



When Does It Pay to Plant Bt Corn?

Farm-Level Economic Impacts of Bt Corn, 1996-2001

*Dr. Charles M. Benbrook
Benbrook Consulting Services
Sandpoint, Idaho
December 2001*

What's in it for farmers?

A series of papers
addressing concerns
about genetically
modified crops

Institute for Agriculture
and Trade Policy

Genetically Engineered
Food Alert

From 1996-2001, American farmers paid at least \$659 million in price premiums to plant Bt corn, while boosting their harvest by only 276 million bushels – worth some \$567 million in economic gain. The bottom line for farmers is a net loss of \$92 million – about \$1.33 per acre.

What's in it for farmers?

When Does It Pay to Plant Bt Corn?

2

When Does It Pay to Plant Bt Corn?

Introduction

Corn farmers have now planted over 70 million acres of Bt corn, genetically engineered to express *Bacillus Thuringiensis* (Bt) toxins in plant tissues for the control of two Lepidopteran insects, the European Corn Borer (ECB) and the Southwestern Corn Borer (SWCB). Farmers pay a significant premium for Bt corn varieties. But do increased yield benefits justify the added expenditure?

From 1996-2001, American farmers paid at least \$659 million in price premiums to plant Bt corn, while boosting their harvest by only 276 million bushels – worth some \$567 million in economic gain. The bottom line for farmers is a net loss of \$92 million – about \$1.31 per acre.

For each farm, the economics will differ depending upon the frequency of ECB/SWCB infestations, how widely the insects occur, insect population dynamics throughout their multi-stage lifecycle, and a whole host of biotic (like natural predators and corn plant defenses) and abiotic (cold weather and hard rains) factors. In this report, the first independent national evaluation of farm-level economic impacts, we boil down all these factors for the major corn producing states for 1996-2001. Our methodology and assumptions were purposefully conservative to be sure to not underestimate the value of Bt corn.

One surprising finding emerges – the price of Bt seed can vary greatly. Some farmers have been paying a premium as high as \$30.00 per acre for Bt corn (far more than the \$8.00 to \$10.00 “technology fee” typically charged), while other farmers receive discounts or price breaks that trim the Bt corn price premium to just a few dollars per acre. In some cases Bt corn seed is actually cheaper than several top-yielding conventional varieties.

The linkage between seed price and yield performance is hit-and-miss, especially in years or regions where ECB/SWCB populations do little or no appreciable damage to corn plants. Between the impact of varietal choice on yields and differences in seed costs, the selection of corn seed can and routinely does shift profits up or down by \$20 to \$40 per acre, and sometimes by as much as \$50 or more per acre. In most years, good managers can limit yield losses with targeted spot applications of insecticides, longer rotations or strip-cropping systems that increase the population of insects that feed on corn borers.

The investment in Bt corn has, on average, paid off for farmers in three years (1996, 1997 and 2001), yet it has resulted in losses in another three (1998, 1999, and 2000). It appears that Bt corn delivered the greatest net benefits in 2001, due largely to increased infestations of ECB/SWCB, but the 2001 data are preliminary. It lacks final corn production, market price, and ECB/SWCB data for some states.

Other key findings of the Benbrook report:

- The cash outlay for seed for a field where farmers decide to plant a Bt corn hybrid is about 30 to 35 percent higher than the cost of otherwise well-adapted conventional varieties. This increase in per acre seed expenditures is by far the biggest in history linked to a single new trait.
- On average farmers have harvested 3.9 more bushels per acre planted to Bt corn. It would have required more than another bushel yield bump, or 5 bushels per acre, for farmers' investments in Bt corn to pay off, on average, at the farm-level.

The Production and Economic Impacts of Bt Corn: Bushels of Corn Loss Avoided, Value of Increased Yield, the Bt Corn Premium, and Impact on Farm Level Profits 1996-2001

State	1996	1997	1998	1999	2000	2001	1996-2001
Colorado	369,200	2,246,149	5,477,784	6,811,740	6,240,780	6,027,840	27,173,493
Illinois	2,549,583	3,806,569	4,165,384	4,053,672	6,013,907	24,301,048	44,890,523
Indiana	276,438	820,573	995,390	5,230,579	3,016,440	5,056,819	15,396,240
Iowa	1,402,080	3,275,005	3,533,718	3,042,394	3,567,000	13,742,001	28,562,198
Kansas	283,227	888,071	1,035,368	923,832	932,880	3,881,196	7,944,574
Kentucky	139,707	355,056	306,811	900,900	484,120	1,146,880	3,333,474
Michigan	103,626	355,680	100,596	188,760	178,957	364,320	1,291,939
Minnesota	1,140,000	2,497,970	3,091,663	2,111,576	2,926,663	12,854,824	24,622,695
Missouri	739,555	1,218,781	1,344,871	1,393,982	317,950	1,468,800	6,483,940
Nebraska	1,685,493	4,974,442	2,723,418	3,108,040	5,569,200	14,710,800	32,771,393
New York	32,218	110,854	125,841	177,710	129,654	277,970	854,246
Ohio	93,240	409,106	295,849	1,147,608	614,739	2,275,416	4,835,958
Pennsylvania	13,114	46,178	59,319	56,700	97,441	133,950	406,701
South Dakota	897,867	1,416,606	1,719,979	2,107,224	3,385,648	8,873,304	18,400,628
Texas	611,520	3,895,545	7,683,624	9,810,450	9,478,560	6,697,600	38,177,299
Wisconsin	305,454	880,610	262,152	1,045,044	944,378	2,120,294	5,557,882
Other States	746,435	1,648,085	2,357,586	1,636,252	2,698,088	6,339,178	15,425,624
U.S. Total	11,388,756	28,845,280	35,279,353	43,746,462	2,698,088	10,272,601	276,128,808
Dollar Value Added Yield [†]	\$30,863,529	\$70,094,030	\$68,441,944	\$79,618,561	\$86,203,258	\$231,572,461	\$566,793,785
Bt Corn Price Premium*	\$11,690,000	\$62,730,000	\$144,720,000	\$147,180,000	\$154,250,000	\$138,560,000	\$659,130,000
Net Profit (loss) from Bt Corn	\$19,173,529	\$7,364,030	\$(76,278,056)	\$(67,651,439)	\$(68,046,742)	\$93,012,461	\$(92,336,215)

[†] Average market prices per bushel of corn by year are reported in Table 3 of the full report. The Bt Corn Price Premium is from Table 8.

*Bt Corn Price Premium based on acres planted to Bt corn multiplied by the average technology fee in Table 12 of the full report.

Source: Benbrook Consulting Services, 2001

Farmers who know and understand corn borer population dynamics in their area and are willing to experiment with non-Bt control options can almost surely find ways to more profitably deal with ECB/SWB pressure than planting most of their acreage every year to Bt corn.

Farmers should keep in mind the following when making corn seed choices:

- The newest and most expensive varieties may not be the most likely to produce the highest yields, nor do lower-cost varieties lack the genetics to produce top yields.
- Well-tested, proven hybrids with traits matched to local soil, climate and agronomic conditions offer the least risk.
- Seed bargains will help maximize per acre profits, not yields. The quest for county yield records may come at the expense of profit margins.
- Comparison shopping for the right seed pays off. The most expensive Bt variety is over \$50 more per unit than the least expensive Bt varieties.
- If new and costly seed technology seems promising, it may pay to test a new Bt variety in a small, representative production field alongside a closely matched conventional variety in the required non-Bt corn refuge acres to evaluate how well each does under various circumstances.

What's in it for farmers?

When Does It Pay to Plant Bt Corn?

For individual farmers, costs and benefits may vary enormously depending on the severity of the corn borer infestation, and the premium paid for the seed. The most expensive Bt variety is over \$50 more per unit than the least expensive Bt varieties.

Conclusion

On average nationwide, from 1996-2001, yield increases due to Bt corn have not increased farm income enough to cover the higher costs of Bt seed. The bottom line for farmers is a net loss of \$92 million – about \$1.31 per acre.

Bt corn is no different than other new technology that increases production. The 276 million more bushels of corn moving through markets in 1996-2001 have had a ripple effect through the farm economy. The average price received by all farmers growing corn is marginally lower as a result of the greater supply.

International concern and controversy over Bt corn has also reduced export sales by hundreds of millions of bushels, increasing supplies in the U.S. and further decreasing prices from the levels they otherwise would have attained.

Six years is too short a period to take the full measure of any major new agricultural technology, especially one as novel and contentious as Bt corn. In all likelihood the farm sector will learn how to make more effective use of this technology and over time the price premium should narrow. The performance of Bt hybrids is also likely to improve as more back-crosses are made and experience is gained with transformed varieties.

However, it remains to be seen whether genetic resistance can be prevented in corn borer populations and whether physiological or soil microbial community problems will surface. No one can predict, either, whether world markets will warm to Bt corn.

Hopefully, lessons learned in the commercial introduction and planting of today's Bt varieties will help breeders develop the next generation of insect-resistant corn. Farmers, in particular, should pay closer attention to whether the next wave of "advanced" corn genetics is likely, in the end, to improve their profitability or shave another slice off per acre profit margins in order to generate the cash needed to meet Wall Street corporate profit expectations.

View the Entire Bt Corn Report at www.iatp.org

The complete report includes the following sections:

"The ECB Numbers Game" analyzes state-by-state corn borer infestation rates with basic calculations, equations and rules of thumb to guide farm-level planning;

"The Incremental Cost of Planting Bt Corn" compares average estimated costs of Bt to otherwise well-adapted conventional varieties, by acres and by state.

"The Performance and Price of Top Conventional and Bt Corn Hybrids" shows that there are real seed bargains out there, whether conventional or Bt, as well as several high priced varieties that perform irrationally;

"Farm-Level Economic Impacts of Bt Corn" quantifies the aggregate impact on farm-level profits by state and nationally.

*Much of the basic information in this report on the corn seed market comes from analysis of Doane Marketing Research, Inc. corn seed data covering 1998-2000. Doane corn seed data are reported by variety/company, type of variety, and Doane's "Maturity Group". (Doane analysts classify all corn varieties into one of eleven "Maturity Groups" based on relative maturity ratings). Doane corn seed data for 1998-2000 encompass 19,710 records, each representing a specific variety sold in one of the three years. Over this period, there were 15,384 conventional varieties sold, along with 2,320 Bt corn hybrids. There were, accordingly, 6.6 conventional varieties on the market for each Bt hybrid. The data purchased by Benbrook Consulting Services (BCS) includes acres planted, units planted (a "unit" is a bag of seed containing about 80,000 kernels, enough to plant 2.5 to 3 acres), average retail prices per unit, average discounts, and net prices (retail prices minus discounts).

**What's in it
for farmers?**

**When Does It
Pay to Plant Bt
Corn?**

4



**Institute for
Agriculture and
Trade Policy**
www.iatp.org



**Genetically Engineered
Food Alert**

designed by **Sustain**