Premium Paid for *Bt* Corn Seed Improves Corporate Finances While Eroding Grower Profits

High Cost Biotech-Based Corn Could Undermine the Solid Economic Return Enjoyed by Farmers Investing in New Corn Genetics

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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."[1]

Table 1 presents a summary of the earlier report's major findings and shows that farmer-expenditures on *Bt* corn have cut their profits by an estimated $92 million since 1996. It is important to note that the projected cost of *Bt* corn encompassed in our first report, and hence the magnitude of losses to farmers, does not include any of several indirect costs associated with the planting of *Bt* corn – costs required to segregate and test *Bt* corn, greater trucking and shipping costs, loss of export markets, the need to address environmental concerns and manage the emergence of resistance.

It is hard to quantify the costs stemming from these indirect impacts of *Bt* corn and no one knows, nor can anyone predict with any level of certainty whether these costs will increase or decrease over time. The answer depends in part on what scientists learn as they more carefully study the food safety, ecological and environmental impacts of *Bt* corn, and in part on how this technology is used.

Table 1. The Production and Economic Impacts of *Bt* Corn, 1996-2001: Bushels of Corn Yield Loss Avoided, Value of Increased Yield, the *Bt* Corn Premium, and Impact on Farm-level Profits, 1996-2001

	1996	1997	1998	1999	2000	2001	1996-2001 Totals
Yield Loss Avoided (Bushels)	11,388,756	28,845,280	35,279,353	43,746,462	46,596,356	110,272,601	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)	$ (67,561,439)	$ (68,046,742)	$ 93,012,461	$ (92,336,215)

Source: "When Does It Pay to Plant *Bt* Corn? Farm-Level Economic Impacts of *Bt* Corn, 1996-2001," (Benbrook, 2001).

[1] This report is accessible at http://www.iatp.org and http://www.biotech-info.net/bt-transgenics.html#ECB). A longer technical version is available at the later website.

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 *Bt* corn price premium 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 2. 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 2 is based on official U.S. Department of Agriculture corn production, cost and return data for the major Corn Belt states.[2] 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 2. 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.

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 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

[2] Access historical corn production, income, and cost data nationwide, by region or state at http://www.ers.usda.gov/data/costsandreturns/testpick.htm

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 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.

Table 2. 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 (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 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	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	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	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	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	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.

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. The nation's major corn seed producer – Pioneer Hi-Bred – took break pride in sharing the economic benefits associated with steadily rising corn yields with its grower-customers, despite the fact that its pricing decisions no doubt somewhat depressed returns to shareholders. Still in the 1980s and through the mid-1990s, Pioneer, DeKalb, Asgrow and other corn seed companies typically reported profits equaling 8 percent to 12 percent of gross revenue, a profit margin about half that common in the pesticide industry, but nonetheless respectable and sustainable.

The days of $3.00 return to farmers for each $1.00 invested in higher-priced corn seed appear on the way out though, as shown in the trends in Table 3. 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.

Table 3. Grower Returns to Corn Seed Expenditures: Corn Belt States, 1975-1999

	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	1975-1999
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.

The data in Tables 1-3 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. No one knows for sure whether biotech-related costs will come down in the future, or whether new methods will emerge to use conventional breeding techniques to achieve comparable advances in hybrid performance.

But today, 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

Table 4. Income, Expenses, Net Returns and Assets of the U.S. Corn Production Sector, 1996 and 2000

	1996	2000
Income		
Corn Yield (bushels per acre)	130	138
Average Farm Price ($ per bushel)	$ 2.82	$ 1.77
Acres Harvested	72,600,000	72,700,000
Gross Corn Sales	**$ 26,651,820,000**	**$ 17,757,702,000**
Commodity Program Payments	$ 2,590,000,000	$ 4,360,000,000
Total Corn Sector Income	**$ 29,241,820,000**	**$ 22,117,702,000**
Expenses		
Cash Expenditures		
Seeds	$ 2,110,680,000	$ 2,386,590,000
Pesticides	$ 2,171,664,000	$ 2,291,190,000
Fertilizer	$ 3,725,568,000	$ 3,103,680,000
Fuel, Oil, Electricity	$ 1,934,856,000	$ 2,315,040,000
Custom Operations	$ 894,960,000	$ 912,660,000
Other Operating Expenses	$ 1,639,440,000	$ 1,830,885,000
Total Cash Expenditures	**$ 12,477,168,000**	**$ 12,840,045,000**
Overhead (labor, land rental, depreciation, interest, taxes)	$ 15,284,808,000	$ 16,959,735,000
Total Expenses	**$ 27,761,976,000**	**$ 29,799,780,000**
Net Return to Producers	**$ 1,479,844,000**	**$ (7,682,078,000)**
Assets		
Land and Buildings	$ 139,392,000,000	$ 168,540,000,000
Machinery	$ 13,207,392,000	$ 15,908,904,000
Total Assets	$ 152,599,392,000	$ 184,448,904,000
Return to Assets (Net return divided by Total Assets)	1.0%	-4.16%

Source: Compiled by Benbrook Consulting Services, 2002. Corn production and price data from Table 17, *Agricultural Outlook*, ERS/USDA. Commodity program payments are from Table 35, *Agriucltural Outlook*, December 2001. Cost of production data are from the ERS/USDA cost of production data series accessible at http://www.ers.usda.gov/data/costsandreturns/. Land values are based on average cropland values in the Corn Belt, from *Agricultural Land Values*, August 2001, NASS/USDA accessible at http://usda.mannlib.cornell.edu/reports/nassr/other/plr-bb/land0801.pdf. Machinery values are estimated based on the average value of the equipment needed to plant and harvest 1,000 acres of corn.

engineered varieties deliver modest economic returns in a era of downward pressure on crop prices.

Tables 4 and 5 help place in perspective the dismal downward trend in the profitability of corn production and indeed all of U.S. agriculture. Table 4 presents a balance sheet for the whole U.S. corn production sector for 1996 and 2000. Like other tables in this report, it is based on official USDA statistics. Note that the yield, price, income, and expense data in Table 4 differ somewhat from Table 2 because the former covers all corn production and Table 2 encompasses corn grown in "Corn Belt" states. Also note that the line "Commodity Program Payments" does not include a range of emergency and disaster related payments. Between 1996 and 2000 land prices were driven upward in large part by the increase in total government payments.

In 1996 corn growers earned $1.48 billion in profits on sales of $26.7 billion, for a profit margin of 5.5 percent – well below the 10 to 15 percent common in most agribusiness sectors. By 2000, corn growers' modest profit margin had turned to red ink, with losses amounting to $7.68 billion. Without the major infusion of government support in that year, farmers would have covered only about three-quarters of their costs incurred in producing a bushel of corn. Such farms – or an industry as a whole – clearly are not sustainable.

Even these chilling statistics fail to capture the dismal economics of corn production in recent years. To fully appreciate how poorly the industry is performing, the net returns must be compared to the value of the assets tied up in corn production. The bottom portion of Table 4 presents this added measure of bad news.

In 1996 the land, buildings, and machinery tied up in corn production represented an investment of over $150 billion. So even in this most profitable year since the mid 1990s, producers earned a mere 1 percent return on their investment in land and machinery. By 2000 their losses would have eroded over 4 percent of the total value of their operations, in the absence of government payments.

Table 5 presents similar income and expense data for the agricultural sector as a whole, based on just-released USDA data on crop year 2001. Again, the increase in costs between 1996 and 2001 has been much steeper than the increase in total income, even taking into account the $12.5 billion in what USDA labels "Net Government Transactions" that year. The net return to producers has declined from $25.8 billion in 1996 to $12.1 billion, a 53 percent reduction. Across the entire sector, farmers earned just over 5 percent on sales of $230.6 billion.

Table 5. Balance Sheet of the U.S. Agricultural Sector, 1996 and 2001

	1996	2001
Gross Sales and Income	**($Billion)**	**($Billion)**
Crops	$ 115.5	$ 97.3
Livestock	$ 92.1	$ 109.0
Other	$ 20.8	$ 24.3
Ag Sector Output	**$ 228.4**	**$ 230.6**
Net Government Transactions	$ 0.1	$ 12.5
Total Ag Sector Income	**$ 228.5**	**$ 243.1**
Cash Expenditures		
Seeds	$ 6.2	$ 7.5
Pesticides	$ 8.5	$ 8.5
Fertilizer	$ 10.9	$ 11.8
Feed	$ 25.2	$ 25.6
Livestock	$ 11.3	$ 15.4
Fuel and Oil	$ 6.0	$ 7.3
Electricity	$ 3.2	$ 3.2
Other intermediate expenses	$ 41.9	$ 47.7
Total Production Expenses	**$ 113.2**	**$ 127.2**
Gross Value Added	**$ 115.3**	**$ 115.9**
Minus Capital Consumption	$ 19.4	$ 20.7
Net Value Added	**$ 95.9**	**$ 95.2**
Other Costs and Payments		
Cropland Rent	$ 41.9	$ 50.8
Debt Service	$ 13.0	$ 14.2
Labor	$ 15.2	$ 18.1
Total Other Costs	**$ 70.1**	**$ 83.1**
Net Return to Producers	**$ 25.8**	**$ 12.1**
Net Return per Farm Family (based on 750,000 commerical and intermediate farms)	**$ 34,400**	**$ 16,133**

Source: Compiled by Benbrook Consulting Services, 2002. "Gross Sales and Income" amd expenses data are from Table 29, *Agricultural Outlook*, ERS/USDA, December 2001. "Cropland Rent" is estimated at 12 percent of the average per acre value of cropland in 1997 and 2001, from *Agricultural Land Values*, NASS/USDA, August 2001. Number of commerical and intermediate farms is from Table 3, *Agricultural Income and Finance Outlook*, AIS-77, Sept. 2001, ERS/USDA.

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. Settlements have been reached in several lawsuits over the control of *Bt* technology, some involving Monsanto, its subsidiaries and Dupont-Pioneer. It is not known whether the terms of any recent settlement agreements 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 6 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 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 6.

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. Such terrible results over an extending period would have triggered a panic on Wall Street.

Table 6. 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.

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 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. Even so, the relatively poor performance of the agricultural divisions of these companies, especially when compared to far more profitable pharmaceutical divisions, has led to the unraveling of the modern "life sciences" corporation, a model for capturing "synergies" that was, just a few years ago, the rage on Wall Street and rich fodder for biotech-hype in the farm press.

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. It is true that there is no turning back the biotech revolution and that much good has and will continue to come from new scientific insights and breeding techniques. But farmers need to pay attention more closely to impacts on their bottom line.

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. 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, Monsanto, Syngenta, Bayer and other major players in the now combined seed-pesticide industry manage 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.

Should money be spent to defend and keep older technology on the market or shifted to new technology?

How much effort should be made to develop and gain acceptance of GMO varieties in contrast to new varieties developed through conventional breeding techniques?

When will a pesticide and treatment-based technology work better and deliver more profit than a genetics and prevention-based technology?

When does it make sense to compete across corporate divisions, offering farmers both a genetic and pesticide based solution to a common problem?

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.