

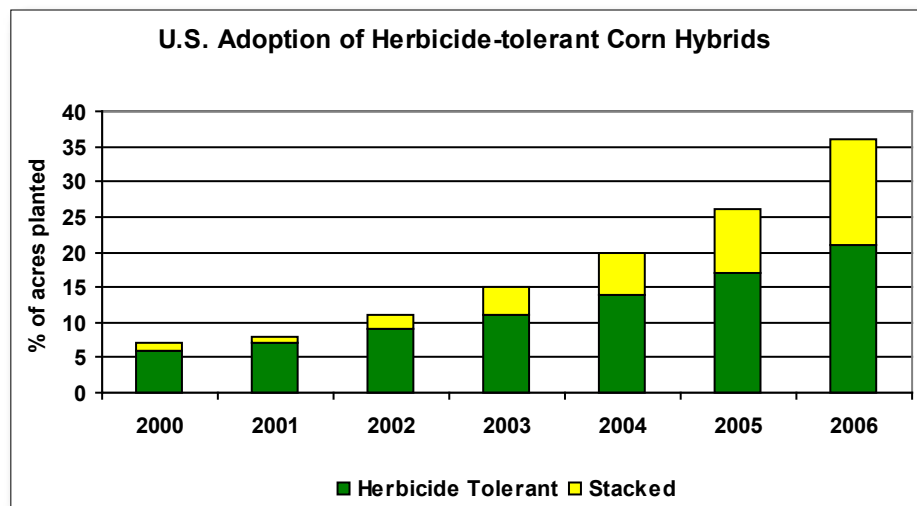
# Sustainability

## Using Biotechnology for Economic and Environmental Sustainability



The commercial introduction of agriculture biotechnology has made a significant contribution to farmers' ability to meet the global needs for food, fuel and feed, and to improving economic and environmental sustainability. Rapid adoption of the technology reflects farmer satisfaction, including more convenient and flexible crop management, lower cost of production, higher productivity and/or net returns per acre, health and social benefits, and environmental benefits including decreased use of pesticides (Brookes, Barfoot).

According to a 2006 update on biotechnology from the International Service for the Acquisition of Agri-biotech Applications (ISAAA), 10.3 million farmers from 22 countries (which collectively represent more than half the world's population) planted biotech crops in 2006, up from 8.5 million farmers in 2005. Of these farmers, 90 percent were small, resource-poor farmers from developing countries whose poverty was reduced by increased income from biotech crops.



Source: USDA, NASS "Acreage"

In 2005 the United States was the principle grower of biotech crops at 55 percent of the global total (James). Globally, farm income in 2005 was estimated to be about \$5 billion more than if farmers had planted conventional crops. The greatest gains in farm income since 1996 have been in the soybean and cotton sectors; biotech corn plantings have boosted farm incomes by more than \$3.1 billion (Brookes, Barfoot vii-xi).

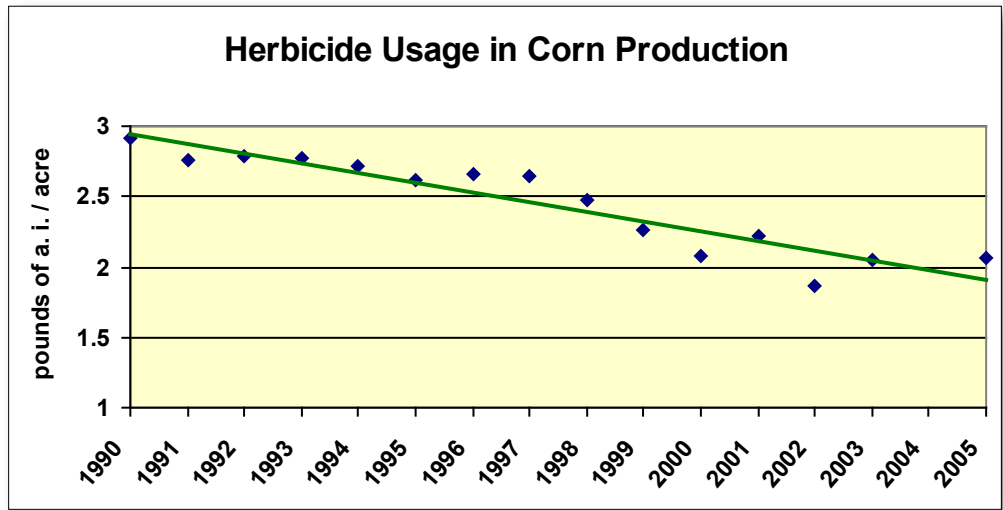
Insect resistance and herbicide tolerance are the dominant biotech traits opted for by farmers, followed by stacked genes for both traits. Now in its second decade of use, biotech crops have demonstrated important environmental benefits, including reduced use of insecticides and herbicides and reduced greenhouse gas emissions associated with mechanized farming (Brookes, Barfoot xii).

### *Herbicides*

Herbicides are the most widely used pesticide. Prior to herbicides, the primary weed control measure was clean plowing (completely turning over soil) followed by multiple passes of mechanical cultivation—a process with

limited effectiveness, that consumed considerable amounts of fossil fuels and increased the likelihood of soil erosion.

The introduction of herbicide-tolerant corn hybrids in the late 1990s resulted in better weed control, higher yields, and the introduction of minimum and no-till practices. Farmers choosing to plant herbicide-tolerant crops derive several important intangible benefits, including increased management flexibility from a combination of ease associated with broad-spectrum, post-emergent herbicides such as glyphosate and the increased window of time for spraying; reduced harvesting costs associated with cleaner crops, resulting in improved harvest quality and higher prices; and elimination of potential damage caused by soil incorporated residual herbicides in follow-on crops.



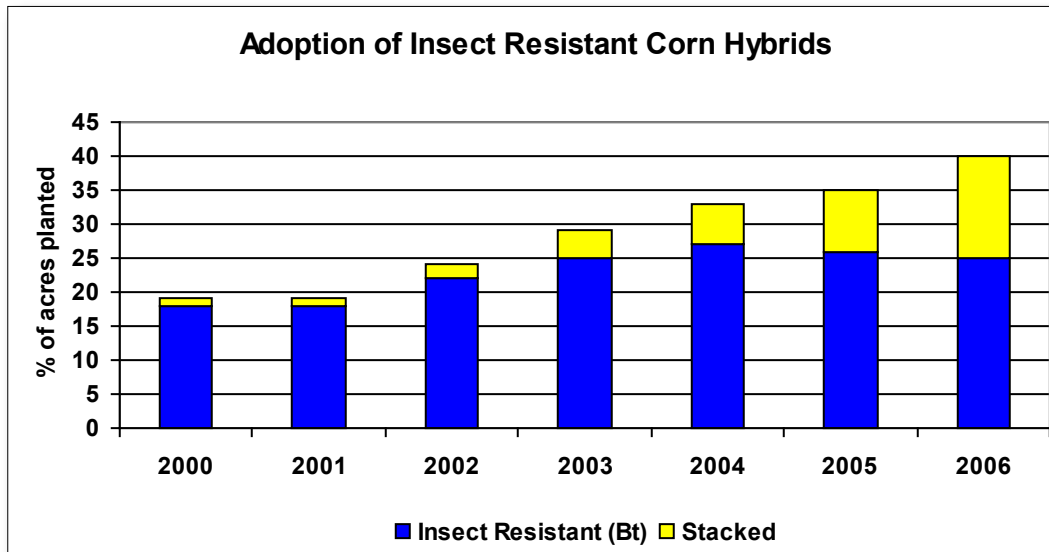
Data Source: USDA, NASS Agricultural Chemical Usage Report

### ***Insecticides***

Nearly 30 percent of all corn acres have been treated with insecticides during the past 15 years. However, the advent of insect-resistant crops in the 1990s enabled growers to treat for soil-borne pests while also reducing usage of insecticides to combat these pests. Insect-resistant crops are infused with proteins from the common soil bacteria *Bacillus thuringiensis* (Bt), the same protein used by organic gardeners, which only affects the targeted pest like European Corn Borer or Corn Rootworm larvae and is benign to beneficial insects and wildlife.

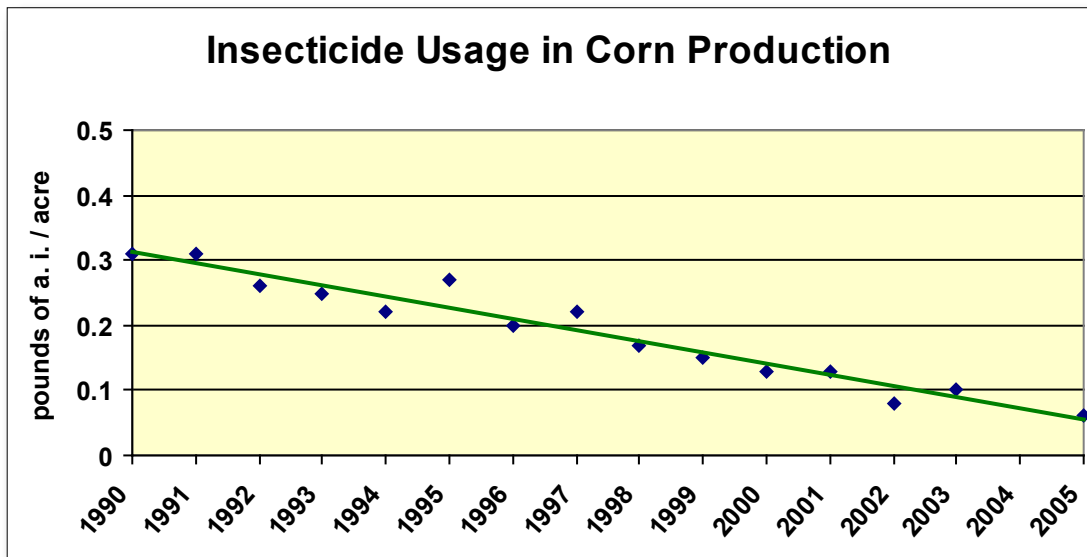
Prior to the introduction of synthetic insecticides, farmers had little control over insects other than through crop rotations. Although farmers still incorporate crop rotation as part of an IPM system, rotation alone has limited impact.

Bt corn, which has been widely adopted by farmers, reduces the amount of insecticide active ingredient (a.i.) used per acre of corn production and cuts back on trips a farmer makes over the field for tillage and pesticide application.



Data Source: USDA, NASS "Acreage"

In addition to new technologies such as Bt, life sciences companies have introduced more effective insecticides and better delivery systems to control targeted pests; adoption of these innovations have further softened farmers' environmental footprint. The National Center for Food and Agricultural Policy estimates the use of biotech corn for control of corn borer reduced total insecticide use by up to 4.7 million pounds of insecticide a.i. with a net savings to growers of \$196 million (USDA/NASS).



Data Source: USDA, NASS Agricultural Chemical Usage Report

**Key Points:**

- The introduction of biotech crops have allowed farmers to reduce the amount of herbicides and insecticides previously used to protect crops from weeds and soil-borne pests.
- Farmers in developing countries have been able to increase their farm income through biotech crops, thus helping to alleviate poverty.
- Biotech crops have demonstrated important environmental benefits, including reduced use of insecticides and herbicides and reduced greenhouse gas emissions associated with mechanized farming.

## **Works Cited**

Brookes, Graham and Barfoot, Peter. GM Crops: The First Ten Years—Global Socio-Economic and Environmental Impacts. International Services for the Acquisition of Agri-Biotech Applications. ISAAA Briefs 36-2006. 20 March 2007.

James, Clive. Global Status of Commercialized Biotech/GM Crops: 2006. International Services for the Acquisition of Agri-Biotech Applications. ISAAA Brief 35-2006. <<http://www.isaaa.org/resources/publications/briefs/35/executivesummary/default.html>>

U.S. Department of Agriculture National Agriculture Statistics Service, Agriculture Statistics Board. "Agriculture Chemical Usage 2005 Field Crops Summary." May 2006.