Projected benefits of areawide pest suppression with GM crops in developing countries: Opportunities and challenges

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Transgenic maize engineered to express insecticidal proteins from the bacterium *Bacillus thuringiensis* (Bt) has become one of the most successful and widely adopted technologies in U.S. agriculture. In 2011, Bt maize was planted on ~60 million acres (24.3 million ha), representing 65% of the U.S. maize crop (single and stacked Bt events combined; USDA-ERS). Using statistical analysis of per capita growth rate estimates, we previously documented that areawide suppression of the primary pest, the European corn borer, *Ostrinia nubilalis*, is associated with Bt maize use; this impact was quantified for 5 major corn producing states in the Midwest ‘Corn Belt’, including: Illinois, Iowa, Minnesota, Nebraska and Wisconsin. Cumulative benefits over 14 years were estimated at $6.9 billion for the multi-state region. However, nearly two-thirds of this benefit, or $4.6 billion, accrued to the nearby non-Bt maize growers; this value was higher because non-Bt maize growers experience the benefits of less pest damage and high yields, without the cost of Bt technology fees. These results suggest that if a similar long-term areawide pest suppression benefit could occur in developing countries, as GM hybrid seed and reliable seed-marketing networks become available. In addition, the results suggest that pro-active Insect Resistance Management (IRM) plans, based on high-dose efficacy and consistent use of effective non-Bt crop refugia (i.e., High-dose-Refuge, HDR model) will be essential for long-term sustainability. In addition to direct economic benefits, the added benefits of reduced insecticide use, and reduced worker exposure to pesticides in developing countries could accrue. Finally, for stem boring insects in maize, reductions in stem borer damage are also known to reduce stalk and ear rot disease pressure, and mitigate kernel loss as well. Briefly, areawide pest suppression should be compatible with traditional small-holder production systems, providing significant reductions in pest damage, on a landscape scale that benefits Bt maize and non-Bt maize farmers. Following a recent analysis of the incidence and damage of two maize stem borer species in sub-Saharan Africa (SSA) – specifically *Chilo partellus* and *Busseola fusca* – the potential benefits and challenges of implementing similar Bt maize hybrids, for both maize and sorghum production regions will be discussed.

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