Projected Impacts of Fruit and Shoot Borer Resistant Eggplant in the Philippines

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Eggplant (*Solanum melongena*, L.) is one of the most economically important vegetable crops in the Philippines. It accounted for 28 percent, or 177,000 metric tons, of the total volume of vegetables produced, in 2003. The value of eggplant production is the highest among Philippine vegetables at PhP1.8 billion (USD32.7 million).

The fruit and shoot borer problem in eggplant and proposed solution

Like many other crops, eggplant is susceptible to damage by several insects and diseases, which attack from seedling to fruiting. Among insect pests, the fruit and shoot borer (*L. orbonalis,* Guenee) has caused the most significant yield losses to eggplant in the Philippines, reportedly ranging from 20 percent to a high of 92 percent. Fruit and shoot borer (FSB) damages eggplants both in the early vegetative stage and at the whole fruiting stage. In the early vegetative stage, FSB larvae feed within the pedicles and midribs of the leaves causing shoots to droop and wither. At fruiting stage, larvae bore into the fruit, rendering them unmarketable and unfit for human consumption.

To date, farmers resort to frequent and heavy spraying of insecticides to control FSB. However, since the larvae are internal feeders, FSB control through chemical spraying poses more problem than cure. Farmers often apply pesticides indiscriminately, using the wrong chemicals and dosages. Many farmers spray their eggplant crops two or more times a week. Informal interviews with eggplant farmers found cases of spraying as often as every other day, or 60-80 times during a normal fruiting duration of at least four months. Baseline surveys of the USAID-funded Integrated Pest Management Collaborative Research Support Program (IPM CRSP) project in 1994 and 1999 found eggplant farmers in Nueva Ecija spraying twice per week on average. While the manual removal of damaged fruits and shoots has proven to be effective, it is rarely adopted by farmers because it is so labor intensive. Farmers then tend to rely on chemical insecticides, which are expensive and potentially damaging to human health and the environment. Frequent pesticide use can lead to borer tolerance or resistance to the chemicals, and presents environmental problems associated with polluted ground water and food supplies, damage to non-target organisms, resurgence of target pests, and excessive chemical exposure for applicators. There is however limited information on other viable and sustainable options to control FSB.

The above realization has stimulated the search for alternative strategies to control FSB, not just in the Philippines but in India, Bangladesh, and other Asian countries as well. The regional significance of FSB was one reason why ABSPII selected it as a focus area for both South and Southeast Asia. The ABSPII project seeks to develop and commercialize transgenic open pollinated (OP) FSB-resistant eggplant for resource-limited farmers in the Philippines, India, and Bangladesh through public-private sector partnerships. To fast track the process, ABSPII is collaborating with India-based Maharashtra Hybrid

Seed Company (Mahyco), which has developed a highly resistant transgenic eggplant variety that in turn is currently undergoing field trials for efficacy and bio-safety in India. The transformation involved the introduction of genes encoding insecticidal proteins of *Bacillus thuringiensis* (*Bt*) into eggplant to confer resistance to FSB.. This brief summarizes the expected economic impacts of introducing this transgenic crop into an IPM program in the Philippines.

Assessment approach

The study analyzed the impacts of adopting *Bt* eggplant on yield, cost, and profitability of eggplant production in the Philippines. The size and distribution of benefits to producers, consumers and society as a whole were projected using both primary and secondary data. Primary data came from focus group discussions, and interviews of scientists and industry experts. Secondary information was obtained from the Bureau of Agricultural Statistics and the PhilRice-IPM CRSP project.

To assess the income and cost effects of the *Bt* eggplant technology, a farm level budget was constructed in scenarios of with and without the technology. The size and distribution of benefits from *Bt* eggplant were quantified using the economic surplus analysis. Sensitivity analyses were performed to determine the effects of varying key assumptions.

Results

Adoption of *Bt* eggplant has significant potential to increase marketable yield, reduce costs, and increase net profits. Partial budget analysis found that the adoption of *Bt* eggplant would provide a net incremental benefit of around PhP50,000 (USD909) per hectare compared to the current eggplant variety used by farmers. The additional benefit was realized from increased marketable yield and from savings in insecticide and labor costs.

When asked about their willingness to adopt *Bt* eggplant, most farmers responded in the positive even if the seed price was higher. The farmers further reported that FSB had caused substantial decline in the marketable yield and profitability of eggplant production, in many instances barely breaking even. While their total yield had not declined as much as their marketable yield, declining profits and marketability have prompted the farmers to switch to other crops such as yellow corn and green corn whose production risks are much smaller.

Bt eggplant technology, once commercialized and adopted, would be economically superior to current technology from consumers' and producers' standpoint, as well as for society as a whole. More than half of the estimated PhP1.86 billion (USD34 million) increase in net income to society would accrue to the producer as a result of the research-induced outward shift in the supply curve. The combined public and private investment would yield an estimated internal rate of return of 87 percent. Even if the assumptions used in the base case scenario, e.g., yield gain, cost reduction, and adoption rate were only half of their assumed values, investment in the development of *Bt* eggplant technology would still be profitable.

The environmental effect of the technology was analyzed in terms of changes in insecticide use. According to scientists, the adoption of *Bt* eggplant would minimize if not totally eliminate insecticide applications for FSB. The reduction in pesticide use would lessen pesticide pollution of waterways

and groundwater, reduce harm to non-target organisms, improve the abundance of flora and fauna in the soil, and minimize hazards posed to farm labor and consumers. Scientific experts indicated that tests have found no significant environmental or health threat due to the GMO itself.

Conclusion

Adoption of *Bt* eggplant would increase marketable yield, reduce usage of insecticides, and increase farmers' income. The technology has the potential to reduce poverty, and improve food security and input use efficiency. Once commercialized, farmers would increase profits because the technology would increase marketable yield and lower production costs. Consumers would have increased supplies of low-insecticide-residue eggplant at a lower price. Money not spent on insecticides, which are anyway not effective in the control of FSB, can be spent on other yield-enhancing inputs. The adoption of *Bt* eggplant technology would also minimize insecticide applications that have been proven harmful to the environment. Experts interviewed believed the *Bt* technology to have few if any unintended effects to the environment.