Impact of Bt corn(Mon 810) in the Philippines: an overview

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Introduction

Safety studies of crops derived from novel biotechnology such as genetic engineering start from the laboratory as the product is being developed and even after the approval for the release of the product to the environment for use as food, feed and propagation.

In the Philippines, the Department of Agriculture has approved the release of Bt corn MON 810 on December 2002. Bt corn is a technology used to control the population of the Asian corn borer, a major insect pest of corn, which can decrease yield from 20-80%. The technology involves the transfer of a gene from a common soil bacterium, *Bacillus thuringiensis (Bt)*, to a corn plant. The gene produces a protein that is lethal to Asian corn borer. Microbial *Bt* insecticides which have been used since the '70s have an established history of safety.

Recognizing the different local conditions in the Philippines, selected scientific safety studies are conducted locally to supplement the available wealth of information on biosafety of biotech crops. These studies dealt mainly on the environmental impact, food safety, and socio-economic impact of Bt corn.

This paper aims to provide a summary of the research conducted by Filipino scientists on safety assessment of Bt corn.

Environmental impact. Research on this aspect aimed to assess the impact of Bt corn on key non-target insect populations and on insect diversity.

Three independent studies were conducted in 2001-2002 wet cropping season at Isabela and Camarines Sur and two studies done during the 2003-2004 planting seasons in Isabela, Camarines Sur and Bukidnon areas. Noting that Bt corn successfully controlled infestation of Asian corn borer, researchers also reported the abundance of natural enemies both in Bt and non-Bt corn fields. They concluded that Bt corn appeared not to have any adverse effect on the insect diversity, insect community structure, and population of insect predators and herbivores.

The 2001-2002 study reported that more beneficial insects and natural enemies are found in Bt corn fields than in non-Bt corn fields sprayed with chemical insecticides. Bt corn also showed less infestation of beetles. Moreover, there were as many kinds of insects (phytophagous, neutrals, predators and parasitoids) in fields planted with Bt corn and non-Bt corn. Using the Shannon index to measure species diversity, results showed that in Bt- and non-Bt corn fields insect diversity is generally the same. These findings suggested that Bt corn does not appear to have any harmful effects on insect diversity, guild structure and abundance of natural enemies or on the population of non-target organisms (Reyes et al, 2004).

After the approval of Bt corn for release to the environment, several farmers have adopted the technology. With more number of Bt corn farms as sample sites, a study was again conducted to determine the impact of Bt corn on target organisms during the 2003-2004 planting seasons. The study reported the abundance and presence of several predatory insects, natural enemies and parasitoids in both Bt and non-Bt corn fields in

Camarines Sur and Bukidnon. These findings suggested that Bt corn does not disrupt insect community structure. Further, at the population level, Bt corn does not have a negative effect on the abundance of key insect predators and herbivore while at the community level, Bt corn does not have a negative effect on insect diversity (Alcantara, 2004).

Another study was conducted in 2003 in order to investigate the impact of Bt corn MON 810 on the effectiveness of *Trichogramma* and on the population of other natural enemies of Asiatic corn borer. A higher number of *Trichogramma* egg parasitism and more numbers of predatory flower bug, coccinellid beetles and spiders were observed in Bt corn plants that in its isohybrids. The findings suggested that the high natural enemy population was able to regulate the impending high Asiatic corn borer population (Javier et al, 2004).

Food and feed safety. Two studies have been conducted, one on the safety of Bt corn as feed to broilers while the other study dealt on the effect of Bt corn on grain quality.

Bt and non-Bt corn isohybrids have similar crude protein content. The Bt corn varieties were as digestible and provided similar energy levels as the non-Bt corn. Broilers fed diets containing Bt corn and non-Bt corn showed comparable feed consumption, body weight gain and feed conversion efficiency. This indicated that the Bt corn Yieldgard varieties and the non-Bt corn varieties are nutritionally equivalent. Regardless of the diets given, the meat of the broilers was comparable in color, off-flavor, juiciness and tenderness. The dressing percentage (with and without giblets) was also similar for both types of corn. Researchers concluded that Bt corn varieties are as

safe and nutritious as their near isohybrids and commercial hybrid for feed when fed to broilers (Querubin et al, 2003).

Leaves with pinholes are signs of ACB infestation. It also tunnels through the stalks and earn of the corn plant. These holes serve as entry point for microorganisms like fungi. Studies from other countries reported a reduction of mycotoxin levels with Bt corn. Mycotoxins are secondary metabolites produced by fungi which are known to cause health problems in man and animals. To determine the effect of Bt corn on fungal microflora under local conditions, a study was conducted in 2001-2002 wet and dry season croppings. The researchers reported that fungal species of microflora isolated from corn grains were similar-*Aspergillus, Fusarium,* and *Penecillium* species suggesting that Bt corn hybrids had no adverse effect on fungal microflora. Bt hybrids also reduced aflatoxin level compared with their non-Bt counterparts under warm and dry environment. The level of aflatoxin was considerably below the limit of 20 parts per billion (ppb) which makes Bt corn hybrids safe for human and animal consumption. The non-Bt counterparts and the commercial hybrid, on the other hand, have significantly higher aflatoxin levels that are higher than 20 ppb (Esteves et al, 2003).

Economic impact. In a study conducted in 2003-2004 planting seasons in Isabela, Camarines Sur, Bukidnon and South Cotabato, researchers reported that Bt corn farmers incurred additional increased yield by 37%. Despite the higher cost of seeds (twice as much as conventional hybrids), farmers were able to reduce insecticide cost by 60% or P168.00 per hectare and a profitability of P 10,132.00 per hectare or 88%. Further analysis showed that the Bt corn technology help reduced per unit cost of production by

P 0.23 per kilo. The aggregate welfare benefit by corn farmers was estimated to be P46M during the wet and dry seasons of 2003-2004, and a gross income of P43M (Yorobe and Quicoy, 2004).

Social impact. One year after the government's approval for the release of Bt corn to the environment, the total area planted to Bt corn is about 1 percent of the total yellow corn area or about 20,000 hectares. In a study conducted in Isabela, Camarines Sur, Bukidnon and South Cotabato, researchers found out that risk, education, training, and insecticide expenditures influence the adoption of Bt corn by farmers. The major perceived risks included health, environment and costs and reducing such risk would likely increase the adoption by 38 times. The profiles of Bt corn adopters were younger farmers, better educated, spend less on insecticides and presently discouraged by people or groups, and with less risks perceived on adoption. The major sources of Bt corn are fellow farmers and friends. The researchers also reported that the presence of detractors or people/groups discouraging the use of Bt corn even favored adoption (Yorobe and Sumayao, 2004).

Conclusion

The researches previously cited suggested that Bt corn MON 810 is a technology that is safe for consumption either as food and feed. It did not adversely affect non-target organisms. Bt corn adopters have also shown increased productivity and income in terms of higher yield and improved profitability, respectively. The Bt corn technology provides an option for increasing farm productivity. A good extension support system is needed in

order to provide factual information on the benefits and risks of biotech corn and biotechnology, in general.

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