industry and Fertilizer and Pesticide Authority, and Executive Order No. 340 of 1990. The Bureau of Animal Industry (BAI) evaluates feed safety, while the Bureau of Agricultural and Fishery Products Standards handles food safety concerns. Quarantine and environmental issues fall under the responsibility of the Bureau of Plant Industry (BPI), while the Fertilizer and Pesticide Authority handles the applications of pest-protected plants.

A unique feature of Philippine regulations is the conduct of a parallel review by the Scientific and Technical Review Panel (STRP), an independent body of experts from the academia and the local scientific community. Four permits are issued by DA AO 8, namely: 1) Application to Field Test; 2) Application to Release for Propagation; 3) Application for Importation for Direct Use; and 4) Petition for Delisting. Permits to import for contained use fall under the purview of the NCBP. The NCBP is composed of several agencies including the DA (as a member), and is chaired by the Secretary of the Department of Science and Technology (DOST). The DA-Office of the Undersecretary for Policy and Planning is responsible for crafting, implementing, and oversight of the overall regulatory regime and biotech policy, in consultation with the NCBP. Draft policies are referred to the DA Secretary for approval. The DA also coordinates biotech regulatory activities and interacts with a scientific multidisciplinary group – the Biotechnology Advisory Team, comprised of respected scientists. BPI is the lead agency in regulating biotech crops, drawing scientific support and advice from the NCBP, the other concerned agencies, and the STRP.

In 2006, Executive Order 514 was issued, further strengthening the NCBP and establishing the National Biosafety Framework. In 2008, the country launched its national biosafety clearinghouse, BCH Pilipinas, to serve as the Philippine node of the Biosafety Clearing House (BCH) mechanism established under the CPB.

Benefits from Biotech Crops

The Philippines, which grows approximately 2.5 million hectares of corn, is still the only country in Asia to approve and grow a major biotech feed crop in 2014. Moreover, the Philippines achieved a biotech mega-country status with biotech corn in 2004, i.e. 50,000 hectares or more. Asia grows 32.2% of the global 184 million hectares of corn, with China itself growing 32 million hectares, plus significant production in India (9.5 million hectares), Indonesia (4), Philippines (2.6), Vietnam (1.2), Pakistan (1.2) and Thailand (1) (Food and Agriculture Organization, 2014).

The benefits of biotech corn to Filipino farmers' livelihood, income, and health, and to the environment have been well studied and documented. Farms planted with biotech corn in the Northern Philippine provinces have significantly higher populations of beneficial insects such as flower bugs, beetles, and spiders than those planted with conventional hybrid corn (Javier et al., 2004, as cited in James, 2014).

The farm level economic benefit of planting biotech corn in the Philippines from 2003 to 2013 is estimated to have reached US$470 million. For 2013 alone, the net national impact of biotech corn on farm income was estimated at US$92 million (Brookes and Barfoot, 2015).

Other studies report that gain in profit at the farmer level was computed at Php10,132 (about US$180) per hectare for farmers planting Bt corn with a corresponding savings of Php168 (about US$3) per hectare in insecticide costs (Yorobe and Quicoy, 2006). In another socio-economic impact study (Gonzales, 2005), it was reported that the additional farm income from Bt corn was Php7,482 (about US$135) per hectare during the dry season and Php7,080 (about US$125) per hectare during the wet season of the 2003-2004 crop year. Using data from the 2004-2005 crop years, it was determined that biotech corn could provide an overall income advantage that ranged from 5-14% during the wet season and 20-48% during the dry season (Gonzales, 2007). In a more recent study covering crop year 2007-2008, biotech corn increased the average net profitability in 9 provinces by 4-7% during the wet season and 3-9% during the dry season (Gonzales, 2009). Overall, the four studies that examined net farm income, as well as other indicators, consistently confirmed the positive impact of biotech corn on small and resource-poor farmers and corn producers generally in the Philippines.

The projected benefits from other biotech crops nearing commercialization, such as the Golden Rice could be higher than corn at US$88 million per year (Zimmermann and Qaim, 2004).

The benefits from Golden Rice are derived from gains due to reduced mortality and reduced disability. On the other hand, benefits from Bt eggplant are projected at almost Php9 million (about US$200,000, Francisco, 2007). Benefits from Bt eggplant include higher income from higher marketable yields, reduction in insecticide use by as much as 48%, and environmental benefits associated with less insecticide residue in soil and water, and the protection of beneficial insects and avian species. Bt eggplant adoption could result to savings of about Php2.5 million (about US$44,414) in human health costs, and Php6.8 million (about US$120,805) in aggregated projected benefits for farm animals, beneficial insects, and avian species (Francisco, 2009). For the virus resistant papaya, a substantial increase in the farmer's net income is projected, with expected returns of up to 275% more than conventional papaya (Yorobe, 2009).

Other recently completed ex-ante studies in Bt cotton and abaca (*Musa textilis*) indicate significant potential social and economic benefits. These studies were conducted to assist Philippine policy makers to decide whether the development and commercialization of these biotech crops in the country is a sound investment. Chupungco et al. (2008) has concluded that Bt cotton commercialization in the Philippines will improve yield by about 20% with a return on investment (ROI) of 60-80%, compared to 7-21% when using conventional varieties. The biotech abaca resistant to abaca bunchy top virus (ABTV), abaca mosaic virus (AbaMV) and bract mosaic virus (BrMV), were estimated to be able to provide an additional increase in yield of 2.5 tons per hectare and 49.36% ROI after 10 years (Dumayas et al., 2008).

In summary, the Philippines has already gained US$470 million, provisionally from biotech corn in a short span of ten years, 2003 to 2013 (Brookes and Barfoot, 2015, Forthcoming), and is advancing the adoption of the corn stacked traits, IR/HT. In 2014, stacked traits in corn represented around 90% of the total biotech corn area in the Philippines. Future prospects look encouraging, with "home grown" biotech products likely to be commercialized in the next 2 years including Bt eggplant in 2014/15 and with a reasonable possibility that the Philippines might also be the first country to commercialize Golden Rice.

Adoption and Uptake Pathways of Biotech Crops

ISAAA commissioned a study titled *Adoption and Uptake Pathways of GM/Biotech Crops by Small-scale, Resource-poor Filipino Farmers* (Torres, et al., 2013). A synthesis of the results in the Philippines is presented below.

A study on the adoption and uptake pathways of biotech corn among small-scale, resource-poor Filipino farmers; and the changes these have brought to the farmers' lives was conducted in three provinces in the Philippines where the crop is mainly cultivated.

The study revealed that farmers have been planting biotech corn for an average of 7 years, with 46.5% having adopted the crop from 6 to 10 years now. Farmers gave multiple reasons for adopting biotech corn. Among those that stood out and considered facilitating factors for adoption in decreasing order of importance were: high income, pest resistance, good grain quality, available financing, lesser production cost, and availability of seeds.

Farmers have multiple sources of information on biotech corn, but these were dominated by interpersonal sources. Seed suppliers/traders ranked as the topmost (56.2%) information sources; followed by DA technicians (34.0%); and then by their co-farmers (30.3%). It should be clarified that while seed suppliers/traders were considered primary information sources, it was their co-farmers who influenced them to adopt biotech corn.

Adoption Pathway of Biotech

Using a participatory rural appraisal tool *Innovation Tree*, information about biotech corn was found to be first brought to the farmers' attention by the seed company technicians. Through community meetings, the technician explained about biotech corn's advantages especially in terms of higher income and tried to prove this by establishing a demonstration farm in the village. Farmers were asked to observe the performance of the crop in the demo farm. Based on their own observations and learnings, farmers decided to try the corn variety themselves. Seed company technicians connected the farmers to financiers in the area; or the farmers themselves, through their local networks, sought out these financiers. Local-based cooperatives also participated in the endeavor by offering loan for capital or inputs at low cost to the farmers. In most cases, the financiers provided the entire needed farm inputs in cash or in kind (seeds, fertilizers, etc.) on loan basis. They also acted as the buyers/traders of the farmers' harvest at a price they set for farmers.

As farmers in one community succeeded in the biotech venture, they shared their experience with fellow farmers in other communities through word-of-mouth. Farmer-relatives and farmer-friends were the typical contact points. The "good news" then spread out to other nearby communities.

Seed company technicians, financiers/traders, and, if present in the area, cooperatives also expanded their reach to these new areas and performed the same roles. Within each community, farmers continuously shared among themselves their experiences, good or bad, and tried to learn from their own encounters with the biotech corn. A common element in their stories was the fact that their income increased two- or three-fold as they adopted the biotech corn variety. An overwhelming majority (93.2%) expressed their intent to continue adopting biotech corn and this was primarily due to both material and non-material benefits they derive from it.

Problems Encountered by the Farmers

Problems encountered by biotech corn farmers include the occurrence of fungal/bacterial diseases and other pests (31.8%); expired seeds that did not germinate (19.8%); high cost of inputs (16.1%); low buying price of traders (8.1%); and lack of own capital (6.8%). Lack of capital is also a problem since few farmers who were not able to repay their loan were "blacklisted" by their financiers. With no capital, they could no longer avail of the expensive inputs, so they stopped. Others were discouraged by their initial try with seeds that did not germinate; so they backed out. Still others opted to go back to planting their white corn variety which according to them requires lesser capital, takes shorter time to harvest, is edible for human food, and enables them to earn equal to or even higher than the biotech corn. They can also easily produce the needed seeds for their next cropping season from their harvest.

Recommendations for Increased Adoption

Based on the findings of the study, recommendations to enhance adoption and uptake of biotech corn among small-scale and resource-poor farmers may involve the provision of material inputs, technical assistance, and policies that would support farmers' adoption and uptake of biotech corn.

Farmers exhibit strong belief in themselves and are inspired by the success of their fellow farmers. Hence, farmer-to-farmer education must be promoted and sustained. People are more likely to follow the behaviors modeled by someone with whom they can identify with. The more perceived commonalities and/or emotional attachments between the observer and the model, the more likely the observer will learn from the model. Also, farmers need to be assisted in addressing the persistent crop pests and diseases other than borers that continuously attack their corn. Seminars may be given by experts on this concern to enable the farmers to understand and solve the problem on their own. Local agriculturists should also be informed so that they could accordingly assist the farmers.

Since the technology starts with the seeds, the government agencies such as Department of Agriculture (DA) may need to put up regulatory mechanisms so that private companies supplying the seeds would comply with certain standards. Right of the farmers to obtain good seed quality must be ensured and protected. Some policies and guidelines addressing seed expiry and other broader concerns such as the price and distribution of seeds and proper labeling of varieties need to be put in place. The government also needs to intervene so that a minimum buying price of produce is set. This is to prevent the traders from abusing the farmers, especially those indebted to them in terms of capital. As the study revealed, the market and buyers are very important to avoid a glut in the face of bountiful harvest of biotech corn. While this role is being performed very actively by the traders, the government may explore setting up of alternative markets with competitive buying price of corn, so that farmers will not be trapped in a no-choice-except-trader situation.

To address the perennial problem of farmers' indebtedness to financiers/traders, an in-depth study on this practice and its alternatives should be undertaken. It would help analyze who the traders are, their unwritten codes and loaning systems, dynamics of their relations with farmers, co-traders, and other actors in the supply chain, among others.

Statements of Support from Stakeholders

Lydia Lapastora

Over the years, biotech crops have been considered safe and nutritious as conventional crops, as attested by international bodies such as the World Health Organization, the Food and Agricultural Organization, 111 Academies of Science all over the world, American Medical Association, European Food Safety Authority, and European Commission among others. In addition, independent reviewers of studies on safety of biotech crops revealed the food, feed and environmental safety of biotech crops. Despite these, critics of biotech crops mislead the public resulting to confusion and misunderstanding. This is also true in the Philippines with the attack and uprooting of two Bt eggplant field trials and one for Golden Rice, long-running court case against Bt eggplant field trial that delays biotech eggplant commercialization, and the anti-propaganda campaign against Golden Rice.

Stakeholders in the Philippines however, have united to jointly face all these intervening negative propaganda and activities. Noted experts in the National Academy, universities, the government, research institutions, as well as farmers have been giving statements of support to biotechnology in general and to Bt eggplant and Golden Rice in particular. Some of these statements have been presented and published and are collected and presented below.

From Scientists and Government Agencies

Dr. Emil Javier, former president of UP and the National Academy of Science and Technology (NAST). "All our Presidents, starting with Ferdinand Marcos, and formalized by Executive Order by Cory Aquino, to the present administration of Benigno Aquino III have adopted an enlightened national policy of safe and responsible use of modern biotechnology. We were so much ahead among developing countries in training people, establishing institutions, and instituting a regulatory framework so much so that our neighbors like Thailand, Indonesia and Vietnam and several countries in Africa, have sent their own regulators to study and observe how the Philippine biosafety system works" (Javier, 2014).

Department of Agriculture Undersecretary Segfredo Serrano. "We have more challenges. Before, we just talk about food security which is a forever issue in this country. But beyond productivity and competitiveness, we need to be able to adapt to the adverse impacts of climate change. And these are inevitable adverse impacts. This double urgency adds more constraints to attaining our food security and productivity goals. And therefore because of these, we have a renewed and scaled up urgency to attain and sustain food security. I think this is where biotechnology will be a lot of help" (SEARCA BIC, 11 May 2012).

Philippine Food and Drug Administration Acting Director Dr. Kenneth Hartigan-Go. "As the National Competent Authority, the FDA supports the robust science-based evaluation system of CODEX Alimentarius Commission using data and information from field trials as well as laboratory tests. For processed food, the main focus of food safety review is on the objective characteristics of the product and on any health or nutritional claims. The focus of evaluation is on the food product and not on the technology used to produce the product." She added that "All food derived from GM crops in the market have met international food safety standards and are as safe as and as nutritious as the food derived from conventional crops for direct use as food, feeds and for processing" (Crop Biotech Update, 26 June 2013).

Dr. Emiliana Bernardo, retired UPLB professor and entomologist. "Ten years of Philippine experience on commercial GM/biotech crops, with hundreds of thousands of Filipino farmers having used the technology, and almost two million cumulative hectares of farms grown to GM/biotech crops in the world have provided solid, unequivocal evidence that the approved GM/biotech crops protect the environment and the welfare of farmers" (SEARCA BIC, 11 May 2012).

Dr. Candida Adalla, former Chair of the DA Biotechnology Program Office. "Because of the consistent biotech policies implemented in the country, agriculture is continuously growing with significant contributions from biotech crop…When we talk about biotechnology, it should be in the context of technology, in the context of science, not in the context of emotion or prediction (Crop Biotech Update, 4 April 2012). "Biotech crops underwent rigorous and extensive study with enormous investment…Modern biotechnology is for skillful, ingenious, and progressive farmers" (Crop Biotech Update, 3 October, 2012).

Mr. Salvador Umengan, former National Corn Competitiveness Board Executive Director, said "We now have very little or zero (corn) importation because of increased competitiveness. A lot is due to biotechnology seeds. That pulled up our production" (SEARCA BIC, 2013).

Dr. Antonio Alfonso, PhilRice Golden Rice project leader and former DA BPO Coordinator. "It is not enough that we develop something good. We should also help in delivering it to those who are most in need" (SEARCA BIC, 2011).

Dr. Gil C. Saguiguit, Jr., SEARCA Director. "Being rational individuals, we should go for scientific evidence, rather than anecdotal basis for choosing between the pros and cons of biotech" (SEARCA BIC, 2013).

Dr. Saturnina Halos, DA Biotech policy adviser. "They say that farmers should have the right to organic farming. Then, farmers should also have the right to GM-based farming…so, there really should be coexistence. It really depends on the farmer's situation" (Crop Biotech Update, 11 February 2011).

From Biotech Corn Farmers (Farmers First, 2013)

Delson Sonza of Sara, Iloilo. "Farmers from our province are one of the early adopters of biotech maize. Iloilo is a mountainous province and some of its hilly grasslands are idle, thus there was a need to convert these grasslands to farms. Before biotech was commercialized in the country, farmers only earn during rice farming season (May-July), sugarcane planting season (October-January), and harvesting of rice and sugarcane (October -December).

In 2005, when glyphosate tolerant was introduced in the Philippines, dialogues with farmers in Iloilo were conducted to convert our grasslands into farms. With farmers convinced to adopt the biotech crop, technology transfer initiatives took place. The adoption of biotech was able to uplift our lives as farmers. This gave us an income of roughly Php30,000 (US$750) per hectare which is far higher than income derived from conventional maize. Also, we no longer need to plow and weed, hence, we have more time to find other means of livelihood. Because of higher income, we can now afford to buy appliances, renovate our houses from nipa hut to concrete shelters, and acquire service vehicles such as motorcycles or even a truck. We can also send our children to school and we can even invest in post harvest equipment."

Rosalie Ellasus of San Jacinto, Pangasinan. "I tried Bt maize after attending the Farmers' Field School. Our speaker had been telling us that we should always choose good seeds. A seed company eventually conducted a Bt maize trial in a nearby town. During that time, infestation of ordinary in our place was so high. But with the Bt maize planted for the trial, I really saw that crops were so healthy. There was not even a trace of pests considering that they did not apply insecticide. Furthermore, you no longer need to visit your field everyday and this gives you peace of mind. The production cost will be lessened as well compared to conventional farming and the yield will be more. This is why I adopted Bt maize."

Pablito Lobendino of Villapaz, Naguillan, Isabela. "Seed company technicians introduced biotech maize varieties to us. They said these varieties are good to plant because it minimizes the cost of farming especially in removing weeds. When we tried biotech maize , it indeed reduced our production cost. The yield is also higher. We still plant ordinary maize from time to time when the Department of Agriculture (DA) provides seeds but farming inputs are expensive. When we were not yet planting biotech seeds, there was barely money left because you spend a lot particularly to remove weeds. When we started to plant biotech seeds, we earned a decent profit.

Indalencio Supan of Balitucan, Magalang Pampanga. "I have been farming since I was 20 years old and now I am already 73 years old. Before Bt

maize was commercialized, I was planting sweetcorn but the crop is prone to borer infestation. I learned about Bt maize through seed technicians from the government and private seed companies. They encouraged us to plant this variety to increase our earnings. We were convinced because Bt maize really yields more than the conventional variety as the latter is usually eaten by the borer. We started to plant Bt maize in 2003 and we are still planting it up to now. Because of planting Bt maize, we were able to buy a house and lot, farm machineries and even farm land. But we still want to learn more from seed technicians during seminars. We also look forward to government support especially in terms of financial assistance so that we can minimize borrowing from traders."

Aquino Gozun of Lacmit, Arayat, Pampanga. "We started to plant Bt maize in 2004. The Office of the Provincial Agriculturist organized a Farmers' Field School in our place where they also conducted farm demonstrations. I was one of the cooperators in their farm demo. That was the very first time I planted Bt maize. I initially saw the big difference between Bt maize and conventional maize. The pests always eat the conventional that's why we sometimes end up with no earning at all. When Bt maize was introduced to us, it brought good results to farmers as we no longer need to apply insecticide and we even have more yield. This gives us an income twice more than what we get from the conventional maize. That's why almost every farmer in my place is planting Bt maize."

Aurea Raso of Macayug, San Jacinto Pangasinan. "We have attended a lot of seminars on biotech farming from different seed companies. We were oriented on proper way of cultivating the crop, its traits, and its benefits. There were also farm demonstrations from seed companies and encouragement from progressive farmers in our village like Rosalie [Ellasus]. This is why we decided to try Bt maize. Bt maize is really good because we no longer have to spray insecticide to control the pests. With ordinary maize, you really need to apply insecticide because they are vulnerable to pests. There are also varieties which can tolerate herbicide. Adopting biotech maize indeed helped my family. When harvesting period comes, we are confident that we will have a sure earning."

Corazon Cabasag of Sta. Rosa, Iguig, Cagayan. "We started to plant Bt eight years ago when the government introduced the variety to us. They said that Bt cannot be infested by borers. Even if the seed's price is higher than ordinary maize, they said Bt's outcome will be far better. Then we attended their farm demo. Since then, we started to plant this variety. Bt maize indeed gives more yield than the ordinary since the latter is prone to borer infestation and you also have to apply insecticide. You will really see the big difference between ordinary maize and Bt maize. Because of Bt maize, we were able to acquire a big thresher."

Faustino Astrero Jr. of Banga, South Cotabato. "In our place, large seed companies organize a harvest festival for farmers. Aside from free food, they also give us samples of their products and they conduct seminars on Bt maize. When I started to plant Bt maize, I felt more relaxed because there is less labor in planting Bt unlike with conventional maize where you still need to till the land. One no longer needs to spray insecticide. It also reduces my time for maize farming and I can spend more time with my other crops. We also get higher yield from Bt maize."

Opinions on the Philippine Court of Appeals order to permanently stop all field trials of Bt eggplant:

Dr. Emil Q. Javier, former president of the University of the Philippines (UP) and the National Academy of Science and Technology (NAST) said, "The CA order was a perverse application of the Writ of Kalikasan which intent is to assure the Filipino people of balanced and healthful ecology because this was precisely what the Bt talong research was trying to accomplish." He added that "Contrary to what Greenpeace and GMO technology detractors claim, the UN World Health Organization, the US National Academy of Science, the British Royal Science Society and many other prestigious National Science Academies consider consuming foods from GM crops 'no riskier' than consuming same foods from crops modified by conventional plant breeding techniques" (Javier, 2013)

(On why the science community seem to be so perturbed over the imposition of the writ of kalikasan by the courts on the further development of Bt eggplant) Dr. Javier said, "As concerned Filipino scientists we are keenly aware of the rapid progress being made all over the world in the development of new products and processes using genetic engineering. Many of these innovations can have profound impacts on farm productivity, farmers' incomes, health and nutrition, integrity of the environment and economic competitiveness. We have the training and expertise to exploit these opportunities to advance our national interests. Unfortunately, the application of the writ of kalikasan on agricultural biotechnology research is tying our hands so to speak, and we are made to hopelessly watch the parade pass us by" (Javier, 2014)

Biotech Coalition of the Philippines President and Dean of the UP Manila College of Public Health, Dr. Nina Gloriani, also expressed her disappointment over the ruling: "Confined field trials allow our scientists to better understand how biotech varieties grow in real-life conditions. Researchers have long taken government guidelines for confined field trials very seriously and have worked to minimize any risks to the environment and human and animal safety...Applicants who wish to conduct confined field trials have to follow strict guidelines and best industry stewardship practices. Our current biosafety laws already provide for a high standard of protection for the environment and human health, and a track record of more than a decade of field trials and commercialization of Bt" (Crop Biotech Update, 17 June 2013).

Dr. Desiree Hautea, UPLB scientist opined, "We're very positive that Bt eggplant is safe. It can increase yield of farmers, it could provide better, healthier food...We should not lose track of the bigger challenge which is to provide adequate, safe, and affordable food to all Filipinos" (SEARCA BIC, 6 October 2011).

Dr. Emiliana Bernardo, retired UPLB professor and entomologist said, "The very basic question is 'which is safer?' The present practice or the alternative, the Bt eggplant which is rigorously evaluated by experts? Is bathing the unharvested eggplant fruits in chemicals, which would end up in dinner tables of people, safe? The insecticide exposure of our farmers and environment is too much. The farmers, the consumers, the eggplant as food, and the environment—these are all affected by the chemical insecticides. We have to be practical" (SEARCA BIC, 11 May 2012).

Dr. Ruben Villareal, academician said, "Biotechnology is a tool that could really develop varieties that would be advantageous to farmers, consumers, and the environment. We are actually very fortunate that the technology is available. With a concrete regulatory system in place, and technical capacities available, there is really a future for Bt eggplant to bring its potential benefits to our farmers" (SEARCA BIC, 27 June 2011).

Future of Biotech Crops in the Philippines

The Philippines has been commercializing biotech corn for the past 12 years. Attempts to commercialize other biotech crops are conducted with focus on Bt cotton, and public sector biotech crops: Bt eggplant, Golden Rice and delayed ripening and papaya ringspot virus (PRSV) resistant papaya. With the current impasse on Bt eggplant, there is a delay in its commercialization. Thus, stakeholder statements on biotech crops enumerated above are essential in pushing for government action to commercialize new crops and traits.

Responding to various issues and concerns of biotech critics is also necessary in influencing decision makers in crafting policies that will allow biotech adoption and improving public perception. To achieve this, scientists and science communicators need to be unified, rationalized and institutionalized, as soon as possible. Key stakeholders that influence consumers and the general public such as policy makers, farmers and the media need to be reached effectively, providing them with science-based information on the science, benefits and safety of biotech crops. The strategies need to be simple, understandable, effective and conducted in a sustainable and continuous manner, noting that the critics have more funds and play around with emotions to gain sympathy from the general public.

Biotech researches in other crops including banana, abaca, rice, tomato, among others, are being conducted in research institutions to address problems of food security and climate change.

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