AGRICULTURAL BIOTECHNOLOGY: BENEFITS DELIVERED

Crops improved through biotechnology have been adopted by farmers in the United States and around the world at rates never before seen by any other advances in the history of agriculture. From the first significant commercial plantings in 1996, double digit growth in each subsequent year has led to more than 252 million acres of biotech crops planted in 2006 in 22 countries.[1] These crops are grown by 10.5 million farmers — 9.5 million of whom are small-scale farmers in the developing world. The reason for such impressive adoption rates is simple — agricultural biotechnology delivers significant and tangible benefits, all the way from farm to fork.

In 2006, U.S. farmers grew eight different biotech crops — alfalfa, canola, corn, cotton, papaya, soybean, squash, and sweet corn — which were primarily of three varieties — disease resistant, pest resistant, and herbicide tolerant which enhances weed control. These traits in biotech crops have delivered widely shared benefits such as increased production, improved quality, increased farmer incomes, and reduction in the environmental impacts of agriculture.

- Increased production. The most detailed study to date indicates biotech helped increase U.S. agricultural production by 8.34 billion pounds on 123 million acres in 2005).[2]

- Increased farmer income. Biotech crops decreased U.S. farmers' production costs by $1.4 billion in 2005, contributing to an increase in net profits of $2 billion that year. Worldwide, conservative estimates indicate biotech crops increased farmer income by $4.8-6.5 billion in 2004, part of a cumulative gain of $19-27 billion between 1996 and 2004.[3] The estimated total value of biotech crops globally is estimated at $44 billion in 2003-4.[4]

- Improved Quality. Biotech crops have improved quality of food and feed by decreasing the amount of foreign material (*e.g.*, weed residues) in harvests, and by reducing the amount of insect damage to harvested crops. For example, biotech cotton fibers are less likely to be insect damaged, and biotech corn is significantly

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[1] James, Clive. January 2007. *Global Status of Commercialized Biotech/GM Crops: 2006*. International Service for the Acquisition of Agri-Biotech Applications (ISAAA).
[2] Sankula, Sujatha. November 2006. *Quantification of the Impacts on U.S. Agriculture of Biotechnology-Derived Crops Planted in 2005*. National Center for Food and Agricultural Policy.
[3] Brookes, Graham and Peter Barfoot. 2005. *GM Crops: The Global Economic and Environmental Impact — The First Nine Years 1996-2004*. AgBioForum 8 (2&3): 187-196.
[4] Runge, C. Ford and Barry Ryan. 2004. *The Global Diffusion of Plant Biotechnology: International Adoption and Research in 2004.*

less susceptible to fungal disease[5] and has substantially lower levels of cancer-causing compounds such as aflatoxin, fumonisin and other mycotoxins.[6]

❖ Enhanced sustainability and reduced environmental footprint. Agricultural biotechnology has helped enable large shifts in agronomic practices that have led to significant and widespread environmental benefits. No-till agriculture,[7] in limited use prior to 1996, has been dramatically adopted due to the availability of superior weed control from biotech crops that are able to tolerate the newer class of lower-impact herbicides. This has led to improved soil makeup and water, reduced runoff, and reduced greenhouse gas emissions from agriculture.

New biotech approaches in pest control have reduced farmer's reliance on pesticide applications, eliminating 69.7 million pounds of pesticide applications in the United States in 2005.[8] Globally it is estimated that pesticide applications decreased six percent in the interval from 1996-2004, eliminating 379 million pounds of pesticide applications.[9]

Farmers have found that the use of biotech crops can reduce the need for plowing to control weeds, which leads to better conservation of soil and water and a decrease in soil erosion and soil compaction. In addition, a reduction in plowing has also enabled farmers to significantly reduce the consumption of fuel and decrease greenhouse gas emissions. Studies show that biotech crops have saved farmers 441 million gallons of fuel through reduced fuel operations – which has resulted in eliminating nearly 10.2 million pounds of carbon dioxide emissions since 1996. This is equivalent to removing four millions cars from the road in one year (which is about 17 percent of all registered cars in Great Britain).[10]

Future Benefits of Agricultural Biotechnology

Researchers worldwide are continually working to develop new biotech varieties of plants, crops and trees that benefit farmers, industry, consumers and the environment. Some exciting new developments include:

- Plants and trees improved through biotechnology to express multiple traits, such as virus-tolerance and pest-tolerance.

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[5] Munkvold, G.P., R.L. Hellmich, and W.B. Showers. 1997. *Reduced Fusarium Ear Rot and Symptomless Infection in Kernels of Maize Genetically Engineered for European Corn Borer Resistance*. *Phytopathology* 87: 1071-1077.

[6] Munkvold, G.P., R.L. Hellmich, and L.G. Rice. 1999. *Comparison of Fumonisn Concentrations in Kernels of Transgenic Bt Maize Hybrids and Non-Transgenic Hybrids. Plant Disease* 83:130-138.

[7] No-till agriculture seeks to conserve topsoil and moisture while reducing erosion by avoiding the use of plowing for weed control.

[8] Sankula, Sujatha. 2006.

[9] Brookes and Barfoot. 2005.

[10] Brookes, Graham. 2006. *Global Impact of Biotech Crops: Socio-Economic and Environmental Effects in the First Ten Years of Commercial Use*. PG Economics.

- Biotech plants and trees that can tolerate or resist certain environmental stresses, such as drought or saline soil.
- Consumers will soon see biotech crops that are nutrient-enhanced and even allergen-free, and oils from biotech crops that are healthier and contain fewer saturated fats and no trans fats after processing.
- Biotechnology can now produce pharmaceutical products, as well as therapeutic proteins, antibodies, and enzymes to assist in the production of biopharmaceuticals.