



The Bt Premium Price: What Does It Buy?

The Impact of Extra Bt Corn Seed Costs on Farmer Earnings and Corporate Finances

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The seed and pesticide industry has, in general, prospered financially throughout the last three decades, while the balance sheet and profits of corn growers has substantially eroded.

When Does It Pay to Plant Bt Corn?

Summary:

The case of Bt corn, thus far, suggests that farmers will be expected to finance a greater share of seed industry intellectual property, research, and development costs from their per acre earnings. The evidence also suggests that these costs are markedly higher for new corn varieties including traits introduced via genetic engineering. Since Bt corn has been introduced, corn seed expenditures grew at \$1.34 per acre annually between 1995-1999, compared to just \$.30 per year in the previous five years. The impact of the Bt corn premium on seed industry profits has been remarkable. The Bt corn premium boosted earnings for Pioneer Hi-Bred by 7.3 percent, Monsanto by 9 percent, and Syngenta by over 18 percent between 1998-2000. Based on current seed-pesticide industry pricing policies and financial performance goals, it is likely that the purchase of technologies like Bt corn will transfer another slice of farm income from growers to the seed-biotechnology industry.

Introduction:

The commercialization of corn genetically engineered to resist feeding damage by the European Corn Borer (ECB) and Southwestern Corn Borer (SWCB) has been the dominant focus of corn breeders and seed companies in the 1990s. Introduced in 1996, this technology now accounts for about 20 percent of the acres planted to corn each year in the U.S. Growers have spent about \$659 million on Bt corn price premiums since 1996, an investment that has only delivered some \$567 million in benefits, as shown in our November 2001 report, *When Does It Pay To Plant Bt Corn? Farm-Level Economic Impacts of Bt Corn, 1996-2001*.

This report focuses on two questions. First, how has the added cost of Bt corn impacted trends in farm-level production expenses and profitability? And second, how has the \$659 million premium that farmers have paid for Bt corn impacted the financial performance of the seed-biotech industry?

Impacts of the Added Cost of Bt Corn on Farm-Level Expenses and Profitability

Every acre planted to Bt corn has increased farmer seed expenditures an average of \$9.80 per acre, about a 35 percent jump. In the 1970s and through the first half of the 1980s, farmers spent less than 10 percent of their gross income from corn sales on seed and pesticides, as shown in Table 1. While yields were about 40 percent lower than today, the market price for corn was \$0.50 to more than \$1.00 higher per bushel compared to today's depressed levels. The disparity would be even greater factoring in the effect of inflation.

Table 1 is based on official U.S. Department of Agriculture corn production, cost and return data for the major Corn Belt states. While this report's focus is on the economic impacts of Bt corn, the depth of the economic depression in corn growing areas is clearly evident in the trend in "Net Income" shown in Table 1. Farmers' net income per acre from corn production has declined sharply from 1975, a year when growers earned a profit of almost \$40.00 per acre.

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Table 1

Trends in Seed and Chemical Production Expenses per Acre, Corn Production and Income, and Seed and Pesticide Chemical Expenditures as a Percent of Income in Corn Belt States, 1975-2000

	1975	1980	1985	1990	1992	1994	1996	1997	1998	1999	2000
Production Expenditures											
Seed	\$9.51	\$14.66	\$18.84	\$20.70	\$21.96	\$22.19	\$27.32	\$29.39	\$31.07	\$30.71	\$30.64
Pesticide Chemicals	12.13	15.13	20.29	24.88	23.91	25.52	28.57	27.97	28.69	29.95	30.51
Seed+Chemicals	21.64	29.79	39.13	45.58	45.87	47.71	55.89	57.36	59.76	60.66	61.15
Other	59.39	89.47	96.19	89.29	85.54	89.69	101.81	101.11	95.07	92.96	99.92
Total Variable Costs	81.03	119.26	135.32	134.87	131.41	137.40	157.70	158.47	154.83	153.62	161.07
Yield and Price											
Yield (bushels per acre)	91.8	98.5	122.0	122.7	135.8	145.5	138.0	136.0	144.0	141.0	148.0
Harvest Period Price	\$2.49	\$3.04	\$2.09	\$2.16	\$2.01	\$2.02	\$2.79	\$2.50	\$1.91	\$1.67	\$1.75
Gross Value and Net Income											
Gross Value of Production	\$228.58	\$299.44	\$254.90	\$265.05	\$272.90	\$293.83	\$385.36	\$341.73	\$276.37	\$236.64	\$259.36
Total Costs	\$189.11	\$268.41	\$281.32	\$299.89	\$296.26	\$313.35	\$356.84	\$365.39	\$365.95	\$367.06	\$380.85
Net Income	\$39.47	\$31.03	\$(26.42)	\$(34.84)	\$(23.36)	\$(19.52)	\$8.46	\$(16.41)	\$(89.58)	\$(130.42)	\$(121.49)
Chemicals as Percent of Total Variable Costs											
Chemicals as Percent of Total Variable Costs	15.0%	12.7%	15.0%	18.4%	18.2%	18.6%	18.1%	17.7%	18.5%	19.5%	18.9%
Chemical Expenditures per Bushel	\$0.13	\$0.15	\$0.17	\$0.20	\$0.18	\$0.18	\$0.21	\$0.21	\$0.20	\$0.21	\$0.21
Seed Expenditures as Percent of Total Variable Costs											
Seed Expenditures as Percent of Total Variable Costs	11.7%	12.3%	13.9%	15.3%	16.7%	16.1%	17.3%	18.5%	20.1%	20.0%	19.0%
Seed Expenditures per Bushel	\$0.10	\$0.15	\$0.15	\$0.17	\$0.16	\$0.15	\$0.20	\$0.22	\$0.22	\$0.22	\$0.21
Seed and Chemicals as Percent of Variable Costs											
Seed and Chemicals as Percent of Variable Costs	26.7%	25.0%	28.9%	33.8%	34.9%	34.7%	35.4%	36.2%	38.6%	39.5%	38.0%
Seed and Chemicals as Percent of Total Costs											
Seed and Chemicals as Percent of Total Costs	11.4%	11.1%	13.9%	15.2%	15.5%	15.2%	15.7%	15.7%	16.3%	16.5%	16.1%
Seed and Chemicals per Bushel	\$0.24	\$0.30	\$0.32	\$0.37	\$0.34	\$0.33	\$0.41	\$0.42	\$0.42	\$0.43	\$0.41
Seed and Chemical Expenditures as Percent of Gross Income											
Seed and Chemical Expenditures as Percent of Gross Income	9.5%	9.9%	15.4%	17.2%	16.8%	16.2%	14.5%	16.8%	21.6%	25.6%	23.6%

Source: Returns and cost of production data series from the Economic Research Service, USDA. Calculations by Benbrook Consulting Services.

A decade later in 1985, losses averaged \$26.42 per acre. The farm commodity policies in place throughout the 1980s and until passage of the Freedom to Farm Act in 1996 included a production control component based on counter-cyclic payments and acreage set-asides. These policies helped keep corn-grower losses below \$35.00 per acre through the 1997 season. But when the major changes in the Freedom to Farm Act severed the linkage between corn program payments and production restraints, corn growers were suddenly at the mercy of market forces and economic trends over which they had little control. For a few years, global demand was strong

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and supplies tight, so prices remained strong, but as always the case, strong markets pull in new supply and prices started to fall in 1997 and have yet to stabilize.

Historic Freedom to Farm policy changes were based on misplaced confidence in the continued growth in foreign demand, especially in China and other Asian countries. Unrestrained U.S. corn production combined with adverse economic conditions abroad to drive down cash corn prices from a profitable \$2.79 per bushel in 1996 to well below \$2.00 since 1998. During this period of declining prices, production costs were also steadily rising, continuing a trend that began in the early 1990s. The impact on corn grower profits has been devastating, with losses exceeding \$100 per acre since 1999. Corn growers have been kept in business only by a dramatic increase in a variety of emergency “market assistance” payments to corn growers totaling \$4.5 billion to nearly \$8 billion annually since 1999, and ranging between \$70.00 per acre to over \$115.00.

Bt Corn Reinforces Upward Trend in Production Costs

The biggest jump in “Seed and Chemical” costs occurred between 1994 and 1996 and coincided with the emergence of Bt corn. These two key production inputs now account for over \$0.40 in expenses for each bushel produced – between one-fifth and one-quarter of gross income. A little over a decade earlier, these expenses accounted for less than 10 percent of gross income. This marked shift in costs is one major reason why the seed and pesticide industry has, in general, prospered financially throughout the last three decades, while the balance sheet and profits of corn growers has substantially eroded.

In the 1960s through early 1990s, farmers used to earn about \$3.00 through higher corn yields for every added dollar spent on hybrid corn seed. Those days are over, as shown in the trends in Table 2. The emergence of Bt corn in 1996 clearly contributed to the 2.64 bushel average annual increase in corn yields in the 1995-1999 period, an increase about 1 bushel per acre higher than in the decade before. But this greater average annual yield gain came at a markedly higher cost – seed expenditures grew at \$1.34 per acre annually between 1995-1999, compared to just \$0.30 per year in the previous five years. As a result, the return per added dollar spent on corn seed dropped over half from 1990-1994 to 1995-1999. Given the erosion in corn prices since 1999, the return to higher-priced corn seed has clearly dropped further in the last two years.

The data in Tables 1-2 show that the technology fee and other premiums charged for Bt corn has shifted to the seed-biotech industry a portion of the economic return farmers have traditionally received when investing in advanced corn genetics. The high costs of the new science that makes Bt corn possible is clearly one reason why farmer-costs have risen more sharply than when earlier advances in corn genetics were brought to market.

It is clear that Bt corn has been costly to develop and market, in large part because of its reliance on genetic engineering techniques and dependence on intellectual property. Higher costs require seed companies to ask farmers to pay more per acre of seed. This trend, especially if it continues, could have significant long-term implications for farm-level costs, returns, and profits, especially if new genetically engineered varieties deliver modest economic returns in an era of downward pressure on crop prices.

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Table 2
Grower Returns to Corn Seed Expenditures:
Corn Belt States, 1975-1999

	1975-79	1980-84	1985-89	1990-94	1995-99	1975-99
Average Yield in Period (bushels/acre)	100.0	104.8	114.1	121.9	135.0	115.2
Average Annual Yield Increase in Period (bushels/acre)	1.09	0.97	1.86	1.55	2.64	2.05
Average Harvest Price in Period (per bushel)	\$2.25	\$2.63	\$1.94	\$2.15	\$2.32	\$2.26
Value of Average Annual Increase in Grower Income Attributed to Genetic Improvement (60 percent of total)	\$1.47	\$1.53	\$2.17	\$2.00	\$3.67	\$2.78
Average Annual Increase in Seed Expenditures per Acre during Period	\$0.62	\$0.79	\$0.48	\$0.30	\$1.34	\$0.88
Grower Return to \$1.00 Increase in Seed Expenditures	\$2.38	\$1.93	\$4.52	\$6.66	\$2.74	\$3.15

Source: Annual data on corn production, yield and expenditures from the costs of production data series compiled by the Economic Research Service, USDA. Calculations by Benbrook Consulting Services.

Impacts of the Bt Corn Price Premium on Corporate Profits

Three companies captured nearly all the \$659 million premium farmers have paid for Bt corn –

- Pioneer Hi-Bred and its parent, Dupont has earned close to one-half.
- Monsanto, through its seed subsidiaries DeKalb and Asgrow and contracts with independent seed producers, received slightly over 20 percent.
- Syngenta, through Novartis and Garst Seeds subsidiaries and its contract partners among the smaller, independent seed companies, was paid just over 30 percent.

This distribution of the Bt corn seed premium is based on the assumption that Pioneer Hi-Bred has retained essentially all the technology fees it has collected since 1996. This assumption reflects the fact that Monsanto granted Pioneer access to its Bt corn technology in the early 1990s in return for a modest one-time licensing fee. Agreements settling long-standing litigation may have altered the distribution of the Bt corn technology fees collected by Pioneer as part of the sale of varieties with Monsanto's Yield Guard Bt technology.

Table 3 captures the impact on company performance of the \$446 million Bt seed corn premium paid by farmers in 1998-2000. We focus on just these three years because this is the period covered by the Doane Marketing Research corn seed data purchased by Benbrook Consulting Services. The balance of the total \$659 million in Bt corn premiums was paid in 1996, 1997, and 2001.

The table encompasses Bt corn varieties sold directly by the three leading companies or their subsidiaries. The remainder of the Bt corn premium over the

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The Bt corn premium increased Syngenta corn seed revenues by over 18 percent in this three-year period. The impact on Syngenta's bottom line was also impressive and surprising. The Bt corn premium accounted for almost one-quarter of the "Net Income" reported by this \$7 plus billion corporation.

Table 3

Impacts of Bt Corn on the Financial Performance of Three Market Leaders, 1998-2000

	1998	1999	2000	1998-2000
Dupont: Pioneer Hi-Bred				
Acres Planted Conventional Seed	20,774,272	20,341,862	20,229,433	61,345,567
Acres Planted Bt Varieties	5,535,600	8,753,941	7,885,148	22,174,689
Total Corn Acres Planted	27,215,257	30,421,019	29,847,075	87,483,351
Revenue from Corn Seed	\$847,432,437	\$993,788,344	\$1,013,819,405	\$2,855,040,186
Bt Seed Premium	\$58,123,800	\$79,660,863	\$71,754,847	\$209,539,510
Bt Premium as % Total Pioneer Corn Seed Revenue	6.9%	8.0%	7.1%	7.3%
Pioneer After Tax Income (underlying)	\$5,000,000	\$(100,000,000)	\$106,000,000	\$11,000,000
Dupont After Tax Income (underlying)	\$3,395,000,000	\$3,474,000,000	\$3,684,000,000	\$10,553,000,000
Bt Premium as % of Pioneer Profits	1162%	NA	67.7%	1905%
Bt Premium as % of Dupont Profits	1.7%	2.3%	1.9%	2.0%
Monsanto: DeKalb Plant Genetics and Asgrow Seed Company				
Acres Planted Conventional Seed	9,683,789	7,133,439	5,216,942	22,034,170
Acres Planted Bt Varieties	1,343,935	1,729,341	1,564,785	4,638,061
Total Corn Acres Planted	12,099,775	10,589,958	8,365,254	31,054,987
Revenue from Corn Seed	\$338,953,311	\$319,932,897	\$263,028,940	\$921,915,149
Bt Seed Premium	\$14,111,318	\$15,737,003	\$14,239,544	\$44,087,864
Two-thirds Bt Licensing Fees	\$8,102,875	\$10,666,145	\$21,378,395	\$40,147,415
Total Bt Premium Earned	\$22,214,203	\$26,403,157	\$35,617,947	\$84,235,279
Bt Premium as % Monsanto Corn Seed Revenue	6.6%	8.3%	13.5%	9.1%
Monsanto Net Income (Loss)	\$(125,000,000)	\$150,000,000	\$149,000,000	\$174,000,000
Bt Premium as % of Monsanto Net Income	NA	17.6%	23.9%	48.4%
Syngenta: Novartis Seeds, Garst Seeds and ICI Seeds				
Acres Planted Conventional Seed	3,155,551	2,985,129	2,775,044	8,915,724
Acres Planted Bt Varieties	5,745,757	3,932,171	3,976,670	13,654,598
Total Corn Acres Planted	10,419,702	7,905,505	7,884,008	26,209,215
Revenue from Corn Seed	\$338,739,693	\$246,195,107	\$252,481,329	\$837,416,129
Bt Seed Premium	\$60,330,449	\$35,782,756	\$36,187,697	\$132,300,902
One-third Bt Licensing Fees	\$4,051,437	\$5,333,073	\$10,689,197	\$20,073,707
Total Bt Premium Earned	\$64,381,896	\$41,115,838	\$46,876,903	\$152,374,609
Bt Premium as % Syngenta Corn Seed Revenue	19.0%	16.7%	18.6%	18.2%
Syngenta Net Income	\$206,000,000	\$222,000,000	\$190,000,000	\$618,000,000
Bt Premium as % of Syngenta Profits	31.3%	18.5%	24.7%	24.7%

Source: Data on acres planted from the 1998-2000 corn survey, Doane Marketing Research, Inc. Corporate net income data are from company 2000 annual reports. Bt corn seed premium is acres planted times \$10.50 in 1998 and times \$9.10 in 1999 and 2000. Dupont corn seed premium does not take into account an initial modest royalty payment made by Pioneer to Monsanto to gain access to Bt corn transformation technology. Syngenta net income in 1998 reflects the combined sales of Novartis and ICI agricultural companies and is estimated as the average of 1999 and 2000 net income, as reported by Syngenta.

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period 1998-2000 – about \$265 million – was split between Monsanto and Syngenta in proportion to their shares of Bt corn seed sales by independent seed companies that licensed Bt corn technology. In all likelihood, Monsanto captured over two-thirds of this additional \$265 million in Bt corn “technology fees” charged by seed companies licensing access to Bt corn technology, with Syngenta capturing the balance. A two-thirds, one-third split of the \$265 million in licensing-based technology fees is reflected in the company estimates in Table 3.

The impact of the Bt corn premium on seed industry profits has been remarkable. In the case of industry-leader Pioneer Hi-Bred, the Bt corn premium boosted earnings from seed corn sales by 7.3 percent over the 1998-2000 period. In terms of Pioneer Hi-Bred’s after-tax income, the Bt corn seed premium was almost 20-times greater, reflecting the loss of \$100 million in 1999. Put another way, without the Bt corn premium, Pioneer Hi-Bred would have lost almost \$200 million over this three-year period, or over 7 percent of total revenue from corn seed.

Even when swallowed within an industrial giant the size of Dupont, Pioneer’s Bt corn premium made a difference, increasing Dupont’s after tax income by 2 percent over this period.

Bt corn had a similar impact on Pioneer and Monsanto revenues from corn seed sales, reflecting the fact that both Asgrow and DeKalb continued to offer many more conventional corn varieties than Bt hybrids. Over the three-year period, the Bt premium accounted for just over 9 percent of Monsanto seed corn sales. The contribution of Bt corn price premiums to Monsanto’s “Net Income” was much greater – close to 50 percent over this three-year period. This surprisingly large share reflects the narrow profits Monsanto was able to sustain in this period of rapid growth through acquisitions and heavy R+D spending.

The financial impact and importance of Bt corn was greatest in the case of Syngenta. About one-half of total Syngenta corn seed sales were Bt varieties, more than twice the share of Pioneer and Monsanto. The Bt corn premium increased Syngenta corn seed revenues by over 18 percent in this three-year period. The impact on Syngenta’s bottom line was also impressive and surprising. The Bt corn premium accounted for almost one-quarter of the “Net Income” reported by this \$7 plus billion corporation.

The Financial Impact of Bt Corn

Clearly, the ability to charge about a 35 percent premium for Bt corn varieties has helped biotechnology and seed companies improve their financial performance. Without the price premium, the collapse of confidence in agricultural biotechnology among investors would have happened quicker and taken a much bigger bite out of the stock value of these corporations.

Still, seed and pesticide companies have and will continue to be profitable. The emergence of biotechnology has created a new income stream linked to intellectual property rights, an income stream that now appears essential to cover the higher cost of developing and marketing genetically engineered varieties.

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The case of Bt corn, thus far, suggests that farmers will be expected to finance a greater share of seed industry intellectual property, research, and development costs from their per acre earnings and that, in the end, their financial position may suffer as a result.

from their per acre earnings and that, in the end, their financial position may suffer as a result. It is also clear that the corn seed industry is fast becoming an operating division of pesticide companies. The biotech portion of the seed industry already is.

Pesticide companies have traditionally earned a much higher rate of return than common in the seed industry. If DuPont/Pioneer, Monsanto, Syngenta, Bayer, Dow Agrosciences and other major players in the now combined seed-pesticide industry expect seed divisions to deliver returns comparable to earnings from pesticide sales, farmers will be asked to pay markedly more for seed in the future.

The historic disparity in seed and pesticide company profits, coupled with the biotech revolution, leads to a chilling prospect. The day may come when relative rates of return to investments in new seed-genetic technologies will be compared to the profits from pesticide-based technology. Already, corporate R+D managers in major companies like Syngenta, Monsanto, and Dupont/Pioneer are struggling with new options and issues in allocating R+D resources.

The emergence of Bt corn and its impacts on industry and farmers deserves more thoughtful study and open debate. Better understanding of how to maximize the benefits of the ag biotech revolution are needed, as well as better ways to fairly share the costs, risks, and benefits that flow in its wake. But based on current seed-pesticide industry pricing policies and financial performance goals, it appears likely that the purchase of Bt corn will, for the foreseeable future, transfer another slice of farm income from growers to the seed-biotechnology industry. Such is the price of “progress” in this early stage of the ag biotech revolution.



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